

CHAPTER 7

SUSTAINABLE ENERGY AND RESOURCE MANAGEMENT

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“Inflation is everywhere and always a monetary phenomenon.”
“If you put government in charge of the desert, within a few years there would be a shortage of sand.”
Milton Friedman, USA Economist

“People believe only what they want to believe.”
Julius Caesar, 100-44 BC

“The process by which money is created is so simple that the mind is repelled.”
John Kenneth Galbraith, USA Economist

“The great enemy of truth is very often not the lie - deliberate, contrived and dishonest - but the myth – persistent, persuasive and unrealistic.”
President John F. Kennedy, Commencement address, Yale University, 1962

“If you are going to tell a lie, make it a big one and people will believe you.”

“To tell a lie is considered by them the greatest disgrace, and next to that to be in debt... especially because they think that one in debt must of necessity tell lies.”
Herodotus, Greek philosopher, about the Persians

“The difference between genius and stupidity is that genius has its limits.”
Albert Einstein

“An imbalance between rich and poor is the oldest and most fatal ailment of all republics.”
Plutarch (46 – 120 AD), Greek historian, biographer and essayist

7.1 INTRODUCTION

We consider the issue of sustainability of energy systems including fossil fuels, biofuels and nuclear energy and the associated economic systems since money is a claim on the available energy resources. Financial assets and liabilities are claims on energy supplies to service them in the present and the future. Increased financial debt necessarily implies an expected future increased energy supply to service it. Food prices are driven by the cost of energy, particularly to deliver the food from the production to the consumption centers. Increased energy prices drive up the costs for transportation, fertilizer, plastic packaging and inks used to print packaging. As an example, in the Middle East where food products are imported from Europe or North America, the cost of food is prohibitive. When threshold unsustainable prices are reached, social upheaval results, as happened globally in the meltdown of capital in 2008 and the Arab Spring of 2011 that deteriorated into the Arab Winter of 2013-2016 with economic and social collapse. A population shift ensued along tribal, ethnic and confessional lines in association with the dissolution of the nation-state established boundaries with refugees and migration flows, whilst external powers rushed in to exercise control on any valuable vacated resources and territories through different proxies.

A “sustainable” system in energy, economics, farming or otherwise; is defined as one with finite resources that operates at a constant rate commensurate with the availability and magnitude of these resources. An “unsustainable” system would be defined as a closed one with a finite size resource that grows at an exponential rate which would eventually deplete its available resource.

As a conjecture, it is considered that a closed system with finite energy cannot grow without external energy inputs. Unsustainable systems with exponential growth eventually disintegrate into smaller units that can use their available resources, including energy, more efficiently and hence evolve into sustainable ones. Common wisdom expresses the situation with a saying that goes as: “If something is unsustainable, at some point it will stop.” According to the 1970s economist Herbert Stein: “If something cannot go on forever, it will stop.” It is also expressed as: “Trends that cannot continue, won’t.” However it does not predict when the trend will stop.

A growing system, requires some form of energy input, be it food that is converted to caloric energy for manual labor, wood, coal, wind solar or nuclear. A zero or near-zero growth system is one that has reached sustainability. This is analogous to how the natural world relies upon the sun’s nuclear fusion energy to sustain itself at a minimum level of organic systems growth. The excess energy input is eventually stored, usually in the form of organic matter such as methane, coal or petroleum.

The Second Law of Thermodynamics states that all systems wind down over time, increasing in entropy. All systems collapse without a new input of energy. The larger and more complex a system is, the more energy input it needs. According to the Second Law of Thermodynamics nothing lasts forever.

Exponential growth and decay involve a doubling and halving processes respectively; leading to rapid growth and decay. The process is generally highly misunderstood, since humans in general tend to perceive, describe, interpret and predict occurrences in the world around them in term of linear, rather than exponential functions. A useful analogy is a lily pad on a pond that doubles its population every day. At the juncture when half the pond surface is half full of lilies; the next day, the pond would be fully covered with lilies with no room anymore for them to continue their growth. Growth is interrupted and a lily population collapse ensues.

Exponential growth is considered as “unsustainable” in a closed system if an external energy source is not available or is not provided. Dividing yeast cells in a petri dish in the laboratory can only continue to grow exponentially with unlimited food resources. The observed actual pattern is a phase of exponential growth, followed by an accelerated collapse, as the food resources are depleted, and toxic wastes accumulate.

Another description is that unsustainable occurrences could continue undetected for long periods of time, but they inevitably end with a “Minsky Moment.” A Minsky Moment is a concept named after the economist Hyman Minsky as a description of when a market fails or falls into crisis after an extended period of market speculation, or unsustainable growth. The phenomenon occurs in the business cycle when investors who are deeply in debt are forced to sell their accumulated speculative assets in order to pay off their debts. This causes a sharp spiraling drop in the value of the assets in the financial markets and a lack of liquidity or demand for cash. A Minsky Moment is based on the idea that periods of speculation, if they last long enough, will eventually lead to crises; and the longer the speculation and complacency occur, the more serious the crisis will be. Any industrial society whether "socialist" like the former Soviet Union or "capitalist" like the USA would endure economic and social decline when its resource base fails.

Robert Ayers showed that the Gross Domestic Product (GDP) is related to applied energy or exergy and only very loosely linked to energy per se, let alone to oil consumption. The research indicates that BTU's only explain 14 percent of GDP, and that the source of those BTU's can change from coal to oil to wind, or other sources of energy. Both energy efficiency and energy intensity can vary. Further, oil is only one source of BTU's. Many energy commentators misunderstand Robert Ayer's research, and think that it supports the idea of a strong causal connection between oil consumption and GDP. Robert Ayers makes two suggestions: "If economic growth is to continue without proportional increases in fossil fuel consumption, it is vitally important to exploit new ways of generating value-added without doing more work. But it is also essential to develop ways of reducing fossil fuel exergy inputs per unit of physical work output (i.e. increasing conversion efficiency)." In addition to increased efficiency and conservation measures, a third action recommendation for sustainability and elimination of the dependency of GDP on fossil fuels is replacing fossil-fuels with low-carbon energy sources such as solar, geothermal, wind and nuclear energy

Sustainable systems can be identified as those systems that satisfy the following criteria:

1. Fulfill basic human needs in food, water, health, lodging, and global social interconnections.
2. Are adaptable, robust to unforeseen perturbations, and "antifragile" thriving on change, particularly in technology and communications.
3. Create economic abundance in new life sustaining technologies such as nanotechnology, robotics and biotechnology.

The global population trajectory is such that from 2012 to 2030, there is a need to build the equivalent of a city of 1 million inhabitants in the developing countries every 5 days. In the report: "Food and Agriculture: The future of sustainability," it is remarked that: "We now face astonishing levels of waste, 30 to 40 percent of all food ... never makes it to market and consumers in rich countries waste as much food as the entire net food production of sub-Saharan Africa." Further: "For the first time in history, we have as many overweight people as under-nourished people." Building new cities for the added population requires the adoption of new economic and financial strategies on how to find more and better use of life-sustaining essentials of energy, food, water and soil.

The world's population is expected to reach 9 billion by 2050. Food production will need to sustain it with a 70 percent growth, according to the United Nations (UN). Present farming practices are facing increased scrutiny beyond safety. Large-scale high-energy input farming in terms of machinery fuel, chemical fertilizers, herbicides, pesticides and its use as a source of fuel in addition of food supply, are considered unsustainable. Energy-intensive, bin-busting industrial agriculture is considered as a model that threatens the long term health of soils, nutrients availability, fragile ecosystems, watersheds, and the human population that they sustain. The food supply system must offer lasting sustainability, protecting diminishing natural resources and providing healthy affordable food.

Prince Charles of Wales spoke in May 2012 to "The Future of Food" conference at Georgetown University in the USA, and in his book: "On the Future of Food," warning that high-energy input farming is "pushing Nature's support systems so far, that they are struggling to cope with what we ask of them." He contends that high-energy input farming dependent on chemical pesticides, fungicides, insecticides, commercial fertilizers, growth promoters and

transgenics is not “ a genuinely sustainable form of agriculture for the long term.” Producing enough food will require a mix of many energy-use approaches to sustainable farming practices that protect the environment and achieve food security for the present and future generations.

The wealth of nations expands through debt and assets creation. Debt is a claim against the value of the assets manufactured or purchased and against the value of future labor and entitlements. The system has the capacity to overproduce both debt and assets and hence becomes unsustainable upon excessive production of debt and assets. The system is self-regulatory and self-correcting in the sense that the excesses are eventually eliminated through a system collapse into smaller entities which survive on their own. The expansion and contraction of the wealth of the system which includes debt usually occurs in a nonlinear way.

Great civilizations experience a period of exponential growth in land, population and wealth. It is suggested that the Romans may have colonized space, should that exponential growth have continued uninterrupted. However, the exponential growth became unsustainable when the top soil in the agricultural areas was depleted, and hence food production collapsed.

Energy, particularly as liquid petroleum, which may have witnessed its global peak around 2010, and is now being supplemented at the margin by natural gas and tar sands liquids, is serving as the source of the global monetary discipline that gold used to perform. The USA, for instance, produced 88 percent more oil in 1970 than in 2009. To pay for oil cheaply, nations have opted to diluting their currencies through increasing their money supply and the process of monetary inflation. Energy producing nations caught up to the game, as the values of their currencies decline, the price of energy supplies tend to rise. This has created a close interrelationship between the energy and financial realms.

The economy must be considered as a surplus energy equation, not a monetary one, and growth in output and in the global population since the Industrial Revolution has resulted from the harnessing of ever-larger quantities of accessible cheap energy. This critical relationship between energy production and the energy cost of its extraction must be a sustainable one for the economy as we have known it for more than two centuries to continue thriving.

Whereas “energy” is a concrete and palpable object, money is just an abstract concept. In the past and present, rocks, cattle, conch shells, salt, silver, gold or green rectangles of paper, even electronic bit-coins are considered as “money” if a socially cohesive group of people decides it is “money”.

The USA would have had a very different economy had it not been for the link between the dollar currency and petroleum. If that link were broken, global demand for the dollar currency would sink. Governments opted to hold the reins of money in their own hands with the global use of petroleum providing a link to the dollar that forced producers and consumers alike to turn to it. The oil producers agreed to the pricing of oil in the USA currency, ensuring that the world’s most powerful economy stayed linked to the world’s most needed commodity.

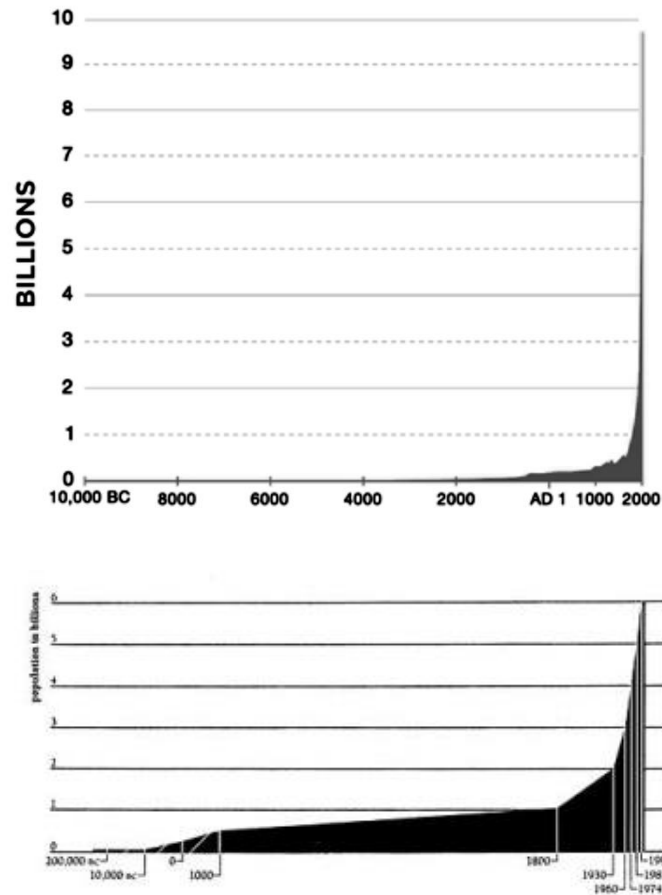


Figure 1. World population exponential growth in billions.

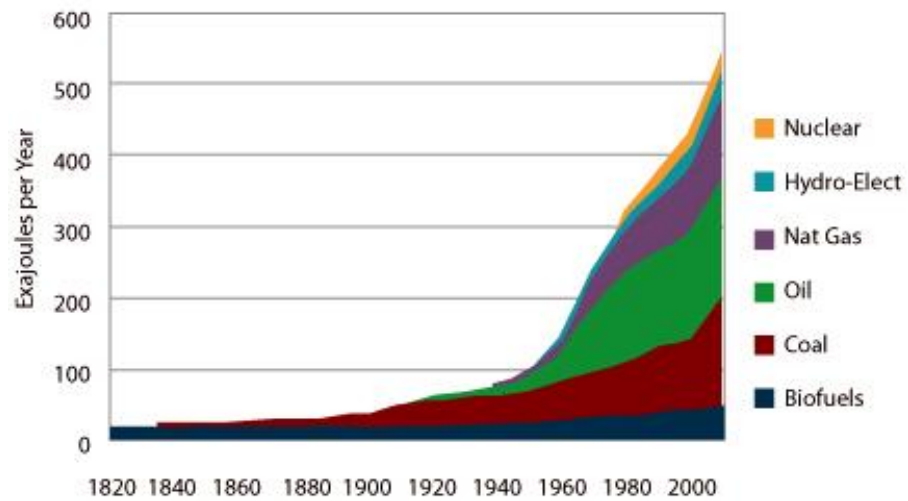


Figure 2. World population growth is sustained by increased energy consumption.
Source: USA Census Bureau.

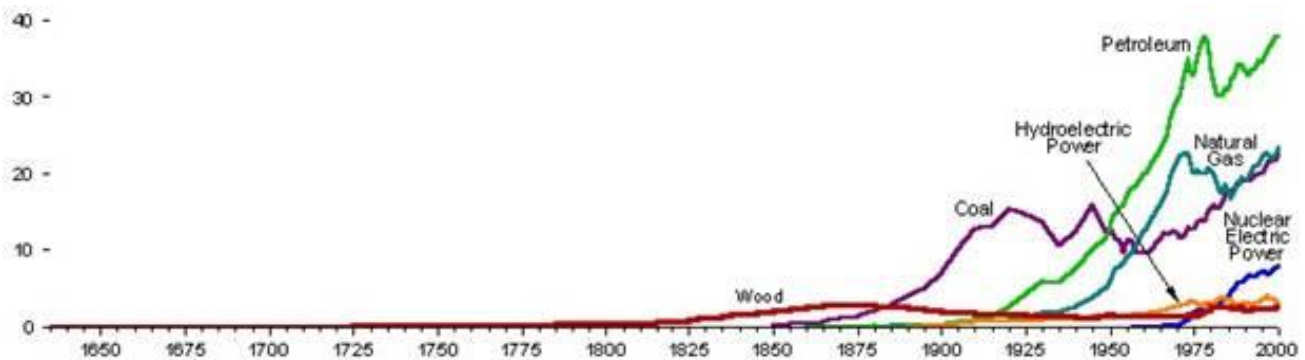


Figure 3. Increased energy consumption from multiple sources. Source: USA Census Bureau.

We recognize such an intricate coupling and describe the mathematical aspect and the unsustainability of exponential growth in energy consumption as well as monetary expansion. In an exponential model, it is argued that sustainability can only be achieved with a zero growth rate option. The main criterion of sustainability in this regard is that leverage and debt appear to be unsustainable illusions of wealth. Sustainable real wealth is based on production associated with saving.

Unsustainable exponential growth exhibits itself in several collapsing global trends: Energy resources depletion, Peak Oil, Peak Fresh Water, overpopulation resulting in poverty, disease, food crises and starvation, financial and credit cyclic crises, depletion of phytoplankton, zooplankton and ocean fisheries, deforestation and desertification as well as global climatic change.

As unsustainable systems are adopted the cost of devoting extra resources for their maintenance as long as possible increases. Eventually, a point is reached at which meeting new challenges leads to diminishing returns followed by negative returns. A systemic shock ensues, either internally such as social upheaval caused by resource exhaustion, or externally such as foreign wars to control the available external resources. The shock causes a rapid collapse disintegrating the unsustainable system, and generating new smaller self-sustaining entities. The conclusion is argued that wealth creation can occur in a sustainable manner only through production followed by saving from production, rather than from debt creation and consumption.

If something cannot be sustained or is “unsustainable,” it is bound to change. Unsustainability occurs when the outputs from a closed system exceed the inputs; when the expenses rise faster than the incomes; when the births exceed the deaths; when the debts exceed the profits, when entitlements (pensions, health care) exceed production. In the nonlinear real world, food, fresh water, energy, fertile soil, mineral resources, technological change, human adaptation and continued growth could become unsustainable.

Unsustainability in increasing debt relative to decreasing Gross National Product (GDP) is already occurring in Japan, Europe, the USA and China despite attempts at “austerity” by promises by governments that cannot be fulfilled, leading to unemployment and eventual social upheaval. A global experiment pits the theories of John Maynard Keynes against von Mises and of Fisher versus Milton Friedman. New paradigms are emerging along the ideas of “creative destruction” by Joseph Schumpeter and those of stability leading to instability by Hyman Minsky. A new world of rapid change will be unavoidable with the norm being survivability. The Austrian

economist Joseph Schumpeter considered that big business cycles are the inevitable consequence of innovation, as well as the resistance to innovative change that always exists within the old order. Societies respond to the pain caused by unsustainability failures, just as B.F. Skinner's pigeons learned complex behaviors without understanding their meaning.

Roman philosopher Seneca the Younger is attributed the saying: "Every new beginning is some other new beginning's end." He lived comfortably as the son of a rich man and worked as a trusted advisor to Emperor Nero of Rome. Having navigated the brutal politics of Rome, he retired on good terms to a rich country estate. Things were looking pretty good until, in the wake of a conspiracy against Emperor Nero, he was forced to commit suicide by cutting his veins and taking a poison.

Something similar, if much less dramatic, is about to happen to the stock market as the Federal Reserve, after years of nursing the financial markets with a steady drip of cheap money morphine, is about to pull out the needle. It's anyone's guess what happens after. Economist John Templeton started his investing career in 1939 by borrowing about \$10,000. With war escalating in Europe and most investors in panicked despair, he bought 100 shares in each of the 104 companies priced under a dollar on the New York and American stock exchanges. Almost all were innovative startups, and 34 were in bankruptcy. He then ignored his portfolio for four years. At that point, only four of the 104 were worthless, and he had quadrupled his money. This is based on the simple assumption that human progress will continue and things eventually get better.

During the Great Depression period in the 1930s, considerable growth occurred in technological innovation. Necessity created a number of innovations that made our lives better and easier such as washing machines, copy machines, the car radio, and the electric shaver. The first nylon material was introduced by the DuPont Companies. Improvements in existing technologies like the automobile and airplanes were constantly happening.

Criteria for the sustainability of energy systems are presented and the relevant equations for resource use and depletion time are derived. The close interrelationship between energy, farming and finance is discussed. The common misunderstanding of the exponential function as a doubling process is clarified. For instance, consider the following problem:

"A patch of lilies floats on the surface of a lake. Every day, the patch doubles in size; this means that the 'doubling time' is one day. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?"

The first response of most smart people is possibly to take a shortcut, and to take $\frac{1}{2}$ of the final answer by leading to 24 days. For a doubling process, this is incorrect. The correct solution is 47 days. It takes only one day to double the size of a patch of lilies covering half the lake to cover the whole lake. The humans' brain appears to be wired for linear processes, whereas nature throws at them exponential functions sometimes.

"Sustainable development" is defined in what is commonly referred to as the Brundtland Report, which is of the basic references in the modern practice of sustainability. The idea behind sustainable development is that some parts of the world have adopted economic incentives that fail to account for the long-term impacts of pollution and the loss of shared resources. Some of the apparent results are that 4.6 million people die each year just from air pollution, the ocean's edible fish are being harvested to extinction and record droughts exacerbated by climate change

are ravishing crops worldwide. The Brundtland Report was the product of a 4 years duration commission set up by the United Nations member countries that were increasingly concerned that the world's resources were being squandered and its environment spoiled. It is generally there defined as: "development in which resource use aims to meet human needs while preserving the environment so that these needs can be met not only in the present, but also for generations to come."

SHALE OIL AND GAS MIRAGE

A major misconception is that the USA is expected to become energy-independent in a few years, even with the end of "Peak Cheap Oil" and in the era described as "Expensive Oil":

1. Even though the USA produced more petroleum in 2015 than it produced 42 years earlier, that cannot last for too long. According to the Energy Information Administration (EIA), the USA produced 9.4 million barrels per day (mbd) during the week of March 23, 2015 compared with 9.3 mbd in December 1972. What is missed is that the Energy Returned On Invested (EROI) fell from 100 - 1,000 in the 1930's to Shale Oil at just 5 around 2014. The reason only 1 percent of the Bakken field was breaking even at \$40 per barrel oil in 2015 was due to its low EROI. Shale oil in the Bakken has an average of 5/1. It takes 1 barrel worth of energy to produce 5 barrels for the market. The EROI in 1970 was 30/1 and in the 1930's 100/1.
2. The USA still imported 6.9 mbd during the week of March 20, 2015. This a very large gap to fill with local production.
3. In 2004, the USA produced 5,665 barrels per drilling rig compared with Saudi Arabia at 157,335 barrels per drilling rig. Saudi Arabia produced $157,335 / 5,665 = 27.77$, or 28 times more oil per drilling rig than the USA in 2004. In 2015, after a significant reduced demand-induced drop in the price of oil, the ratio is still $129,333 / 11,420 = 11.3$.
4. The average oil drilling rig number in 2014 in the USA was 1,527 compared with just 62 in Saudi Arabia. The 2014 drop in the oil price cut the USA oil drilling rig fleet from a high of 1,600 in 2014 to nearly one half at 825 in March 2015. The Saudi Arabian oil rigs number increased to 75 in February 2015.
5. Oil and natural gas in the Bakken, DJ-Niobrara, Permian, Marcellus, and Eagle Ford basins are technically called "Tight Shale Oil" and "Tight Shale Gas." Tight Shale Oil is confused with "Oil Shale." To extract oil from oil shale, the shale has to be crushed and then heated using steam to remove the oil. Oil shale resources, at an EROI around 2, cannot be placed in the same category with high EROI light sweet crude. Claims that North America in the USA and Canada has a trillion barrels of oil resources, including oil shale and tar sands, appear exaggerated since these resources are uneconomically exploitable.

The world has run out of a particular form of oil: affordable oil. The peak oil story is still valid, just playing a different tune. Expensive oil destroys industrial economies; whereas cheap oil destroys the oil producing nations and companies.

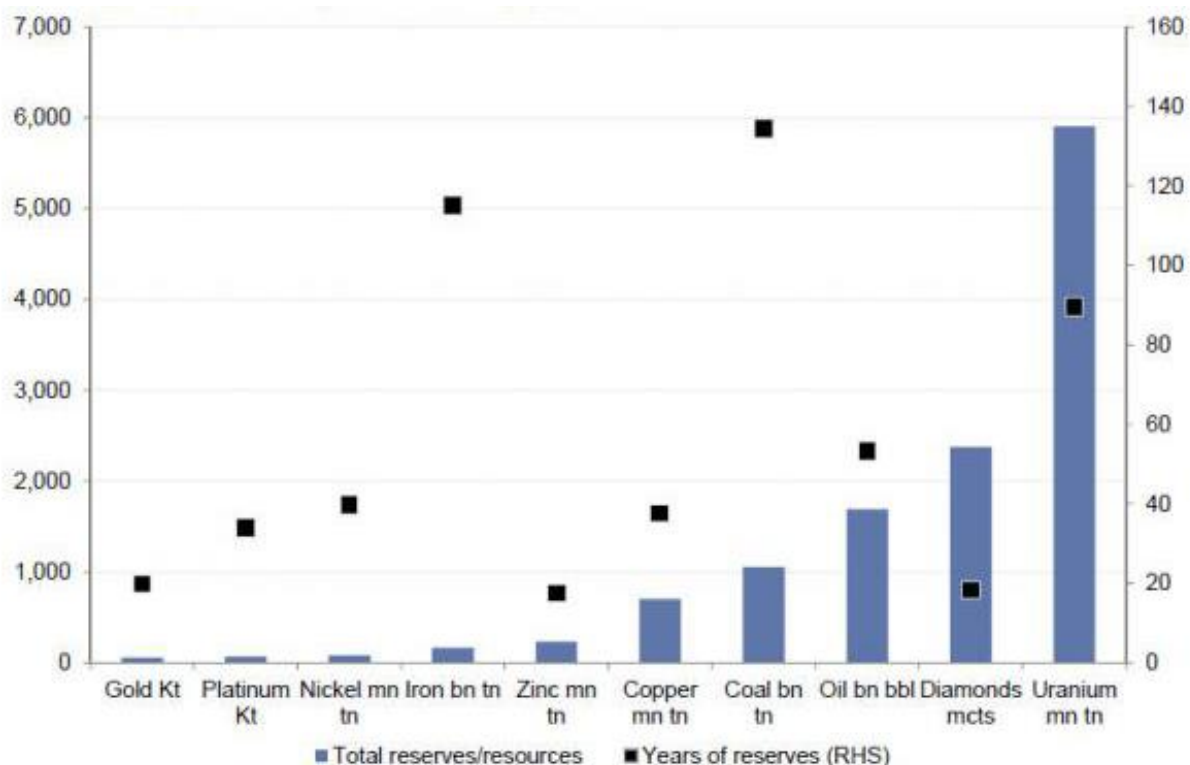
Shale oil and gas through the new technologies of hydraulic fracturing and horizontal wells operated used cheap financing and expensive oil to flourish. The problem is that at \$100 a barrel, hardly anyone made any profit on shale. At \$40 a barrel shale was losing money. The consequence was that in 2015 the shale oil companies fired thousands of workers and idled the drilling rigs. North Dakota became littered with unfinished apartment complexes.

The financing came in the form of high-yield junk-bonds issued by the oil companies with commissions for the big banks. When the price of oil crashed below to the \$30 level, many oil companies without cash flow could not service the interest payments on the loans leading to bond defaults and bankruptcies in the USA oil patch. Industrial economies evolved to depend on cheap oil, which no longer exists.

7.2 ENERGY SUSTAINABILITY

Energy sustainability has become the most central issue of our time and collective existence and well-being. Mankind has benefited for a century from cheap and abundant supplies of energy, particularly fossil fuels, and built a world that is dependent on it. The occurrence of economically disrupting energy crises and the global competition and rush using political as well as military means for securing fossil fuel supplies creates a motivation to look in detail at the issues of sustainable energy use and the management of limited resources that are subject to depletion and need eventual replacement. It is reported that \$44 billion per year is spent by the USA Department of Defense to protect the access to the global petroleum supplies.

The world may be living in a monumental cheap and plentiful energy and fresh water supplies availability illusion. The world's conventional crude petroleum output appears to have already peaked around 2010. What are being reported as crude oil supplies are primarily marginal natural gas and tar sands liquids and deep water supplies.



Source: Statista, World Coal, BP, World Nuclear Association, Goldman Sachs Global Investment Research.

Figure 4. World mineral reserves and resources, years of supply left.

A global competition and grab for the global petroleum resources exists. The USA liquid petroleum consumption is over 18 million barrels per day, whilst its production is around 7 million barrels per day. Chinese consumption is around 9 million barrels per day, on the way to 15 million by 2015. Indian consumption is currently 4 million per day, headed to 7 million by 2015.

Average USA citizens use 327 GJ of energy per year compared with 22 GJ/year in Vietnam and 21 in India. In Brazil, it is 44. These countries have room to grow using the energy inputs, whereas the rich countries find it hard to put more technology into service profitably with energy declining in the USA, Europe and Japan.

A Joint Operating Environment report issued by the USA Joint Forces Command suggests that the USA could face petroleum shortages much sooner than many have anticipated. The report speculates that by 2012, surplus petroleum production capacity will dry up; by 2015, the world could face shortages of nearly 10 million barrels per day; and by 2030, the world will require production of 118 million barrels of oil per day, but will produce only 100 million barrels a day.

The world supply of petroleum as of 2009 was about 85 million barrels per day, whilst demand was 87 million barrels per day; generating an unsustainable fundamental supply and demand imbalance.

The world uses about one cubic mile of crude petroleum per year. The International Energy Agency (IEA) estimates that petroleum production will be ramped up from its current level of 85 million barrels per day to 105 million barrel per day by 2030. An insider to the IEA, Kjell Aleklett, professor of physics at the Uppsala University in Sweden, and co-author of a report "The Peak of the Oil Age," states that: "oil production is more likely to be 75m barrels a day by 2030 than the 'unrealistic' 105 million barrels per day used by the IEA." The French company Total SA, that is making a move into the Alberta oil sands, does not accept the IEA's optimistic claims. The company runs on the belief that oil production would not surpass 95 million barrels. Former chief executive officer of Canada's Talisman Energy, Jim Buckee, agrees that the IEA prediction is an overestimate. Sadad Al Hussein, energy consultant and the former exploration and production chief of the world's largest oil company, Saudi Aramco, recently said: "Oil supplies have reached a capacity plateau and will not meet a growth in demand over the next decade."

New petroleum fields, generally smaller, are less productive than old ones. A virtual free fall in production rates from the North Sea fields occurred after reaching peak output in 2000.

The world's output of conventional crude petroleum peaked around 2010. The global total output of what is generically call "oil" has slightly risen in recent years. But this is so because there are increasing volumes of Natural Gas Liquids (NGLs) in the mix, as well as unconventional oil such as Canada's oil sands. But the production of conventional oil has already peaked. The future of conventional petroleum output is down, even with the future output from recent deep water offshore discoveries off Brazil, Nigeria and Gulf of Mexico coasts 150 miles offshore, 8,000 feet of water depth and below 20,000 feet of rock and salt.

The USA imported 65 percent of its oil by 2009. By 2025 it will be importing 92 percent of it, according to the present trends.

The global petroleum reserves have fallen for the first time in a decade. The global reserves totaled 1.25 trillion barrels at the end of 2008, according to the British Petroleum (BP) Company's Statistical Review of World Energy down from the 2007 reserves of 1.26 trillion barrels. *At the current rate of consumption, production and supply*, the world would have enough

reserve to last 42 years. This assumption is unrealistic since it does not allow for any growth in the rate of consumption.

Yet, without new investment, the output from the world conventional petroleum fields is declining at an annual rate of 9.1 percent according to the International Energy Agency (IEA). With extra investment to raise production, the decline rate is still expected to remain at an annual rate of 6.4 percent. World consumption by 2030 is expected to be 106.4 million barrels per day; an unattainable paradoxical goal with the projected decreased production.

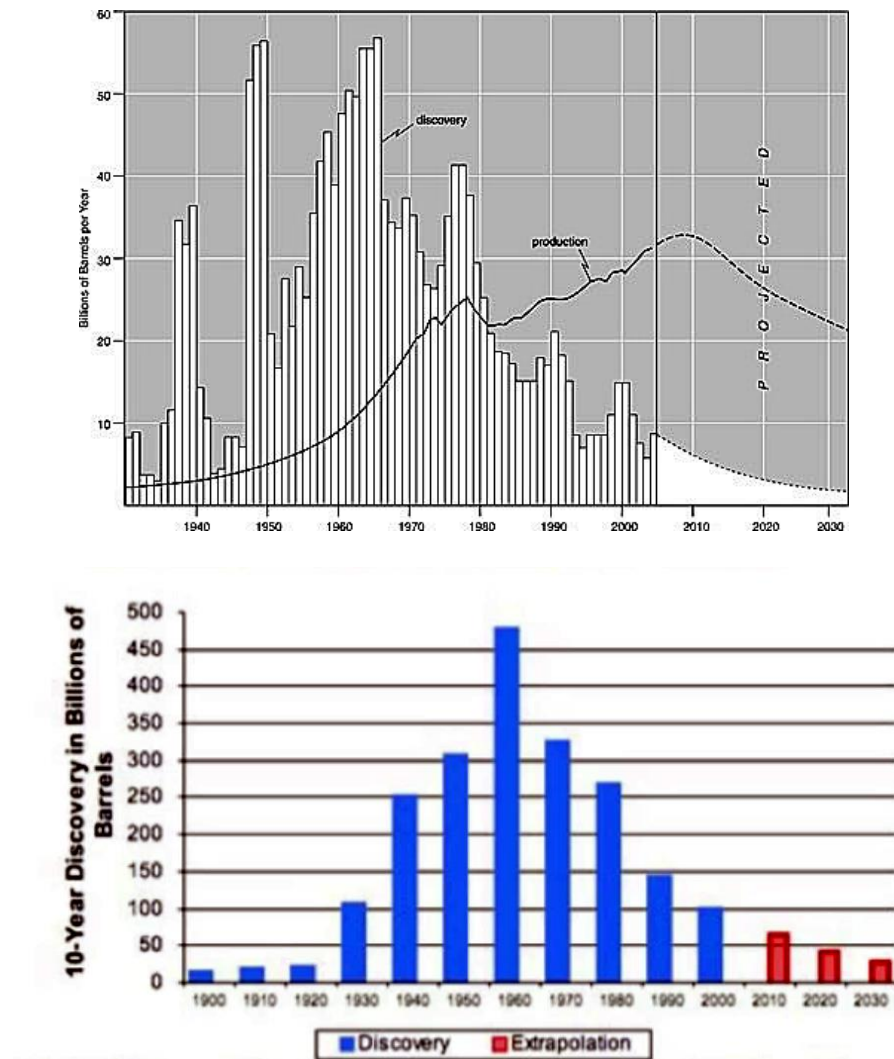


Figure 5. Increasing conventional petroleum production cannot be sustained by decreasing new discoveries.



Figure 6. Fluctuating petroleum price. 2006-2011.

Humanity is facing Peak Oil, Peak Grain and Peak Fresh Water supplies in the face. It needs to develop substitutions for the depleting energy, food and fresh water sources to sustain human development and fight poverty. Humanity faces Jevon's Paradox: "The more efficient you make means for using a resource, the more of that resource you will use."

The concept of "Peak" here is understood to mean that the consumption rate will grow exponentially, reach a maximum, followed by a decreased output over time; not that the world will totally run out of any of them. However, as they are more difficult to extract or produce and as demand exceeds the supply, their costs of production and consequently their prices are expected to inexorably increase.

Peak Oil is a real observation, not a theory. It draws upon and has at its disposal decades of geological experience with individual oil fields, producing basins, and entire countries all repetitively experiencing the exact same behavior: Oil production increases up to a point, and then it decreases afterwards. One should caution here that the definition of propaganda is "a form of communication that is aimed at influencing the attitude of a community towards some cause or position." Propaganda about Peak Oil being a theory rather than an actual observation, usually involves the selective use of facts or the avoidance of appropriate context, coupled with loaded messages and words, in order to elicit an emotional rather than rational response.

Some suggest that the competition for the control of the remaining resources would lead to social dislocations and conflicts that could eventually result in a worldwide civilization and population collapse. They suggest that this process may apparently have already been ongoing in the Middle Eastern region with contagion into Europe.

Table 1. Global hydrocarbon resources in trillions (10^{12}) of barrels of oil equivalent (boe) at different extraction costs.

Resource	Size [10^{12} boe]	Production cost [\$ / boe]
Conventional liquid petroleum, already extracted	1	1-40

Conventional liquid petroleum, remaining to be extracted	1	15-100
Heavy oil, tar sands, bitumen	2	50-100
Oil shale	1.5 -2	60-125
Natural gas to liquid	2	60-125
Coal to liquid	1.5	60-150

boe = barrels of oil equivalent

The Point of No Return (PNR) has been reached in the conventional liquid fossil fuels energy supply, the die has been cast, and the Rubicon has been crossed. The PNR is a technical term that refers to the point of an airplane flight at which, having consumed half of its fuel load, it is no longer capable of returning to its airfield of origin. PNR implies an irrevocable commitment. “Crossing the Rubicon” is a similar popular idiom meaning to go past a point of no return. The Rubicon was an ancient river boundary between the Gaul territory and Italy. Julius Caesar crossed it in 49 BC. It was a deliberate acts of war in which he was reputed to have originated the “die is cast” expression, after which he eventually seized power.

The world did in fact run out of “cheap petroleum.” In 1998, petroleum traded for around \$12/barrel. The price rose to \$147 in July 2008. The financial panic of 2008 collapsed the price to \$34/barrel. By early 2011 petroleum prices rose back to over \$100/barrel.

This higher price increased the available oil supplies from new resources in deep waters and from shale deposits and oil sands. Today the world consumes roughly 90 billion barrels a day. The cheap oil still exists in the politically volatile Middle East which holds 56 percent of the light sweet world’s reserves. Canada has the world’s third largest reserves in the form of oil sands heavy oil. Twenty percent of the oil traded in the world goes through the Straits of Hormuz choke point.





Figure 7. As oil is priced in dollars, crude oil price has a positive correlation with the Euro currency and a negative correlation with the dollar currency. It must be noticed that correlation does not imply causation. Political price manipulation on the commodity exchanges, and not market forces, eliminates the competition from small producers about every 20 years.

Most of the proven petroleum reserves in the world are controlled by national oil corporations and governments as a result of “resource nationalism,” where countries have become more sophisticated in the protection of their resources and their environment. These large state-owned and managed National Oil Companies (NOCs), such as Saudi Arabian Aramco, Kuwait Oil Company, Brazilian Petrobras, Mexican Pemex, National Iranian Oil Company, Sonangol, Petroleos de Venezuela, Russian Gazprom and Rosneft, control 85 percent of the world’s hydrocarbon resources.

Just 7 percent of the world's hydrocarbon reserves are still controlled by the Western companies. These are pumping petroleum from the ground but are not replacing their reserves neither through resource expansion nor reserve growth. Their profits are used to buy back their own stock and acquiring each other, in effect mining the stock exchanges for reserves and practically liquidating themselves, unless allowed to explore and produce offshore and other frontier areas such as in the Arctic National Wildlife Refuge (ANWR).

The largest USA oil company; Exxon-Mobil is just the 14th largest oil company in the world. American oil companies have lost the once unlimited access to oil that they had in the past. For instance, Exxon-Mobil buys 90 percent of the oil it refines for the USA market from the larger players. President Jimmy Carter imposed a “windfall profit tax” on them, to a devastating effect, putting them at a competitive disadvantage relative to their international competitors. USA oil companies make 8.3 cents in gross profit per dollar of sales, compared with 13.7 cents for computer equipment makers, 14.5 for the electronics industry, and 27.5 for the software industry, according to the Census Bureau.

Meanwhile, for political correctness, the USA has adopted an unsustainable agricultural and energy policy using 30 percent of its corn crop to produce 3 percent of its transportation fuel. This has resulted in soaring prices of food. The energy producers and the food producers are squeezing others in the middle. Yet, the USA is the economic and scientific engine of the world.

and the hope of pulling the globe from an unsustainable energy and monetary situation will depend on its leadership.

Since the petroleum use predictions are presented by consultant firms which consider their numerical models and data as proprietary and do not publish them, we derive the underlying equations from first principles. We consider here the mathematical basis of a depleting resource usage based on a model suggesting an exponential rise in its usage followed by an exponential decay, and derive the underlying concepts of doubling time, and the depletion time of a limited resource. We propose a model that best fits the data on existing energy sources consumption picture of an exponential growth up to half the depletion time followed by an exponential decay over the other half of the depletion time.

We extend the perspective by considering nuclear energy as an expandable rather than a depleting resource only when the process of fissile fuel breeding is used, and present the relevant equations for its exponential growth and doubling time.

7.3 SUSTAINABLE ENERGY

Economic growth and social progress are dependent on future supplies of energy. Energy experts project that up to 40 percent of the electrical power stations the world will need by 2020 have not yet been built. Developing countries like Brazil, India and China are rapidly industrializing resulting in a projection of world energy consumption to increase by 57 percent from 2002 to 2025, according to the USA Energy Information Administration (EIA).

From the perspective of sustainability, energy systems can be classified into three categories:

1. Renewable: This includes wind, solar thermal and photo voltaic, biomass as well as geothermal and tidal and Ocean Thermal Conversion (OTC).

2. Depletable: Includes stored energy sources that are not replenished at a faster rate than they are depleted. These include the fossil fuels such as petroleum, natural gas and coal.

3. Expandable: With proper application, only nuclear fission and fusion energy possesses the unique feature that it can be made to generate more fuel through the breeding process than it consumes.

Nuclear processes are recognized as the basic sources of energy in nature and are the “mother” of all other forms of energy. Nuclear fusion reactions in the sun are the source of renewable sources such as wind, solar and biomass, as well as depletable sources such as petroleum, natural gas and coal which are in fact, forms of stored solar nuclear fusion energy. Another nuclear process in the form of radioactivity in the Earth’s crust and mantle is the source of geothermal energy as a renewable source.

The petroleum industry is betting its future on moving to build the first commercial combined hydrogen power and carbon storage and segregation projects. Fossil fuels such as coal, petroleum or natural gas would be converted to hydrogen as an energy carrier and CO₂. The hydrogen would be used as transportation fuel and to generate electricity using fuel cells as an engine, and the CO₂ would be captured and pumped into depleted oil and gas reservoirs to help increase their lost pressure and the secondary recovery of more oil from them. If feasible, it is

estimated that the carbon emissions from this mode of power production would be 90 percent lower than from directly burning fossil fuels.

7.4 USA AND WORLD ENERGY PICTURE

The USA is touted as the world's largest consumer of energy, using 26.3 percent of the world's total oil supply, while representing just 5 percent of the global population. An average Chinese citizen consumes less than 2 barrels of petroleum per year, the average Indian citizen consumes less than one barrel of petroleum per year, whereas the average USA citizen consumes 25 barrels per year. The USA's greatest technological, economic and strategic challenges are the achievement of energy independence, necessitating a serious energy conservation, substitution and production program for the next century.

On a per capita basis, the World Resources Institute's data for 2003 on total energy consumption in units of kilograms of oil equivalent (kgoe / capita) is shown in Table 2.

The residents of the Middle East are the largest consumers of energy in the world. With a combined wealth and population explosions in the oil producing countries, their citizens are the largest consumers of energy in the world. Depending on depletable oil as their main source of income, makes them face an unsustainable economic future.



Figure 8. Early high gusher petroleum well. The petroleum pumped out of the ground since Colonel Drake drilled his well in 1859 would cover the state of California to a depth of about 10 feet.

The first petroleum well was dug by Colonel Edwin Drake, a train conductor with interestingly absolutely no military background, in Titusville, Pennsylvania in August 1859, and produced 25 barrels of oil per day. It was a hole dug near a known oil seep near Oil Creek. The world as of 2009 produced 86.9 million barrels of oil per day or:

$$\frac{86.9 \times 10^6}{24 \times 60 \times 60} = 1,005.8$$

or around 1,000 barrels per second.

Table 2. Per capita total energy consumption, 2003.

Country	Total energy consumption [kgoe / person]
USA	7,794.8
UK	3,018.1
UAE	10,538.7
Qatar	21,395.8
Kuwait	9,076.0
Bahrain	10,250.5

In 2007, the International Energy Agency (IEA) estimated the global oil demand at 86.1 million barrels per day (bpd) with a year over year (yoy) growth in oil demand of 2 percent. The world's suppliers, with the Organization of Petroleum Exporting Countries (OPEC) providing 40 percent of the demand, are producing the 86.9 million barrels per day.

Spare petroleum capacity, according to the IEA, is capacity that can be turned on for 30 days and sustained for 90 days. A comfortable level of spare global capacity would be 5-6 million bpd. Recently that value has been less than 3 million bpd, with 1-2 million bpd of that spare capacity from the Kingdom of Saudi Arabia. The USA lost its spare capacity as of 1970.

The world population is increasing at the rate of about 77 million people every year. It was as of 2005 about 6.5 billion people.

The USA imported 55 percent of the petroleum it consumed as of 2005. This was up from 45 percent in 1992. This percentage is estimated to grow to 68 percent by 2025. Petroleum accounts for about 41 percent of the USA's total energy use.

If compelled to rely on its own resources, the USA is expected to run out of present petroleum supplies in about 18-20 years, even taking into account Alaskan petroleum and the Strategic Petroleum Reserve established in 1975 and located at a number of sites in the states of Texas and Louisiana. Within 15 years, the USA will require about 50 percent more natural gas and 33 percent more petroleum to meet its escalating energy demand. It is inevitable that it would have to consider lifting any bans on drilling in its continental shelf for environmental considerations.

The USA keeps 696 million barrels in the Strategic Petroleum Reserve, stored in underground salt caverns in Texas and Louisiana, according to the USA Department of Energy (DOE). The stockpile was created in 1975 to protect against supply interruptions after an Arab embargo. The last major drawdown was a 30-million-barrel sale in 2011 amid unrest in Libya. While the nation is committed to holding enough oil to cover 90 days of imports, it currently has enough for more than 200 days, according to the International Energy Agency (IEA); the organization of oil-consuming countries that coordinates stockpiles.

The USA's population has reached a size of 300 million in 2006 which is $300 \times 10^6 / 7.0 \times 10^9 = 0.043$ or about 5 percent of the world's population. It is expected to reach 400 million people by 2050.

As the USA consumes 22 million barrels of oil per day, or fully $22 / 83.5 = 0.263$ which is 26.3 percent of the world's production, the entire continent of Asia including India and China consumes only 20 million barrels of oil per day. The Asian population is about 3 billion people. This suggests that the per capita petroleum consumption in the USA is:

$$\frac{22}{300 \times 10^6} / \frac{20}{3 \times 10^9} = 11$$

or 11 times that of Asia's population. As China, India, South Korea, Brazil and other countries develop economically, this gap is expected to decrease creating massive pressure on the global petroleum supply. It can be noted for instance that by 2004, China's petroleum imports increased by 40 percent. Europe imports about 30 percent of its natural gas from Russia through pipelines that cross the Ukraine. Oil and gas account for about 50 percent of Russia's government revenue.

Overall, as of 2013, the per capita oil use in the USA is about 22 barrels per year and 24 barrels in Canada supporting their high standard of living and their large-distance transportation system. In Europe, with high fuel taxes, short distances and passenger rail system, the per capita oil use is about 10 barrels per year. In comparison, in China the per capita oil use is about 2.5 barrels per year. In India, the per capita oil use is just over one barrel per year.

The world used 86.8 million barrels of crude petroleum per day as of 2008 or $86.8 \times 365 = 31.68 \times 10^9$ barrels per year, corresponding to a usage of about 1 billion barrels every $365 / 31.68 = 11.52$ days. With a world population at 7.0 billion people, the average daily per capita consumption is: $86.8 \times 10^6 / 7.0 \times 10^9 = 1.24 \times 10^{-2}$ barrel / (person.day) or about one hundredth of a barrel per day per person.

What is not well known is that 90 percent of the world's petroleum reserves were discovered more than 25 years ago. In 2000 there were 16 new large discoveries. In 2001 this number was 8, and in 2002 it was 3, and in 2003 it was zero. In 2008 a discovery was reported offshore Brazil. The world petroleum consumption currently outstrips new discoveries by a factor of 4:1 or four barrels of petroleum are disappearing for each one discovered. The world's cheap petroleum has already been discovered and is being consumed and depleted.

The Kingdom of Saudi Arabia is reported to have reserves of 260 billion barrels, which, if it were the only source, would supply the world for just $260 / 31.68 = 8.2$ years.

The USA was faced with energy crises in 1970s and the early 1980s, forcing an automobile driving speed limit of 55 miles per hour, long gas station refueling lines, dialing down of home heating thermostats and the implementation of conservation of fuel and energy efficiency measures in appliances and transportation vehicles.

Conservation itself is constrained by the Jevons Paradox. The British economist William Stanley Jevons in 1865 advanced the thesis that increased efficiency would raise energy use rather than cutting it: “It is wholly a confusion of ideas to suppose that the economical use of fuels is equivalent to a diminished consumption. The very contrary is the truth.”

Population growth in the USA and the collapse of the price of petroleum in the period 1986-1999 led to a 30 percent boost in energy demand, half of it in the decade 1995-2005. Energy demand is projected to grow by 32 percent in the USA over the next two decades. By 2025, the USA population is expected to increase by 20 percent to 337 million, with a corresponding increase in energy demand.

The Energy Policy Act of 2005 required that the USA Department of the Interior prepare a comprehensive inventory of Outer Continental Shelf (OCS) oil and gas resources for the USA Congress. The ensuing report stated that, for “technically recoverable oil and gas on the OCS, 2006,” total endowment or mean estimate, is 115.43 billion barrels of oil, with a cumulative production to date of 14.12 billion barrels. For natural gas, the estimate is 633.62 trillion cubic feet, with a cumulative production of 153.57 trillion cubic feet. Thus the USA has used, in the last 150 years, and at the current production rates, about 12 percent of its OCS oil and about 24 percent of its OCS natural gas.

In 2008, the Exxon-Mobil USA oil company reported that its average output fell by 614,000 barrels / day. British Petroleum’s Thunder Horse Project in the Gulf of Mexico took 20 years to complete at a cost of \$6 billion will produce 250,000 barrels per day, replacing less than half of the Exxon-Mobil shortfall. Chevron’s Jack 2 project in the Gulf of Mexico cost \$240 million for a single exploratory well.

7.5 ECONOMIC AND STRATEGIC IMPLICATIONS

A USA Department of Defense (DOD) study on the security implications of fossil fuels depletion entitled: “Imagining the Unthinkable,” predicts that in the not too distant future, wars will be fought primarily over resources including energy sources, fresh water supplies, and minerals such as rare earth metals. The report suggests: “Humanity would revert to its norm of constant battles for diminishing resources. Once again, warfare would define human life.”

Currently, to provide access to Middle Eastern petroleum, the defense budget of the USA is estimated to add a hidden cost of about \$5 per gallon of gasoline consumed in the USA.

Developing countries such as India, Korea and China are emerging as large energy consumers. The world needs to find another 40 million barrels of petroleum per day on top of what is currently being produced to meet the rising demand. This seems to some experts as unlikely, suggesting a looming crisis.

As of 2005, the global petroleum reserves were distributed as shown in Table 3. Forty six percent of African oil is sub Saharan in primarily Nigeria, Angola, Gabon, Equatorial Guinea, Congo, Chad and the Sudan. The petroleum territories distribution mirrors the areas of local and global social upheaval and military conflict.

Table 3. Estimated global petroleum reserves, 2005-2010.

Location	Percentage [percent of global market share]	Amount [billion of barrels]

Saudi Arabia	12.0	264.5
Venezuela	3.2	211.2
Iran	5.2	137.0
Iraq	3.1	115.0
Kuwait	3.1	101.5
United Arab Emirates, UAE	3.3	97.8
Russia	12.9	77.4
Lybia	2.0	46.4
Kazakhstan	2.1	39.8
Nigeria	2.9	37.2
Canada	4.2	32.1
USA	8.7	30.9
Africa	8.0	
Middle East	57.0	
USA and Canada	15.5	
Latin America	9.0	
Former USSR	6.0	
Asia-Pacific	3.0	
Europe	1.5	
Total	100.0	

Table 4. USA Imports of petroleum. August 2006 - August 2007.

Source	10 ⁶ barrels/day [mbd]
Canada	1.853
Mexico	1.448
Saudi Arabia	1.427
Venezuela	1.112
Nigeria	1.025
Angola	0.524
Algeria	0.509
Iraq	0.481

Table 5. Estimated global oil incomes, exports and production.

Location	Oil Export Revenue, 2005 [10 ⁹ \$]	Net exports, 2007-2009 [mb/d]*	Production, 2006 [mb/d]*	USA oil imports [%]
Kingdom of Saudi Arabia	153	8.728	10.9	15
Russia	122	5.430	9.7	4
United Arab Emirates, UAE	46	2.700	2.8	
Kuwait	39	2.349	2.6	

Nigeria	45	2.327	2.45	11
Iran, Islamic Republic of	47	2.210	4.259	
European Union		2.196		
Venezuela	38	2.182	2.855	13
Norway	53	2.061	3.1	
Canada		2.001		25
Iraq	-	1.910	1.942	5
Algeria	36	1.891	2.13	6
Mexico	-	1.756	3.791	13
USA		1.704		
Netherlands		1.660		
Lybia	28	1.542	1.7	
Angola		1.407		6
UK		1.393		
Kazakhstan		1.345		
Singapore		1.289		
Mexico		1.225		
Ecuador				2

* mb/d = million barrels per day

Most of the USA petroleum imports come from its neighbors Canada and Mexico. However, Canada already consumes 90 percent of the petroleum it produces, and Mexico 60 percent. Mexico may soon become a net petroleum importer and Canada's only abundant reserves are its oil sands that are difficult and expensive to extract. Both face challenges with their level of reserves, creating an unsustainable situation.

7.6 GLOBAL OIL DEPLETION

The discovery of new large oil and gas basins has peaked in the 1960s. Production is set to peak too, with five Middle Eastern countries regaining control of the world supply. Almost 57 percent of the world's total reserves of crude oil are located in the Middle East, notably in Saudi Arabia, Iraq and Iran. The depletion pattern of petroleum shows that between 1980 and 1998 there was an 11.2 percent increase in world crude oil production, from 59.6 to 66.9 million barrels of oil per day. This was a fractional increase of $(66.9 - 59.6) / 59.6 = 0.1225$ or a 12.25 percent increase.

It took the world 150 years to consume its first 950 billion or about 1 trillion barrels of oil, which is about half the oil known to humans. The world is consuming 31 billion barrels of oil per year.

With an overly optimistic assumption, at the present *constant rate of consumption*, the remaining one half of the known oil would be consumed in: $950 / 31 = 31$ years. With a more realistic assumption of an *increasing rate of consumption*, this period could become correspondingly shorter as is discussed later.

As of 2005, the world oil supply and demand were balanced at 84 million barrels per day, the filling of six Yankee stadiums, but demand reached about 86.5 million barrels by the end of 2005. Of these, the USA consumed around 22 million barrels/day. By 2006, the demand was expected to grow by 2.2 percent which amounts to an extra 1.9 million barrels per day. This would consume the excess spare capacity of the Organization of Petroleum Exporting Countries (OPEC) at 1.0 to 1.5 million barrels per day. The only way to get the spare capacity back and slow the demand is through the energy market rationing demand through higher prices and the introduction of replacement sources of energy.

A former executive at Aramco in Saudi Arabia, Sadad I. Al Husseini, asserts that the major oil producing nations are inflating the estimates their oil reserves by 300 billion barrels in a competition to increase their assigned production quotas within the OPEC organization. Saudi Arabia reported reserves of 267 billion barrels. The giant fields of the Arabian Gulf region are reported to be 41 percent depleted. The production in the Middle Eastern region is primarily from mature reservoirs and is constrained by the maturity of the exploited reservoirs to a 15 years production plateau. The inability of supply to satisfy demand is adding \$9.6 per barrel to the price of oil for every million barrels per day of increased demand.

EXAMPLE

In 1999 the global petroleum demand was 75×10^6 barrels/day. It became 85×10^6 barrels/day in 2007. The average rate of increase in demand over the period 1999-2007 becomes:

$$\frac{85 \times 10^6 - 75 \times 10^6}{2007 - 1999} = \frac{10 \times 10^6}{8} = 1.25 \times 10^6 \frac{\text{barrels}}{\text{day} \cdot \text{year}}.$$

Assuming a continuation of this average rate of increase in demand and the inability of supply to satisfy demand is adding \$9.6 per barrel to the price of oil for every 10^6 barrels per day of increased demand, one can estimate the expected price increase per year as:

$$\frac{9.6}{10^6} \times 1.25 \times 10^6 = 12 \frac{\$}{\text{barrel} \cdot \text{year}}$$

At a price in 2007 of \$95 per barrel, the price in 2010 would be expected to reach:

$$95 + 12(2010 - 2007) = 95 + 12 \times 3 = 95 + 36 = 131 \frac{\$}{\text{barrel}}$$

If one ventures a more distant forecast to 2015, the price would be:

$$95 + 12(2015 - 2007) = 95 + 12 \times 8 = 95 + 96 = 191 \frac{\$}{\text{barrel}},$$

which corresponds to a doubling of the price per barrel in 2015 relative to 2007, suggesting a price doubling time of 8 years.

7.7 PEAKING PRODUCTION

The world has four giant oil fields: Al Ghawar in Saudi Arabia, Cantarell in Mexico, Burgan in Kuwait, and Daqing in China.

The USA oil production has already peaked around the year 1974. Norway's giant North Sea field has peaked in production. Libya's production peaked in 1970. Iran peaked in 1974. Europe as a whole peaked in 2000. Indonesia peaked in 1997.

Venezuela's oil output fell to 2.7 million barrels a day in 2005 from nearly 3.5 million barrels per day in the late 1990s. Its output is about 400,000 barrels a day short of its OPEC production quota. A not so much disclosed fact is that OPEC's production capacity has in fact declined over the last quarter century from 34 million barrels per day in 1979 to 30 million barrels per day in 2004.

The Kingdom of Saudi Arabia holds just over 1/4 of the world's proven conventional oil reserves at 264 billion barrels. Its production has been decreasing since 2004. The USA hoped for Saudi Arabia to increase its steady state output of 9 million barrels per day to 20-25 million barrels per day. The Saudi Arabian government suggested it may be able to eventually produce 15 million barrels per day. Saudi Arabia has 7 giant oil fields which produce 90 percent of its oil production and 10 percent of the world's supply of oil. All of these fields are aging, considering that the last one was discovered in 1968.

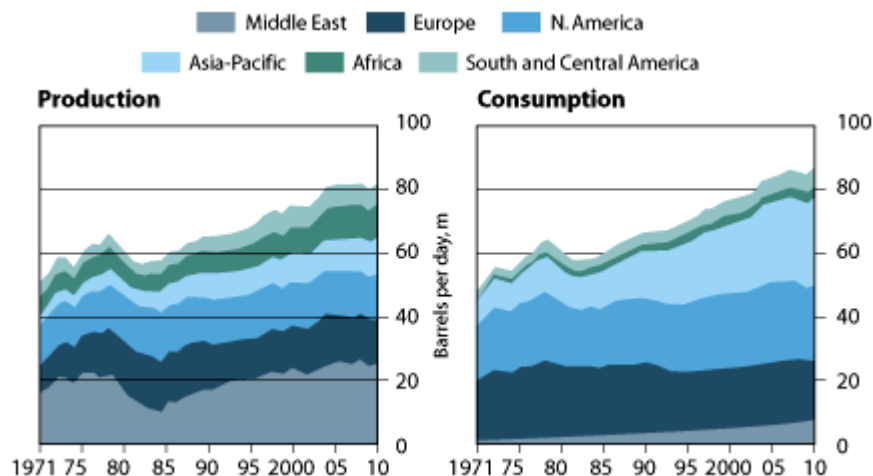


Figure 9. Flattening conventional petroleum production and increasing consumption. Oil production from crude oil, shale oil, oil sands and Natural Gas Liquids (NGLs) is forming a plateau region from 2004 to 2011 at 82-84 mm b/d. The higher consumption than production is supplemented by fast-depleting Liquefied Natural Gas (LNG) resources, subject to the limitation of Energy Return On Investment (EROI). Source: British Petroleum (BP).

In Saudi Arabia, the Al Ghawar oil field is the largest oil field on Earth, and is responsible for about 60 percent of the Saudi Arabian production at 5.5 million barrels per day. It extends over 145 miles in length and 20-25 miles in width at its widest point. The Al Ghawar field originally produced 2.5 mbpd from about 50 wells. By 2012, Al Ghawar produces about 5 mbpd from about 10,000 producing wells and about 20,000 injection wells.

Decreased pressure, porosity and permeability eventually lead to low recovery rates. Sandstone reservoirs have 30 percent recovery under primary production, 50 percent under secondary recovery, and 60 percent under tertiary recovery. Carbonate reservoirs have recoveries of 15 percent, 25 percent, and 50 percent respectively. Steam flooding helps carbonate reservoirs. Shales have recovery rates of about 1.5-2.5 percent, 5 percent, and 10 percent, respectively.

Al Ghawar field is meeting 6 percent of the global oil demand, but its production is decreasing at the rate of 8 percent per year. It was discovered in the early 1950s with reserves of 87 billion barrels of oil. In the 1970s, USA oil companies estimated that there were still 60 billion barrels left. However, the Al Ghawar field has produced 55 billion barrels, suggesting that there might not be much oil left. Most of the Al Ghawar production is from its northern part with its central and southern parts containing lower grade and hard to extract more viscous oil. The Saudi Arabian Aramco national oil company engineers report that the Al Ghawar's water content is 30-50 percent. Oil wells that hold 40 percent of water are considered as declining since the natural pressure of the reservoir forces the oil to the ground surface, and water is injected into it to keep the pressure up. Al Ghawar's decline rate is estimated at 8 percent suggesting a depletion process. About 10 million barrels of oil are pumped from Al Ghawar per day, along with 3 million barrels of water per day, undermining the structural integrity of the field. To remedy the situation, 7 million barrels of sea water are injected back into the field per day. The Al Ghawar oil field is basic to Saudi Arabian oil production. Saudi Arabian oil production in turn supports world production, which could be on the verge of a decline.

The Al Ghawar field is surrounded by other untapped smaller fields that soon will have to be exploited. The situation is that production of this giant field has peaked. To increase its production, Saudi Arabia tripled the number of oil rigs in use since 2001, but this did not lead to any increase in production and just helped maintain the present rate of production. It appears that the ultimate production capacity of Saudi Arabia is 12 million barrels per day. If more water is pumped into aging oil fields to increase the production further, this would create the risk of permanent damage to the reservoirs. Matthew Simmons, an oil industry investment banker was quoted as saying: "If Saudi Arabia has damaged their fields, accidentally or not, by overproducing them, then we may have already passed Peak Oil."

Mexico's overall oil output fell to just below 3 million barrels per day (bpd) in December 2005, down from almost 3.4 million barrels at the start of the year, the lowest rate of oil output since 2000. Some experts predict that Cantarell, named after the Mexican fisherman who complained in the 1970s about its oil seeps fouling his nets 50 miles offshore in 150 feet shallow water, is the world's second largest oil field holding about 20 billion barrels of oil. From 1980-1995 it produced about 1 million barrels per day (bpd). Its output peaked with nitrogen injection to increase its pressure around 2004 at 2.1 million barrels per day and dropped to 1.74 million barrels per day in 2007. The Cantarell oil field's output decreased from 1.74 mbpd in 2007 to 1 mbpd in 2008. The annual decline rate is about 28 percent. The national oil company, Petroleos Mexicanos or Pemex, might try increase output by 200,000 barrels a day at other fields, leaving the country with a net decline of 400,000 barrels per day (bpd) by 2007 end and daily exports of less than 1.4 million barrels. Forecasts from the Mexican government are for 0.52 million bpd by 2008. Mexico's proven oil reserves are expected to last only about 10 years as of 2007 at the current rates of production. Cantarell, in the shallow Gulf waters off the shore of Mexico's southern Campeche state, is a prolific giant field that is past its prime. Monthly production peaked in late 2004 at just over 2.1 million barrels a day and has fallen more than 28.5 percent since then. Experts agree it has nowhere to go but down. Its proven reserves have tumbled by more than one

third since 2000. Cantarell's output is declining at a 14 percent per year rate, with a projection that Mexico will stop being an oil exporter by 2012. Mexico's oil exports to the USA are expected to fall from 1.5 million bpd to 0.5 million bpd, with the possibility that Mexico may stop oil export to satisfy its own demand unless new oil fields are discovered in the deep waters of the Gulf of Mexico and in the Veracruz state.

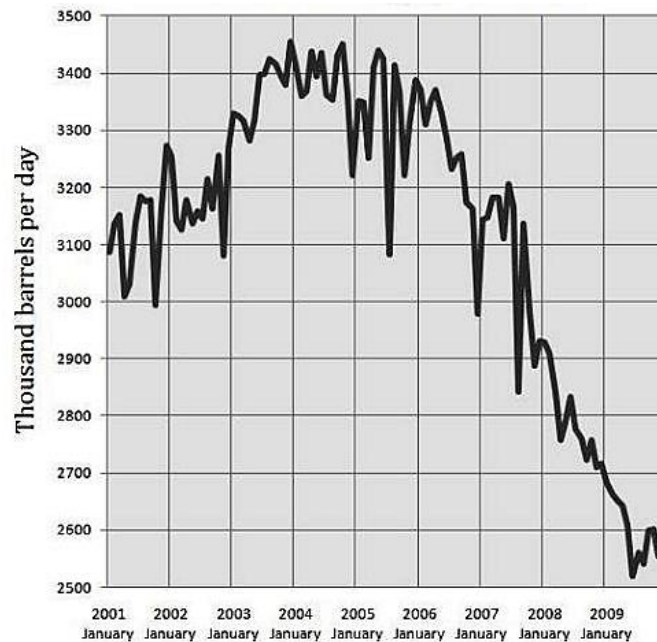


Figure 10. Depletion of Mexican oil production.

Kuwait has the world's third largest oil deposit in the Burgan field. Statements that the field could produce 2 million barrels/day were modified to suggest only 1.7 million barrels/day, implying an aging deposit.

In addition, Russia's surge in production from its aged oil fields has reached its saturation level. Russia temporarily surpassed Saudi Arabia at 18 percent in 2006 in producing 19 percent of the world's oil and gas supplies. It produced 9.23 million barrels of oil per day compared with Saudi Arabia at 9.19 million barrels per day. The Russian oil output over the period 1995-2005 increased by 50 percent. This resulted from using new technologies for secondary recovery from aged oil fields. In 2005, the growth stalled, and the Russian oil fields are back declining in production at a rate of 5-10 percent per year. In 2007, Russia used a research diving submersible to set its flag two and a half miles below the surface of the Arctic Ocean at the North Pole, claiming it as territorial waters. What it is eyeing is that with global climatic change, the arctic is expected to melt from ice into open water making its estimated 20 percent of the world's hydrocarbons supplies accessible for exploitation. Other countries including Canada, the USA and Iceland promptly objected to the action, seeding the seeds of future conflicts.

The UK's resources in the North Sea are rapidly depleting. Norway's production from the North Sea fell from 2.2 million barrels per day 10 years ago to 1.0 million barrels per day.

Iran's oil production has peaked and is set to decline. This was foreseen in the 1970s at the time of the Shah Reza Pahlawi: "Petroleum is a noble material, much too valuable to burn." Iran pursued what its leaders consider as a visionary attempt at introducing nuclear energy as an

eventual replacement to oil, to ensure its energy supplies into the future. In 1975 the National Security Decision Memorandum 292 was signed between Iran and the USA Secretary of State Henry Kissinger defining the terms of collaboration between the USA and Iran in the field of nuclear energy. Dr. Ali Morteza Samsam Bakhtiari a previous senior employee of the National Iranian Oil Company is quoted to say: "As for Iran, the usually accepted official 132 billion barrels (reserves) is almost 100 billion barrels over any realistic assay." Iran is not able to increase its production of 3-3.5 million barrels per day for lack of infrastructure caused by sanctions for its nuclear program. A confrontation about it with the USA and Israel is in the making with 150,000 USA troops in Iraq, 50,000 in Afghanistan, and the aircraft carriers USS Enterprise, and the USS Iwo Jima as naval Expeditionary Strike Groups intermittently deployed in the Arabian Sea and the Persian Gulf. Rumors abound that air strikes against its nuclear facilities, infrastructure and manpower are in the advanced planning stages awaiting suitable circumstances for execution, leading to an unstable situation threatening the world oil supplies as a consequence.

China imports 3.5 million barrels a day. The USA imports 12.2 million barrels per day for a population that is less than 1/4 the size of China's. China has a challenging task of managing the production decline underway at Daqing, one of the older giant oil fields in the world. This field began producing oil in the early 1960s and produced at a rate of 915,000 barrels per day in 2005, below its 1.134 million barrels per day level in 1998. This is pushing China to seek foreign sources of petroleum such as the acquisition of Petro China of a \$2.7 billion 67 percent share in Petro Kazakhstan in 2006.

Indonesia's need for energy has turned it from an oil exporter to an importer.

The USA Energy Information Administration (EIA) estimates that global demand for oil will reach 98 million barrels per day by 2015. Estimates are that the yearly world's oil use is growing at the rate of 2 million bpd, whereas oil production is falling every year at the rate of 4 million bpd; necessitating a need for alternative sources of energy to compensate for the equivalent of 6 million bpd.

7.8 GLOBAL ENERGY USAGE

According to International Energy Agency (IEA) as of October 2004, the world daily oil supply was 83.4 million barrels exceeding demand at 82.4 million barrels; a comfortable situation. On the other hand as of October 2006, it was demand at 86.0 million barrels that exceeded supply at 85.4 million barrels. Energy, as well as food is shared by a growing world population that is adding 130 million new people per year.

Fossil fuels as coal, oil and natural gas provides 86 percent of the USA's total energy supply. Nuclear energy provides 8 percent of total energy but 19 percent of electricity production. Renewable energy sources are about 3 percent of the total USA energy supply (Table 6). Interestingly, about 2/3 of the renewable energy is accounted for by the forest companies burning wood chips to run their lumber mills.

The USA around 2005 depended on oil for 41 percent of its energy production and on coal for 52 percent of its electricity production. About 37 percent of the energy output is used to produce electricity, and this figure is expected to rise to 40 percent at the end of the decade. In 2003 the USA produced 3.5 trillion kiloWatt.hours (kW.hrs) of electricity; ahead of any other economy in the world. The majority of electricity was coal generated at 52 percent, followed by nuclear energy at 19 percent.

For comparison, France around 1975 used fossil fuels to generate 80 percent of its electricity. It relied on fission nuclear energy as of 2004 to generate 77.68 percent of its electrical generation.

At the present rate of consumption, the USA has the equivalent of 250 years of coal supplies. An increase in the consumption rate would significantly decrease this period. From 2005 to 2007, the worldwide consumption of coal increased by 35 percent. Italy is increasing its reliance on coal from 14 percent to 33 percent. There is a new coal fired power plant going on line in India or China almost every week. In early 2007, regulators received 151 coal plants proposals, of which 60 were scrapped over pollution concerns.

Both coal and oil are fossil fuels that have been stored over millions of years in biological matter of solar nuclear fusion origin. These fossil fuels are being used at an increasing rate threatening them with depletion, according to the pessimistic view of the geologists. Not so, object the optimist economists who suggest that market dynamic forces and demand will create new supplies through new extraction technologies and replacement with alternative energy sources.

Table 6. Percent share of energy sources for energy and electricity production, 2005.

Resource	Energy production share [percent] USA	Electrical energy production share [percent] USA	Electrical energy production share [percent] World
Oil	41	3	10
Coal	23	52	39
Natural gas	22	15	15
Hydroelectric	3	9	19
Nuclear	8	19	16
Other renewables	3	2	1

In a remarkable process of division of labor, geologists and physicists find sources of energy, engineers develop and use them, and economists and bankers finance and manage them. Economists like to point out that higher energy prices would create a virtual available supply through reduced demand and conservation, as well as a real supply through enhanced exploration and discovery. They argue that regional production may reflect resource scarcity, but global production is driven by demand, and the declining demand growth since the energy price shocks in the early 1970s is evidence of greater efficiency and fuel switching, not scarcity. They suggest that geology is not the driving factor in energy availability, but demand and market forces instead.

The opinions of the economists are countered by the geologists, physicists and engineers with the suggestion that at some point the laws of economics are challenged by the laws of physics and nature, particularly in the case of a limited resource as shown in Table 7.

Table 7. Economical and geological perspectives regarding global oil resources.

Economics	Geology
“The Stone Age did not end for lack of stone, and the Oil Age will end long before the world runs out of oil,” Sheikh Zaki Al Yamani, Saudi Arabia’s oil minister, The Economist, “The End of the Oil Age,” October 23, 2003.	A global peak in oil production is predicted.
The market system provides incentives to expand and redefine resources.	The peaking production, not running out of the supply, is what matters.
The rate of technological progress will exceed the rate of depletion.	The new discoveries lag production.
Economics, dynamic supply and demand rule the process.	Geological structures and available extraction and production technologies rule.

An attempt at reconciling the two arguments can be tried by admitting that sustainability implies that raw materials should be priced as their being depletable and irreplaceable. Since petroleum, for instance is depletable, it is inconceivable that it would be forever priced at the marginal cost of producing a marginal barrel from an undepletable oil reservoir of an unlimited size, as has been the case in the preceding 100 years of petroleum production. Such an approach would lead to an exponential growth in the consumption rate depleting the resource within a limited time frame, irrespective of its original size. To assure sustainable production of petroleum for the petrochemical and fertilizer industries, the real cost should be considered as the *replacement cost* and not the *marginal cost* of production.

7.9 NATURAL GAS RESOURCES

INTRODUCTION

The USA Energy Information Administration (EIA) expects natural gas consumption to increase more than 20 percent over the next few decades. Natural gas for electric power generation is expected to rise by more than 60 percent due to its favorable profile as a low particulate, clean burning fossil fuel. However, the USA domestic production growth over the last 10 years has come at an annualized rate of under 1 percent. According to Matt Simmons: “Using natural gas for electricity turned out to be an unbelievably stupid decision. Using electricity for heat was equally stupid. Natural gas should be refined to one use and one use only, and that’s creating instantaneous and high-efficiency heat.”

PRODUCTION

The Greeks reported about the “burning springs” of natural gas as far back as 1000 BC but they did not come up with a commercial use for it.

The Chinese built a natural gas pipeline transport system out of bamboo poles. Chinese merchants used the gas to heat and evaporate seawater and harvest the valuable salt left behind

for trade. Confucius documented the existence of natural gas aquifers and bamboo pipelines circa 600 BC.

Around 100 AD, the King of Persia used natural gas in his kitchens. Rather than bring the gas to his stoves, he had his royal kitchens built in close proximity to a gas spring, where the seepage fueled a continuous hot flame.

By the late 18th century, the UK was using manufactured gas produced from coal to light houses and street lights. The city of Baltimore in the USA was one of the first American cities to be lit this way in 1816. In 1821, the gunsmith William Hart dug the first designated natural gas well in Fredonia, New York. Hart, regarded by many as the Father of American natural gas, later founded the Fredonia Gas Light Company.

One of the key commercial developments for natural gas was the Bunsen burner, conceived by German scientist Robert Bunsen in 1885. Bunsen's regulated mix of gas and air offered a convenient way to control the flame, and thus greatly increased the safety and precision of its use.

In the USA, existing wells are being depleted faster than new wells can be developed. The average natural gas well in North America is experiencing an accelerated decline rate with the average well posting a 30 percent production decline rate.

A nearly 50 percent increase in the number of producing natural gas wells has not helped as the yield per well continues to decline.

Even though the USA still has untapped gas reserves, most of those reserves are politically restricted, too hard to access or otherwise off limits for various reasons. As with crude oil refineries, natural gas is an industry in which the politics of Not In My Own Backyard (Nimby) and Build Absolutely Nothing Anywhere Near Anybody (Banana), sometimes apply.

Alaska has significant quantities of natural gas, but building a pipeline to the lower 48 states would be quite expensive, even though it may become a future necessary alternative.

LIQUEFIED NATURAL GAS, LNG

Most of the world's natural gas reserves are located far from the major population centers. When gas is too expensive to transport by pipeline, it is designated as "stranded" natural gas. To get stranded gas to market is to cryogenically cool it until it reaches a liquid state and transport it on ships designed to carry LNG.

For decades, LNG has not been cost competitive with oil and coal. But continually rising oil prices are heightening the sense of urgency to develop a tradable LNG market.

Imported Liquefied Natural Gas (LNG) holds significant potential and meets only 3 percent of the current USA energy needs. LNG demand could more than triple, to 500 million metric tons a year, in 2030, from 150 million metric tons a year today. About 20 percent of gas consumed in North America could be imported by then. Building enough LNG terminals poses a challenge: in the event of an accident, an exploding LNG tanker at a port facility could produce a fireball intense enough to incinerate a circle of 1/3 of a mile in radius around it. For this reason, the Exxon oil company plans to build a LNG regasification terminal 20 miles off the coast of New Jersey.

In 2008 less than 90 million tonnes of natural gas were shipped globally. This is the equivalent of about 780 million barrels of oil, at less than 10 days of world oil consumption.

Six liquefaction plants would come on line by the end of 2009 to nearly double global LNG production. The massive Sakhalin II project off the coast of Eastern Russia is supplying

the Japan market. An expansion of a liquefaction plant in Indonesia is underway. QatarGas' liquefaction facilities in Qatar are bringing an additional 24 million tonnes of LNG on the market, nearly a 30 percent increase in LNG supply.

Japan relies on LNG for 97 percent of its gas and South Korea relies on it for 100 percent. Japan consumed 39 percent of the world's LNG supply in 2006. South Korea came in second, at 16 percent. Both countries have a significant stake in LNG, so they will keep expanding their LNG regasification and storage infrastructure.

The cost to produce and distribute LNG is so high that to make LNG work in any kind of financial reality, one needs a 25-30 years guaranteed supply to amortize the cryogenic liquefaction, transportation and regasification infrastructure. For a spot supply, it must be written off over 30 years. This will need \$40 per million BTU to make the economics meaningful.

An energy penalty exists in the use of LNG in that about 35 percent of the hydrocarbon energy content gets used up in the process of cryogenically freezing natural gas, transporting it, and then reheating the liquid into a gas.

NATURAL GAS PROSPECTS

In a testimony to Congress in October 2004, Cambridge Energy Research associates (CERA) chairperson Daniel Yergin described the natural gas situation in the USA:

“The reason we are in a crisis is not that demand has surged, it is that supplies are stagnant. In the Lower 49 United States, we have not been able to increase gas production for a decade.”

“There is strong evidence that simply adding more drilling rigs will not solve the problem, as it has in previous decades. North American natural gas productive capacity is not expected to grow meaningfully, and USA gas productive capacity, like oil, is now in permanent decline.”

“At the same time, North America is set for a large increase in gas demand to fire electric power plants. In recent years, almost 200,000 megawatts of gas fired power plants have been installed, equal to one fourth of the country's total installed capacity in 2000. With these plants in place, demand for natural gas will grow steadily as economic growth inevitably pushes their usage higher. With supplies unable to grow in the near term, power demand is squeezing price sensitive industrial demand out of the market, with negative consequences for competition and employment in gas-intensive industries in the USA and Canada.”

7.10 FIGURES OF MERIT FOR SUSTAINABLE ENERGY SYSTEMS, ENERGY BREAK-EVEN CONDITION

A fundamental insight is that the dynamic which effectively drives the economy, which usually is regarded as a monetary construct, is thermodynamics. In fact in the final analysis, the economy is principally an energy system. The critical supply of surplus energy driving the world economy has been in decline for at least three decades and is expected to decline further unless new technologies for extracting energy are introduced. The Energy Return on Energy Invested (EROEI) decline is associated in a non-linear fashion with an increase in the cost of energy as a percent of Gross domestic Product (GDP).

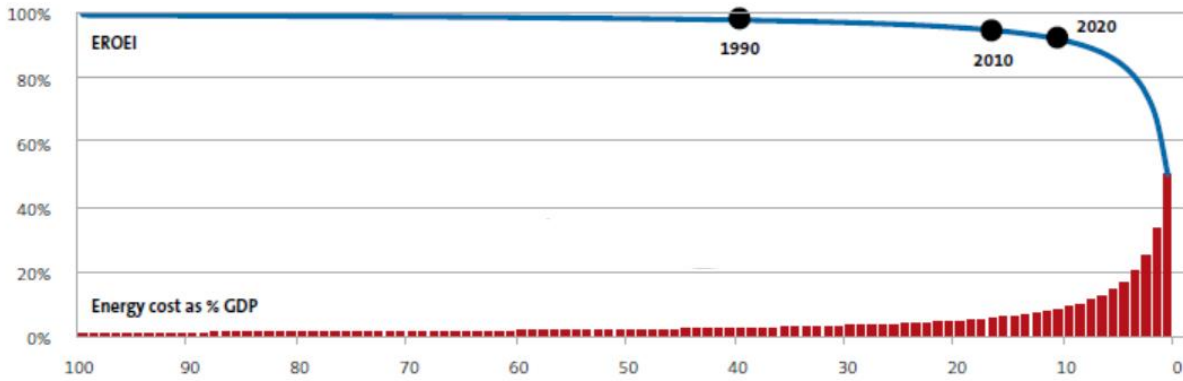


Figure 11. The Energy Return on Energy Invested (EROEI) decline is associated with an increase in the cost of energy as a percent of Gross Domestic Product (GDP).

Three figures of merit are used by economists for the assessment of the sustainability and viability of energy systems.

In the Return On Investment (ROI) figure of merit, the assessment is performed in monetary units such as dollars per unit of energy produced and dollars per unit of energy sold. As an example, if an oil well produces enough oil that could be sold at a price per unit of energy produced that is sufficient to cover its cost of production, with some profit achieved, then the ROI is positive. Some oil may cost more to produce than the current price obtained from selling it. Economists suggest that the production of this oil can only be justified if its price rises sufficiently so as to exceed its cost of production.

Alternatively, for the Energy Return On Energy Invested (EROEI) figure of merit, the accounting is performed in terms of energy units. It is also referred to as the EROI for Energy Return on Invested. Energy is invested in the production of any form of energy or food source. Energy is required to explore for oil, drill a well, pump the oil, transport it in a pipeline or in tanker, refine it and then distribute it to the consumers. This energy investment E_{in} should be subtracted from the energy output E_{out} obtained from using the produced oil. The ratio of the difference between the energy output E_{out} and energy input E_{in} is divided into the energy input E_{in} to obtain a dimensionless figure of merit. If the difference between E_{out} and E_{in} is positive, the EROEI is larger than zero. The production of any energy source becomes unsustainable if the EROEI value is negative. Oil wells may still be drilled and pumped in this case. This would require that the produced oil should preferably be used for producing high value-added products such as fertilizers or petrochemicals, not for direct energy production in transport or heating so as to make its ROI figure of merit positive.

The figures of merit or criteria for the sustainability of a given energy system could thus be advanced in terms of economics by the price and costs of a product as:

$$ROI = \frac{\text{Price of product (\$) per unit energy} - \text{Cost of production (\$) per unit energy}}{\text{Cost of production (\$) per unit energy}} > 0 \quad (1)$$

After all, economist Hyman Minsky said: “Money is not everything. It is the only thing.” According to Robin Mills, with Manaar Energy and earlier petroleum manager for the Emirates national oil company in Dubai:

“Generating electricity, usually at a thermal conversion efficiency of less than 50 percent plus transmission losses, has an EROEI of much less than 1, but is still rational and economic because electricity is such a useful form of energy.”

From a different perspective, a figure of merit depending on energy inputs and outputs is the EROEI:

$$\text{EROEI} = \frac{E_{\text{out}} - E_{\text{in}}}{E_{\text{in}}} = \frac{E_{\text{out}}}{E_{\text{in}}} - 1 = \frac{\Delta E}{E_{\text{in}}} > 0 \quad (2)$$

Interestingly, the ROI and EROEI (EROI) are ratios mathematically, so they cannot go negative, cannot be equal to zero, but could go below unity. One can venture saying a society that falls into the EROEI equal to unity or less area becomes unsustainable, heading towards bankruptcy, and eventual societal and economic collapse. It could survive only temporarily through the creation of virtual debt assets to cover its negative cash flow.

The second relationship implies that the ratio of net energy output to energy input must be larger than unity, leading to the energy breakeven condition:

$$\frac{E_{\text{out}}}{E_{\text{in}}} > 1, \text{ or: } E_{\text{out}} > E_{\text{in}}$$

which also expresses the intuitive simple notion that the energy output E_{out} must exceed the energy input E_{in} .

A third figure of merit can be defined as the Energy Return Per Unit Energy Output (ERPUEO):

$$\text{ERPUEO} = \frac{E_{\text{out}} - E_{\text{in}}}{E_{\text{out}}} = 1 - \frac{E_{\text{in}}}{E_{\text{out}}} = \frac{\Delta E}{E_{\text{out}}} > 0 \quad (3)$$

This implies again the energy breakeven condition:

$$1 - \frac{E_{\text{in}}}{E_{\text{out}}} > 0, \text{ or: } 1 > \frac{E_{\text{in}}}{E_{\text{out}}}, E_{\text{out}} > E_{\text{in}}$$

which again expresses the breakeven notion that the energy output E_{out} must exceed the energy input E_{in} .

An EROEI of 200 was reported with some oil wells about 50 years ago. Middle Eastern oil wells have a value of 30. Oil wells in deep water achieve an EROEI of less than 5. Oil as an

energy source would be reaching its unsustainable stage if its ROI, EROEI and ERPUEO become zero or negative. As President Ronald Reagan asserted: “There is no such thing as a free lunch.”

For comparison, the EROEI for different sources of energy are reported as: Hydroelectric 40, Photo-Voltaic 10-28, Wind 6-20, Natural gas 6-25, Coal 15-60, and Nuclear 15-60. It is unsustainable for the USA to use 10 percent of arable land to produce ethanol from corn at a less than unity return EROEI of $1/1.4 = 0.71$.

Richard Manning states: “A couple of generations ago we spent a lot less energy drilling, pumping, and distributing than we do now. In the 1940s we got about 100 barrels of oil back for every barrel of oil we spent getting it. Today each barrel invested in the process returns only ten, a calculation that no doubt fails to include the fuel burned by the Hummers and Blackhawks we use to maintain access to the oil in Iraq.” The corn being diverted into ethanol in the USA could feed as many as 40 million people worldwide for up to a year.

Driven by government biofuel mandates on oil refineries, USA farmers converted about 1.3 million acres of grassland into corn and soybean fields between 2006-2011. This pasture destruction led to higher beef and milk prices, as well as environmental harm including groundwater contamination by fertilizers and pesticides. Grassland soil captures carbon better than cropland. If USA farmers are converting these grasslands into conventional crops production, ethanol production loses its carbon advantage over gasoline.

The EROI value for petroleum and gas production has been declining since the early 1930's. In 1930, the oil and gas industry could produce 100 barrels of oil for every barrel of energy cost. By 1970, production fell to a ratio of 30 to 1, and by 2000 it reached at 11 to 1. As the net energy produced declines, this translates into the incurred costs and subsequently the asked prices to rise throughout the world's economy [32-34].

The EROI in 1970 of the USA oil and gas industry being 30 to 1 means that it took the energy of one barrel of petroleum to produce 30 barrels of petroleum for the market. By 2014 the EROI ratio is down to 10 to 1. The USA domestic Shale oil industry has a 5 to 1 EROI. Oil shale in the western part of the USA with an estimated resource of over 1 trillion barrels has an EROI of 1.5-2 to 1 is considered as a nice joke shared among oil geologists and engineers. Pre-industrial farming methods depending on manual and animal labor provide between 1-10 calories of energy (food) for every calorie of energy consumed in planting and harvesting suggesting an EROI of 1 - 10. On the other hand, modern energy intensive food production industry, depending on chemical fertilizers, herbicides, fungicides, pesticides, and planting and harvesting consumes a staggering 10-16 calories of energy for every calorie of energy delivered to the market, yielding an EROI of just 0.10 – 0.625. Scholars pointing out such unsustainability include Professors Kent Klitgaard of Wells College and Charles Hall of the SUNY College of Environmental Science and Forestry. They consider this mishandling of resources the “Trojan horse of our times.”

7.11 CANADIAN TAR SANDS SUSTAINABILITY

INTRODUCTION

The tar sands of Canada, referred to by some as oil sands, are an extensive deposit of oil rich bitumen located in the northern Alberta province, with extensions into the adjacent province of Saskatchewan. The tar sands consist of a mixture of crude bitumen, which is a semi solid form of crude oil, where the hydrocarbons are primarily carbon and less hydrogen that impregnates

rocks that are composed primarily of sand and clay. The bitumen is almost entirely immobile within the rock matrix, and does not flow into a well bore like conventional crude oil.

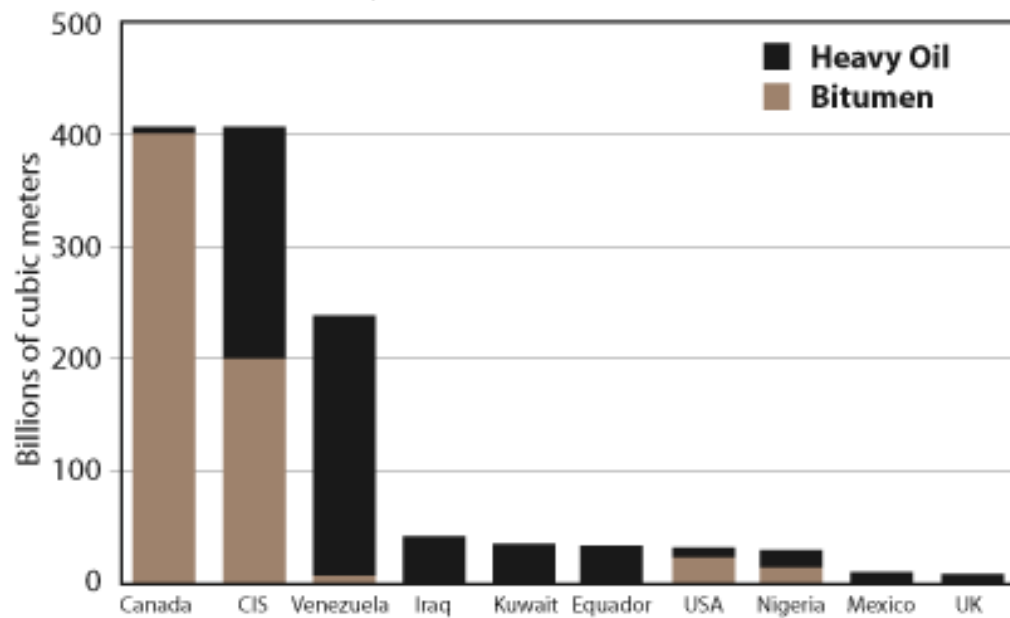


Figure 12. Heavy oil and bitumen resources.



Figure 13. Tar sands mining operations.



Figure 14. Strip mining of bitumen sands, Alberta, Canada. Source: Suncor Company.

During the geological Pleistocene period, glaciers covered North Alberta in some places to a depth of 1 mile. During warm up period these glaciers melted forming large dammed lakes which would eventually collapse sending a large amount of water downstream scouring up the rock covering lower Cretaceous period oil deposits that have lost their volatile components hence they are called “bitumen.”

The largest deposit in Alberta is called the Athabasca tar sands. Two other smaller bodies are known as the Peace River and Cold Lake deposits. These tar sand deposits cover about 140,000 km² or about 54,000 mile². This is an area about the size of the state of Florida in the USA. The region is a sparsely populated boreal forest and peat bogs.

The Athabasca tar sands are named after the Athabasca River, which runs through the heart of the eponymous deposit. The resource base is estimated at 1.4 trillion barrels of bitumen of which 175 billion barrels are considered as recoverable reserves. This is about 8 times the USA petroleum reserves. Twenty percent of the recoverable reserves or 35 billion barrels are within 250 feet near the surface and can be strip mined. Traces of tar and heavy oil have been found along the riverbanks since ancient times. As the Seneca Indians of Pennsylvania and New York, who extracted oil from seeps long before Colonel Drake ever set foot in the region, the Cree and Dene tribes water proofed their canoes bottoms using the Alberta bitumen. The first record of the tar sands being noted by the early European explorers dates back to 1788. It has the consistency of peanut butter and flow in warm weather but becomes hard when cold.

Another important oil sands deposit is the Orinoco field in Venezuela which produces a modest 600,000 barrels per day at a cost of \$20 per barrel which is economical but well in excess of the cost of Saudi Arabian or even Mexican offshore oil. Its importance stems from the size of its reserves which have been estimated at 1.2–1.8 trillion barrels of oil. At the latter figure, the Orinoco deposit represents 34 percent of all known world oil reserves, and 58 years of world oil consumption at the current levels of consumption. Current estimates are that only around 1/5 of these sands can be economically exploited.

LIQUIDS EXTRACTION FROM TAR SANDS

The Athabasca tar sands deposit is shallow enough to be suitable for surface strip mining. About 10 percent of the Athabasca tar sands are covered with less than 75 meters or about 250 feet of overburden. The area accessible to strip mining covers about 3,400 km² or about 1,300 mile² north of the city of Fort McMurray. The overburden consists of 1-3 meters or 3-10 feet of water logged muskeg on top of up to 75 meters or 250 feet of clay and barren sand. The extractable pay zone is typically 40-60 meters thick or about 200 feet in thickness and lies above a flat limestone bed.

The first tar sands strip mine was started by the Great Canadian Oil Sands Company later called Suncor in 1967. The Syncrude mine, among the largest mines in the world, followed in 1978. The Albion Sands mine, operated by the Shell Canada Company, opened in 2003. These three strip mines are associated with massive handling and processing systems that mine the rock with giant earth moving equipment and hauling trucks. The mined rock is hauled to a facility that upgrades the material and converts the otherwise almost unusable bitumen into synthetic crude oil for shipment to refineries in Canada and the USA. More such mines and facilities are in the planning stage and coming on line.

Large mechanical shovels scoop large volumes of bitumen sand into big loaders that haul the rock to a crusher. The crushed rock then goes to a washing bin where the bitumen is washed off the sand using naphtha. The bitumen is recovered and the naphtha is reused. The sand is dumped back in the mined pits. The process uses large amounts of water that is recycled about 18 times. It also uses a large amount of energy as natural gas.

DELIVERABILITY ISSUES

David Hughes, a geologist from the Geological Survey of Canada (GSC) describes the tar sands as: "Great White Hope of a panacea to support business as usual" in the world of increasing energy consumption based on depleting conventional oil reserves. He suggests that: "Forecasts do not live up to the hype."

The figures quoted for reserve and resource calculations, reach as high as 300 billion barrels of oil equivalent (boe), are comforting, yet meaningless when it comes to offsetting declines in conventional oil production; the difficulty being in their lack of deliverability.

Tar sands are a complex resource, requiring much time, energy, capital, and other inputs to achieve deliverability. Even though they constitute a significant hydrocarbon resource, there is a doubt about whether they are ultimately deliverable as a usable end product, at a total affordable price. The deliverability of tar sands as a liquid hydrocarbon involves some unresolved difficult issues.

LEAD TIMES, CAPITAL INVESTMENT

The tar sands are not expected to significantly offset the impending decline in world oil production, because of the long lead times and massive capital investment required. Even under the best and most optimistic of scenarios, Canadian tar sands might yield about 3 million barrels per day (bpd) of product by 2025, or about 2.5 percent of the forecast world demand of 120 million bpd by the International Energy Agency (IEA).

ENERGY INPUT

Production of liquid oil from the tar sands is an energy intensive process. For 2025 the energy input will require between 1.6-2.3 billion cubic feet (bcf) of natural gas per day, approximately equal to the planned maximum capacity of the proposed Mackenzie Valley gas pipeline of 1.9 bcf per day out of northern Canada, or about 1/5 of anticipated daily Canadian gas production.

Pipelines or otherwise, the energy requirements of the projects planned for tar sands development already exceed the amount of available natural gas from the entire Mackenzie River project. Estimates for natural gas usage in tar sands operations by 2015 exceed the projections for available amounts of natural gas.

Using natural gas for tar sands development creates a political issue for Canada due to its obligations under the North American Free Trade Agreement (NAFTA). If Canada uses natural gas for tar sands development, it will have less gas available for export to the USA. Under the terms of NAFTA, Canada cannot reduce natural gas exports to the USA unless it also reduces natural gas consumption within Canada. There may be a domestic Canadian political issue wrapped into the process.

The expansion of Canadian tar sands capacity is limited by the natural gas supply, and indirectly by the price of natural gas, which will drive the economics of expansion and continued use of the tar sands resource.

A solution to the natural gas limitation would be to develop non thermal processing technology or to switch to alternate fuels for the tar sand process heat required. These types of alternate solutions are not even on the drawing boards, and hence are highly speculative.

Some examples of alternate energy sources are burning the bitumen that is extracted from the tar sands, or using coal bed methane. Each technique will require its own rather extensive industrial infrastructure. In addition, these energy sources emit relatively higher levels of greenhouse gases than natural gas, so Canada will face international criticism, if not other sanctions, over higher CO₂ emissions.

There is a proposal to build nuclear power plants in Alberta to provide process heat or other required energy input, provided that a source of water for cooling the power plants is available.

WATER RESOURCES DEPLETION

A limitation on tar sands expansion is that the processing capacity is limited by the available water supply. Much water is already being recycled using current technology, but current production techniques require 1-2 barrels of makeup water per barrel of product.

Surface water flows from the Athabasca River, are simply inadequate to meet the forecast needs. Deeper water from underground aquifers is brackish and must be diluted with fresh water or otherwise desalted.

Significant amounts of water are currently being discarded into settlement ponds, in which it may take 200 years for the smallest particles to settle down to the bottom. The water is toxic, and mixed with high levels of heavy metals. Some of these impoundment ponds cover many miles in area, and will pose an environmental problem or hazard for many centuries.

DILUENT AND TRANSPORT ISSUES

Assuming that there will be sufficient energy and water to utilize in tar sands operations, any expansion of bitumen export capacity from Alberta may be limited by projected shortfalls of a suitable diluent.

Bitumen is thick, heavy, and viscous. It will not flow, and cannot be moved through a pipeline unless it is diluted with a lighter medium, or diluent. The best types of diluents are natural gas condensates, but these are becoming rapidly scarce due to the depletion of gas reserves. The tar sand bitumen needs a 1/3 blend of condensates or a 1/2 blend of synthetic light oil to reduce its viscosity and allow it to be pumped through a pipeline.

The Enbridge Company is considering the importation of 150,000-200,000 barrels per day of condensate or light oil, to re-export it as a diluent in pipeline operations. The projected cost exceeds \$4 billion per year. Without importing a diluent to the Alberta region, it will be necessary to upgrade the bitumen on site to a synthetic grade and use it for that purpose. This will require additional capital investment and cost. The pipeline that Enbridge is proposing to construct will run from the tar sands region to the Pacific Ocean coast and supply the product for export to overseas markets such as Japan and China

PIPELINE LIMITATION

The existing pipeline system in the Alberta region is inadequate to support the anticipated exports of bitumen, let alone the possible imports of significant quantities of diluent. Thus, the region will require a new pipeline capacity of about 1 million barrels per day.

The existing Alberta pipeline system will be at maximum capacity by mid 2008. Proposed expansions are intended to accommodate product movement, but these expansions will be fully utilized by 2009-2011. There are no announced plans for pipeline capacity expansion after 2011. Absent further expansion of the pipeline system, by 2011, there will be a limit of about 3.5 million barrels per day on product movement. This includes the diluent coming in and product moving out.

CAPITAL COSTS

Construction and expansion activities in support of tar sands development in Alberta are competing in a world market for materials, equipment, and human labor. This includes steel and cement, complex industrial equipment, engineering talent and field labor. Some firms are flying welders into the region from as far away as Nova Scotia, and there is a serious housing shortage in the tar sands region.

As with energy development projects in the world, cost overruns in the tar sands region are dominant. Every major project has seen major cost overruns. Petro Canada has put its Fort Hills project on hold until 2008 due to cost estimates ballooning to the range of \$19 billion, or over \$130,000 per barrel per day of capacity. Shell Canada has also scaled back expansion plans due to the cost estimates more than doubling.

One alternative to massive build outs of facilities in high cost Alberta, proposed by EnCana and Conoco Phillips, is to export non upgraded bitumen to the USA, but still at a capital cost of \$35,000 per barrel per day for infrastructure. There are no USA refineries currently capable of processing this bitumen material; hence the capital cost for the upgrade will have to be incurred in the USA.

Estimates for capital investment over the next 20 years in tar sands production in the Alberta region are estimated as 120-220 billion dollars. The trend in cost overruns suggests a maximum production of 2.5 million bpd of bitumen by 2020, unless much of the bitumen is exported and the upgrading facilities are built elsewhere. In the latter case, the estimated maximum bitumen production could be 2.8 million bpd by 2020.

For all of the cost of infrastructure and facilities, the strip mining operations for tar sands will peak in about 30 years, and play out quite rapidly thereafter because of the anticipated scale of ongoing operations between now and then. Afterwards, the bulk of oil recovery operations will be through in situ operations, at a lower efficiency of recovery.

ENERGY BREAK-EVEN

The Energy Return On Investment (EROI) for tar sands exploitation is extremely low, on the order of 5-10 percent. The development is occurring, but the long-term costs and tradeoffs are questionable. By investing in one form of development with a low EROI, the North American energy industry is failing to invest in better alternatives such as wind power and nuclear energy.

DISCUSSION

The critical issues for the development of the Canadian tar sands include large capital costs, lengthy lead times to build, constraints on natural gas and water supplies, the need for large volumes of pipeline diluents, Canadian domestic and international politics, and environmental degradation. Under the best of scenarios, Canada will have 2.5-2.8 million bpd of bitumen production, certainly not all of which will be available for export to the USA through pipelines that are not yet built.

Public perception in many energy quarters is that the Canadian tar sands will be fueling the USA transportation needs. This perception does not match the reality of what is going on out in the field.

7.12 SUSTAINABILITY OF THE METHANOL TO CORN TO ETHANOL SYSTEM

INTRODUCTION

A legally required notice at USA gasoline station is: "Product may contain up to 10 percent ethanol." By mandating ethanol in motor fuel, the USA government has merged the global food supply with the world's energy supply. The global population reached the 7 billion mark, with about 200,000 net new births every day. Across the world, grain consumption is growing by about 40 million tons per year. Meanwhile, the USA devotes about 40 percent of its annual corn crop to alcohol for fuel, and in fact devotes more corn to ethanol than to food and/or cattle feed.

In 2012, USA automobile drivers consumed about 133 billion gallons of gasoline, or about 3.17 billion barrels. The 10 percent ethanol requirement translates into about 13.3 billion gallons of grain alcohol, which is about 317 million barrels.

A supertanker such as an Ultra Large Crude Carrier (ULCC) is 1,000 feet in length, 250 feet in width, with a draft of 40 feet. An ULCC is larger than an aircraft carrier and hauls about 2 million barrels of product. For 3.17 billion barrels of ethanol, a fleet of 1,585 ULCC vessels is needed. There exist only 175 ULCC tankers in the world. Lined up, 1,585 ULCC tankers would stretch about 300 miles. For the 317 million barrels of ethanol, 158.5 loads of ULCC vessels are needed, stretching 30 miles in length.

THE BLEND WALL

The “blend wall” problem arose by 2014 when the annual requirement mandated by the USA Congress exceeded the amount of ethanol that could be mixed into the conventional blends of gasoline. Refiners suggest that the suggested E15 blend containing 15 percent ethanol could damage automobile engines through inducing corrosion. Ethanol makers countered that the oil industry is fanning false fears to protect its own product.

The Environmental Protection Agency (EPA) in 2013 reduced the 2007 Congressional mandate requiring refiners to blend 14 billion of ethanol the 10 percent gasoline blend in 2014 to the 12.7 -13.2 level. The EPA went further in reducing the level of mandated advanced cellulosic ethanol made from non-corn sources such as grasses to 2.0 - 2.5 billion gallons. Congress had mandated an unrealistic level of 3.75 billion gallons of advanced fuels in 2014.

RENEWABLE IDENTIFICATION NUMBER, RIN

Every gallon of ethanol has its own unique identity of a 38-digit Renewable Identification Number (RIN), administered through the Environmental Protection Agency (EPA). Refiners have to track each gallon of fuel they produce, including the ethanol using the RIN. When the refiners mix ethanol with gasoline, they have to account for the RIN before shipping the fuel out to the gasoline stations. Absent a satisfactory RIN evidence, refiners have to pay a fine to the EPA.

This created a market for RIN credits within the refining industry. Refiners buy RIN credits from ethanol producers and use this as proof that they are complying with the national fuel laws. The RIN credits have been relatively inexpensive, until recently when they have exploded in price. From \$0.01 in June 2012, they were up to \$1.10 as of the first week of March 2013. This is due to what is called the “blend wall” within the refining industry. There is a mandate from the EPA for refiners to use more and more ethanol, which requires RIN for each gallon.

Yet, overall motor fuel demand is declining across the country. In 2011, the USA consumed 133 billion gallons of fuel, down from 140 billion three years earlier. Advanced reasons are: higher fuel prices at the pump, improved fuel-efficiency in new cars, a lingering recession and an aging population that drives less.

With less fuel demand, the EPA still mandates larger and larger amounts of ethanol going into the shrinking volumes of the country’s fuel supply. Thus the RIN credit prices have exploded in value. There is less and less demand in the marketplace for the fuel that refiners produce. Refiners cannot put more than 10 percent alcohol into gasoline, because alcohol will damage all but the specially built engines E-85 and other engines with seals and gaskets optimized for high percentages of alcohol. One solution for refiners is to export gasoline and reduce volumes inside the USA, legally avoiding the RIN issue. The other solution for refiners is to pay increasing costs for RIN credits which get passed along to buyers at the pump, adding \$0.10 per gallon of gasoline in the first quarter of 2013 despite stagnant or declining oil prices.

UNSUSTAINABILITY OF CORN ETHANOL

For the first half of the 20th century, USA corn yields were limited between 20–30 bushels per acre. In World War II, the USA government sponsored a crash program to build ammonium nitrate plants, the output of which went into explosives for munitions. After the war, the ammonium nitrate plants stayed in business, producing fertilizer for the agricultural markets. Without large amounts of energy input from mechanization and nitrogen fertilizer, the corn market would crash. Ethanol, at best is a break-even form of energy. When accounting for all the energy it takes to grow corn, ethanol is a net energy user, not producer.

In 2011, almost 40 percent of the USA corn crop went into making ethanol fuel, and the USA still exported more than half of all corn shipments worldwide. Following the 2012 drought, the spike in USA corn and soybean prices to record highs rationed demand in ways that hurt food production. What is observed is that a 3 - 4 percent decline in supply lead to a 40 - 50 percent increase in prices.

The livestock groups in the USA appealed to the Environmental Protection Agency (EPA) to curb or suspend an ethanol production mandate, warning against the ruinous impact of soaring feed costs. Corn and soybean meal make up basic animal feed.

HISTORICAL BACKGROUND

Crop prices started to plummet following the 1996 farm bill. The price of corn remained below the loan rate during the last four years of 1996 farm bill, dragging down other commodities with it. Corn was priced at \$3.25 per bushel in 1995, then \$1.97 from 1996 to 2001, despite the corn planted acreage declining by 3.9 million acres. This required massive government payments to farmers into the 2001 crop year. With corn prices below the loan rates, the farmers' organizations and their check-off boards searched for suitable products that could use the surplus corn.

For a while, ethanol from corn was suggested as a replacement for the tetra-ethyl-lead and instead of the MTBE oxygenates additives with limited success. Farmers invested in lobbying their state legislatures to mandate the use of 10 percent ethanol in motor fuels as a way to support farmers and to move towards energy independence.

Farmers also invested in ethanol cooperatives. For instance, farmers who were receiving \$1.85 per bushel of corn were investing \$10,000 in an ethanol cooperative for the right to sell 10,000 bushels of corn to the cooperative at a 2 – 5 cents premium over the current market price.

The USA became involved in two foreign wars, MTBE, a carcinogen, was found leaking in California ground water, hurricanes hit the petroleum refining facilities in the Gulf of Mexico shutting down the oil production rigs, and the stage was set for the USA Congress involvement. The Energy Policy Act of 2005 and the Energy Security Act of 2007 created a federal mandate for the use of ethanol.

With high oil prices, the price of ethanol also rose and farmers received a good return on their ethanol cooperatives investments. The profits attracted the attention of Wall Street with private investors replacing farmers and the ethanol plants under construction rose from 16 in January of 2005 to 76 in January of 2007.

The USDA projected an increase in the use of corn for ethanol production increasing from 1.6 billion bushels in 2005 to 4.4 billion bushels in 2016. Corn prices went through the roof. The

higher prices caused an over-investment and excess capacity in agriculture by farmers in the USA and globally, particularly among the USA corn production competitors. As the demand for corn for ethanol production levelled off with the advent of natural gas production through hydraulic fracturing or fracking, at the same time as the world productive capacity peaked, an unsustainable situation was reached whereas prices had only one way to go: down.

CORN ETHANOL BOOM AND BUST MANIA

What drove the corn ethanol boom and bust was a combination of private and public support to both supply and demand for corn ethanol. This included

1. The USA government supported ethanol demand through a Renewable Fuels Standard (RFS), blending subsidies, the phase-out of the MTBE additive to gasoline and Research and Development (R&D) for ethanol research.
2. The USA government also supported the domestic supply of corn ethanol through tax credits on biofuel facilities construction and the imposition of custom tariffs on imported ethanol.
3. Private industry supported the demand for corn ethanol through the expansion of the manufacturing of hybrid and flexible fuels vehicles and gas stations as well as the overall growth of the green technologies investment industry.
4. The supply side was supported by the agricultural industry with a large supply of cheap corn due to advances in Genetically Modified Organisms (GMOs) and favorable growing conditions weather. The private equity and investment banking sectors supported supply with large sum of cheap credit.

The net effect of private and public support was a surge of around 200 ethanol plants operating in the USA's Great Plains consuming 30 – 40 percent of its corn production. The price of corn jumped from \$2.37 per bushel average price over the period of 1970 – 2005 to a range of \$ 4 – 7 per bushel. The doubling and tripling of the average price is suggestive of a mini tulip mania.

The corn ethanol boom mania created demand for 5 billion bushels of corn, most of which was satisfied from new production. Since it is well known that commodity prices are set by the marginal demand in the market, this 40 percent new marginal demand drove corn prices to new heights and raised the entire commodity crop prices since they compete with corn for available planting acres.

Monetary policy with the Federal Reserve Central Bank issuing currency at the rate of \$85 billion per month and rescuing the banking system a zero-interest rate policy reduced the relative value of the USA dollar, which supported higher commodity prices. With the end of the so-called “Relative Easing” and the instigation of the “Tapering” processes, interest rates start increasing, the dollar currency value increases and commodity prices, including corn and grains collapse [35].

ARBITRAGE WITH PETROLEUM

Since crude oil is converted into gasoline, and corn ethanol is a substitute for it, a direct positive correlation exists between their prices. This is beneficial to the agricultural sector when petroleum prices are high, and is detrimental when oil prices fall under the effect of global recession resulting in a lack of demand, or the introduction of other hydrocarbon temporary

supplies as those arising from hydraulic fracturing or fracking and horizontal drilling in shale deposits.

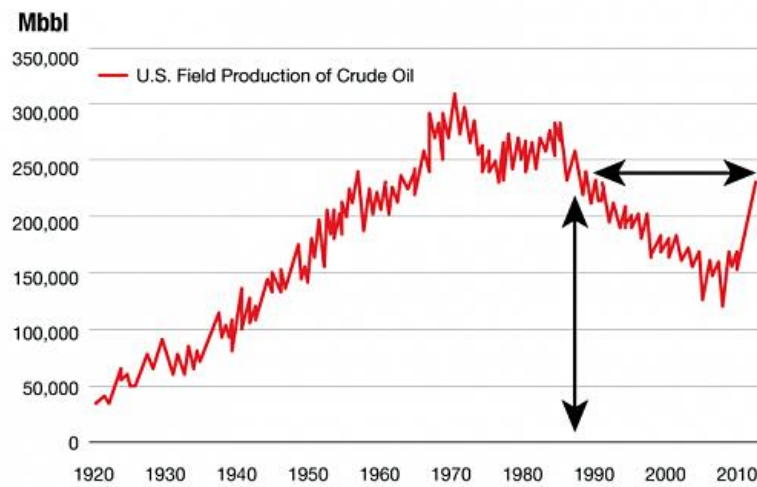


Figure 15. Increased USA field production of crude petroleum resulted in decreased prices.
Source: USA EIA.



Figure 16. Evolution of petroleum prices. West Texas Intermediate (WTI), Cushing, Oklahoma. Shaded areas correspond to recession periods. Source: USA Energy Information Administration (EIA).

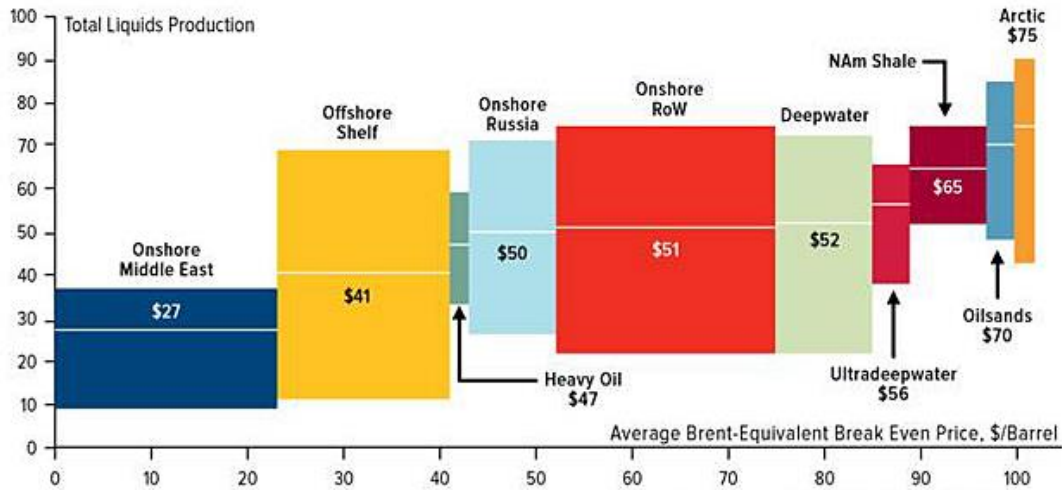


Figure 17. Cost of Production of petroleum in different production zones. Row: Rest of World. Nam: North American. Source: Rystad Energy, Morgan Stanley, USA Global Investors.

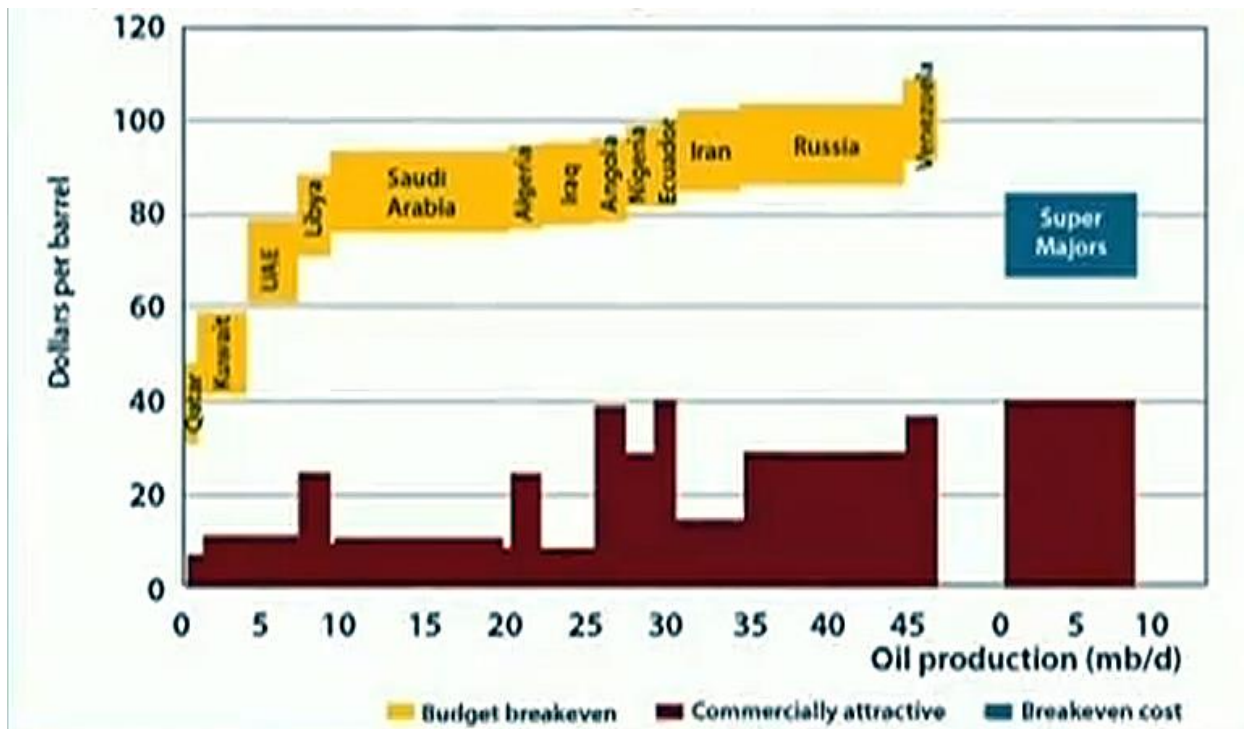


Figure 18. Breakeven petroleum production cost.

THE METHANOL TO ETHANOL CONVERSION CYCLE

Natural gas as methane CH_4 is used to produce anhydrous liquid ammonia NH_3 necessary as a nitrogen fertilizer to produce corn in the USA. In a curious twist of events this corn as human and animal feed is then turned back into alcohol as ethanol or ethyl alcohol $\text{C}_2\text{H}_5\text{OH}$. The process involves an inevitable process of multiplication of the conversion efficiencies, leading to a net

energy loss. The methane CH_4 could have been turned directly into a liquid fuel as methanol CH_3OH or methyl alcohol making the two extra conversion steps totally unnecessary.

At the end of 2007, an energy bill was passed in the USA Senate: the Energy Independence and Security Act of 2007 which expanded the Renewable Fuels Standard (RFS) law. Beginning with 9 billion gallons of biofuels in 2008, it required ramping it to 36 billion gallons/year of renewable fuels by the year 2022, with 15 billion gallons/year as corn ethanol. On the other hand, China started down on the corn ethanol road and ended up banning it. The European Union is reaching a similar conclusion to be eventually reached in the USA.

Ethanol production in 2008 outstripped demand. The demand was 8.5-9 million gallons and the industry had 11.5 billion gallons of capacity. The result was many idle plants, unable to handle their debt loads and filing for bankruptcy. Many postponed their plans for new capacity such as VeraSun Energy Corporation, Sioux Falls, South Dakota with 1.64 million gallons of capacity from 16 plants, which did not start up three of its new plants. It was the second largest ethanol producer after privately held Poet LLC, with 13 percent of USA capacity. VeraSun, founded in 2001 filed for Chapter 11 bankruptcy protection on October 31, 2008 and provided a list of more than 4,000 creditors including many of its corn supplier farmers.

Pacific Ethanol Inc., the largest West Coast-based producer and marketer of ethanol, put its production plants in California, Oregon and Idaho in Chapter 11 bankruptcy in May 2009. The company's marketing arm, which buys and sells ethanol, did not file for bankruptcy. Pacific Ethanol, based in Sacramento, California, said that the volume of ethanol sold fell 24 percent in the quarter, while the average sales price was down 28 percent. It said in court documents it had between \$50 million and \$100 million in assets and between \$100 million and \$500 million in liabilities.

Initially, the Federal government provided 51 cents of subsidies per gallon of corn ethanol to 177 plants with the capacity to produce 11.5 gallons per year, without which the program would not have taken off. In addition, to protect it from competition with sugar cane ethanol, 54 cents per gallon tariff was imposed on such imports from Brazil and the Dominican Republic.

The Food, Conservation and Energy Act of 2008 or Farm Bill, includes \$1.01 per gallon credit for cellulosic biofuels produced after December 31, 2008. The credit is paid from a reduction in the credit for grain ethanol from 51 cents / gallon to 45 cents /gallon.

As of December 2007, the corn ethanol industry production was 7.3 billion gallons/year, and the existing renewable fuels mandate was 7.5 billion gallons/year.

It takes 1 bushel of corn to make 2.8 gallons of ethanol, thus the ethanol industry in 2007 used $7.3 \times 10^9 / 2.8 = 2.6$ billion bushels of corn. By the end of 2008, the industry had the capacity to produce an additional 6 billion bushels of ethanol bringing the total to $6 + 7.3 = 13.3$ billion gallons of corn ethanol using $13.3 \times 10^9 / 2.8 = 4.75$ billion bushels of corn.

CORN ETHANOL INDUSTRY

The corn ethanol industry, started in 2003, produced 1.5 billion gallons of ethanol in 2014 and has become crucial for the corn farmers and the livestock producers in the USA. About 17.5 lbs out of the 56 lbs in each bushel of corn used in producing ethanol is produced as dried distiller's grain livestock feed.

Ethanol plants are also recovering corn oil at the back end of the process which is mostly used to produce biodiesel fuel in addition to the produced ethanol. There is 76,000 BTUs of

energy in each gallon of ethanol, and with the introduction of various new efficiencies into the process, it is claimed that it takes 23,000 BTUs to produce it.

In 2003, it took about 3.4 gallons of water to produce 1 gallon of ethanol. By 2014, this has been reduced to 2.7 gallons. A gallon of ethanol is claimed by the industry to reduce carbon dioxide emissions by 45 percent compared with gasoline.

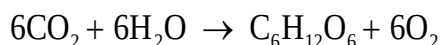
The industry faces a hurdle by the Environmental Protection Agency (EPA) in the form of the Corporate Average Fuel Economy (CAFE) standards which aims at increasing the resulting miles per gallons and reduce greenhouse emissions. The CAFE standards favor electric and natural gas vehicles.

The industry continues to optimize the production process and has hopes for the adoption of higher percentage blends of ethanol in gasoline and on the production of cellulosic ethanol.

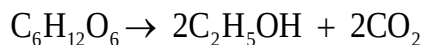
PROPERTIES OF ETHANOL

Ethanol or ethyl alcohol C_2H_5OH as a fuel has a high 113 Octane number, making it suitable for racing cars to compete at speeds reaching 220 miles per hour. It is manufactured by fermenting and distilling starch or sugar crops using another form of energy such as natural gas or coal as an input.

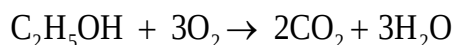
Glucose, a simple sugar is formed by photosynthesis in plant materials using water and carbon dioxide:



As glucose in plant materials is fermented, ethyl alcohol and carbon dioxide are formed:



In burning ethanol water and carbon dioxide are formed back again:



Ethanol has the highest oxygen content of any available fuel, making it burn cleaner than gasoline, reducing emissions. It is blended with gasoline to make a 10 percent ethanol mixture designated as E10, and an 85 percent mixture designated as E85.

Using natural gas as a fuel source, a typical corn ethanol fuel plant such as one built by Liberty Renewable Fuels in Ithaca, Michigan, would produce 110 million gallons of ethanol per year and 354,000 tons of distillers grain solids, using in the process 40 million bushels of corn. At 200 bushels per acre of corn this would cover an area of $40 \times 10^6 / 200 = 2 \times 10^5 = 200$ thousand acres and providing 46 new jobs. At 6-10 gallons of water per gallon of ethanol, it would also use 660-1,100 million gallons of aquifer water per year.

ETHANOL'S HISTORY: GASOHOL TO ETHANOL

One hundred years ago, Henry Ford designed his Model T automobile to run on ethanol, calling it "the fuel of the future." Earlier on, it was the choice fuel for the first designs of internal

combustion engines. Samuel Morey in the 1820s used an ethanol blend in experimental engines. Ethanol remained in obscurity for 40 years due to the rise of the steam engine. The internal combustion engine rose to prominence on the basis of the more efficient design by Nikolaus Otto from Germany. At this time, gasoline from oil as a cheap fuel supply also came to prominence and became the preferred fuel for internal combustion engines despite ethanol's earlier introduction.

At the time of President Jimmy Carter "ethanol" was referred to as "gasohol." The reintroduction of ethanol is passing off an old idea as a new and improved solution to modern energy problems and we are faced with debates about ethanol's true energy output and its overall effectiveness as an alternative to other fuels.

ETHANOL ENERGY BALANCE

An example of both ROI and EROEI accounting pertains to the debate on the use of ethanol or alcohol derived from corn as transportation fuel in the USA. Some critics voice the opinion that it bears resemblance to the famous Tulip and the South Seas manias, which were economical bubbles that eventually burst.

The standard measurement of specific energy for ethanol is 26.8 Mega Joules per kilogram (MJ/kg). This is less than the energy density of gasoline at 45 MJ/kg, implying that one needs $45 / 26.8 = 1.67$ times as much ethanol by weight to produce the same amount of energy as gasoline.

From a different perspective, ethanol produces only $26.8 / 45 = 0.5955$ or 59.6 percent of energy as a similar mass of gasoline.

The USA demand for corn used to make ethanol, a gasoline additive, was expected to rise 34 percent to a record 2.15 billion bushels in 2007

As of 2007, there were 116 factories producing ethanol in the USA. They have boosted their annual capacity by 12 percent in 2006, to 5.3 billion gallons. An additional 6 billion gallons of capacity was added in 2007-2008 as 79 new plants or expansions were completed, pushing final corn demand from ethanol to 3.8 billion bushels. There were further 200 other plants in the planning stage.

The USA grew 11.1 billion bushels of corn in 2005. The fraction of the crop consumed for ethanol production was 12 percent in 2004-2005. It was projected to almost double to 23 percent around 2014-2015.

The marching cry of ethanol promotion has been: "Reducing the dependence on foreign oil." What is conveniently ignored is that corn cannot be grown without a substantial input of nitrogen fertilizer as anhydrous liquid ammonia NH_3 . The USA imports 64 percent of its nitrogen. As the USA grows more acres of higher yielding corn to supposedly become more energy independent, it is becoming more nitrogen dependent instead. Since nitrogen fertilizer is manufactured from natural gas or methane CH_4 , what is happening is not reducing hydrocarbons demand, but merely conveniently shifting it from oil to natural gas.

Advocates of corn ethanol point out that just 1.9 percent of corn is directly used for human food consumption, whilst 58.7 percent of corn production is used for livestock feed which can be diverted to fuel production. In addition corn gluten as a product of ethanol production is used as livestock feed [1]. They suggest that there will be enough corn grown in the USA to satisfy feed, food and export demand as well as the growing demand for ethanol. They identify as contributing factors increased corn yield through new hybrids generated from biotechnology, and improved farming practices efficiently using the nitrogen fertilizer input as anhydrous ammonia manufactured from natural gas or methane as a feed stock. They suggest that acreage shifts would

occur from soybeans, cotton and wheat to corn, that only the starch in corn is fermented into alcohol and that the remaining surplus distiller grain solids which contain the corn fiber, proteins and oil will replace corn feed rations in livestock feed, and that new processing technologies in ethanol production would increase the yield in gallons per bushel of corn. They point out that ethanol is produced from yellow field corn and not from sweet corn or white corn which are used for human consumption [2].

On the other hand, critics point out that about 2/3 of USA grain corn is labeled as “processed,” meaning it is milled and otherwise refined for food or industrial uses. More than 45 percent of that becomes sugar, specifically high fructose corn sweeteners which is the keystone ingredient in 3/4 of all processed foods, especially soft drinks. Protein being more expensive than carbohydrates, sugar “trickles down” as a food source and is consumed as an energy source by the poor working classes in the manufacturing, agricultural and service economies of the world. In the USA it is suspected of contributing to obesity, heart disease, and shorter life expectancies.

The USA Department of Energy (USDOE) has set a goal that biomass will provide 30 percent of the USA’s transportation fuel by 2030. This is equivalent to 60 billion gallons of fuel per year. President George W. Bush in a 2006 speech suggested that the USA is “addicted to foreign oil,” and directed that oil imports from the Middle East be reduced by no less than 75 percent. This translates into a need for producing 45-47 billion gallons of ethanol annually for transportation and other uses.

The number of corn ethanol plants has doubled since 1999 reaching 101 in mid July 2006 in 19 states with a combined capacity of 4.8 billion gallons of corn fuel ethanol, and with 41 new or expanded plants under construction. By the end of 2007, the combined capacity reached 7.2 billion gallons. In 2006, 19 percent of the corn produced in the USA was used to produce ethanol compared with 14 percent in 2004 and 11 percent 4 years earlier. By 2025, 33.3 percent of the corn or 5.5 billion bushels is expected to be used for ethanol production. The USDOE goal is that 30 percent of the fuel used by motorists would be corn and cellulosic ethanol by 2030.

This follows the 2005 government Renewable Fuels Standard (RFS) of 7.5 billion gallons of corn ethanol by 2012. It will take longer to implement the standard since new manufacturing plants rarely produce at their full capacity at startup.

ETHANOL MANUFACTURING

Front end process:

In the front end ethanol production process, whole corn kernels are ground in a hammer mill and mixed with water to create a mash. It is heated and mixed with enzymes and then cooked. The mixture is cooled, more enzymes are added, the mixture is mashed and then the mash goes into a fermenter where the sugars are converted into ethanol or Ethyl alcohol; basically the same process used for making whiskey and moonshine.

Nine parameters control the process:

1. The screen size for the hammer mill,
2. The process water flow rate,
3. The temperature during the heating process,
4. The temperature during the fermentation process,
5. The residence time,

6. The enzyme input rate,
7. The temperature during the cooling process in the jet cooler,
8. The temperature during the liquefaction process,
9. The residence time during the liquefaction time.

Back end process:

In the back end process, the whole stillage is taken and separated into a wet cake and thin stillage. Then the stillage is concentrated into a syrup.

The wet cake and syrup are recombined with dry distillers grains and that mixture is dried in a drum dryer to produce dried distillers grains with solubles.

Three parameters control this process:

1. The flow rate of the centrifuge, which varies the input of the wet cake into the dryer,
2. The temperature of the drum dryer,
3. The addition rate of the syrup also helps maintain a consistent moisture content of the mixture entering the dryer.

The process yields as waste product consisting of the corn kernels minus the starch designated as distillers solids. Every 56 pounds bushel of corn results in 17.4 pounds of solids. These can be used as animal feed or burned as fuel. Another possibility is to spread it on farm fields to decompose as fertilizer.

Water and energy are needed not just to produce the corn, but also in the ethanol production process. It takes about 3-5 gallons of water to produce 1 gallon of ethanol, placing a requirement on the available surface or underground water supplies surrounding an ethanol manufacturing plant, including the possibility of depletion and of contamination.

A typical plant would have large 500,000 gallons capacity fermentation tanks. Whereas initially energy is used to heat the mash, the fermentation process needs to be cooled with water to keep the temperature at an optimal 90 °F.

After fermentation, the mixture is boiled to remove water, then is dehydrated to boost the alcohol content.

Before leaving the plant, a denaturant toxic material is added to make the alcohol unfit for drinking as liquor, avoiding the otherwise imposed taxes.

The ethanol cannot be sent through pipelines since it tends to absorb moisture degrading it and possibly causing corrosion in the piping. Accordingly, trucks and train cars are used to ship it to the fuel storage terminals where it is blended with gasoline and then distributed to the gas stations. The most common blends are the 10 percent ethanol or E10, approved for any make or model of cars used in the USA, and the 85 percent ethanol designated as E85 used in specialized flexible fuel vehicles.

CORN ETHANOL ENERGY BALANCE

More calories of fossil fuel energy are spent producing corn ethanol than is gained from it as calorific value when burning it. Nitrogen in the form of anhydrous ammonia NH_3 that is manufactured from natural gas is nowadays used as a source of nitrogen fertilizer necessary to produce a corn crop. It is a practice dating back to after World War II when cheap ammonia used in the manufacture of explosives turned into surplus and found an alternate use as a fertilizer.

The early settlers learned from the native Indians to grow corn by burying fish in a mound of soil, then planting a few corn kernels on top of the mound that would grow using the nitrogen provided by the decomposing fish.

The USA Department of Agriculture (USDA) suggests that a gallon and a quart of corn ethanol is produced for every gallon of fossil fuel invested. The USDA asserts that this is a bargain, because gasohol is a “clean fuel.” This claim of cleanliness is in dispute, pointing out to the hypoxia dead zone in the Gulf of Mexico caused by nitrogen fertilizer leaching, and phosphorus from soil erosion, topsoil depletion, herbicides and insecticide pollution, and the haze of greenhouse gases gathering over every city and farm field at planting, cultivation, land and air spraying and harvest time. This claim does not cover another counter argument that the Sport Utility Vehicles (SUVs) on the highways demand for fuel competes with the world poor’s demand for food grain.

Cornell College of Agriculture and Life Sciences’ Professor David Pimentel chaired a USA Department of Energy panel that investigated the energetic, economic and environmental aspects of ethanol production. He led a detailed analysis of the corn to ethanol fuel process. His findings were published in September 2001 in the Encyclopedia of Physical Sciences and Technology.

According to Pimentel, a single acre of USA corn yields about 7,110 lbs of corn for processing into 328 gallons of ethanol. However, planting, growing and harvesting this corn requires about 140 gallons of fossil fuel and costs about \$347 per acre in 2001. Thus, even before corn was converted to ethanol, the feedstock cost about $347/328 = 1.05$ \$/gallon of ethanol.

At the processing plant, where the grain is crushed then fermented to produce alcohol, three distillation steps are needed to separate the 8 percent ethanol from the 92 percent water. Additional treatment and energy are required to produce the 99.8 percent pure ethanol for mixing with gasoline.

Adding up the energy costs of corn production and its conversion to ethanol, $E_{in} = 131,000$ British Thermal Units (BTUs) of energy are needed to make 1 gallon of corn ethanol. One gallon of corn ethanol has an energy content of $E_{out} = 77,000$ BTUs. When 1 gallon of corn ethanol is manufactured, there results a net energy deficit of:

$$E_{in} - E_{out} = 131,000 - 77,000 = 54,000 \text{ BTUs.}$$

This suggests that the energy return on energy invested figure of merit for sustainability, EROEI from Eqn. 2 is:

$$\begin{aligned} \text{EROEI} &= \frac{E_{out} - E_{in}}{E_{in}} \\ &= \frac{77,000 - 131,000}{131,000} \\ &= \frac{-54}{131} = -0.4122 = -41.22 \% \end{aligned}$$

which is a *negative* return on the invested energy of 41 percent.

From another perspective considering the ERPUEO figure of merit from Eqn. 3 is:

$$\begin{aligned}
 \text{ERPUEO} &= \frac{E_{\text{out}} - E_{\text{in}}}{E_{\text{out}}} \\
 &= \frac{77,000 - 131,000}{77,000} \\
 &= \frac{-54}{77} = -0.7013 = -70.13 \%
 \end{aligned}$$

or that 70 percent more energy is required to produce a gallon of corn ethanol than the energy content obtainable from burning the produced ethanol. Converting corn into ethanol thus requires the use of 70 percent of the energy that comes from the corn ethanol itself.

Other crops do not fare better from that perspective. The investment banking company Goldman Sachs, using data from the USA Department of Agriculture (USDA) reports similar energy deficits from different biofuel options.

Table 8. Energy deficit from biofuel options.

Source	Energy deficit ERPUEO [percent]
Sugar cane	-10
Cellulose	-25
Soybeans	-37
Rapeseed	-40
Corn	-70
Wheat	-90

The shipping energy cost of ethanol is not even accounted for here. Ethanol is difficult to transport in pipelines as alcohol can absorb water, so much of it has to be trucked or sent by rail to the gasoline blenders.

From a monetary perspective, ethanol from corn costs about 1.74 \$/gallon to produce, compared with about 0.95 \$/gallon to produce gasoline in 2001. In fact fossil fuels, not ethanol, are used to produce corn in planting, harvesting and chemicals spraying, equipment fuel, and the manufacture of fertilizers, herbicides and insecticides. Growers and processors cannot afford to burn ethanol for long to produce ethanol without going bankrupt. USA drivers could not afford it either without government subsidies that artificially lower the price. Approximately \$1 billion a year in federal and state governments' subsidies were allocated primarily to large corporations, such as the commodity giant Archer Daniel Midland (ADM) company in Decatur, Illinois, and some farmer cooperatives. The stock price of ADM was up more than 37 percent in 2006 being the producer of 29 percent of the USA's ethanol, while the next largest player had less than a 5 percent share. ADM was benefiting from the shift of the USA to feed and power itself with what it grows on its agricultural land.

TRANSPORTATION ISSUES

There exists no convenient method of transporting ethanol derivatives through the USA pipeline system due to their corrosive effect and their propensity to absorb water from the atmosphere. Special train and truck tankers are being used to the gasoline and ethanol blending stations. These blending stations are concentrated in the Northern Midwest.

Automotive tests indicated that ethanol blended gasoline provides only 75 percent of the productivity of pure gasoline necessitating the handling and transportation of larger volume of fuel.

With ever increasing mandates, every ear of corn planted would have to be unrealistically committed to ethanol production by 2017. The \$6 billion in subsidies expended by federal and state agencies in 2006 will increase following the increasing mandates.

ECONOMIC CONSEQUENCES OF SUBSIDIES

Mark J. Perry, an economics and finance professor at the University of Michigan, Flint, claims that corn ethanol cannot be justified on a scientific or economic basis. The only reason the industry has survived and barely profited was the very generous subsidies the government has given to corn farmers and corn ethanol producers with \$5.5 billion annually and more than 200 ethanol tax breaks and subsidies. Ethanol is produced by mixing corn with USA tax dollars. According to Perry: "In the headlong rush to replace gasoline with corn ethanol, America is doing itself real economic harm." He suggests that the ethanol push will not only increase taxes and damage the environment, but will add to America's burden of high fuel and food costs, especially hurting people on fixed incomes.

He asserts that: "And it will do next to nothing to reduce the dependence on foreign oil. All of the ethanol produced this year (2007) will replace less than 5 percent of the gasoline sold." He contends that food costs escalated by \$47/person, according to an Iowa State study. The price of milk jumped by 40 cents/gallon and 60 cents/lb of cheese.

Plans under a Lugar-Harkin, USA senators, measure exist to raise the ethanol production to 60 billion gallons by 2030 costing \$205 billion over 25 years. The ethanol subsidies are proposed to be extended through 2022, costing taxpayers an estimated \$131 billion, according to the Tax Foundation.

Since ethanol contains about 1/3 less energy than gasoline, a motorist must purchase 1/3 more fuel to travel the same distance.

EFFECT ON PRODUCTION INPUTS AND FOOD PRICES

The world may have reached the peak for grain production. World farmland planted with grain has declined since 1980, mostly due to environmental factors such as soil erosion, water logging and salinization of irrigated land, air pollution as well as water shortages.

The world may also be running out of crop varieties and has pushed the usefulness of fertilizer as far as possible. The world grain output has been holding flat at around 1.6 billion tons and may begin to fall.

On October 26, 2007, the United Nations' expert on the right to food, Jean Ziegler asked for a five year moratorium on the production of biofuels. She called the use of food crops for fuel a "crime against humanity" saying that it causes food shortages and price jumps that cause millions of people to go hungry. Her reasoning for the moratorium is that within five years, research in using agricultural byproducts and waste for fuel production would be viable.

Italian consumer groups in 2007 called for Italians not to purchase pasta for one day as a protest over the increasing price of pasta by 20 percent, of which durum wheat as a grain cereal is an ingredient. High pasta prices sparked street protests in Milan, Italy. The causes were historically low levels of reserve grain stocks in Asia, North America and Europe. In the European Union the reserve grain stocks dramatically dropped from 14 million tons to just one million tons in 2006, trying to meet the shortages. Global prices for durum wheat have spiked to more than \$350 per ton. Wheat producers in France, where wheat stocks were at their lowest levels in 20 years, said that wheat prices there have gone up 40 percent in a matter of weeks. Since pasta has only two ingredients: durum wheat and water, pasta producers are in a bind. In the USA, in 2007 grain stocks were at their lowest level in 38 years. An increased pressure on these stocks existed as more cereal and grain crops were used for biofuels such as ethanol.

In January of 2008, 10,000 people demonstrated in Jakarta, Indonesia to protest high soybeans prices. The Senegalese protested the price of rice and Indians protested the price of onions. Food price inflation globally and the prospect of mobs of angry and hungry people rampaging in the streets caused Argentina, China, Egypt, Venezuela and Russia to impose unsustainable controls on food prices to contain possible public backlashes.

Three billion people, many of them with very marginal incomes, eat rice every day. The price of rice rose 50 percent in April of 2008, causing Thailand farmers to sleep in their fields to protect their harvests, while the Philippine farmers posted armed guards at their granaries. Vietnam, India, Kazakhstan, Egypt and China restricted rice exports or banned them altogether.

In Argentina, the government imposed a 49 percent windfall tax on foreign sales of corn and soybeans to lower the prices for Argentine consumers and raise money for the government coffers. The gauchos farmers considered it as an unfair measure, went on strike, and blockaded the roads into Buenos Aires with their tractors and farm equipment and threatened to starve the city.



Figure 19. Lines for purchasing government-subsidized flat loaves of bread at bakeries, Cairo, Egypt, 2008.



Figure 20. “We want bread” protest in the USA during the Great Depression, 1939.

The UK’s Financial Times newspaper had a front page story titled: “Fears grow over rice crisis.” WorldNet Daily reported: “Silent famine sweeps the globe.” The head of the International Monetary Fund (IMF) Dominique Strauss-Kahn suggested: “Thirty three nations face ‘unrest’ because of food shortages. Thousands, hundreds of thousands of people will be starving. Children will be suffering from malnutrition, with consequences for all their lives.”

In January 2007, tens of thousands of people marched through the streets of Mexico City to protest a 400 percent increase in the price of tortillas. Earlier in February 2007, Mexico's president, Felipe Calderon signed a pact with a number of business groups committing them to cap the price of tortillas at 8.5 pesos or 77 USA cents per kilogram, but many have chosen to ignore the agreement, which is not legally binding. Mexico used to get cheap corn imports from the USA, but, as corn ethanol became all the rage in the USA as a transportation fuel, the price of corn kept going up, making this staple practically unattainable to Mexico's poorest people. Mexican corn was being sold to American ethanol distillers rather than Mexican corn meal millers, who could not match their bids.

The American Farm Bureau Federation reported in April 2007: “Easter eggs will cost USA consumers about 25 percent more than last year,” as “The average USA retail price for a dozen large eggs was \$1.51 in the first quarter, 43 cents more than a year earlier.” The explanation offered for this increase in the price of eggs was that: “The increase stemmed mostly from higher corn and soybean prices,” which were used in the production of chickens, as “ethanol demand drives up feed prices.” Similar increases occurred in other staples such as milk, poultry, meat and even breakfast cereal.

China has discouraged corn based ethanol development because of food security concerns, as corn is a staple food for people and livestock. Officials changed the permit process for new grain processing plants to slow the rising demand from that sector, particularly biofuel plants.

In April 2008, because of its rising price, wheat imports comprised fully 1 percent of Egypt’s entire Gross Domestic Product (GDP). Ordinary Egyptians waited in line for bread for three times per day because of an imposed maximum limit of twenty loaves per person for each purchase. Fights have broken out in those lines with seven people killed.

With food stamps the symbol of poverty in the USA, a record 28 million Americans in 2008 were relying on them to survive. Since January 2005 the average price of a loaf of bread in the USA increased by 32 percent. The USA Department of Agriculture reported that USA retail food prices rose 4 percent from 2007 to 2008, the largest jump in 17 years. Restaurant owners faced wholesale price increases of 7.4 percent, the biggest jump in nearly three decades. The Market Basket Survey, conducted by the American Farm Bureau Federation, said that a basket of food staples such as bread, milk, eggs and meat cost \$3.50, or 8.9 percent more in 2008 than in 2007. Both a five pound bag of flour and a dozen eggs were up over 40 percent in from January 2007 to January 2008.

Robert Zoellick from the World Bank in Washington D.C. was reported to have said: "Thirty three countries around the world face potential social unrest because of the acute hike in food and energy prices. Since 2005, the prices of staples have jumped 80 percent." Rice, the staple food for half the world, doubled in price from a year earlier, with a five-fold increase from 2001. Over an eight years period, the price of food world-wide has increased 75 percent with particularly the price of wheat going up a dramatic 200 percent.

In the USA meat and dairy prices in 2007 increased since the summer of 2006. The Labor Department in USA reported that ground beef increased by 6.7 percent, chicken breasts by 6.9 percent and whole milk by a notable 26 percent.

The situation is not likely to turn around any time soon. In a report released by the UN Food and Agriculture Organization (FAO), the authors pointed to biofuels as one of a host of factors, including population growth and steadily growing economies in the developing world, driving global consumption to outstrip grain production for the next 10 years. According to the FAO report: "Production of renewable energy in general, and biofuels in particular, has risen to the top of policy agendas in many countries and has become a major issue for markets." The FAO expected the use of wheat for biofuels production in Europe will increase twelvefold by 2016.

The biofuels boom has a cascading effect across the dinner table. As manufacturers turn more and more grain into ethanol, the resulting higher grain prices meant increases in everything from the spaghetti to the meat sauce as grain used for animal feed gets more expensive.

Mexican consumers in January 2007 were hit with a tortilla crisis, as grain prices doubled and tripled the cost of tortillas and caused riots in some places.

Beer prices in Germany ticked upwards in May 2007 partially due to the increased production of biofuels.

Subsidized corn resulted in higher prices which is a desirable feature for corn farmers and a well-deserved reward for their effort in feeding the world. However, it leads to artificially higher prices for meat, milk, eggs, cereals food, corn syrup, etc. since about 70 percent of corn grain is fed to livestock and poultry in the USA.

Full implementation of the existing and proposed supports for the corn ethanol industry could boost grain costs by \$34 billion/year and cost each family of four in the USA \$460/year in higher food costs. Poultry feed costs have risen more than 40 percent in a year. The environmentalist organization Food and Water Watch (FWW) noted that USA food prices rose 6.2 percent during the first half of 2007. The American Meat Institute, National Chicken Council, and National Turkey Federation have argued that the corn ethanol industry no longer needs federal price supports.

An increase in the milk price was attributed to the increased cost of cattle feed. The increase in the price of cereals was astutely achieved by decreasing the volume of boxes of

breakfast cereals by one third while keeping the price constant. Popcorn prices increases were attributed to an increase of 65 percent in contract costs, the largest increase in 30 years, to grow popcorn because of the competition with regular yellow corn. Even the price of pizza was increased by 5 percent because of the increased cost of raw materials, including corn, as well as energy, health care and transportation.

In addition to paying tax dollars for the ethanol subsidies, consumers in general, including the farmers themselves were paying significantly higher food prices in the market place. The increased prices also affected the competitiveness of agricultural products for exports as well as domestic consumption.

The price of farmland increased, accelerating the sale of small farms to large corporate entities, and further reducing the 1.5 percent of the USA population involved in farming, the lowest percentage in the world.

In the fall of 2007, the fall fertilizers prices also increased. Anhydrous ammonia reached \$500 per ton, and di-ammonium phosphate (dap) \$74 per 400 lbs. This adds up to about \$100 per acre on corn following soybeans which provide their own nitrogen credit. With the rising expenses, corn at \$6 per bushel became no better for the grower farmers than the \$2 per bushel corn it was.

The corn ethanol industry has become in fact a convenient scapegoat for corporate America to justify price increases and inflate profits.

With federal and state government subsidies, the corn ethanol business became highly profitable, that is until a shakeout would occur and the bubble bursts. The price of corn would have to rise from \$2/bushel to \$8.30/bushel before an ethanol plant would start losing money.

DILUTION AND INFLATION

The concept of “dilution” is familiar in the corporate world, when it comes to the paper instrument known as “stock.” When a corporation prints more stock, all other things being equal, it dilutes its share structure, and all shares decrease in value.

The concept of dilution has its counterpart in the paper instrument known as “currency”. When a government represented by its central bank, creates more currency, all existing currency loses value. The process, although identical, is given a different name: “inflation.”

THE EXPORT OF INFLATION TO THE WORLD

Peter Schiff describes the process of the export of inflation from the USA to other parts of the world as follows:

“Over the course of my career, I have witnessed the government dramatically change the way it calculates inflation, GDP, and other statistics. While Washington's latest figures show a year-over-year CPI increase of just 1.2 %, the private service Shadow Stats, which recalculates the data along the lines that the government used to, finds that real consumer inflation is closer to 9%.

My guess is the true number lies somewhere in between, but that it would be much higher were the US not able to export much of its inflation abroad. The process works as follows: the Fed prints money (inflation) and uses it to buy Treasuries and mortgages. The government and banks, in turn, pass much of that

money to consumers, who spend it on imported goods. The money then flows to foreign manufacturers of those products, who then sell it to their own central banks, who print their own currencies (inflation) to buy it. This money goes out to pay wages, rents, etc., which the recipients then spend on goods & services. Finally, the foreign central banks use the dollars they buy to purchase US Treasuries and mortgages, starting the cycle again.

It's a complicated relationship, but the end result is that inflation created in the US ultimately bids up consumer prices abroad and Treasury prices at home. In other words, our trading partners have to pay much more for goods & services while Americans get to borrow limitless money for next to nothing. The products our trading partners "sell" us increase the supply of goods available to American consumers while simultaneously decreasing the supply available to everyone else. That is what I mean by "exporting inflation," and the important thing to remember is that its result is to mask inflation at home and transfer wealth from emerging markets to the US."

ENVIRONMENTAL EFFECTS, MARGINAL LAND USE

Some economic analyses of corn to ethanol production overlook the cost of environmental damage. On average, it takes 5.5 gallons of fossil energy to restore a year's worth of lost fertility to an acre of eroded land. David Pimentel estimates that this adds another 0.23 \$/gallon to the cost of ethanol for a total of $1.74 + 0.23 = 1.97$ \$/gallon, which is about $1.97/0.95 = 2.07$; or about twice the cost of producing gasoline in 2001. Corn production in the USA erodes soil about 12 times faster than the soil can be replenished. Moreover, irrigating corn mines ground water 25 percent faster than its natural recharge rate. It takes 3-6 gallons of water to process 1 gallon of corn ethanol. The environmental system in which corn is produced is being depleted both in terms of soil and water supply.

An average USA automobile would travel 10,000 miles a year. If it were to use pure ethanol, not the 85/15 ethanol/gasoline or gasohol mixture, it would need about 852 gallons of the corn based ethanol. This would require 11 acres to grow the corn, which is the same area of cropland required to feed 7 persons in the USA. If all the automobiles in the USA were fueled with 100 percent ethanol, a total of about 97 percent of the USA land area would be needed to grow the corn feedstock. Corn would have to cover nearly the total land area of the USA.

A July 2006 University of Minnesota study estimated that corn based ethanol could meet at most 12 percent of the USA fuel needs, even tapping every acre of domestic corn, and argues that the use of grain for fuel jeopardizes the existing grain and meat fuel supplies.

Increases in government subsidies to corn based ethanol fuel or in the price of petroleum cannot overcome the fundamental thermodynamic input yield dilemma: It takes more energy to produce ethanol from grain than what the combustion of ethanol produces. According to David Pimentel: "Abusing our precious croplands to grow corn for an energy inefficient process that yields low grade automobile fuel amounts to unsustainable, subsidized food burning." Corn cannot be considered a renewable resource for ethanol energy production if human food is being converted into the produced ethanol. This provides an example of an unsustainable energy system.

Nevertheless, domestic ethanol production in the USA reached 4.3 billion gallons/year and accounted for 14 percent of corn usage in 2005. It is expected to use about 22 percent of the

corn production in 2010. In 2005, 95 ethanol plants were in operation producing 4.3 billion gallons/year of ethanol, 14 began operation, and 10 were expanded. As of 2006, there were 35 refineries under construction, which were to boost production another 2 billion gallons/year. The passage of the renewable fuels standard as a part of the 2005 USA national energy policy was expected to nearly double ethanol production from 4.3 billion gallons/year to 7.5 billion gallons/year in 2012.

Richard McGuire, formerly a commissioner of agriculture for the State of New York pointed out to the effect of using less productive land for corn ethanol production. Presently grown corn uses the best available land resources that average 150 bushels per acre. If it takes 0.75 gallons of oil equivalent to produce 1 gallon of ethanol, the situation will be different for new land put into corn. If we consider that such land produces 120-130 bushels of corn per acre, the energy to produce it will increase. In this case, the ratio will be reversed 1 gallon of oil equivalent energy will produce only 0.8 gallons of ethanol.

INDIRECT LAND USE CHANGE CONCEPT

The concept of "indirect land-use change" means that if one takes a field of grain and switch the crop to biofuel, somebody, somewhere, will go hungry unless those missing metric tonnes of grain are grown elsewhere.

The crops to make up the shortfall could come from anywhere, and economics often dictate that will be in tropical zones, encouraging farmers to hack out new land from fertile forests.

Burning forests to clear that land can pump vast quantities of climate-warming emissions into the atmosphere, enough to cancel out any of the benefits the biofuels were meant to bring.

European plans to promote biofuels would drive farmers to convert 69,000 km², an area the size of the Republic of Ireland, of wild land into fields and plantations, depriving the poor of food and accelerating climate change. The indirect effects of the European Union's biofuel strategy of getting 10 percent of transport fuel from renewable sources by 2020, 90 percent of which would come from food crops, will generate an extra 27 to 56 million metric tonnes of greenhouse gas emissions per year. That would be the equivalent of putting another 26 million cars on Europe's roads, according to a report compiled by 9 European environmental groups: ActionAid, Birdlife International, Client Earth, European Environment Bureau, FERN, Friends of the Earth Europe, Greenpeace, Transport and Environment, and Wetlands International.

SMOG EFFECTS OF ETHANOL

Mark Jacobson, a civil and environmental engineering professor from Stanford University and a top atmospheric chemist, suggests in a study published in the journal: Environmental Science and Technology, that switching from gasoline to an ethanol fuel blend by 2020; which is heralded as a green alternative, may create dirtier air resulting in higher levels of smog formation. He contends that the use of ethanol cannot be based on health grounds since it is slightly worse from that perspective than gasoline.

About 4,700 people in the USA die per year from respiratory problems caused by ozone, the unseen component of smog together with small particles. Ethanol would raise the ozone levels particularly in some areas of the country where smog is already a serious problem such as the Northeast and the Los Angeles areas.

Interestingly, smog will be reduced in the Southwest because of the unique blend of chemicals in the air and the heavy vegetation. Part of the explanation is that ethanol produces more hydrocarbons than gasoline, and ozone is the product of hydrocarbons and nitrogen oxide cooking in the sun.

The ethanol also produces longer lasting chemicals that eventually turn into hydrocarbons that can travel farther, spreading pollution over a larger area.

In addition, whilst ethanol produces less nitrogen oxide; that can actually be a negative in some very smoggy places like Los Angeles since when such an area reaches a certain high level of nitrogen oxide, a well-known effect occurs where the excess chemical begins eating up the spare ozone.

The Environmental protection Agency estimated a 1 percent increase in the smog levels if gasoline consumption is reduced by 20 percent over a 10 years period and replaced by alternative fuels; mainly ethanol.

WET AND DRY DISTILLER GRAIN SOLUBLES (DDGS)

Distiller's grain as a byproduct of ethanol production can be used as a livestock feed; but it possesses some drawbacks. It is usually delivered wet, and transporting wet products is difficult. Wet distillers do not store well in the summer. It is hard to maintain high quality feed unless they are delivered and immediately fed. Feed yards close to the ethanol plant would be the most likely to efficiently use it. It has a short shelf life; especially during hot spring and summer days. The wet grain must be used within days and it is not economical to dry it. Efforts at pelletizing it for long distance shipping is underway.

A mountain of distillers grain is piling out in the corn belt. For every 120 bushels of corn distilled into ethanol, 1 ton of dry distiller is left behind, with 25 million tons produced in 2007. Wet distiller grain has been selling at \$40/ton with 35 % dry matter amounting to $\$40 / 0.35 = \$114.29/\text{ton}$ of dry matter. This would compare well with \$3.40/bushel corn at 15 % moisture or 85 % dry matter, corresponding to \$142.86/ton of dry corn matter.

The sulfur content of DDGS ranges over 0.3-0.9 percent. Diets containing up to 0.38 percent sulfur can be fed to pigs without affecting palatability or growth performance. Polioencephalomalacia, or sulfur induced polio toxicity is a main health issue when using distiller grain as animal feed. The total dietary sulfur intake must be considered, including the sulfate value of drinking water. The National Research Council recommends 0.4 ppm total dietary sulfur intake. The distiller byproduct portion of the diet can be as high as 0.8 ppm, with some producers feeding higher amounts. Feeding 150-200 mg/day of thiamine per animal helps in controlling the problem. Thiamine is injected intravenously in case of polio.

About 30 percent of the energy cost of an ethanol plant is used for drying the Dry Distiller Grain Solubles (DDGS) since wet distiller grains have a very short life span for storage. These DDGS must be either used as animal feed or burnt as a fuel, possibly providing energy to the ethanol production process itself. It may be possible in the future to separate the germ, where the protein and oil is, ahead of the fermentation process. The distiller grain solids will no longer have a nutritional value becoming a fiber feed without the protein and fat.

The debate is expanded with a 2006 study at the University of California at Berkeley authored by Alex Farrell. It took into account ethanol byproducts such as the DDGS as ruminant animal feed because of its high fiber content, and corn oil, which would displace other products

that require energy to make. The study ignored the water and soil depletion facets, and concluded that there exists a 20 percent energy gain in the use of ethanol.

According to Vijay Singh at the University of Illinois Department of Agricultural and Biological Engineering, each bushel of corn going through a dry grind facility, 2.5-2.7 gallons of ethanol and 15-17 lbs of DDGS are produced. These DDGS are used as: 46 percent as dairy cattle feed, 39 percent as beef cattle feed, 11 percent to swine, and 4 percent as poultry feed. Since the beef and dairy industries are not growing at the same rate as the ethanol industry, a surplus is accumulating and the price of the DDGS is coming down to a level equal to or lower than the price of corn. Thus 1/3 of the corn goes through the dry grind process and exits at the back end without value addition at a price equal to or lower than the price of corn. For poultry and swine producers in the USA Midwest, the shipping cost is about \$6/ton. When shipped to Texas for beef cattle production and California for dairy cattle feed, an additional cost of \$14/ton is incurred for a product that sells at \$18/ton. To enhance the value of the DDGS, Singh suggests the introduction of a wet fractionation process that recovers the germ, pericarp fiber and endosperm fiber as co products at the front end of the dry grinding process.

Research is pursued aiming at getting as much ethanol as possible from the grain pericarp and fiber that is currently ending up in DDGS which are glutting the market and are being considered for burning, as well as corn kernels in power plants. The fact remains that alcohol contains only 59.6 percent of the calorific content of gasoline and large quantities of it would have to be produced.

IMMUNOLOGICAL AND BACTERIAL FOOD SAFETY ASPECTS OF DISTILLER GRAIN

Kansas State University in 2007 released results from a research project looking at the prevalence of E. coli found in the manure of cattle fed dried distillers grains. The study found that cattle fed dry distiller grain had a higher prevalence of E. coli. E. coli is present in all cattle, and research is focusing on finding the reasons for the increase in E. coli with dried distiller's grain and work to find a way to change it.

Ethanol production relies on enzymes and yeast to convert corn into fuel. The main concern is a bacterium contaminant producing lactic acid that competes with the yeast for the starch and sugar. So instead of producing alcohol, lactic acid is produced. If too much of that bacterium is present, the fermentation process can be ruined. It gets acidified by the presence of the produced lactic acid to the point that the yeast is no longer able to produce ethanol, resulting in an unusable batch of corn mash waste.

To avoid the problem, ethanol producers use antibiotics, mainly penicillin, erythromycin, tylosin and virginiamycin to keep the lactic acid bacteria in check. This raises a side effect concern since these treatments would introduce into the food chain of bacteria that are resistant to antibiotics, or "superbugs." These are a major concern in health care since they reduce the effectiveness of human medications. Some resistant bacteria were in fact found in the sampling at four Midwest plants by Mark von Katz from the University of Minnesota's Biotechnology Institute.

If restrictions are placed on the sale and use of distiller grain as a low-cost livestock feed, it could have far reaching consequences on the economic viability of the ethanol industry and the livestock producers who rely on it.

METHYL TERTIARY BUTYL ETHER (MTBE) SUBSTITUTION

Ethanol found success in a market ironically associated with the oil industry. There exists a demand for a mandated replacement for the oil based gasoline oxygenate additive Methyl Tertiary Butyl Ether (MTBE) which has been banned in many states in the USA since it is suspected of polluting ground water and being carcinogenic. As of May 5, 2006, oil refiners stopped using MTBE in response to the lifting of a federal requirement for a clean air oxygenate, as part of the summer 2005 energy law. A 51 cents/gallon federal tax credit for ethanol added a safety net.

Roughly 68 percent of all the produced ethanol is added to gasoline as a federally required environmental oxygenate additive.

The mandated usage of ethanol in Illinois and other USA states pushed the product to a market that had no choice than to buy it. The 2006 Illinois Renewable Fuels Act, Senate Bill 2236, adds as much as 1 billion gallons of new ethanol production. It provided \$25 million over two years to fund the Renewable Fuels Development Program and provides incentives for plant expansion and new construction.

NATURAL GAS AND COAL IN ETHANOL PRODUCTION

Marquis Energy LLC of Hennepin, Illinois and Babcock and Brown, a global investment and advisory firm listed on the Australian Stock Exchange, proposed a 200 million gallon fuel grade corn ethanol facility. The twist is in the forms of energy used by the milling plant: in the 100 million gallons per year Phase I construction, natural gas is used as an energy source to convert 72 million bushels per year of corn from around a 60 mile radius into ethanol. Then in the next 100 million gallons per year Phase II construction, it is reported that converting the plant from natural gas to coal from Wyoming or Illinois: “Will reduce the plant’s energy expense by up to 70 percent.” Natural gas and coal are obviously used because they are more economical than the produced ethanol as a fuel source for the refinery. Ethanol in this context is best used to harvest the subsidy funds.

NATIONAL SECURITY AND DEFENSE RATIONALE

The agricultural economists David Bullock and Peter Goldsmith presented a paper at a 2006 conference at the University of Illinois: “Sustainable Bioenergy: Focus on the Future of Biofuels and Chemicals.” They suggested that those involved in the promoting of biofuels need to clearly define the reasons for the redirection of resources and funds involved in government support for a specific industry and that the federal and state tax subsidies for ethanol production need a new rationale: “Rather than saying ethanol creates jobs or lowers the price of gas, ethanol proponents will need to justify the subsidies along the lines of national defense or creating a lower cost industry for the future.” Bullock qualifies the politics and policies surrounding biofuels production as “colorful” and “complicated.” He notes: “Net job creation claims for ethanol are based on economic models that are speculative. These models do not account for the lost tax revenue that could be used for other needs,” “When you implement these policies you have winners and losers. The Midwestern rural areas are clearly winners because the tax dollars that support these programs are coming from other areas of the country, as well,” and: “The idea that ethanol will, by itself, produce lower gas prices is false. It will be a long wait before U. S. farmers can produce energy more cheaply than the Saudis can pull crude oil out of the desert. Pulling it

out of the desert is cheaper than trying to grow energy through corn. And if the price of crude oil does go down too low, the price of ethanol won't pay the producers' cost to grow corn."

The most recent farm bill added several provisions including rural development, energy efficiency, biofuels and energy security. The federal 2007 farm bill is purported to be "energy based" rather than income supporting. In 2007 ethanol use of corn is expected to be comparable to the corn exports. In 2006, if the estimate of 4.5 billion gallons and a bushel of corn producing 2.5 gallons of ethanol are accepted, the ethanol industry should use: $4.5 / 2.5 = 1.8$ billion bushels of corn, while the USA would export 1.85 billion bushels of corn. In 2007, ethanol would exceed corn exports: the USA Department of Agriculture guesses that 2.6 billion bushels of corn will be needed to produce an anticipated 6.5 billion gallons of ethanol.

From a farmer's perspective, Brian Niemann from Walshville, Illinois wondered: "This leads me to a question for you – with 90 percent of our fertilizer coming from overseas, can ethanol really be considered a homegrown fuel? See you later!"

WATER SUPPLIES LIMITATION

In many parts of the USA corn-belt, the water table is dropping exceeding 10 feet or more in some places, because of the water usage in producing corn as well as ethanol from it.

At Tampa, Florida the state's first ethanol facility put in a request for 400,000 gallons per day of water. This makes it one of the top 10 consumers of water in Tampa, with plans to double the plant's capacity. This is occurring while Florida's rivers and lakes are at near record low levels.

In the rush to build ethanol plants, 47 plants were proposed for the state of Illinois, each having typically a capacity of 100 million gallons per day. The water supply in what is a water-rich state will not be sufficient to have them built everywhere, and even if water is used smartly and financing becomes available, only a fraction of them will be built. Even with a new dry grind process under development, eliminating four stages in the corn ethanol production process, and reducing the water usage from, 4 gallons of water would still be used per gallon of ethanol. Some further reduction are claimed to be achievable, if enzymes are used with the dry grind process, to 1.5 gallons of water per gallon of ethanol. Still a plant producing 100 million gallons per day would undoubtedly impact the local water supply and affect the neighboring private well owners, especially if the existing aquifers instead of surface water from lakes or rivers are used.

Ethanol plants in Minnesota use from 3.5 - 6 gallons of water to produce 1 gallon of ethanol from corn, according to the Minneapolis based Institute for Agriculture and Trade Policy. Some of the water is recycled or returned to rivers, but most of it evaporates. For the USA as a whole, there was a 254 percent increase in the volume of water used in ethanol production from 1998 through 2008.

In Nebraska, the third leading ethanol producer, in 2006, it was reported by Derrel Martin, an irrigation and water resources engineers that 2 billion gallons of water were used at 15 ethanol plants to produce 676 million gallons ethanol. This amounts to $2,000 / 676 = 2.96$ gallons of water per gallon of ethanol. Nebraska is struggling to meet the water demands of its farmers and those in the neighboring states relying on water that passes through Nebraska, whilst it is poised to become the second in the nation in corn ethanol production after Iowa.

David Pimentel, the ecology and agricultural professor from Cornell University questioned the above figures suggesting it takes 15 gallons of water rather than the roughly reported 3 gallons to produce a gallon of ethanol.

In fact these two figures include only what an ethanol factory uses. If the water used to grow the corn is also included, then fully 1,700 gallons of water are needed to produce a gallon of ethanol.

From the perspective of Jerald Schnoor, professor of environmental engineering and co-director of the Center for Global and Regional Environmental Research at the University of Iowa, both water quality and the availability of water could be threatened by increased use of irrigated crops which need 2,000 gallons of water for each bushel of corn. This is in addition to the water needed by the factories that produce the corn ethanol. As a chairperson of a National Research Council panel he suggested that the stated goal to increase biofuels production about six times to 36 billion gallons by 2022 generates an environmental situation of fertilizers and pesticides discharges.

Water is an increasingly precious resource for drinking, municipal uses, hydropower, cooling thermoelectric plants, recreation, habitat for fish and wildlife as well as agriculture. The water supplies are already stressed in some areas such as the underground Ogallala aquifer which is the world largest underground water system extending from west Texas up into South Dakota and Wyoming. It is used to irrigate 1/3 of the nation's crop and providing drinking water to the states of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas and Wyoming. Growing biofuel crops requiring additional irrigation in areas with limited water supplies has become a major concern.

Water availability is a limiting factor in the growth of the ethanol industry. In a study by the Institute for Agriculture and Trade Policy (IATP): "Water Use by Ethanol Plants, Potential Challenges," it is suggested that few states are monitoring ethanol plants water usage with a lack of public information.

Water has curtailed the siting of ethanol plants in North Dakota's Red River Valley. Officials in Champaign, Illinois requested a potential impact study of a plant using water from the Mahomet Aquifer.

According to Dennis Keevey and Mark Muller : "Despite steady improvements in the efficiency of water use in ethanol plants, the sheer number of new ethanol plants being built has the potential to put a strain on the Corn Belt's water resources."

The consumption of water in ethanol plants arises from the water evaporation during cooling and waste water discharge. Consumptive water use is defined as any use of water that reduces the supply from which it is withdrawn, whether it is surface or underground water.

An ethanol plant uses 10 gallons/minutes for each 1 million gallons of ethanol that is produced. A typical 50 million gallon plant would thus need a flow rate input of 500 gallons/minute of water.

The only available record about water consumption in ethanol plants exists in Minnesota. There, ethanol plants use 3.5-6 gallons of water per gallon of ethanol produced. With increased efficiency the average water use has been reduced from 5.8 in 1998 to 4.2 gallons of water in 2005 per gallon of ethanol, with a goal of 4 gallons of water per gallon of ethanol with existing technology.

Regions of the Corn Belt with competing water usage such as the greater Chicago area, western Iowa, Nebraska and in general west of the Missouri River, would be affected by the projected 254 percent increase in the volume of water used in ethanol production from 1998 to 2008.

The groundwater tables in some states such as Missouri have been drawn down to dangerous levels near some ethanol plants. With corn prices rising with ethanol production, there

were 19 percent more acres of irrigated corn across the country with 1 million more irrigated acres in Nebraska.

Moratoria on new ground water wells were put in place in some regions such as along the Platte River, and the Republican River basin has caps on groundwater usage. However the plans for curtailing water use in some water basins are becoming toothless tigers in the face of market pressures.

Careful consideration is required of the regulatory oversight by state and local governments on the siting of ethanol plants with emphasis on the water availability and supply as well as the discharges and possible pollution of surface and underground water bodies. Ethanol plants will have to be sited adjacent to municipal waste water treatment facilities whose capacities would have to be enlarged.

Water must be assigned a larger economic value charged to the ethanol producer, with public records maintained on industrial ethanol water consumption to avoid water resources depletion and the consequent demise of the communities dependent on such water supply. We shall know the true price of water, when corn syrup becomes more expensive than oil.

David Pimentel comments on the situation: "The entire water use picture, coupled with the fuel it takes to produce ethanol, makes long term, mass production of ethanol unsustainable. I wish it were sustainable, I am an agriculturalist. I wish this whole deal was a major benefit, but you've got to be a scientist first and an agriculturalist second."

AGFLATION: EFFECT OF CORN PRICE AND INFRASTRUCTURE

The brokerage firm Merrill Lynch coined a new term to capture the phenomenon of food prices forcing up consumer prices more broadly: 'agflation.'" This is akin to the word "stagflation", which was a term used in the 1970s to describe an economy that is stagnant, but in which prices are inflating. Corn prices reached a 10 year high level in 2007, pushing up the cost of feed for livestock and therefore meat as well. Wheat, eggs and dairy prices went also up across the board. Milk reached its highest price ever.

According to the Illinois Corn Growers Association the 2006-2007 corn usage in the USA amounted to 17.2 percent, with 46.8 percent allocated to feed and residual, 17.2 percent to exports, 10.8 percent to other uses leaving 7.9 percent as surplus.

As ethanol production increased, the demand for corn drove corn prices upward. The ethanol producers felt the effects of the climb in prices. Archer Daniels Midland from Decatur, Illinois (ADM), the largest USA ethanol producer, cited high corn prices when it reported quarterly earnings that fell short of expectations in the Spring of 2007.

VeraSun Energy Corporation reported that it paid more than \$4 per bushel for corn which was more than twice what it paid the previous year. This resulted in a loss in its first quarter of 2007. Aventine Renewable Energy Holdings spent an average of \$3.58 per bushel of corn in the same quarter which was 69 percent more than a year earlier. Most ethanol plants would face losses at the point where corn prices would reach \$4.80 per bushel based on ethanol prices of \$2.20 per gallon according to Dan Basse, the president of the Ag Resources Company.

Ethanol demand was lagging behind supply in the second half of 2007, with a projected supply of 445,000 barrels a day but a demand of 420,000 barrels. The oversupply was partly blamed on the lack of infrastructure for transporting ethanol to the pump in the USA.

SUGAR SWAPPING DANCE, FEEDSTOCK FLEXIBILITY PROGRAM

The best way to make ethanol is from sugar cane. However this is not practical in the USA because of Federal price subsidies. If these subsidies were removed, sugar production in the USA from sugar cane and beets can compete like the rest of the world.

High fructose corn syrup from corn is sent to Mexico to displace sugar that is then be shipped to the USA, whose taxpayers can then pay for buying surplus sugar and converting it to ethanol.

Indeed, a sweet amendment carefully tucked into the USA House of Representatives version of the 2007 farm bill provides that as Mexican sugar flows into the USA in 2008, the USA Department of Agriculture will oversee a supply balancing program where the extra sugar can be purchased at government subsidized prices by the ethanol manufacturers. The swapping program has been given the official name: "Feedstock Flexibility Program." The USA, like most nations, has a domestic sugar price support program, needing still another program to handle the unrestricted Mexican sugar imports starting 2008.

When passed in 1993, the North American Free Trade Agreement (NAFTA) gave the USA a 15 years reprieve from unrestricted low cost Mexican sugar exports, until 2008. This was a key compromise cut by the senior President George W. H. Bush and President Bill Clinton to be able to pass NAFTA through the USA Congress. During the moratorium, high fructose corn syrup made from subsidized cheap American corn poured into Mexico to replace its sugar in its soft drink industry. Now Mexico, starting 2008, would export its surplus sugar according to the NAFTA agreement back to the USA in a carbohydrates swapping dance.

Thomas Elam from Carmel, Indiana, describes the unsustainable subsidy biofuel policies as self-defeating: "Grain based USA fuel ethanol production is using an increasing amount of our global food supply, increasing the global costs of food production and contributing almost nothing to USA or global net energy supplies. In effect, by linking food and energy costs through grain based ethanol, we have ransomed our food costs as well as our energy costs to the interests of global crude oil producers."

The sugar swapping dance is performed with the ethanol industry asking for more subsidies because of the high price of corn that is itself caused by their own ethanol making in the first place; with an infinite positive feedback process.

DEFORESTATION AND SAVANNAH CLEARING EFFECT

The USA's decision to promote the use of corn-based ethanol and soybeans-based agrodiesel resulted in deforestation across the globe with corn being increasingly grown in the Amazon, and palm oil in Indonesia. By eliminating the efficient carbon fixing trees, ethanol corn production would be contributing to increased CO₂ emissions rather than a decrease as advocated.

Two studies published in the journal Science suggested that clearing land to plant corn and other crops for agrofuels production does more to exacerbate global warming than using traditional fossil fuels.

A report by Princeton University's Woods Hole Research Center and Iowa State University researchers concluded in February of 2008 that within 30 years the use of corn based ethanol would produce twice as much greenhouse gas emissions as regular gasoline in terms of increased crop production. Tim Searchinger from Princeton maintains that: "The land we are likely to plow up (for ethanol feedstocks) is the land that we have had taking up carbon for decades."

A University of Minnesota's Nature Conservancy study in February 2008 argues that converting Asian and Latin American grasslands and rain forests for bioenergy production would boost the long term greenhouse emissions linked to global warming.

Brazil has some of the strictest environmental laws on the planet, but their enforcement is traditionally spotty. Brazilian businesses that clear these lands for agriculture are required to set aside 20 percent of the producing area as reserves. Heavy market demand for corn, soybeans and cattle resulted in a dramatic jump of Brazil's rain forest and savannas or wooded grasslands clearing in the final months of 2007. President Luiz Inacio Lula da Silva called an emergency meeting of Cabinet ministers to consider measures to stop the deforestation. The rising deforestation was a reverse of a 3 years decline.

The Brazilian government estimated that 2,703 square miles of rain forest was cleared from August to December 2007. This suggests a loss of $2,703 / 5 = 540.6$ square miles per month. If this loss rate continues, a yearly loss to August of 2008 will amount to $540.6 \times 12 = 6,487$ square miles. About 4,334 miles square miles were cut down and burnt from August through July of 2006. The agrofuels contribution is thus an increase of $(6,487 - 4,334) / 4,334 = 2,153 / 4,334 = 0.4968$ or 49.68 percent.

The destruction was concentrated in the Amazon states of Mato Grosso do Sul, Parana, and Rondonia. The jungle is cleared in the Amazon to initially provide pasture for cattle, then soybean and corn farmers move in.

METHANOL INSTEAD OF ETHANOL

China has grasped the thermodynamic reality that it is unrealistically unsustainable to use methane in natural gas in a multi-step process to produce anhydrous ammonia to fertilize and grow corn then ferment it into ethanol, while methane could be used in a single step process to produce another alcohol: methanol instead of ethanol.

Methanol has become the main alternative fuel in China. It is made from methane in natural gas as well as from coal.

China blends methanol into gasoline. Taxi and bus fleets in China run on high-methanol blends. Retail pumps sell low-methanol blends, similar to the way USA gasoline stations market government-subsidized low-ethanol blends.

UNINTENDED CONSEQUENCES

An unintended consequence of the obsession with corn ethanol is that it is prompting the oil companies to scale back their plans to expand refinery capacity. According to John D. Hofmeister, president of the Shell Oil Company:

“If the national policy of the country is to push for dramatic increases in the biofuels industry, this is a disincentive for those making investment decisions on expanding capacity in oil products and refining. Industrywide, this will have an impact.”

An emphasis on ethanol might lead to increased volatility in fuel prices. With a bad corn crop, we will end up paying for it at the pump and on the food shelves, in this case instead of getting security market volatility is being increased.

The paradox is that the grand design of politicians to create cheaper, more plentiful fuel are creating more expensive and more scarce fuel.

RESEARCH EFFORTS

Armed with the provisions of the Energy Independence and Security Act of 2007 providing support from the federal government in the form of subsidies and tax credits, 33 percent of the 2008 USA corn crop was used to produce corn ethanol replacing 330,000 barrels of petroleum per day in gasoline products, with 1/3 of it used as animal feed in the form of distiller grain.

The new Renewable Fuels Standard mandates that 36 billion gallons of biofuels be produced in the USA by 2022.

To maintain the sustainability of the established system research is attempting at addressing the issues of land usage, energy consumption and water use. As a result of these efforts, water consumption is being reduced by 27 percent, grid and electricity use by 16 percent and total energy use by 22 percent.

Seed companies are improving corn traits with yield in the range of 300 bushels/ acre in sight.

A corn fractionation technology that breaks each kernel into three parts: one for making food grade products such as corn grits for snack foods, one for burning as a fuel source and one for making ethanol, is being pursued.

Feedstocks other than corn and soybeans are under consideration: fast growing grasses such as miscanthus, algae species producing half their body weight in oil, corn cobs, corn stalks, wheat straw, rice straw, switchgrass, vegetable/forestry/landscape waste, food processing waste, garbage, byproducts from the manufacture of wood and paper and other organic matter including manure and sawdust.

PROJECT INDEPENDENCE, SYNTHETIC FUEL CORPORATION EXPERIENCE, 1970s, 1980s

Project Independence was introduced in 1973 by a generation of central planners with the goal of making the USA independent of foreign oil by 1980. It included the provision of subsidies to synthetic fuel manufacturers, increased oil tariffs, conservation schemes, and increased government spending on mass transit systems.

Later in the decade the government also imposed a Windfall Profits Tax on the oil companies.

The bureaucratic measures implemented by the USA government with the aim of creating energy independence actually made it more dependent on foreign oil because they misdirected energy related investment and crimped the abilities of the USA oil companies to increase

As described by Thomas DiLorenzo in his book “How Capitalism Saved America” :

“In 1979 the federal government created a Synthetic Fuels Corporation...that would make low-interest loan guarantees to companies developing synthetic fuels. As with all government programs, however, the indirect subsidies were distributed according to whichever members of Congress had the most clout and could funnel the subsidies into their home districts or states,

not according to whatever firms held the most promise in developing synthetic fuels. In other words, it was a giant political pork barrel.

The government promised to be producing 500,000 barrels of synthetic fuel per day by 1987, but it never supplied more than 10,000 barrels. Moreover, the loan guarantees were limited to those companies that had such poor prospects that they could not obtain private funding. In other words, only the most unprofitable companies qualified.

There is even evidence that the Synfuels Corporation impeded the development of synthetic fuels. Energy industry analyst Milton Copulos explains that "virtually all lending [by investment banks] for alcohol fuel plant construction came to a halt as the banking community waited to see what the federal programs would eventually include." As a result, says Copulos, "construction of alcohol plants came to a virtual halt." Thankfully, the whole program was scrapped in 1986."

7.13 CELLULOSIC ETHANOL ALTERNATIVE

INTRODUCTION

There are three possible inputs to produce biofuels: a finished product like corn, wheat or soybeans, a cellulosic based dedicated energy crop like switchgrass, crop residues and wastes like corn stover, rice hulls, wood chips and orange peels, and non-grain crops such as sugar based system that extracts sugar juices from a plant like the sugar cane, beets, sweet sorghum, as well as starch based systems such as cassava, potatoes or sweet potatoes.

The Energy Independence and Security Act of 2007, expanding the Renewable Fuels Standard (RFS), starts with a mandate of 9 x 10⁹ gallons of biofuels in 2008, and expands it to 36 x 10⁹ gallons / year by 2022.

Table 9. Ethanol Production from biomass. Source: USDOE, USDA.

Source	Harvestable Biomass [tons/acre]	Ethanol production [gallons/acre]	Acreage for 35 x 10 ⁹ gallons goal by 2022 [10 ⁶ acres]	Percent of 2006 acreage for 35 x 10 ⁹ gallons goal by 2022 [percent]
Switchgrass	5.6	563	62	20.1
Giant Miscanthus	14.1	1,410	25	8.0
Corn grain	4.6	456	77	24.7
Corn Stover	3.0	300	117	37.6
Corn total	7.6	756	46	14.9

Japan has adopted a biomass policy that will convert rice straw and other waste products into liquid fuels.

Cutrale, the world's largest orange juice producer is planning to produce ethanol from the peels and other leftovers from the juice production process at its Auburndale, Florida plant, and to reach an annual ethanol production of 8 million gallons by 2010.

TRICHODERMA REESEI FUNGUS

The hopes of the ethanol industry are based on a fungus called *Trichoderma Reesei*, which American soldiers first discovered at the end of World War II, when they found it eating away at their tents and uniforms on the Pacific island of Guam in the Marianas Islands in the Pacific. When grown in the laboratory, it looks like the pale green mold on aged bread. More importantly, the fungus releases enzymes that convert the fiber structure of plants into sugar.

It could be one of the most important organisms for all of mankind and could play a key role in liberating the ethanol industry from its dependency on food crops. Using it, a ton of switchgrass can produce 400 liters of ethanol. The portion of the straw waste on a grain field that does not have to be plowed under to regenerate the soil can amount to 10 tons per hectare each year. Pure energy grasses in the southern USA already produce yields of more than 20 tons which could increase to almost 30 tons. This makes it possible to produce more than 10,000 liters of ethanol annually per hectare, which corresponds to roughly the energy content of 6,600 liters of gasoline. This is more than three times as much as can be achieved with the first generation technologies. Lignin, a waste product that comes from turning straw into sugar can be used to cover almost all the heating requirements for this type of system enhancing the thermodynamic energy balance.

Virtually all existing biofuel production is from finished crops and the cellulosic based model exists mainly in the research laboratories and experimental farms and is years away in terms of implementation.

The economics of cellulosic ethanol are also unclear since cellulosic ethanol, still at an experimental stage, is twice as expensive as corn based ethanol. In addition, there are currently no commercial scale cellulosic plants.

In 2006, with \$160 million allocated to build 3 biorefineries, a new kind of ethanol or “cellulosic ethanol” came under consideration, to be made from biomass products such as switchgrass, *Miscanthus* (native to Asia), Indian grass, big bluestem, eastern gamma grass, sweet sorghum, triticale, kenaf, corn cobs and stalks, waste wood, poplar trees, black locust, prairie cord grass, wood pulp, giant reed (native to Asia), reed canary-grass (native to temperate Europe, Asia, and North America). Switch grass is a perennial grass native to eastern and central USA. Kenaf is grown for industrial fiber, but also is a potential biomass crop.

A double crop sequence of winter and summer biomass crops is possible. For instance, triticale, a cross between wheat and rye, can be planted in October and harvested for biomass the following June. Warm season crops such as corn, sorghum, sudan-grass and crotalaria, a legume that can fix large quantities of atmospheric nitrogen, can then be planted.

Cellulosic ethanol can be produced from the fibrous, woody, and generally inedible portions of plant matter. This could also include corn stover or wood chips.

PRODUCTION

Bioethanol production

Under the effect of heat, acids and enzymes split the cellulose in wood or grasses into glucose. Lignin, which is a component of wood, is isolated and sent to a wood plant for burning.

The remaining sugar solution is combined with yeast in a reaction tank where it ferments, producing alcohol.

In a distillation stage, using heating again, the excess water is evaporated with the end product being ethanol.

Biomass to Liquid (BTF) Fuels, SunDiesel or Choren Method

The dried and shredded biomass is fed into a low temperature gasifier. It is heated to 400-500 °C and broken down to tar rich volatiles and solid char. The char is then blown into the gasifier. The generated slag must be disposed of.

The raw gas is fed into Carbo-V gasifier. With oxygen added, the temperature reached is 1,400 °C, at which stage the ash and particulate matter melt.

In a recuperator stage, the raw gas is cooled.

A particle filter separates the ash particles and char from the raw gas to be disposed of.

In a scrubber, using a water spray, the contaminants such as chlorine and sulfur are removed from the synthesis gas. Waste water is generated at this step.

The last stage is a Fischer Tropsch process synthesis process using a cobalt catalyst to transform the gas into a liquid form.

Biomethane

In an air tight container, bacteria are used to decompose the biomass and generate biogas. Energy is used and water are used to enhance the fermentation process.

The resulting gas or biogas is composed of 50-70 percent methane and 25-45 percent carbon dioxide.

A comparison of the above mentioned alternatives is shown in Table 10.

Table 10. Comparison of biofuels alternatives produced per year from one hectare of crops.

	Annual yield per hectare of land	Efficiency compared with petroleum diesel [percent]	Efficiency compared with petroleum gasoline [percent]	Vehicle range from annual yield of 1 hectare* [km]
Bio-methane	3,560 kg	-	140	99,600
Btl, SunDiesel	4,050 liters	93	-	75,330
Bio-ethanol	2,560 liters	-	66	33,790
Rapeseed biodiesel	1,550 liters	91	-	28,210

* Assuming an average consumption of 5 liters/km.

GIANT MISCANTHUS GRASS

Giant Miscanthus (*Miscanthus x giganteus*) is a perennial low maintenance grass native of Japan used as an ornamental with a life expectancy of 15-20 years. It grows from an

underground rhizome that is resistant to winter harvest losses. The harvested stems can be burnt as a direct fuel source in coal boilers in electrical power plants or used as an ethanol feedstock.

The plant outgrows weeds, requires moderate water and fertilizer and be planted in untilled fields. It has little susceptibility to pests and diseases. It grows to 10-15 feet in height. Once established, it does not need the use of herbicides. It is widely adaptable from Nebraska to the Atlantic Seaboard.

An inter-specific hybrid is a cross between *Miscanthus Sinensis* Anders and *Miscanthus Sacchariflorus* resulting in a sterile non-invasive *Miscanthus x giganteus* that is propagated by transplanting the rhizomes. It is advocated by Stephen Long, a University of Illinois crop scientist as an ideal biomass crop with a long canopy duration, efficient photosynthesis, nutrient recycling in the roots, clean burning, low input, sterile, non-invasive with a winter stand, easily removed, high water efficiency, no known pests or diseases and would use existing farm equipment. It has been grown as a commercial crop in Denmark for 30 years, and it requires zero inputs after the first year of its establishment.

At three Illinois locations Giant *Miscanthus* produced double the biomass of switchgrass at 14.1 tons / acre with a potential to produce 1,400 gallons of ethanol / acre.

New stems appear on the surface in late March, cover the soil by mid-May and reach a height of 8 feet by July. The plants flower by late October. Afterwards their stems die after storing nitrogen and other nutrients into the rhizome underground to survive the winter and supply next spring's growth.

Winter harvest of the dry biomass yields 17-25 tons/acre compared with switch grass at 10 tons/acre. It is advocated that if the state of Illinois used 10 percent of its 35.6 million acres of farmland, it would produce 50 million tons of dry mass per year, supplying 50 percent of the state's electricity needs. The dry mass can be burned in power stations or turned into pellets for heating purposes.

One ton of dry biomass would yield 80 gallons of cellulosic ethanol or 1,360 gallons per planted acre, or 4 billion gallons for the state of Illinois which consumes 5 billion gallons of liquid fuel per year. At \$2.50/gallon for ethanol, an acre yield $2.50 \times 1,360 = \$3,400$ in gross revenue.

Miscanthus is advocated as an efficient fuel source that requires only mechanical inputs in its cultivation. Harvesting would be done with conventional hay cutting and baling equipment.

It has been used commercially in Europe for two decades as a fuel for heat and electrical power generation. The ratio of output energy yield to input energy yield is estimated to be in the range of 5.

An estimated 1.3 billion dry tons of biomass feedstock would be available for the process in the USA. The environmental impact of such an approach in terms of soil erosion and the depletion of soil nutrients remains to be considered.

SWITCHGRASS

Switchgrass (*Panicum virgatum*) is a Native American grass. There is still no knowledge base on how to grow, harvest, and store it. South Dakota State University (SDSU) is developing improved upland varieties of switchgrass for the Northern Great Plains.

Unlike *Miscanthus* that is propagated by rhizomes, switchgrass is propagated by seeds like other crops. It is native to the prairies of North America. It is tolerant of a wide range of environmental conditions compared with many other perennial grasses.

In Nebraska, non-transgenic switchgrass cultivars yield an average 3-5 tons/acre of biomass, with the potential to produce 240-400 gallons/acre of ethanol. If production can be increased to 6-7 tons/acre, the ethanol production could be increased to 480-560 gallons/acre. The conversion technology yield 80 gallons of ethanol per ton of biomass. The Agricultural Research Service (ARS) at Lincoln, Nebraska is developing switchgrass that can yield 10 tons/acre yielding 800 gallons of ethanol per acre. Ten years are needed to fully develop these cultivars for commercialization. Seeding rates, herbicide and fertilizer applications, frequency of cutting, are being evaluated.

Data in the January 7-11, 2008 Proceedings of the National Academy of Sciences from the joint USDA and Institute of Agriculture and Natural Resources (ARS), greenhouse emissions from cellulosic ethanol from switchgrass are estimated to be 94 percent lower than estimated greenhouse emissions from gasoline production and to produce 5.4 times more energy than needed to grow, harvest and process it into cellulosic ethanol.

Instead of producing ethanol, switchgrass can be fed directly as a supplement to coal in co-firing electrical power plants boilers.

SWEET SORGHUM

Another alternative is sweet sorghum as a source of alcohol. The plant's high sugar content makes it suitable for producing ethanol. Sweet sorghum, like sugar cane, has been used for making molasses for a long time. It is a close relative to grain sorghum, largely used for poultry feed. The crop is often grown as a hedge against drought as it does well with relatively little rainfall.

What is interesting in this approach is that just 300 acres of farm land growing it could become the basis of a mini scale ethanol factory that can be sold to potential customers at the farm gate. The process would be part field work and part in-plant work. In the field, the sweet sorghum would be cut and crushed and the juices are extracted and collected in a collection tank on a trailer. The juices are transported to the farm facility and loaded into a retaining bladder. Yeasts are added fermenting the juice for 3-7 days in a sophisticated mini distillation plant producing the ethanol.

The challenge with sweet sorghum is that it must be used locally since it cannot be hauled over long distance as it is possible with corn. The crop also has a very short harvest window. The solution may lie in designing a partial small scale preliminary distillery process on the farm.

The Ceres company in Thousand Oaks, California has entered into an agreement with Texas A&M University' Agricultural Experiment Station to research and commercialize high biomass sorghum.

Biomass will be produced from the stems, stalks and leaves, more so than from the grain per se.

ALFALFA ETHANOL

Alfalfa is touted as a sleeping giant in developing cellulosic ethanol sources. In the USA alfalfa is grown on 20 million acres, some of it marginal land. It is harvested 3-5 times per year. Alfalfa varieties would have to be modified to be lodging resistant and leaves be stripped from the stems after harvest to yield a high protein leaf meal that could be returned to the food chain. Leaf meal and corn Dry Distilled Grain (DDG) offer the same protein concentration. However,

DDG is high in fat and phosphorous and low in calcium, whereas leaf meal is low in fat and phosphorous and high in calcium. The stems can thus be used for cellulosic ethanol production. As a deeply rooted perennial, it helps in soil carbon accumulation and erosion control and can be rotated with corn.

CORN COBS ETHANOL

The POET ethanol producer in Sioux Falls, South Dakota is working with equipment manufacturers on methods to harvest, store and transport corn cobs in large quantities. It plans on converting its 50 million gallons per year grain to ethanol plant in Emmetsburg, Iowa into an integrated corn to ethanol and cellulose to ethanol plant.

The corn cobs represent 18 percent of the above ground corn stover. Their carbohydrate content is higher than the rest of the corn plant, allowing the production of more ethanol. The cobs also have a higher bulk density than other parts of the corn stalk, making it easier to transport them from the field to the ethanol plant.

WOOD CHIPS AND INDUSTRIAL WASTE ETHANOL

The General Motors Company bought a stake in the second generation ethanol Coskata startup-company that plans on producing ethanol from wood chips and pulp, sugar cane bagasse refuse, grass, corn stover and other industrial and municipal waste such as old tires and yard waste. The claim is that the approach uses less than one gallon of water per gallon of ethanol produced and yields more energy per ton of input than other processes.

The process used is not the enzymatic hydrolysis process commonly associated with cellulosic ethanol production. Instead, a gasification process is used in which the front end material is superheated to create synthesis gas or syngas, as a mixture of H_2 and CO in a gasifier.

The syngas passes through a scrubber into a bioreactor where microorganisms breathe the carbon monoxide and hydrogen and excrete ethanol and water. The ethanol is recovered and the water is recycled to the bioreactor in a continuous flow system instead of a batch process like used in the production of corn ethanol. One ton of dry material yields 100 gallons of fuel grade ethanol in a three minutes process from the time the dry material is fed into the gasifier.

The process is claimed to cost \$1 per gallon of ethanol, uses 1 gallon of process water and produces 7.7 units of energy per unit of energy used. The process is capital intensive requiring \$400 million for a commercial plant within 2 ½ years to build.

ROADMAP FOR CELLULOSIC ETHANOL RESEARCH

Although the first biorefineries using cellulosic biomass resources are not expected to be in operation until the next decade, the USA Department of Agriculture (USDA) and several land grant universities are conducting research in addition to the work at the Department of Energy (DOE) research centers.

A document issued by the USDOE: "Breaking the Biological Barriers to Cellulosic Ethanol: A Joint Research Agenda," outlines a plan for developing new technologies to transform cellulosic ethanol into an economically viable transportation fuel. The goal is to displace 30 percent of the 2004 transportation fuel with biofuels by 2030.

To make large scale cellulosic ethanol production a sustainable system, the following research hurdles have been identified by the USA Department of Energy as part of a roadmap that must be overcome in the future:

1. Maximizing biomass feedstock productivity: Making better biomass through advanced breeding or biotechnology modifications that could result in crops tailored for more efficient ethanol processing.
2. Developing better processes by which to break down cellulosic material into sugar: Razing the plant cells walls by studying lignin fiber, in an effort to possibly deconstruct the tough cell wall material prior to processing. This would be a daunting task since deconstructing switch grass fiber would be different than deconstructing poplar trees fibers. The task has been assigned to the DOE's Joint Genome Institute to map the genes of key energy crops to understand how fiber can be broken down.
3. Optimizing the fermentation process to convert sugars to ethanol: Identifying microorganisms or chemical enzymes best suited for the fermentation of various cellulosic materials into ethanol.

The focus of the research plan is to use advances in biotechnology, those used in the Human Genome Project and continued in the Genomics GTL program to jump start a new fuel industry.

Awaiting the results of the research program, the safe and guaranteed suggestion that can be proposed for the immediate use of cellulosic materials is to burn them as an energy source for the existing corn ethanol plants. After all, some farmers burn their own produced subsidized corn kernels in specially designed furnaces to heat their dwellings.

PRIVATE SECTOR RESEARCH

British Petroleum (BP) from the UK sponsored a \$500 million research program at the University of Illinois in collaboration with the University of California at Berkeley and the Lawrence Berkeley National Laboratory in research at the Energy Biosciences Institute (EBI). The University of Illinois established a 340 acres farm where Giant Miscanthus is produced as a cellulosic ethanol feedstock. The use of corn residue switchgrass and other herbaceous perennials will also be studied.

GOVERNMENT RESEARCH

The USA Department Of Energy (USDOE) allocated \$375 million for basic research on cellulosic ethanol and other agrofuels at three DOE sponsored research centers.

At Oak Ridge National Laboratory (ORNL) the BioEnergy Research Center will study the plant cell walls of corn, switchgrass and poplar, and how those cell walls can more easily be broken down by enzymes in the ethanol production process.

At The University of Wisconsin at Madison's Great Lakes BioEnergy Research Center, in collaboration with Michigan State University will breed plants in which carbon is directed into easily degraded cell walls, with a focus on switchgrass and Miscanthus.

The Lawrence Berkeley National Laboratory's Joint BioEnergy Institute would direct its efforts towards improving plants for ethanol feedstock and studying the molecular mechanisms behind the breakdown of lignocellulose into fermentable sugars.

CORN STOVER AND SOIL FERTILITY

The use of corn stover could raise soil fertility and erosion issues. David Laird, professor at the Iowa State University (ISU) Department of Agronomy wrote in a report titled: “The Charcoal Vision: A Win-Win-Win Scenario for Simultaneously Producing Bioenergy, Permanently Sequestering Carbon, while improving Soil and Water Quality,” that although corn stover is referred to as waste, it is a vital component of soil agrosystems: “Crop residues contain substantial amounts of plant nutrients. If crop residues were harvested every year, these nutrients would have to be replaced by increased fertilizer use. If all above-ground crop residues were removed year after year, the quality of our soils would rapidly deteriorate.”

ENVIRONMENTAL ISSUES

The plants considered for bioenergy production raise ecological concerns. The characteristics that are ideal for a biofuel crop are similar to those of invasive species requiring careful risk-benefit analyses. Giant reed and reed canarygrass have significant environmental impacts related to their known invasiveness. Despite this potential risk, 15,000 acres of giant reed are planned in Florida and 30,000 acres in Alabama.

Some cultivars of switchgrass are strong competitors to native species in restoration areas. In fact, native plants in one region can become invasive in another. For instance, smooth cordgrass (*Spartina alterniflora*) is native to the Atlantic coast of the USA, but is a major invader of estuary habitats on the Pacific coast.

Miscanthus benefits from 20-30 years of European experience as having a low risk of invasiveness. However, the invasion history of exotic plant species shows that they can lie low for several decades prior to becoming invasive, hence their designation as sleeper weeds. In this context it is important to remember the scientific caveat: “The absence of evidence is not evidence of absence.”

The Conservation Reserve Protection (CRP) lands and the riparian buffers have been suggested as locations for growing biofuel crops to avoid competition with prime food productive farmland. This could place these species on land prone to erosion that is adjacent to pathways of dispersal helping to spread them throughout the landscape. These would also lead to a decrease in the biodiversity and function of these ecosystems.

Jorn P.W. Scharlemann and William F. Laurance, from the Smithsonian Institution’s Panama Tropical Research Institute conclude in the January 4, 2008 issue of the magazine *Science*: “Not all biofuels are beneficial when their full environmental impacts are assessed; some of the most important, such as those produced from corn, sugarcane, and soy, perform poorly in many contexts.” Those contexts include land use, impacts on ecosystems, and “trace gas” emissions. They suggest: “The arguments that support one biofuel crop over another can easily change when one considers their full environmental effects.”

If tropical forests are razed to plant sugar cane the tradeoff results in vast increases in carbon dioxide emissions. Another example, according to the article, is growing corn or rapeseed for fuel, which requires a lot of nitrogen fertilizer. The breakdown of the fertilizer can yield copious amounts of nitrous oxide, a potent greenhouse gas, and also an alleged major atmospheric ozone depleter.

They suggest: “In the debate about different biofuels, one can easily be overwhelmed by the ‘apples and oranges’ problem. Each biofuel has certain benefits and potential costs, and there is no common currency for comparing them.” “Not all biofuels are beneficial when their full environmental impacts are assessed; some of the most important, such as those produced from corn, sugar cane, and soy, perform poorly in many contexts.” So governments “should be far more selective about which biofuel crops they support through subsidies and tax benefits.”

GREENHOUSE GASES EMISSIONS FROM BIOFUELS

A team of researchers led by German Nobel Prize winning chemist Paul Crutzen found that the growth and use of biofuels produced from rapeseed in Europe and corn in the USA can produce 70 percent and 50 percent more greenhouse gases respectively than fossil fuels in a study published in 2007 in the scientific journal Atmospheric Chemistry and Physics. They warned that the cure could end up being worse than the disease.

Paul Crutzen and his team of researchers have calculated the emissions released by the growth and burning of crops such as corn, rapeseed and cane sugar to produce biofuels. The team of American, British and German scientists has found that the process releases twice as much nitrous oxide N_2O as previously thought. They estimate that 3 to 5 percent of nitrogen in fertilizer is converted and emitted, as opposed to the 2 percent used by the Intergovernmental Panel on Climate Change (IPCC) in its calculations.

Crutzen is widely respected in the field of climate research, having received the Nobel Prize in 1995 for his research into the ozone layer.

The findings come in the wake of an earlier OECD report which warned against rushing to grow renewable energy crops because they cause and damage biodiversity while producing limited benefits.

ETHANOL PRODUCTION GOAL

President George W. Bush signed an Energy Bill in August of 2005 including a Renewable Fuels Standard (RFS) mandating the usage of 7.5 billion gallons of corn ethanol by 2012. In January of 2006, he pushed for increased ethanol production in his State of the Union Address in January of 2006 in an Advanced Energy Initiative suggesting that the USA must end its addiction to foreign oil. Production was 25 percent above the 4 billion gallons called for in 2006. This was due to 22 corn ethanol plants breaking ground by 2006.

Lifting of the oxygenate requirement by the 2005 Energy Bill replaced MTBE by a 2 billion gallons amount.

The National Corn Growers Association (NCGS) envisions a goal labeled: “15x15x15” meaning a 15 billion bushels/year corn crop, from which 15 billion gallons/year are produced by the year 2015. As optimistic as these figures may sound, they are outdone by those advanced by an alliance of agricultural, forestry, national security, business, labor, and environmental groups designated as “25x25” meaning: 25 percent of the USA’s energy needs derived from farms, ranches and forests by 2025, as compared to 6 percent in 2006. This goal encompasses ethanol, biodiesel, wind and animal wastes.

POLLUTION FROM CELLULOSIC ETHANOL PRODUCTION

The director of Iowa State University's Water Center, Rick Cruse, warned about the possibility of an ecological disaster in an address to the Iowa Environmental Commission: "The political machine has said, with multiple voices that Iowa is, has been and will be the big energy capital of the world. If done correctly, it could be a Garden of Eden, literally. If it is done inappropriately, it might look like Saudi Arabia desert, with an empty oil field underneath."

If corn stubble that is needed to replenish the top soil were converted to cellulosic ethanol, this would imply lower soil fertility as well as soil erosion. Climatic trends are pointing to heavier rainfall events in the Midwest leading to even higher soil erosion.

Corn based cellulosic production in large centralized plants would pose major transportation and storage problems. An ethanol plant would need a pile of crop residue covering 100 acres and 25 feet deep.

The way around the problems could be to use multiple crops such as the less valuable switchgrass to reduce the erosion threat and perform some form of preprocessing at the farm sites before shipping the residue to the ethanol plants.

DISCUSSION

Corn ethanol is an expectation and is not a cure all and savior for the USA's and the world's energy needs. It is not a silver bullet that will solve the USA's energy problems and is not totally green and environmentally friendly as some supporters claim. Even if it produces 12 percent less greenhouse gases, it is associated with markedly larger releases of nitrogen, phosphorus and pesticides into waterways as runoff from corn fields. At high concentrations it produces more smog causing pollutants than gasoline per unit of energy produced. According to Jason Hill from the University of Minnesota: "There is a lot of green in the money that is going into ethanol, but perhaps not so much green is coming out as far as the environment.

A booming corn ethanol industry has driven up corn prices to \$5 per bushel, soybeans to \$13/bushel and wheat to \$11/bushel as of 2008, and will have long term repercussions for cattle and poultry feeders competing for the same feed grain. A shift to corn production from soybeans is expected to drive up the price of soybeans and turn the USA into an importer of soybeans for the first time. The poultry industry has started shifting its production facilities out of the USA sending poultry and other meat products higher. A \$1/bushel increase in corn prices takes 20-25 dollars off the value of a 550 pounds calf. Without counting the government incentives, ethanol plants are making 51 cents per gallon profit from their operations and they can pay \$5 a bushel for corn and still remain profitable. To boost domestic production of corn and soybeans releasing acreage from the Conservation Reserve Program (CRP) is under consideration.

A claim of 25 percent energy gain is made for corn ethanol, upon close scrutiny, appears to be related to an energy value attributed to the resulting distiller grain. The argument that is advanced is that since ethanol has dry distilled grain as a co-product, and corn must be grown for livestock, anyway, it is not appropriate to assign all the energy needed for corn production to just the ethanol. Even if such a claim is valid, if every acre of corn grown in the USA were used to produce ethanol, it would supply a meager 12.3 percent of the USA motoring fuel.

If cellulosic ethanol moves into production beyond the laboratory scale, ethanol from 300 million acres of switch grass still could not supply the gasoline and diesel consumption which is projected to double by 2025. As far as alternative fuels are concerned, biodiesel from soybeans oil may be a better alternative than corn ethanol. Neither corn ethanol nor soybean biodiesel can replace much petroleum without impacting the food supplies. Biofuels, even from non-food

sources are not a practical long term solution, and could have a devastating impact on agriculture by reducing soil fertility by not returning crop residues back to the soil, increasing soil loss by erosion and creating a competition between food and energy crops.

It is worth noting that historians suggest that the demise of the Carthage civilization in North Africa, which challenged Rome as Hannibal crossed the Alps with his elephants, at the location of present day Tunisia, was caused by uncontrolled soil depletion and erosion.

The average American motorist drove 13,657 miles in 2005. That is 40 percent than 25 years earlier because of longer commutes to the suburbs and the larger use of the automobile for daily chores. The average motorist consumed 703 gallons of gasoline per year for a total need of $300 \times 10^6 \times 703 = 2.19 \times 10^9$ gallons of gasoline per year for the 300 million USA's population.

It is difficult to convert existing vehicles to run on ethanol, even with an 85 percent gasoline and 15 percent ethanol mixture: E85, or the traditional 10 percent mixture. The chemical properties of ethanol are very different than that of gasoline and vehicles combustion systems must be adapted for exposure to alcohol. This includes fuel lines, fuel pumps, fuel injectors, oxygen sensors, exhaust after treatment, as well as the electronic engine control module which must be reprogrammed to match the characteristics of ethanol. Alcohol is more volatile than gasoline.

On an afternoon stroll on the streets of Sao Paulo, Brazil, a distinct alcohol smell can be discerned, and multiple car fires can be watched. To prevent serious air pollution, the conversions must follow a lengthy and costly process: the Mobile Source Enforcement Memorandum 1A issued in June 1974 by the Environmental Protection Agency (EPA) enforcing the tampering prohibitions under Section 203(a)(3) of the Clean Air Act. Thus it is preferable to purchase new flexible fuel vehicles that are specifically designed to run on the mixture.

Corn growers are advocating an E20 instead of an E10 blend. Auto manufacturers respond that they would not honor the warranties of cars designed for E10 if they use E20 in their tanks because a higher blend is corrosive to the fuel system.

The E85 fuel has 10-15 percent lower fuel economy compared with gasoline requiring the handling of larger quantities of fuel, which in turn will translate into a higher cost than gasoline, which could make it less attractive than gasoline.

Wholesale ethanol prices as of 2006 were \$3/gallon, compared with around \$2/gallon in 2005. As a gallon of ethanol costs \$1-1.30/gallon to make and the USA government paid an additional \$0.51/gallon in 2008 in subsidies to be reduced to \$0.41/gallon in 2009, and expire in 2010, profits boomed in 2006. Ethanol plants became money printing machines, paying for themselves within about a year.

However, there exist plenty of reasons for doubting that corn ethanol is a sustainable answer to the USA's energy needs. It would take 85 percent of the USA corn acreage to produce enough of it to replace just 10 percent of gasoline demand. Rising demand for human and animal corn feed could send corn prices soaring, making ethanol investments much less of a sure thing. It takes 3.5-6 gallons of water to manufacture a gallon of ethanol, placing pressure on the water resources and polluting them. The USA Department of Agriculture (USDA) expects a bushel of corn from the 2006 harvest to fetch 24 percent more than in 2005.

Corn ethanol cannot completely replace oil in the transportation sector. In 2006, ethanol production was 4.9 billion gallons representing only 3.5 percent of the USA's total consumption of 140 billion gallons. Even if 100 percent of USA grown corn were used to produce ethanol, it could still replace only 29 percent of the total fuel consumption.

Table 11. Estimated transportation fuels by source.

Year	Petroleum 10 ⁹ gallons/year	Corn ethanol 10 ⁹ gallons/year	Cellulosic ethanol 10 ⁹ gallons/year	Total 10 ⁹ gallons/year
2006	135	5	0	140
2010	133	13	0	146
2022	133	21	15	169

Since the corn to ethanol process uses energy, logically not ethanol itself, to make ethanol, producers are vulnerable to energy price spikes. As of 2006 there were 101 ethanol plants in existence, more than 41 new facilities and expansions were in the works, and another 100 were in the planning stages. At an average construction cost of \$75 million/plant, this is potentially: $141 \times 75 = \$10.6$ billion invested in ethanol plants.

The USA was the largest ethanol producer in the world followed by Brazil and China.

If one barrel contains 42 gallons, the USA's production of 11 billion barrels of ethanol per year translates into:

$$\frac{11 \times 10^9}{42} = 261 \times 10^6$$

barrels of ethanol per year. Assuming the same density for ethanol and gasoline, and considering that ethanol contains as calculated earlier 59.6 percent as much energy as gasoline by weight, one can calculate a number of barrels of gasoline equivalent as:

$$261 \times 10^6 \cdot \frac{59.6}{100} = 155 \times 10^6$$

barrels of gasoline equivalent per year or:

$$\frac{155 \times 10^6}{365} = 0.426 \times 10^6$$

or just 426,000 barrels of gasoline equivalent per day.

The USA daily oil import is about 12 million barrels. The implication is that the ethanol production is just: equivalent to just 3.55 percent of the daily USA import of oil, even assuming that all the oil is refined into gasoline.

The USA consumption of liquid fuels is 21 million barrels per day. The ethanol production would be even more insignificant:

$$\frac{0.426 \times 10^6}{21} = 0.0203$$

or an insignificant 2 percent of the daily USA liquid fuels consumption.

According to David Pimentel, from Cornell University, if the entire USA corn crop were converted to ethanol, it would satisfy about 15 percent of its automotive fuel consumption.

The production of ethanol from corn, at the present state of technology, may be justified as a clean alternative of the oxygenate MTBE, or as needed for national security, but it is doubtful that it qualifies as a renewable or sustainable energy source. Until this is recognized, it is unavoidable, with its existing momentum, that ethanol production will feather the nests of a new class of capitalists for decades in the future. Some financial circles suggest that unwise money appears to be thrown around on a possibly unsustainable new tulip mania boom.

Table 12. World ethanol production, 2005.

Country	Production [10 ⁶ gallons/year]
USA	4264
Brazil	4227
China	1004
India	449
France	240
Russia	198
Germany	114
South Africa	103
Spain	93
UK	92
Thailand	79
Ukraine	65
Canada	61
Poland	58
Indonesia	45
Argentina	44
Italy	40
Australia	33
Saudi Arabia	32
Japan	30
Sweden	29
Pakistan	24
Philippines	22
South Korea	17
Guatemala	17
Ecuador	14
Cuba	12

Mexico	12
Nicaragua	7
Zimbabwe	5
Kenya	4
Mauritius	3
Swaziland	3
Other	710

The corn ethanol industry is self-limiting. Low petroleum prices and high corn prices drive down its profitability.

7.14 SUSTAINABILITY OF ENERGY FORESTRY AS A FUEL SOURCE

INTRODUCTION

Energy forestry can be construed to have a net zero carbon inprint if, without the use of significant energy inputs, carbon is fixed into plant material then released back upon its combustion.

An estimate of the Earth's agricultural production land reveals the potential of biomass. According to an estimate by the United Nations Food and Agricultural Organization (FAO), the world's 6.5 billion people have about 5 billion hectares or about 12.35 billion acres of developed farmland and pasture at their disposal (1 hectare = 2.475 acres). Western lifestyle meat protein eaters require about 10 hectares or 24.7 acres to feed 25 people. Vegetarians need only about 1/10th as much land.

For a Western style eating habit, this would still leave:

$$12.35 \times 10^9 - (6.5 \times 10^9 \times \frac{24.7}{25}) = 12.35 \times 10^9 - 6.42 \times 10^9 = 5.93 \times 10^9$$

or about 2.4 billion hectares or 5.93 billion acres of land that could be used to produce biofuel.

Usable farmland in the USA amounts to 412×10^6 hectares or 1.02×10^9 acres. With a population of 300 million, if all American ate meat,

$$300 \times 10^6 \times \frac{24.5}{25} = 294 \times 10^6$$

acres or 118.8×10^6 hectares would be needed to produce food. The difference:

$$1,020 \times 10^6 - 294 \times 10^6 = 726 \times 10^6$$

acres could be used for energy production. It is estimated that 386×10^6 gallons or 1.46×10^9 liters of biofuel could be produced from this land. For comparison, 180×10^6 gallons or 0.68×10^9 billion liters of fuel are consumed per year as transportation fuel in the USA. As of 2007, 20 percent of American farmland was being used for corn ethanol production. The state of Iowa,

one of North America's bread baskets, will have to allocate its entire corn crop to fuel distillers when the planned plants would have been completed in a few years' time.

Sweden plans to be the first nation to completely wean itself from its dependency on oil by 2020. It wants to achieve that goal without getting rid of cars. Instead, the Swedes plan to use bioethanol to keep their country mobile.

In Brazil, bioethanol from sugar cane already meets almost half of the country's gasoline demands.

In Germany, Renewable resources, referred to in Germany as "Nawaro," an acronym for *Nachwachsende Rohstoffe*, have long been the most important element of renewable sources of energy. They provide 3.2 percent of the primary energy used in Germany, which is almost three times the share held by solar, water and wind power combined. The German Agency of Renewable Resources (FNR), a part of the country's Agriculture Ministry envisions scenarios in which about 3.5 million hectares or 8.6 million acres, which is about 1/3 of all German farm land could be used to produce energy plants by 2020, without causing conflicts with food production. Only about 1.6 million hectares or 3.9 million acres are used for energy production.

However, one must note the reality of the situation and read the fine print in that the use of these materials in Germany is limited primarily to the well tested and ancient practice of wood heating in residential fireplaces and wood burning stoves.

THE CASE FOR BIOFORESTRY

Sugar cane, which Brazil uses to manufacture its ethanol, does not grow very well in the North American climate. The USA uses corn and other grains as the raw material. The yields are barely 1,000 liters per hectare in some areas, compared with about 6,000 in Brazil. Even that 1,000 liter figure is misleading. Farming one hectare of land requires roughly 300 liters of energy to power farm machinery and transport vehicles and to fertilize the crops.

In the same way, the gross yield of the rape seed harvest in Europe shrinks from to a net yield of no more than 1,250 liters per hectare. In worst cases, turning grain into ethanol can even result in a negative energy balance because distilleries also consume energy. A tremendous amount of energy is lost converting biomass into fuel for transportation.

It could be argued that biomass could be put to more effective use generating heat and electricity rather than as a substitute for gasoline.

COFIRING BIOMASS

Biomass can be mixed with coal to reduce the carbon footprint of electrical utilities. About 20 utilities in North America are using wood chips to replace about 25 percent of the coal or natural gas used.

In Sweden 19 percent of the energy comes from biomass through co-firing. Sweden expects to produce 40 percent of its energy from biomass by 2020.

It should be noted that biomass contains about half the energy content of coal. Yet it is a sustainable way to reduce CO₂, SO_x and NO_x emissions and other waste using existing plants and available technology.

ENERGY FORESTRY

The highest annual yield per hectare from energy producing plants is about 20 tons of dry plant matter. That is the equivalent of about 9,000 liters or 2,370 gallons of petroleum.

Salix viminalis, osier or the willow plant is proposed as a sustainable addition to the arsenal of biomass fuel plants using the concept of energy forestry.

Energy forestry is a form of forestry in which a fast growing species of tree or woody shrub is grown specifically to provide biofuel for heating or electricity production.

The advantage to using grown fuels is their sustainability as compared with fossil fuels such as coal, natural gas and oil: while they are growing they absorb through photosynthesis carbon dioxide, which they release later as they are burned, for a zero net increase in the carbon dioxide level.

Fossil fuels, on the other hand are increasing atmospheric carbon by burning carbon that was added to the carbon sink over millions of years in a time when the Earth would have had a very different climate, and this is a cause of global warming.

Energy forestry would be carried out is by dedicating marginal agricultural areas such as the Conservation Reserve Program or the stretches of ditches along the national highways for the cultivation of appropriate species of trees, shrubs or grasses.

SALIX VIMINALIS, BASKET WILLOW, COMMON OSIER

An appropriate species choice is the *Salix viminalis*, known also as the common osier or basket willow. This species possesses a broad acceptance of climate and soil conditions. It is relatively non susceptible, from year two onwards, to pests and diseases. It is easy to propagate with vegetative cuttings and has a fast vegetative growth.

The plant is a many branched shrubby species of willow (*Salix*). It usually grows to between 3-6 meters in height. It possesses long, straight branches with exceptionally long and slender leaves about 10-15 cm in length and 1 cm in width. Its flexible twigs allowed it to be used in basket making, hence its other common name of basket willow.

Its leaves are dark green, with a silky grey underside. The plant's male catkins are yellow and oval-shaped, and appear in the early spring before the leaves. The female catkins are longer and more cylindrical, appearing at the same time as the leaves.

These trees grow in the wild by streams and wet places. They can be found along drainage ditches in Illinois in the USA. They are also common throughout both Britain and Ireland at lower altitudes. It is one of the least variable willows, but it can hybridize with other willow species.

GEIJERA PARVIFLORA, AUSTRALIAN WILLOW

Another possible choice is *Geijera parviflora* or Australian willow Graceful. It is a fast growing tree with the branches sweeping up and out, with little branches hanging down. It has a medium green color.

It is similar to the weeping willow, but is not susceptible to the same pests. It grows to a maximum of 25 feet, with a maximum spread of 20 feet. With low maintenance, it needs only corrective trimming. It grows at a moderate rate without invasive roots.

WILLOW CULTIVATION

Willow trees' high production can be maintained by short rotation periods of about three to five years. After each harvest the established root system and the nutrients stored in the roots and stumps guarantee vigorous growth for the shoots.

Willow plantations can easily be established with stem cuttings about 20 cm in length. This matches an observed natural propagation process of the willow tree, where green branches broken out by high winds and storms, get imbedded into the ground, sending roots and starting new trees. The cuttings are soaked in water for about two days before planting. During the establishment year the plantation is susceptible to drought and weeds with irrigation and efficient weed control recommended.

A planting density of about 18,000 cuttings/hectare can be used. Weed control and preparation of the land in the spring would be followed by planting the cuttings. The high moisture of the soil in the spring and the amount of sunshine in the early summer will stimulate root penetration and shoot development. The most efficient planting machines plant four rows at a time. It takes about an hour to plant a hectare.

Production during the establishment year is low, usually less than 1,000 kg/hectare. Following the first summer, the shoots are cut and the actual production period starts after the establishment year.



Figure 21. *Salix Viminalis*, common osier or basket willow plant for bioenergy forestry.

As the plantation is properly established, it may be possible to attain an annual yield of about 9,000-12,000 kgs of dry matter per hectare. This would have an energy content equivalent to the content of 3.7-4.9 tons of heating oil. Repeat harvesting of a plantation is possible without re-establishing it for about 25-35 years.

During the establishment year the dry matter production is expected to be low. The few following years after the establishment are part of the establishment phase. In subsequent rotations the annual yield will be better than at the beginning. As a pioneer species, the yield of the willows may decrease after the third growing rotation.

The willow plantation would be harvested in the winter after leaf fall, above frozen soil. Since the shoots are harvested as whole stems, they are easy to store and ship. The scheduling of the subsequent operations is more flexible. The stems can be dried for combustion in a pile

outdoors; the moisture content of the wood will decrease to about 30 percent on average until the next fall period.

The harvesting is done with heavy self-powered machinery, which cut and chip the shoots and drop them on a loading platform. The direct chipping reduces costs considerably, since a separate chipping in the store will be excluded. Some chipping harvesters can be attached to an existing tractor. About 3 hours are needed to harvest a hectare.

An energy forest that is ready for harvesting would have about 40 –50 tonnes of dry matter per hectare. The shoots would be 5-6 meters in height with a diameter of about 3-5 cms at breast height. This amount of dry matter fills a solid volume of about 110-135 m³.

In Europe, the price of dry willow used as a heating fuel is about 45 Euro/metric tonne. Even though this not a high-return, it is compensated with low maintenance and input., is a way of utilizing difficult fields, and is an environmentally friendly type of farming as little pesticides and treatments are necessary, and above all is a sustainable system of energy production.

BLACK LOCUST

Black locust (*Robinia pseudoacacia*) can be used as a potential woody biomass crop. It exhibits a higher yield and a shorter harvest than other woody species. It can be used for direct combustion and may possibly be broken down to extract its sugars to be turned into alcohols.

Coppicing the plant, or cutting the plants back from a single stem a few inches above ground, allows the plant to grow back with multiple stems as a bush with multiple stems arising from the base and shoots from the root system. After coppicing, the plants can be harvested after 2-5 years in the same way as other woody plants such as willows, producing about 12-16 tonnes / hectare.

7.15 SUSTAINABILITY IN FOOD PRODUCTION

WORLD FOOD SUPPLY

The peak world population is expected to rise to 8.5-9.5 billion in 2050. The largest population growth, if unchecked by voluntary population control measures or involuntary starvation, disease, wars and other calamities, is expected to occur in Asia and India.

Food production covers 40 percent of the Earth's land surface, as reported at a December 2005 meeting of the American Geophysical Union. In 1700, just 7 percent of the globe was used for farming. Today, an area roughly the size of South America is devoted to crop production alone. Farmland grew by 12.4 million acres between 1992 and 2002, according to United Nations statistics.

The USA and some South American countries have more arable land to satisfy part of the demand. Asia, where most of the population growth is to occur has only 30 percent arable land. Peak global food demand is expected to at least double, if not triple over the next 50 years. Crop land and yields will have to increase to meet the increased demand for food.

FOOD, FEED AND FUEL, THE THREE F'S DEBATE

The amount of grain that is required to fill a 25 gallon tank with ethanol could otherwise feed one person for a year.

In the USA, food processors, soda bottlers, livestock groups and even the oil companies spoke against federal energy policies aiming at raising biofuels usage to 36 billion gallons per year.

Food cereal packagers in the USA, while keeping the price constant decreased the content of their “family size” boxes from 21 ounces to 19 ounces (The “regular” size weight is 16 ounces). This is a stealthy increase in the price of a box of cereal of $(21-19) / 21 = 2/21 = 0.095$, or 9.5 percent.

Rising bread and flour prices have sparked protests across drought-stricken Morocco, where the wheat crop dropped by 76 percent in 2007. Public disturbances have also been reported in Yemen, Niger, and the Ivory Coast.

Milk and cheese prices are at record highs, as well as rice. ... In Japan, where the government is the sole importer of wheat, bread prices have gone up for the first time in two decades. Russia, the Ukraine, and Kazakhstan have imposed restrictions on their wheat exports to ensure that their domestic supplies

Coca-Cola and PepsiCo complained that this would drive up the cost of their corn syrup sweetener. Food processors like the Kellogg Company worried that this would drive up the cost of their cereals. In fact, they did not wait too long: they reduced the sizes of their packages, correspondingly raising the prices. Livestock producers complained that the increased price of their feed corn and soybean meal. The oil companies complained that the expanded biofuel production prompted them to scale back plans for oil refineries capacity expansions.

An epic competition is arising between the 800 million motorists who want to protect their mobility and the 2 billion poorest people in the world who need food to survive. According to Lester Brown, President of the Earth Policy Institute: “The grain required to fill a 25 gallon SUV gas tank with ethanol, for instance, could feed one person for a year. If today's entire U.S. grain harvest were converted into fuel for cars, it would still satisfy less than one-sixth of U.S. demand.”

In 2006, 74.505 million acres were planted to soybeans and 71.047 million acres to corn. The corn production in 2006 at an average yield of 151.2 bushels/acre yielded 10.744,806 billion bushels of corn, the second largest production ever after the 2004 production at 11.8 billion bushels. The soybeans production at an average yield of 43 bushels/acre yielded 3.203,908 billion bushels, an all-time record.

At the 106 ethanol plants operating in 2006, 2.1 billion bushels of corn or $2.1/10.74 = 19.6$ percent were used for ethanol production. In 2007, 53 new and expanded plants are expected to need an extra 1.4 billion bushels or a total of $2.1+1.4 = 3.5$ billion bushels of corn. This means a need to expand the corn acreage by: $1.4 \times 10^9 / 151.2 = 9.3 \times 10^6$ acres, to a total of $71.047+9.3 = 79.347$ million acres. This would be the highest corn production since 1946; a thirty years phenomenon, leading to increased corn prices, in turn increasing the prices of beef, poultry, and even soft drinks using corn syrup as a sweetener. This increase in the corn acreage would be at the expense of the soybeans, wheat and cotton acreage and leading to increased prices in these commodities.

The 159 corn ethanol plants would be capable of producing 9 billion gallons of ethanol/year. The USA uses 140 billion gallons of gas per year. Thus the ethanol would only supply: $9/140 = 6.4$ percent of the fuel needs.

Iowa State University economist Bob Wisner observes that the 56 distilleries operating and under planning in Iowa would use its entire corn harvest. He notes: “If all these plants are built, it would use virtually all the current Iowa corn crop, adjusted for trend yields out to 2012. That means the market will almost certainly have to buy substantially more corn acres in the next

several years, through higher corn prices. December 2007 and 2008 corn futures already are sending that signal.” South Dakota’s corn ethanol distilleries are claiming over 1/2 of the state's crop.

A food and feed versus fuel debate is ongoing in the grain industry. In May 2006, the privately owned Cargill grain company’s Chairperson and Chief executive Officer (CEO) Warren Staley expressed his concern about the effect of the growing corn ethanol industry, and urged USA’s agriculture to adhere to: “ ... a hierarchy of value for agricultural land use: food first, then feed, and last, fuel.”

On the opposing side, rival Archer Daniel Midland (ADM) Company appointed Patricia Woertz, a top executive with the Chevron oil company as its new president and CEO, signaling a commitment to the use of food crops for fuel production, with ADM as the premier corn ethanol producer in the USA.

The CEO of the National Corn Growers Association suggests: “We can easily foresee a 15 billion bushels corn crop by 2015. That is enough corn to support production of 15 to 18 billion gallons of ethanol per year and still support the feed industry and exports, with some room for growth.” He attributes the increase from the 2006 corn production figure of 10.9 billion bushels to the 15 billion level expected from advances in corn genetics and an acreage increase.

At the local level, grain elevators managers face the critical prospective that the corn ethanol business would put them out of business and affecting the economy of small rural towns in the USA. The typical local grain elevator must adjust to the new situation by supplying corn to the nearby ethanol plants rather than shipping it out of state and overseas, and serve as intermediaries to dispose of the surplus distiller grain byproducts as animal feed.

David Pimentel from Cornell University estimated that if the entire world ate the way the USA eats, humanity would exhaust all known global fossil fuel reserves in just seven years. Pimentel detractors accused him of being off on other calculations by as much as 30 percent, which would extend the seven years estimate into ten years. The rest of the world is adopting the USA model: Mexico feeds 45 percent of its grain to livestock, up from 5 percent in 1960, Egypt went from 3 percent to 31 percent in the same period, and China, with 1/6 of the world’s population, has gone from 8 percent to 26 percent. These countries have poor people who could use the grain for food, but they cannot afford to purchase it.

The grinding, milling, wetting, drying, and baking of a breakfast cereal requires about four calories of energy for every calorie of food energy produced. A 2 lbs bag of breakfast cereal burns the energy of a half-gallon of gasoline in its making. The food processing industry in the USA uses 10 calories of fossil fuel energy for every calorie of food energy it produces. This does not include the fuel used in transporting the food from the factory to the consumption centers nor the fuel used by millions of people driving to thousands of super discount stores on the edge of town.

A measure of the energy efficiency of food production that allows a comparison between different farming practices is the energy consumed per unit output, often expressed as the energy consumed per metric tonne of food produced (MJ/tonne) or the energy consumed per kilogram of food (MJ/kg).

$$\eta_{\text{food}} = \frac{E}{m} = \frac{\text{Energy consumed}}{\text{product mass}} \left[\frac{\text{MJ}}{\text{metric tonne}} \right] \quad (4)$$

A comparison of organic and conventional livestock, dairy, vegetable and arable systems in the UK found that, with average yields, the energy saving with organic production, considered as sustainable, ranged from 0.14 MJ/kg to 1.79 MJ/kg, with the average being 0.68 MJ/kg or 42 per cent. The improved energy efficiency is primarily due to lower fertilizer and pesticide inputs, which account for 1/2 of the energy input in conventional potato and winter wheat production and up to 80 per cent of the energy consumed in some vegetable crops. Many authors suggest that the present food supply system is vulnerable, inefficient and unsustainable.

A general issue of energy use sustainability is revealed in a 2005 Land Stewardship Letter: “Myth: Industrial Agriculture is Efficient” by the center for Integrated Agricultural Systems at the University of Wisconsin, USA, suggesting that if both the distribution and production of food are taken into account in the USA, it takes 10-15 calories of energy for each calorie of food energy produced. The energy ratio or E_{out}/E_{in} in agriculture has decreased from being close to 100 for traditional pre-industrial societies to less than 1 in most cases in the present food system, as energy inputs in the form of fossil fuels, have gradually increased.

In terms of the amount of energy it takes to produce each calorie of food, industrial farming systems are extremely inefficient. According to Richard Manning in a book: “Against the Grain,” in 1940, the average USA farm produced 2.3 calories of food energy for every calorie of fossil fuel energy it used. By 1974, that ratio was 1:1. Today, according to David Pimentel from Cornell University, who has studied the environmental impacts of different cropping systems, this ratio is 3:1.

This does not include the energy expended to process and transport the food to the consumption centers. When both production and distribution are taken into account, it takes 10 to 15 calories of energy for every calorie of food energy produced, according to the Center for Integrated Agricultural Systems at the University of Wisconsin. The more processing done to food, the more energy it consumes: “It takes around 500 to 600 calories to process a kilogram of flour or canned fruits and vegetables. A kilogram of breakfast cereal gobbles up more than 15,000 calories when it is processed, and instant coffee slurps nearly 19,000 calories.”

During the past half century agriculture has become increasingly dependent upon abundant and cheap petrochemicals to perform important tasks from running cropping equipment to manage stockpiles of liquid manure. It takes diesel fuel to operate tractors and other equipment, and natural gas to produce fertilizer and pesticides. The USA Department of Energy estimates that natural gas accounts for 70 to 90 percent of the cost of producing anhydrous ammonia, a key source of nitrogen fertilizer necessary for corn growing. Farmers use energy to dry corn, irrigate fields and transport their product to market. It takes fossil fuels to produce chemicals that control insect and weed pests, as well as to heat and cool large livestock confinement structures.

On dairy farms in the USA, \$8 out of every \$10 spent can be traced back to oil. The agribusiness magazine “Feedstuffs” ran an article on poultry production headlined: “Energy projected to soon replace feed as biggest factor in production costs.” For USA crop farmers, energy related expenses range from 10 percent to 30 percent of operating costs, depending on the region of the country and type of enterprise, according to the USA Department of Energy. Such dependence can only be tolerated as long as energy prices remain relatively low.

If the produced food is shipped hundreds and thousands of miles to reach the consumers, much of their energy benefits are canceled out. A team of British researchers examined in “Food Policy” the “externalized” costs, such as damage to the environment, traffic congestion and human health hazards caused by vehicle emissions that are a part of a market basket of food in the UK. Of the 12 commodities assessed, livestock products were the most costly on a per

kilogram basis. These external costs could be cut by 90 percent only with a shift to a local food system, where food is consumed within 12 miles of where it is produced. Such a dramatic shift in the food supply system is not likely any time soon, but may be imposed in the future by dwindling fossil fuel supplies and increasing transportation costs.

Meanwhile, the USA farmer's share of the consumer dollar amounted to just 19 cents of every dollar spent on food. Grain farmers fared even worse with 10 cents of every dollar in a box of cereal, with the 90 cents going to multinational grocery manufacturers.

The fears have become reality. On January 18 of 2007, President Felipe Calderon of Mexico signed an accord with businesses to curb soaring tortilla prices, as the corn tortilla is "The basic staple of the Mexican diet and is especially crucial for the poor." The president meant: "To protect Mexico's poor from speculative sellers and a surge in the cost of corn driven by the USA ethanol industry." "The accord limits tortilla prices to 8.50 pesos or \$0.78 per kilogram and threatens to use existing laws to achieve prison sentences of up to 10 years for company officials found hoarding corn. Tortilla prices were raised by 14 percent in 2006, more than three times the inflation rate, and they have continued to surge in the first weeks of 2007."

7.16 BIODIESEL FUEL

INTRODUCTION

Rudolf Diesel used peanut oil to fuel his early diesel cycle engines.

The USA economy is fueled by diesel fuel: 94 percent of the nation's total freight is driven by diesel vehicles. Nothing matches the diesel engine combination of durability, economy, engine safety and continuous power under load. However, it has been observed that over time, low lubricity fuels cause premature engine failure. The production of biodiesel results in the accumulation of large quantities on glycerine from the esterization process, for which a use must be found.

Biodiesel motors use more oil and frequently change their filters, which raises costs. Biodiesel also has slightly less energy content than traditional diesel, meaning cars and trucks tend to use more on any given trip. For economic competitiveness biodiesel must be priced at less than conventional diesel fuel at the pump.

Biodiesel has the advantages of restoring the lost lubricity and of being free of sulfur causing less pollution. Diesel fuel blends in the USA have had their sulfur content drastically cut by The Environmental Protection Agency (EPA) because of pollution and air quality concerns. A new EPA mandate reduces sulfur content in diesel fuels by 95 percent, from 500 ppm to 15 ppm. Accordingly, 80 percent of all diesel sold must be "ultra-low sulfur diesel", or ULSD.

ENERGETICS OF CORN AND SOYBEANS AS BIOFUELS

Soybeans are raised for protein and oil production whereas corn is raised for carbohydrates production. It takes more nitrogen to produce protein and oil physiologically than it takes to produce carbohydrates. About 4.9 lbs of nitrogen are used per bushel of soybeans compared with just 1.35 lbs of nitrogen per bushel of corn. The nitrogen has to be fully supplied to the corn plant as nitrogen fertilizer produced from a hydrocarbon such as natural gas, whereas soybeans are a legume that fixes about 80 percent of its nitrogen needs from the air. The rest is absorbed from organic matter or the nitrate flux in the soil.

For every unit of glucose a plant can produce 0.83 units of carbohydrate, whereas only 0.33-0.40 units of protein and oil can be produced. This implies that $(0.83 - 0.40) / 0.83 = 0.52$ or 52 percent more energy is needed to produce a bushel of soybeans than it is needed to produce a bushel of corn.

Another difference between corn and soybeans is related to the efficiency in energy consumption in the photosynthesis process. Corn is C4 plant and soybeans as a C3 plant. Almost 1/3 of the efficiency in energy conversion is lost in a C3 crop compared with a C4 crop because of photorespiration where O₂ competes with CO₂ and it is lost. A soybean plant has to work twice as hard and uses about 2 ½ times the amount of energy to produce a bushel of soybeans than it is needed to produce a bushel of corn.

That extra need in energy for the soybean plant translates eventually into the price paid for a bushel of soybeans being 2.25-2.5 times that of corn in the marketplace.

When a commodity is bought, it is essentially an energy product that is bought.

INTERNATIONAL PICTURE

The growing focus on climate change encourages biodiesel fuel since its emissions are some 50 percent lower than diesel made from fossil fuels, according to the International Energy Agency.

Corn, vegetable oil, animal fat, and sugar from sugar cane and beets have become eagerly sought commodities. Concurrently to ethanol production from corn, biodiesel from vegetable fat such as soybean oil, peanut oil, rapeseed, castor bean plant oil, and palm oil, as well as from animal fat such as beef tallow and catfish oil, as well as restaurants waste oil, has increased by a factor of 100 times from 1999 to 2004.

The world's production of biodiesel fuel amounted to 5 million metric tonnes in 2006 and is expected to reach 16 million tonnes by 2009.

Germany's biodiesel sector, depending as rapeseed as a feedstock, has been a growth success story using a tax free status of 9 euro cents per gallon, that has been recently discontinued. After a decade of low level growth in the 1990s, production boomed since the turn of the millennium: The amount of biodiesel produced in 2006 was 18 times the volume produced in 2000 at over 4.5 million tons, up from 250,000. The amount of rapeseed planted has skyrocketed. Germany's €2 billion biodiesel industry produces more than five times as much as Italy, its next biggest competitor in Europe. The European Union has a plan to cut Europe's CO₂ emissions by 20 percent by 2020 compared with the 1990 levels. The plan calls for 10 percent of European cars and trucks to run on biofuel by then.

USA'S SITUATION, SOYBEANS AND ANIMAL FATS

There were 88 plants in the USA that produced an estimated 250 million gallons of biodiesel in 2006, triple the 2005 production of 75 million gallons.

Global use of vegetable oils in fuel is expected to rise 17 percent in 2007 to 21.6 million tons from 2006 and more than double the 8.7 million tons used six years earlier. That is almost equal to the entire food consumption of vegetable oil in China, the largest consumer.

In the USA emphasis has been on the use of animal fats and soybeans for the production of biodiesel. The soybeans are crushed into two main products: oil and meal. The apportionment is ¼ oil and ¾ meal. Soybean oil is used for human consumption such as for cooking oil. Nearly

all the soybean meal at 98 percent of the meal market is used for animal feed because of its high quality protein profile. This amounts to over 32 million tons of soybean meal per year. This corresponds to \$9 billion worth of soybeans used for animal feed, compared with \$6.2 billion for international marketing and \$0.75 billion for biodiesel production.

The poultry sector as broilers, egg layers and turkeys uses the most soybean meal at 16 million tons produced from 13.6 million acres. Hogs use the equivalent of 8.4 million tons produced from 6.7 million acres. Beef and dairy cattle consume 4.5 million tons produced from 3.8 million acres.

RAPSEED OR CANOLA AS FEEDSTOCK

The crop which was all the rage in the 1980s, fell out of favor, but may undergo a comeback. It is grown in Canada and the Northern Plains of the USA, The difficulty is that it has to be hauled to a crushing plant in the state of Georgia. It is grown as a winter annual and can be grown in a double crop rotation with soybeans in Southern Illinois.

The cultivation of rapeseed has turned the German landscape into a yellow color. Rapeseed oil, converted into halfway decent diesel fuel when combined with methanol, was the first vegetable based fuel to make its way into German gas tanks. German refineries have the capacity to produce more than 3 million tons of vegetable oil based diesel annually, which is more than 1/10th of German diesel consumption.



Figure 22. Yellow colored rapeseed or canola field in Germany (left). Rapeseed or canola seed (right).



Figure 23. Neckermann biodiesel factory in Eastern Germany. DDP photograph.

However, the German Federal Environment Agency gave devastating marks to early domestic use of rapeseed. It contends that the environmental benefits of rapeseed derived biodiesel are negligible. The energy content of the fuel obtained from the plant is largely offset by the amount of energy that goes into operating agricultural machinery and producing and applying pesticides and fertilizers. Rapeseed requires vast amounts of pesticides and fertilizer, thereby consuming energy and adversely affecting the ground water supply.

PRODUCTION

The chemistry involves the conversion of fats or triglycerides to methyl esters. This is blended by fuel distributors at varying rates with petroleum diesel fuel. There are state incentives such as in Illinois for those who go beyond a 10 percent blend, giving them sales tax exemptions.

The oil containing seed is moved through a screw press or extruder which is thermostatically controlled and electrically heated. Up to 90-95 percent of the oil is extracted from the seed and is passed through a screen. The oil is pumped into a processing tank where the right amounts of methanol, which is produced from methane CH_4 or natural gas and potassium hydroxide (lye) are added. Potassium hydroxide being an environmentally hazardous material, it can be substituted-for by potassium chloride (potash) which is a common fertilizer. After processing the resulting product is settled and the reaction products such as glycerin are drained out. The oil is cleaned with a water wash resulting in the B100 product.

The leftover meal has 25-50 percent protein, depending on the seed used and can be fed to livestock. It has a value of about \$200 per ton.

Table 13. Oil production from different oil seed crops.

Oil Seed	Fuel production [USA gallons/acre]	Oil content [percent]	Oil production [lbs/acre]	Oil production [USA gallons/ton]	Meal production [lbs/ton]

Pecan nuts	191	45-50	1344	123	1,100
Canola	133	40-45	975	110	1,200
Rapeseed	127	38-45	795	96	1,300
Peanuts	113	40-45	795	123	1,200
Camelina	102	40-45	750	123	1,200
Sunflowers	102	40-45	714	123	1,200
Safflower	83	38-45	585	98	1,200
Sesame	74	35-40	522	96	1,300
Mustard	61	35-40	430	96	1,300
Linseed, Flax	51	35-40	359	96	1,300
Soybean	48	12-18	335	46.5	1,700
Cotton	35	30-35	244	82	1,400

Other oil seeds hold a better potential for fuel production compared with soybeans with their low oil content, which are ranked as second after cotton in terms of gallons of fuel produced per acre at 48, compared with canola at 133 and even pecan nuts at 191.

Soybeans, being legumes, fix their own nitrogen from the air, and do not need a nitrogen fertilizer like corn. However methanol must be used in the esterization process.

The National Biodiesel Board in the USA estimated that biodiesel sales have grown from 2 million gallons in 2000, to 25 million in 2005.

An advantage of the use of biodiesel is that there is no need to convert the vehicle use as in the case of corn ethanol. It is non-toxic and biodegradable. It has a high flash point at 350 degrees, so that it would not ignite unless a very high temperature is reached. It is lubricating to the fuel injection pump in diesel engines.

One bushel of soybeans produces 1.5 gallons of biodiesel fuel. The large amount of soybean meal left as a byproduct of soybeans based biodiesel is only 20 percent of crushed soybeans is oil and will limit the use of soybeans in biodiesel production. Other oil seeds, such as rapeseed, would have to fill the demand with less byproduct. Rapeseed will be sourced from Eastern Europe in coming years.

Malaysia emerged as the biofuel leader in Asia with its exports of palm oil. After approving 32 biodiesel refineries, it suspended further licensing while it assesses the adequacy of its palm oil supplies. Fast rising global demand for palm oil for both food and biodiesel purposes, coupled with rising domestic needs, has its government concerned that there will not be enough of it to go around.

BIOFUEL FROM PEANUTS

As an alternative to soybean oil, peanut oil can be used for biodiesel production. The choice of varieties with high oil content and low input costs such as those requiring no more than a single herbicide application instead of the usual 3-4 treatments, and without the use of fungicides, is imperative. Varieties with high oleic acid content, which is a desirable feature for the extended shelf life of food peanuts, are also suitable for biodiesel.

Soybeans produce about 50 gallons of fuel per acre, while traditionally grown peanuts can produce 120-130 gallons of biodiesel fuel per acre.

ALGAE AS A SOURCE OF BIODIESEL

Algae are among the fastest growing plants in the world, and about 50 percent of their weight is lipid oil that can be used to manufacture biodiesel fuel.

Instead of growing algae in ponds that have a limited area for absorbing solar energy, a closed vertical system of long rows of moving plastic bags is used. The system is called as Vertigo, a joint venture between Valcent and Canadian alternative energy company Global Green Solutions. By going vertical, one gets a lot more surface area to expose the cells to the sunlight and it keeps the algae hanging in the sunlight just long enough to pick up the solar energy they need for the photosynthesis process.

About 100,000 gallons of algae oil can be produced per year per acre, compared with about 30 gallons per acre from corn and 50 gallons from soybeans.

The USA Department of Energy studied the process from 1978 to 1996. Scientists experimented with algae in open ponds in California, Hawaii, and in Roswell, New Mexico.

The use of ponds involved a large land area, with inherent problems of evaporation and contamination from other plant species and various flying and swimming animals.

There are about 65,000 known algae species, with hundreds of thousands more still to be identified. Research involves determining what type of algae produces what type of fuel. One species may be best suited for jet fuel, while the oil content of another may be more efficient for truck diesel.

The Aztecs knew used algae as a high protein food. The common commercial use of algae today is as a health food drink, usually sold as “Spirulina” flour.

Some algae reproduce sexually, some asexually, while many combine both modes. In some green algae the type of reproduction may be altered if there are changes in environmental conditions, such as lack of moisture or nutrients.

Locating algae processing plants intelligently can add to their efficiency. Locating algae facilities next to carbon producing power plants, or manufacturing plants, for instance, the plants could sequester the CO₂ they create and use those emissions to help grow the algae, which need the CO₂ for photosynthesis.

The 2007 Energy Security and Independence Act includes language promoting the use of algae for biofuels.

INDUSTRIAL HEMP

Hemp is indigenous to Asia and America and is highly productive for seed oil. Industrial hemp has a high yield of oil per acre, which could make it the best crop for biodiesel fuel. It has a short growing season, and it grows with virtually no chemical pesticides and herbicides. It has a long taproot and involves a chemical free growing process. The stalks can be used for a multitude of fiber applications, from ropes to cloth and paper.



Figure 24. Industrial hemp belongs to the cannabis family.

An impediment to the use of industrial hemp is that it is a member of the *Cannabis sativa* L. species and have some similar characteristics to marijuana. The major difference is that hemp contains only trace amounts of the narcotic substance delta-9 tetrahydrocannabinol or THC.

JATROPHA OIL

As a highly efficient, easy to grow biofuel source that has no direct effect on the global food supply, the jatropha plant is a large shrub filled with golf ball size oily green fruit. It can grow almost anywhere, and does not require an abundant water supply. It is inedible, resistant to pesticides and is used in India to build hedges.

The *Jatropha* plants contains many toxic compounds such as lectin, saponin, carcinogenic phorbol and a trypsin inhibitor. The sap is a skin irritant. Ingesting as few as three untreated seeds can be fatal. Small amounts of *Jatropha* can induce vomiting.

The *Jatropha curcas* plant is also known as Habb Al Muluk (in Arabic: Grain of kings), physic nut and piñoncillo. It is used to produce jatropha oil for making candles and soap.



Figure 25. Jatropha fruits.

To produce biodiesel, the seed is shelled, pressed and then the oil pressed out. The whole seed can be used with its oil as feed to digesters and gasifiers to produce biogas for cooking and in engines.

What is interesting is that jatropha oil can be poured right into a biodiesel fuel tank, making it one of the low impact, high efficiency, natural biofuel sources. In addition it is one of the least expensive potential sources of biofuel feedstocks.

The jatropha bush is an ugly, fast growing and poisonous weed. The hardy jatropha, resilient to pests and resistant to drought, produces seeds with up to 40 per cent oil content. Every hectare can produce 2.7 tonnes of oil and about 4 tonnes of biomass. Every 8,000 hectares of the plant can run a 1.5 megawatt station, enough to power 2,500 homes.”

Jatropha grows in tropical and subtropical climates. Whereas other feed-stocks for biofuel, such as palm oil, rape seed oil or corn for ethanol, require reasonable soils on which other crops might be grown, jatropha is a tough survivor prepared to put down roots almost anywhere. It can grow in the poorest wasteland, generating topsoil and helping to stall erosion, but also absorbing carbon dioxide as it grows, thus making it carbon neutral even when burnt.

A jatropha bush can live for up to 50 years, producing oil in its second year of growth, and survive up to three years of consecutive drought.

Jatropha plantations have been laid out on either side of the railway between Bombay and Delhi, and the train is said to run on more than 15 per cent biofuel. Backers say that the plant can produce four times more fuel per hectare than soybeans, and ten times more than corn.

Jatropha, a native of Central America, was brought to Europe by Portuguese explorers in the 16th century and has since spread worldwide. An ingredient in folk remedies around the

world, it earned the nickname “physic nut”, but its sap is a skin irritant, and ingesting three untreated seeds can kill a person.

Some fear that in areas dependent on subsistence farming it could force out food crops, increasing the risk of famine. Some countries are also cautious for other reasons: Western Australia banned the plant as invasive and highly toxic to people and animals.

Jatropha needs at least 60 cm or 23 in of rain a year to thrive. However, it can survive three consecutive years of drought by dropping its leaves. It is excellent at preventing soil erosion, and the leaves that it drops act as soil enriching mulch. The plant prefers alkaline soils. Each jatropha seedling should be given an area two square meters. Twenty per cent of seedlings planted will not survive. Jatropha seedlings yield seeds in the first year after planting.

Table 14. Price of different biofuels.

Source	\$/barrel of fuel
Jatropha	43
Sugar Cane	45
Corn	83
Sugar beets	100
Soybeans	122
Rapeseed	125
Wheat	125
Cellulose	305

CASTOR OIL

Castor oil is unique and is valued as a lubricant for heavy machinery, for making greases, pharmaceuticals, and paints. It is also used as a food additive, in flavorings and candy as a mold inhibitor, in the manufacture of soaps, lubricants, hydraulic and brake fluids, paints, dyes, coatings, inks cold resistant plastics, waxes and polishes, nylon, pharmaceuticals, perfumes, lubricant softeners and dyeing assistants.

A gene called RcdGAT may play a role in directing the castor plant to put the oil's most important component, known as ricinoleate, into it. Ricinoleate is safe and free of ricin, the castor bean plants' natural toxin. The word "ricin" in the name "ricinoleate" stems from the plant's scientific name: *Ricinus communis*.

Castor oil is extracted from the seed of the castor oil plant. The oil has a long and varied history of use as a healing agent in folk medicine around the world. Castor bean seeds, believed to be 4,000 years old, have been found in Egyptian tombs. Historical records reveal the medicinal use of castor oil in Egypt for eye irritations, India, China (for induction of childbirth and expulsion of the placenta), Persia (for epilepsy), Africa, Greece, Rome, Southern Europe, and the Americas. In ancient Rome, the castor oil plant was known as Palma Christi, which translates into hand of Christ.



Figure 26. Castor beans.

The castor oil plant is used for shade and fences in many parts of the world. It is a medicinal plant whose oil is used as a laxative to relieve constipation with its major site of action as the small intestine. Since it easily penetrates the skin, it is used as warm packs and rubs it is used as a muscle relaxant to relieve sciatica muscle pain, skin eruptions, abdominal complaints, headaches, inflammatory conditions, and lesions. Ricinoleic acid is the main component of castor oil exerting anti-inflammatory effects.

CAMELINA SATIVA OIL

Biodiesel can be produced from the Camelina plant, which is an oil seed from the mustard family.

The crop can grow on marginal land using little moisture and can provide a good rotation crop in continuous small grains production systems.

Camelina is part of the brassicaceae family along with canola. Other more familiar brassicaceae are cabbage and turnips.

Research shows that camelina is well suited to conditions in the Pacific Northwest, requires low inputs of water and nutrients, and reduces disease, insect and weed pressure in wheat fields planted the following year.

Camelina produces seeds that have high oil content. These seeds get crushed by a crusher that squeezes out the oil, which is turned into cleaner-burning biodiesel. The leftover crushed seed is a meal that goes to livestock as feed.



Figure 27. The Camelina Sativa plant.

FIELD PENNYCRESS, THLASPI ARVENSE, OIL

Field pennycress, also known as stinkweed, a winter annual, is a potential biodiesel feed stock of the mustard family that is now largely viewed as a weed. Pennycress seed has about 36 percent oil content and can be planted as a double crop winter crop option following corn or soybean harvest and harvested prior to spring planting. It has good agronomic characteristics of low water and nutrient need and requires low or no herbicides.

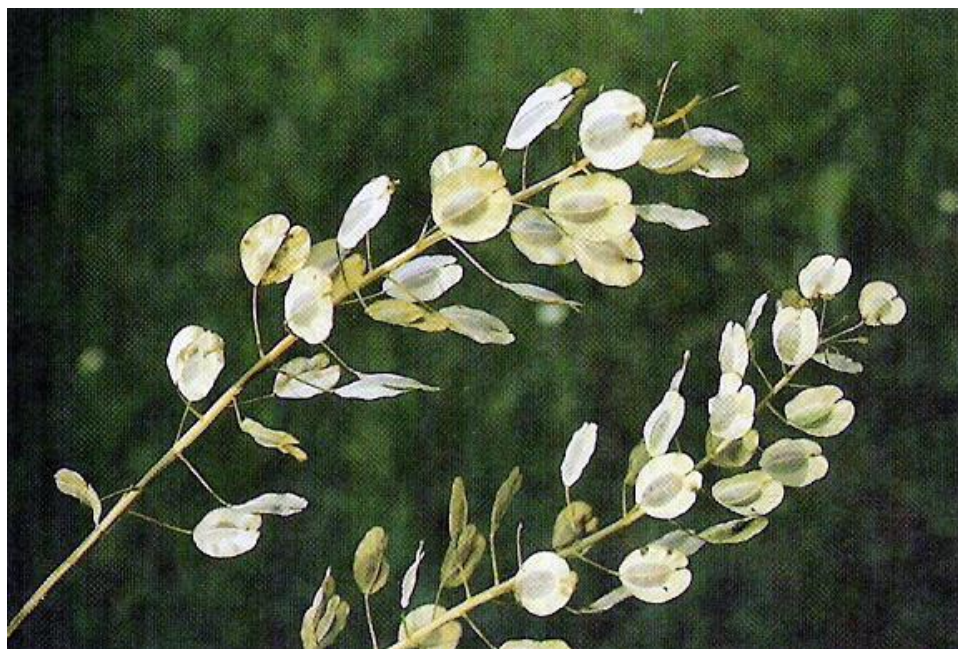


Figure 28. Field pennycress, *Thlaspi Arvense*.

Pennycress has a fatty acid profile similar to that of soybeans, but its seeds contain about 36 percent oil. The remaining material after the extraction of oil or press-cake can be burned, gasified or pyrolyzed into bio-oil.

An acre of pennycress can produce 95 gallons of biodiesel and another 95 gallons of bio-oil. The crop can be planted in the early fall with an optimal planting date of September 1st to October 15. The plant emerges and grows over the winter months. In April, the plant bolts and produces a white flower which sets seed in May. The mature plant can be harvested in June and followed by a soybean crop. It does not germinate until the next fall, causing no problems for the soybean crop or other summer crops. The plant is heat dependent like corn, a warm spring would be ideal for its growth.

As a biofuel crop, pennycress is a non-food crop that produces non-edible oil. It is grown as a winter cover crop which means that no land will be taken out of corn or soybean production to grow it. It can be followed as a winter cover crop by soybeans, but not corn since harvest would be too late to follow it with corn. The crop can be planted and harvested using technology already being used, including standard grain harvesting equipment.

Some varieties of pennycress are planted to remove heavy metals from soils at previous industrial sites. It removes cadmium, lead and zinc from the contaminated soils.

Crop carryover where pennycress persists in the field has been noticed, but it has no negative impact on the following crop or yield.

JOJOBA, *SIMMODSIA CHINENSIS* OIL

Jojoba is a perennial woody shrub native to the semiarid regions of southern Arizona, southern California and northwestern Mexico. Jojoba is being cultivated to provide a renewable source of a high quality oil.

The Native Americans extracted the oil from jojoba seeds to treat sores and wounds. Collection and processing of seed from naturally occurring stands in the early 1970s marked the beginning of jojoba domestication. In addition, the ban on the importation of sperm whale products in 1971 led to the discovery that jojoba oil is in many regards superior to sperm oil for applications in the cosmetics and lubrication industries.

The interest in jojoba worldwide is the result of the plant's ability to survive in a harsh desert environment. The utilization of marginal land that will not support more conventional agricultural crops could become a major asset to the global agricultural economy.

Jojoba seed contains a light gold colored liquid wax ester which is the primary storage lipid of the plant. This is unlike conventional oilseed crops, such as soybean, corn, olive, or peanut which produce oils as the primary storage lipid. Jojoba wax makes up to 50 percent of the seed's dry weight. The physical properties of jojoba oil are: high viscosity, high flash and fire point, high dielectric constant, high stability and low volatility. Its composition is little affected by temperatures up to 570°F or 300°C. Jojoba oil contains straight chained C₂₀ and C₂₂ fatty acids and alcohols and two unsaturated bonds, which make the oil susceptible to many different types of chemical manipulations. The extracted oil is relatively pure, non-toxic, biodegradable, and resistant to rancidity.

Most jojoba oil produced in the U.S. today is sold at a high price for use in cosmetics and hair care products. As many as 300 products containing jojoba have appeared in the USA in recent years. As the supply of oil increases and price decreases, more uses will become economically feasible. For example, the viscosity index of jojoba oil is much higher than that of petroleum oil; therefore, it may be used as a high temperature, high pressure lubricant. The stability of jojoba oil makes it attractive to the electronic and computer industries.

Since jojoba oil contains no cholesterol or triglycerides and is not broken down by normal metabolic pathways, it may become an important low-calorie oil for human consumption. The oil can be used as an antifoam agent in antibiotics production and as a treatment for skin disorders. Other proposed uses include candles, plasticizers, detergents, fire retardants, transformers oil, the leather industry and for biodiesel production.



Figure 29. Jojoba plant and seed.

BAMBOO

Bamboo as a grass has the potential to significantly offset carbon emissions and be used as an energy crop. It is stronger than steel and is a buffer against climate change in two ways: by

providing low-income communities with a material to build climate-resistant homes and by sequestering carbon faster than other species such as eucalyptus. It also grows at the rate of 1.2 meters per day.

It is readily available in many of the world's poorest countries, and is referred to as the wise man's timber, because it helps support the livelihoods of 1.5 billion people, grows fast, is found across the globe, and is a significant source of trade dollars at about \$5 billion per year.

China, India, and Vietnam are the main sources of bamboo for trade and there is talk of developing schemes whereby bamboo stocks come labeled with a sustainability certification and indication of the source country.



Figure 30. Bamboo plants can grow at a rate of 1.2 meter per day.

BARLEY AS BIOFUEL CROP

Barley can be grown as winter cover crop, followed by other crops in the summer. Planted in the winter, it would reduce water erosion and nitrogen leaching.

Barley grain can be used to produce ethanol, and the leftover byproducts as barley straw, hulls and dry distiller grains can be used to produce bio-oil through pyrolysis. Fast pyrolysis uses a fast burst of heat in the absence of oxygen for the conversion process. The bio-oil can be used as transportation fuel or for producing the heat needed for the grain to ethanol conversion process.

Under laboratory conditions, one kg of barley straw and hulls yields $\frac{1}{2}$ kg of bio-oil with an energy content half that of number 2 diesel fuel oil.

The energy content of bio-oil made from Distiller Dry Grain Solids, DDGS, including that contaminated with mycotoxins which cannot be used to supplement livestock feed, produces bio-oil that is $\frac{2}{3}$ the energy content level of number 2 diesel oil.

However, bio-oil is more viscous and has a shorter shelf life than that produced from straw or hulls.

A solid “biochar” byproduct is produced that could improve the water holding capacity and nutrient content of soils. Adding it to soils can sequester carbon in the soil for thousands of years.

THE FISCHER TROPSCH METHOD, BIOMASS TO LIQUIDS

Franz Fischer and Hans Tropsch, two chemists from Mülheim, Germany, devised a process that uses catalysts to convert a synthetic gas derived from coal into gasoline or diesel fuel. The process, which detractors derisively call the “Hans and Franz method,” wastes an enormous amount of energy. In fact, the direct use of coal in modern power plants is far more efficient. However, the Fischer Tropsch method aided politically isolated or poor countries that had plenty of coal but lacked oil.

The first to benefit from it was Germany during World War II. Being rich in both hard and brown coal, it built enormous liquefaction plants. Annual production volumes of about a million tons of coal based fuel, which were enormous by contemporary standards, powered the German’s war machine during World War II.

Anxious to secure its resources, East Germany, a state built on industrial labor and agriculture, operated the German Fuel Institute (DBI), a center for coal processing in the mining town of Freiberg. After German reunification the DBI left behind a group of scientists and engineers who were highly specialized in a field abandoned by the West that offers the key to a more efficient way of using biomass.

The method, called BtL, or “Biomass to Liquids,” closely resembles CtL or Coal to Liquids, or the conversion of solid coal into liquid fuels. The central figures in the nascent BtL sector are three former East German academics who each have their own technological approach in this field.

Bodo Wolf, a former DBI engineer, who established Choren Industries shortly after Germany’s reunification, is the first to get this type of industrial plant off the ground.

The two other key figures are university professors: Eckard Dinjus, a chemist who now runs the BtL division at the Karlsruhe Research Center, and Bernd Meyer, Wolf’s former colleague at DBI and now the director of an institute at the Technical University of Freiberg. The two professors would rather see more research done on BtL before it makes the transition to general industrial use. When they testified as experts at an official hearing, they advised the government against providing Choren with loan guarantees.

Wolf’s model has a substantial weakness: Initially, it will only run reliably with wood, a raw material that will become scarce in the foreseeable future and one that has gotten more expensive since residential wood heating systems became popular in Germany.

The first plant will also be relatively small, consuming 75,000 tons of shredded tree material a year. This is a quantity that can be derived from recycled wood and waste from the forestry industry.

Sourcing raw materials for the bigger plants Choren envisions as its next step will be a lot more challenging. To achieve an estimated annual output of 250 million liters of diesel fuel, these plants will need 1 million tons of dry biomass. Choren has been eyeing a possible site in Lubmin, directly adjacent to the remains of the Greifswald nuclear power plant, but the company is also considering building its larger plants near the western German town of Brunsbüttel.

Both sites are well-positioned geographically for bringing in last-minute shipments of wood from Scandinavia or Russia when local supplies run low. But local, high-turnover tree

farms would serve as the normal source of wood. Fast growing trees like willows could be planted in the region surrounding the refinery to meet the plant's requirements. About 90 farmers, each cultivating about 1,000 hectares or 2,471 acres of land; a total area about the size of Berlin, would have to switch to growing nothing but trees.

The skeptics suggest that anyone who grows trees is making a long term commitment. Within a few years, the ground becomes a tangle of roots and is difficult to convert back into normal farmland.

INCENTIVES AND SUBSIDIES

Biodiesel B100, defined by ASTM-6751 International, is an established fuel that can replace petroleum-derived diesel fuel. The two fuels are blended in blends of B2 with 2 percent biodiesel, B5 and B20. These blends are subject to the same engine performance and emissions standards as petroleum based diesel.

Biodiesel usage credits were created by the USA Federal Government, in the 2004 Federal transportation bill, rebating Federal motor fuels excise taxes. Blenders are eligible for a tax credit of \$1.00 per B100 gallon if the fuel is made and used on the farm. The USA Department of Agriculture (USDA) grants 25 percent of the costs of an installation as well as offers a loan guarantee of up to 50 percent.

QUALITY ISSUES

Quality is important when ethanol is reacted with soybean oil to produce methyl esters. The product is biodiesel and glycerin. Too much glycerin would cause engine filters clogging when the temperature drops in the winter season. The production goal is no more than 0.08 percent total glycerin in the fuel.

Another quality issue is the acid value of the product, since soybean oil has a tendency to degrade over time, and it is necessary to keep the product within its technical specifications. An antioxidant must be used in the manufacturing process to prevent the oil from going rancid over time.

The ultra-low sulfur biodiesel fuel in use possesses completely different properties than the regularly used diesel fuel. It has a high wax content, is a lot drier as a lubricant, and does not resist algae growth in storage tanks. It does not perform as well with the cold flow additives as the petroleum based fuel. Testing has revealed that some biodiesel samples do not meet technical specifications and that it reacts differently than the usual diesel fuel, particularly under cold weather conditions. In the winter of 2005, out of specification biodiesel in Minnesota caused filter plugging in some vehicles. In response, the state's requirement that 2 percent of its diesel fuel should contain biodiesel was temporarily suspended.

Environmental groups have given the nod of approval for biodiesel on the basis that it reduces 41 percent less greenhouse gas emissions than diesel fuel, compared with corn ethanol that reduces them by 12 percent. Hydrocarbon emissions are reduced by 30 percent, carbon monoxide by 20 percent and sulfur compounds associated with acid rain by 20 percent. However, it requires the use of methanol from natural gas and water for washing the product.

DISCUSSION

The use of oil that is not of edible grade, waste oil from restaurants and food processing and animal fat that could be processed into biodiesel is a desirable process since this avoids the problem of disposing of them. The economics of these oils as biofuel on a marginal basis are excellent.

However, the value of edible oils as food is much higher than their value as fuel. Expecting soybeans, coconut or palm oil to replace the diesel fuel market is shooting for the stars.

BUTANOL

Butanol production dates back to World War I where it was produced in the UK as a precursor for manufacturing acetone for smokeless gun powder, and as a fuel for tanks and trucks.

The process, using a different fermentation bacterium than ethanol was mothballed in the 1950s when it became cheaper to crack butanol from oil.

It is being reconsidered with modern fermentation technologies and controls as a second generation liquid fuel after ethanol. It has good solubility characteristics, unlike ethanol. It has a better energy density than ethanol. It can be transported in pipelines instead of in trucks and railroad cars like ethanol.

SUGAR CANE ETHANOL

Some countries which are self-sufficient in oil production such as Brazil have been supplementing their oil production over 30 years with government subsidized alcohol produced from sugar cane, which does not require a nitrogen fertilizer like corn, as a transportation fuel. Corn is mostly starch that has to be converted to sugar by a malt enzyme and energy is used to drive the fermentation process. Brazil starts out with cane juice ready for fermentation.

Brazil with its tropical climate plants several crops per year of sugar cane that is specially bred for the purpose. It is cultivated on a 6-7 year cycle, and its growth and cultivation requires far fewer inputs of manufactured nutrients than corn. Sugar cane fixes nitrogen from the air through the *Gluconacetobacter diazotrophicus* bacteria, and does not require a nitrogen fertilizer like corn. Sugar cane cultivation uses about 1 percent of Brazil's arable land, and tends not to be a significant cause of soil erosion, because the soil remains covered all year round. Most sugar cane fields in Brazil are not irrigated, and the sugar cane is watered solely via rainfall. Almost all of the sugar cane stubble left from making ethanol is fed to animals, mulched, or returned back to the soil.

In 2005, Brazil with increased oil production from its newly discovered Campos oil basin, 90 miles off the coast at Rio de Janeiro, exported 684 million gallons of ethanol; a 10 fold increase over 2000. It has a physical capacity to export 2.2 billion gallons/year, but shipping capabilities are lacking.

Brazil's gasoline consumption is 4 billion gallons per year, which is supplemented by ethanol consumption of another 4 billion gallons. The gasoline consumption in the USA is about 140 billion gallons per year. Brazil's combined gasoline consumption is thus: $(4+4)/140 = 0.057$ or 5.7 percent of the USA's consumption. Meeting a demand of 4 billion gallons is minimal compared with 140 billion gallons.

James Hill and coworkers from the University of Minnesota published online on July 11, 2005, a paper in the Proceedings of the National Academy of Science showing that biodiesel returns 93 percent more energy than is used to produce it, while corn ethanol provides a lesser 25

percent more energy. On close scrutiny this 25 percent excess energy is attributed to the dry soluble distiller solids byproduct, which is perishable unless dried and promptly shipped to the consumption centers and in excess supply. In estimating the energy balances, the researchers assert that they took under consideration the inputs for producing the fuels as well as the products and co-products that are produced. They included the energy required to produce the tractors and other equipment used on the farm to produce the corn and soybeans feed stocks and the energy used to build an ethanol or biodiesel facility.

Author Byron King comments: "The USA is wasting its resources and time in a boondoggle effort to make significant amounts of transportation fuel from corn that will eventually prove to be futile. The American political class needs to stop viewing Peak Oil, and the ominous future energy situation of the world, as just another political issue. It is long past time to get rational and serious about developing a long term energy policy for the country. Subsidized ethanol is just another way to buy the farm vote."

Farmland is disappearing across the world at an alarming rate. Hundreds of thousands of acres are falling victim to urbanization and water and wind erosion. The USA has been losing about an acre of farmland per minute. Between 2002 and 2007, 4,080,300 acres of agricultural land were converted to other developments; an area equal to the size of the state of Massachusetts.

THE FOOD AND ENERGY ECONOMIC CONNECTION

According to Lester Brown, the president of the Earth Policy Institute in Washington DC and the author of "Plan B 2.0: Rescuing a Planet Under Stress and a Civilization in Trouble," cars, not people, claimed most of the increase in world grain consumption in 2007. The USA Department of Agriculture projected that world grain use will grow by 20 million tons in 2006. Of this, 14 million tons were to be used to produce fuel for cars in the USA, leaving only 6 million tons to satisfy the world's growing food needs.

In some USA Corn Belt states, ethanol distilleries took over the corn supply. In Iowa alone, 55 ethanol plants are operating or have been proposed. Iowa State University economist Bob Wisner observes that if all these plants are built, they would use virtually all the corn grown in Iowa. In South Dakota, ethanol distilleries are claiming half of the corn harvest.

Japan, Egypt, and Mexico are worried that the reduction in USA corn exports; 70 percent of the world total, will disrupt their livestock and poultry industries. In sub-Saharan Africa and in Mexico, corn is the staple food. In the United States corn supplies sweetener for soft drinks and is used in breakfast cereals, but most corn is consumed indirectly. The milk, eggs, cheese, chicken, ham, ground beef, ice cream, and yogurt in the typical refrigerator are all produced with corn.

Whenever the food value of a commodity drops below its fuel value, the market converts it into fuel. Brazil, the world's largest sugar producer and exporter, is converting half of its sugar harvest into fuel ethanol. Despite only 10 percent of the world's sugar harvest going into ethanol, the price of sugar has doubled.

The European Union (EU) produced 1.6 billion gallons of biofuels of which 858 million gallons were biodiesel, produced from vegetable oil, mostly in Germany and France, and 718 million gallons were ethanol, most of it distilled from grain in France, Spain, and Germany. Margarine manufacturers, competing with subsidized biodiesel refineries, have complained to the European Parliament.

China and India are building ethanol distilleries. In 2005, China converted some 2 million tons of grain as corn, wheat and rice into ethanol. In India ethanol is produced largely from sugarcane. Thailand is concentrating on ethanol from cassava. Malaysia and Indonesia are investing heavily in palm oil plantations and in new biodiesel refineries. Malaysia has approved 32 biodiesel refineries, but recently has suspended further licensing while it assesses the adequacy of palm oil supplies.

Biofuel production threatens to draw grain away from the production of beef, pork, poultry, milk and eggs, and to reduce grain available for direct human consumption. By the end of 2007 the emerging competition between the 800 million automobile owners who want to maintain their mobility and the world's 2 billion poorest people who want simply to survive will be on center stage.

Higher grain prices are inevitable. The prices of wheat and corn hit historical highs. For the 2 billion poorest people in the world, many of whom spend half or more of their income on food, these rising prices can quickly become life threatening. Food riots and political instability in lower-income countries that import grain, such as Indonesia, Nigeria, Mexico, Haiti, Egypt, the Philippines and Cameroon and scores of other countries, could disrupt global economic progress.

An ethanol plant of 100 million gallons capacity in Linden, Indiana, requires 10,000 railcars of corn per year which would have gone for export to the southwest to feed livestock and poultry.

Dedicating all current USA corn and soybean production to biofuels, which is an impossibility, would only meet 12 percent of gasoline demand and just 6 percent of diesel demand.

According to Howard L. Simmons at Bianco Research, even if 100 percent of the world's vegetable oil production were diverted to biodiesel, it would only displace 27 days of current diesel and fuel oil consumption. If the entire USA corn crop were distilled for ethanol and none used for human consumption, only 85 days of gasoline use would be displaced. Similarly, the global sugar cane production is equivalent to 113 million metric tonnes of ethanol, compared with the global gasoline consumption of 982 million metric tonnes.

Howard L. Simmons stipulates: "As much as drivers everywhere want cheap fuel, most want to eat on occasion. Where does that leave us? The combination of high conventional energy prices and government mandates are going to put fuel claims on what had been the sole province of food claims. This means that energy prices will drive agricultural prices and the energy markets impact on agricultural prices will be far stronger and more immediate than will the food market's impact. And as seen before, any downturn in the conventional fuel market will render biofuels uneconomic very quickly."

He adds: "The prospect is unsatisfying. If high prices strengthen energy's claim on food supplies, governments everywhere will intervene on behalf of hungry citizens. If low prices torpedo biofuels economics, governments everywhere will respond with subsidies for those industries. Only an elimination of current mandates and subsidies today will avoid these problems tomorrow, but the likelihood of this happening is near zero. Somehow, I believe we will rue the day when we decided to make food and fuel substitutes at the margin."

One hopes that innovations such as corn fractionation and biomass gasification will emerge as partial solutions to the problem.

EFFECTS OF AGROFUELS ON WEATHER

Several factors can alter the seasonal cycle of exchanges of water and energy between the land and the lower part of the atmosphere. Perennial grasses use more water early in their growing season than corn and soybean plants. As the land surfaces are changed for agrofuel crops, the characteristics of the seasonality of the vegetative growth and water use are changed.

A NASA study at South Dakota State University addresses the issue of the change in regional weather patterns as a result of shifts in plantings. At the university's Geographic Information Science Center of Excellence considered different scenarios in South Dakota, North Dakota, Nebraska, Western Minnesota and Northern Iowa.

A move toward widespread use of perennial grasses could increase the potential for large expanse wildfires. Grasslands fires initiated by lightning strikes were common in the tall grass prairies thousands of years before modern settlement. After building their homesteads, the first priority of settlers was to surround their dwellings with some form of firebreak around the settlements. Fire is used today just locally in managing grazing ground.

Dried grasses such as switchgrass are highly flammable and are a hot fuel source with farm equipment easily providing a spark for their ignition, particularly in regions with a sustained winds leading to large grass fires that are fast and furious.

If the hazards are recognized and well understood, then anticipatory measures ahead of the curve for their mitigation and minimizing their risks can be addressed, instead of just a reactive mode response after their occurrence.

ALPHA-AMYLASE GENETICALLY MODIFIED CORN

Genetically modified commercial corn with an incorporated alpha-amylase enzyme gene would make it easier to convert it into ethanol, lowering the cost of the process. It was being developed by the Syngenta AG Company from Switzerland.

However, safety advocates fear that the gene would be transferred to human food, since the enzyme could trigger allergies in people exposed to the crop.

CATAclysmic Projections

A Pennsylvania farmer is quoted as: "It looks like we're going to burn up the last remaining six inches of Midwest topsoil in our gas tanks;" a variation of the "Red Queen Syndrome" from Alice in Wonderland in which one has to run faster and faster to stay in place.

In 2006, the average household yearly income of farmers at \$77,654 was about 17 percent above the USA average. It was expected to reach \$90,000 in 2008. In a debate about the 2008 Farm Bill and its subsidies, Independent Institute Senior Fellow William F. Shughart II jumped in to defuse an awkward situation by telling the old joke about: "How to starve a farmer?" Answer: "Weld his mailbox shut so he can't collect his government checks."

Syndicated columnist Alan Guebert suggests that the biofuels boom has the hunger advocates concerned. An adage criticizing the heavily subsidized ethanol effort notes that Americans would rather make fuel to drive to Disney World than "feed the world." He suggests: "True; America, 5 percent the world population, burns 45 percent of world's gasoline. Our thirst, because of our wealth, is insatiable. Well, at least as long as we have corn." He adds: "But bigger will not be better if \$4 corn drives 15 percent of the livestock sector into bankruptcy, a

large chunk of American soybean production is exported to South America and SUV owners are stupidly promised \$2 gas through 2025.”

7.17 FADING OF THE AGRO-FUELS RUSH

Some governments in 2008 began to respond to the chorus of criticism about the unsustainability of biofuels and the assertion that they are even more harmful to the environment than conventional fossil fuels. In the autumn of 2007 the Canadian province of Québec announced that it would cease building plants to produce the biofuel ethanol. The UK's House of Commons Environmental Audit Committee called for a stop in the increase of biofuel use. According to committee chairperson Tin Teo: “Biofuels can reduce greenhouse gas emissions from road transport. But at present, most biofuels have a detrimental impact on the environment overall.”

Dr. Andrew Boswell, a Green Party councilor in England and author of a study on the harmful effects of biofuels suggested that: “The biofuels route is a dead end. They are going to create great damage to the environment and will also produce dramatic social problems in tropical countries where many crops for biofuels are grown. There basically isn't any way to make them viable.”

The evidence against biofuels marshalled by environmentalists appears quite damning. Advertised as a fuel that only emits the amount of CO₂ that the plants absorb while growing; making it carbon neutral; it actually has resulted in a profitable industrial sector attractive to countries around the world. Vast swaths of forest have been felled and burned in Argentina and elsewhere for soybeans plantations. Carbon-rich peat bogs were drained and rain forests destroyed in Indonesia to make way for extensive palm oil farming.

Because the forests are often torched and the peat rapidly oxidizes, the result is huge amounts of CO₂ being released into the atmosphere. Healthy peat bogs and forests absorb CO₂ and are carbon sinks, making their disappearance doubly harmful.

The Stern Review on the Economics of Climate Change, released in October 2006, estimated that deforestation and other comparable land use changes accounted for 18 percent of all greenhouse gas emissions around the world. Biofuels accelerate that process.

Greenpeace agricultural specialist Alexander Hissting suggested: “We are causing a climate catastrophe by promoting agro-fuels. We are creating a huge industry in many parts of the world. In Indonesia, something akin to a gold rush has broken out.” He used the term agro-fuels that Greenpeace prefers to use.

The European Union has taken notice of the gathering biofuels storm. Its plan of 10 percent goal of energy production on agro fuels was made dependent on whether “production is sustainable.” The EU also made it illegal to use biofuels made from crops grown in nature reserves or in recently clear cut forest lands. Crops grown in places valuable as carbon sinks were also to be avoided.

Environmentalists noted that emissions were not the only serious problem created by the biofuels boom. Even crops grown in northern climates, like corn in the USA or rapeseed in Germany and the rest of Europe, harbor major hazards to the climate. Both corn and rapeseed are voracious consumers of nitrogen, leading farmers to use large quantities of nitrous oxide fertilizers. But when nitrous oxide is released into the atmosphere, it reflects 300 times as much heat as carbon dioxide does. Paul J. Crutzen, who won the 1995 Nobel Prize in chemistry, estimates that biodiesel produced from rapeseed can result in up to 70 percent more greenhouse

gas emissions than fossil fuels. Corn, the preferred biofuel crop in the USA, results in 50 percent more emissions, according to Paul J. Crutzen.

Another issue receiving increasing attention is that of rising food prices as foodstuffs are turned into fuel. Price increases for soybeans and corn hit developing countries particularly hard. Indeed, there have already been food price riots in Mexico, Morocco, Senegal and other developing countries. While the price increases cannot be pinned entirely on biofuels, it has certainly played a role. In October 2007, the United Nations' Special Rapporteur on the Right to Food Jean Ziegler called for a five year moratorium on biofuels to combat rising prices. According to Ziegler: "Using arable land for biofuels is a total disaster for those who are starving."

When the 2005 Renewable Fuel Standard (RFS), which set forth a minimum annual volume of renewable fuels nationwide, was first introduced, one of the primary arguments for mandating ethanol use was that it was a greener, more environmentally friendly source of fuel that released fewer greenhouse gasses into the atmosphere. Researchers reached the conclusion that, when the entire production process is taken into account, most green biofuels actually emit more greenhouse gasses than traditional fuels.

Some proponents of the ethanol mandate argued that the requirement was nonetheless necessary in order to spur demand for and development of more advanced, environmentally friendly biofuel like cellulosic ethanol, which is converted into fuel from corn-farm leftovers. Two serious problems with cellulosic ethanol.

The first is that cellulosic ethanol turns out to be rather difficult to produce; despite EPA projections that the market would produce at least 5 million gallons in 2010 and 6.6 million in 2011, the USA produced exactly zero gallons both years and just 20,069 gallons in 2012.

The second is that cellulosic ethanol is also bad for the environment. At least in the short-term, the corn-residue biofuels release about 7 percent more greenhouse gases than traditional fuels, according to a federally funded, peer-reviewed study that appeared in the journal *Nature Climate Change* in April 2014.

Another study published recently in *Nature Geoscience* found that in São Paulo, Brazil, the more ethanol that drivers used, the more local ozone levels increased. The study is important since it relies on real-world measurements rather than on models, many of which predicted that increased ethanol use would cause ozone levels to decline.

Ethanol requirements are bad for cars and drivers. Automakers say that gasoline blended with ethanol can damage vehicles by corroding fuel lines and injectors. An ethanol glut caused by a misalignment of regulatory quotas and demand has helped drive up prices at the pump. And the product is actually worse: ethanol blends are less energy dense than regular gasoline, which means that cars relying on it significantly worse mileage per gallon.

The global poor have it far worse. Ethanol requirements at home have helped drive up the price of food worldwide by diverting corn production to energy, which dramatically reducing the available calorie supply. A 25-gallon tank full of pure ethanol requires about 450 pounds of corn which is equal to the amount of calories required to feed someone for a year.

Some 40 percent of the USA corn crop went to ethanol production, which in effect meant that food was used for automobile fuel rather than eating it. Studies by economists at the World Bank have found that a one percent increase in world food prices correlates with a half-percent decrease in calorie consumption amongst the world's poor. When the world's food prices spiked over the 2007-2008 period, about 20-40 percent of the effect was attributable to increased global reliance on biofuels.

Ethanol requirements have few serious defenders except the people who profit from its production and the politicians who rely on those people for votes and campaign contributions. An EPA proposal would reduce the amount of renewable fuels the agency requires in 2014 from 18.15 billion gallons to 15.2 billion gallons.

7.18 UNITED NATIONS POSITION ON THE GLOBAL USE OF AGRO-FUELS

Regan Suzuki of the United Nation's Food and Agriculture Organization (FAO) acknowledges that agro-fuels are friendlier to the environment than fossil fuels and that they could enhance the energy security for many countries. However, he argues that those benefits must be weighed against the possible pitfalls that are just appearing as their implementation is spreading.

One major pitfall is that countries are converting millions of acres to palm oil, sugar cane and other crops for agro-fuels, which have become a flashpoint through which a wide range of social and environmental issues are playing out.

The main concern is the increased competition for productive as well as marginal agricultural land which has caused increased prices for corn, wheat and soybeans in the USA and Mexico and could lead to food shortages in developing countries.

India and China could face worsening water shortages since agro-fuels require large amounts of water.

Forests in Indonesia and Malaysia could face threats from the expansion of palm oil plantations. In the Asia-Pacific region, land availability is a particularly critical issue since tropical and subtropical countries possess a comparative advantage in growing agro-fuels, yet this is where the land rights of vulnerable groups and protected forests are the weakest.

Initially, agro-fuels were considered as a panacea for countries struggling with the rising cost of depleting oil or those looking to reduce greenhouse gas emissions. The European Union, for instance, plans to replace 10 percent of its transportation fuel from energy crops such as canola and sugar cane by 2020.

Lately, scientists and private agencies have realized the possible pitfalls from the rush and have come to a realization that agro-fuels could cause more harm than good. The argument is that rather than protecting the environment, energy crops can destroy forests that actually store carbon and are thus a key element in the effort to reduce global climatic change.

Accordingly, plans to mandate agro-fuels for transport without weighing the potential risks are being rolled back. Thailand delayed the introduction of diesel fuel blended with 2 percent biodiesel because of palm oil shortages.

The Philippines is considering shelving a biofuels law over the concerns about the negative environmental effects.

India is facing local opposition and criticism about its plans to plant 30 million acres of the *Jatropha* shrub-like plants for biofuels by 2012, which could force communities out of their lands and worsens deforestation. It is doubtful that it will be able to find the 100 million acres of vacant lands that are eventually planned to be planted. In addition, according to Varghese Paul, a forest and biodiversity scientist at the Energy and Resources Institute in India, the dependence on a single species is dangerous: "An outbreak of pests and diseases could wipe out entire plantations in one stroke."

7.19 GREENHOUSE EMISSIONS FROM LAND USE CHANGES

A study published in Science on February 7, 2008 challenges the adoption of agrofuels as a response to global warming. Past studies showing the benefits of ethanol in combating climate change have not accounted almost certain changes in land use worldwide; if ethanol from corn and from other cellulosic feed stocks become a prized commodity.

The study was supported by NASA's Terrestrial Ecology Program and by the Flora Hewlett Foundation and authored by scientists affiliated with Iowa State University, Princeton University, the Woods Hole Research Center, the German Marshall Fund of the United States and the Agricultural Conservation Economics institute. According to the study: "Using good cropland to expand biofuels will probably exacerbate global warming." The researchers contend that farmers under economic pressure to produce biofuels will increasingly "Plow up more forest or grasslands," releasing much of the carbon formerly stored in plants and soils through decomposition or fires.

Globally, more grasslands as savannahs and forests will be converted to growing the crops to replace the loss of grains when the USA farmers convert land to biofuels.

The December 2007 energy legislation in the USA mandating the increase of ethanol use 6 times to 36 billion gallons/year by 2022, calls the requirement as key to weaning the nation from imported oil. The new "green" fuel from corn has been widely promoted as a clean fuel producing 20 percent less greenhouse gases in production, transportation and use than gasoline and that cellulosic ethanol has an even greater benefit of 70 percent less emissions.

The study maintains that these analyses "were one-sided" and counted the benefits of using land for biofuels but not the carbon costs of diverting land from its existing uses. After taking into account expected worldwide land use changes, corn based ethanol instead of reducing greenhouse gases by 20 percent, will increase it by 93 percent compared to gasoline over a 30 years period.

Even cellulosic agrofuels from switchgrass, if they replace croplands and other carbon absorbing lands would result in 50 percent more greenhouse gas emissions.

Tim Searchinger, a lead study author from Princeton University's Woodrow Wilson's School of Public and International Affairs maintains that: "The other studies missed a key factor that everyone agrees should have been included, the land use changes that actually are going to increase greenhouse gas emission," and: "Use the right biofuels, but do not require too much too soon. Right now we are making almost exclusively the wrong biofuels."

The alternative is a focus on biofuels from waste products such as garbage which would not result in changes in agricultural land use.

The study prompted a letter sent to leaders in Congress and the President of the USA by a dozen scientists who urged them to pursue a policy "that ensures biofuels are not produced on productive forests, grasslands or cropland."

A great effort is directed towards following a politically correct, yet unrealistic disastrous notion of producing agro fuels. These must be considered at best as a stopgap measure along the road to developing sustainable energy systems depending on wind, solar, agroforestry and nuclear processes that are a serious solution to the energy problem.

7.20 FRESH WATER DEPLETION AND RECHARGE

An important saying describes the energy and water nexus or energy and water balance: "It takes a lot of water to make oil, and it takes a lot of oil to make water."

Fossil fuels depletion is sometimes compared with fresh water depletion. In water hydrology and aquifer management, some hydrologists argue that a higher water discharge rate from a water aquifer should be encouraged, since it would lead to a higher recharge rate. Their argument is that the aquifer acts as a sponge. If it is squeezed, it will further absorb more surface water instead of having it lost to runoff and river flow. The fallacy here is that it is assumed that there exists an infinite supply of water falling as rain and recharging the aquifer. The analogy to a sponge may be partially true in a wet environment, except maybe in drought periods, but is definitely not true in an arid environment, where the discharge rate would exceed the recharge rate.

The water balance equation of a wet region can be calculated as an equation over a period of time as follows:

$$P = Q + ET \pm \Delta S$$

where:

P = Precipitation (mm/year);

Q = Streamflow or Runoff (mm/year);

ET = evapotranspiration (mm/year);

ΔS = Change in the amount of storage or depletion in the watershed (mm/year).

A measure of an aquifer's utility is its *safe yield*, or the amount of water that can be pumped without adverse effects on the water left in storage. This is considered to be equal to the annual recharge rate for the aquifer.

In the case of a wet environment a sustainable rate of production is considered as equal to the estimated runoff rate assuming that it would seep into the ground to replace the discharge rate. Such an assumption may be also false if impervious clay soils are predominant in the subsurface profile, which is commonly the case, since they would limit the seepage into the aquifer except at thin vertical lenses of sand and gravel along rivers and waterways. These would possess almost infinite permeability, but are localized in nature, invalidating the assumption of uniform recharge from runoff as a convenient fallacy.

Still, the main difference here is that an aquifer can be recharged, but an oil field has already been charged once in the distant past and cannot be recharged, if one accepts the belief that hydrocarbon reservoirs are biogenic in nature resulting from the decay of ancient plants and animals.

7.21 FOSSIL FUELS DEPLETION

Fossil fuels represent an accumulation of over 500 million years of geological time, and any supplemental accumulation in the next few thousand years are just negligible. When these fuels are burned their ashes remain as the constituent minerals on Earth, but their energy content that is converted into heat or infrared radiation that leaks from the earth as long wave length and low temperature radiation.

Geologists argue that we are thus dealing with an essentially fixed storehouse of energy that we are depleting at a monumental rate. The amount available at any given time is equal to the amount initially present less what has already been consumed. The amount consumed up to a given time is the integral of the area under the curve of annual production plotted against time. This amount can approach but can never be equal to the total amount present. Geologists

announce with certainty that the production curve of any type of fossil fuel will rise, reach one or more maxima, and then asymptotically decrease to zero in such a way that the total amount under the curve must be equal to or less than the amount initially present.

Economists argue that as the production of a fuel source peaks, human ingenuity replaces it with another source of energy that inevitably follows the same shape. Wood fuel followed such a shape after England during the industrial revolution in England. When its woods and forests were denuded, it was discovered that black rocks called “sea coles” would burn, introducing coal as a source of energy. The discovery of oil replaced coal, but is itself reaching a peak. The new forms of replacement energy within our technological capability and on the horizon are unquestionably high energy density nuclear fission and geothermal and low energy density direct solar, and indirect solar hydroelectric, wind and biomass. In the long term, the energy source of the stars including our very own sun; nuclear fusion, is the ultimate alternative.

Oil statistics can include the Reserves to Production (R/P) ratio. It would appear that this is a measure of how long the oil will last. This is misleading because this assumes that production will remain constant until the last drop is produced.

What happens when an oil reservoir is discovered follows a general history. At first, production grows exponentially as each new well adds its output. Eventually production for the oil field reaches a peak as each new well produces less oil and the older wells run dry. Then there is an exponential decay as more and more wells run dry. The productivity of a particular well is described by the Dupuit’s equation and depends on the rate at which oil flows horizontally toward the well head, the effective well radius the pressure within the oil bearing formation and the viscosity of the oil. There is an optimum rate of production for any well. If oil is produced too fast, the amount ultimately produced is reduced. The productivity curve of the oil field looks like a growing then decaying exponential with the midpoint corresponding to the point when half of the oil is produced.

7.22 THE USA AND THE GLOBAL HUBBERT PEAK

Marion King Hubbert, a geophysicist with the USA Geological Survey in Reston, Virginia, was recognized as a world authority on the estimation of energy resources and on the prediction of their discovery and depletion patterns. He also acted as an Associate Director in the exploration and production research division of the Shell oil company. He worked for a period at the Illinois Geological Survey in Champaign, Illinois.

He presented an article titled: “Energy from Fossil Fuels,” in a Symposium on Sources of Energy, held in Washington, DC on September 15, 1948, during the Centennial Celebration of American Association for the Advancement of Science (AAAS), which later published it in its archival Journal: “Science.”



Figure 31. Marion King Hubbert, 1903-1989.

In a graph presented by Marion King Hubbert he assumes that oil depletion follows the shape of a Normal or Gaussian distribution (Bell Curve) with the area under the curve equal to the size of the resource. In Fig. 32, the lower dashed curve gives his estimate of USA oil production rates if the ultimate discoverable oil is 150 billion barrels (Bb). The upper dashed curve for 200 Bb was his prophetic prediction that the USA oil production would peak in the early 1970s, which indeed happened in 1970. The actual USA production for 1956 to 2000 is shown in the dotted line and shows the fact that since 1985 the USA has produced slightly more oil than predicted by Hubbert, largely because of the drilling in Alaska and in deep waters off the Gulf of Mexico coast. The interesting aspect of his analysis is that the prediction of Peak Oil production in the USA was uncannily correct and did indeed occur around 1970.

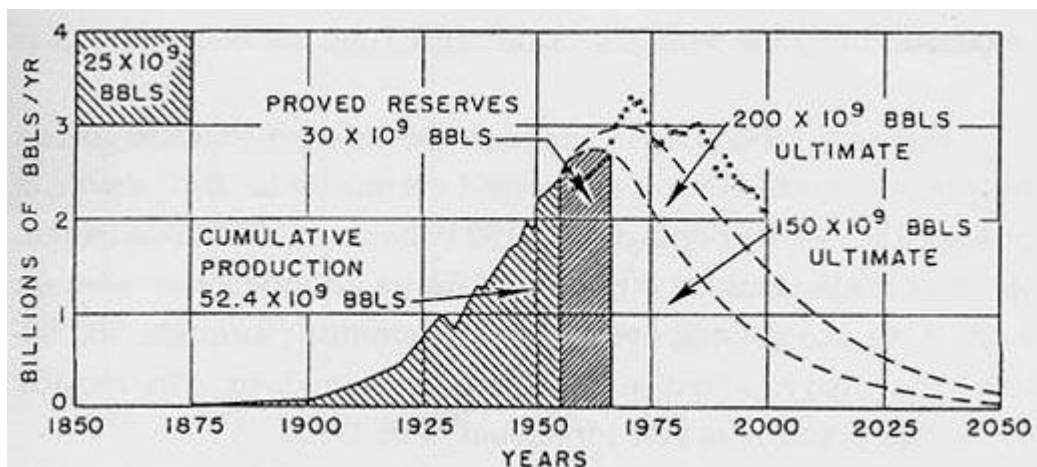


Figure 32. Marion Hubert King normal distribution of petroleum resources.

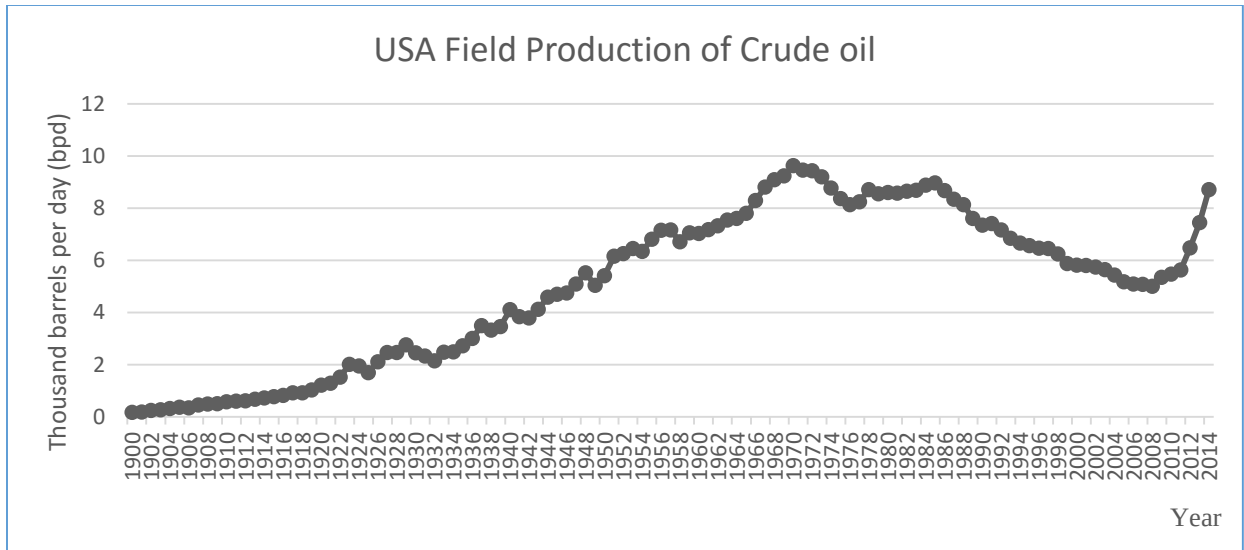


Figure 33. History of usage and peak of USA crude oil. Peak USA oil production occurred in 1970 with secondary peaks of production from Alaska in 1984 and from fracking and horizontal drilling in 2014. Data: USA EIA.

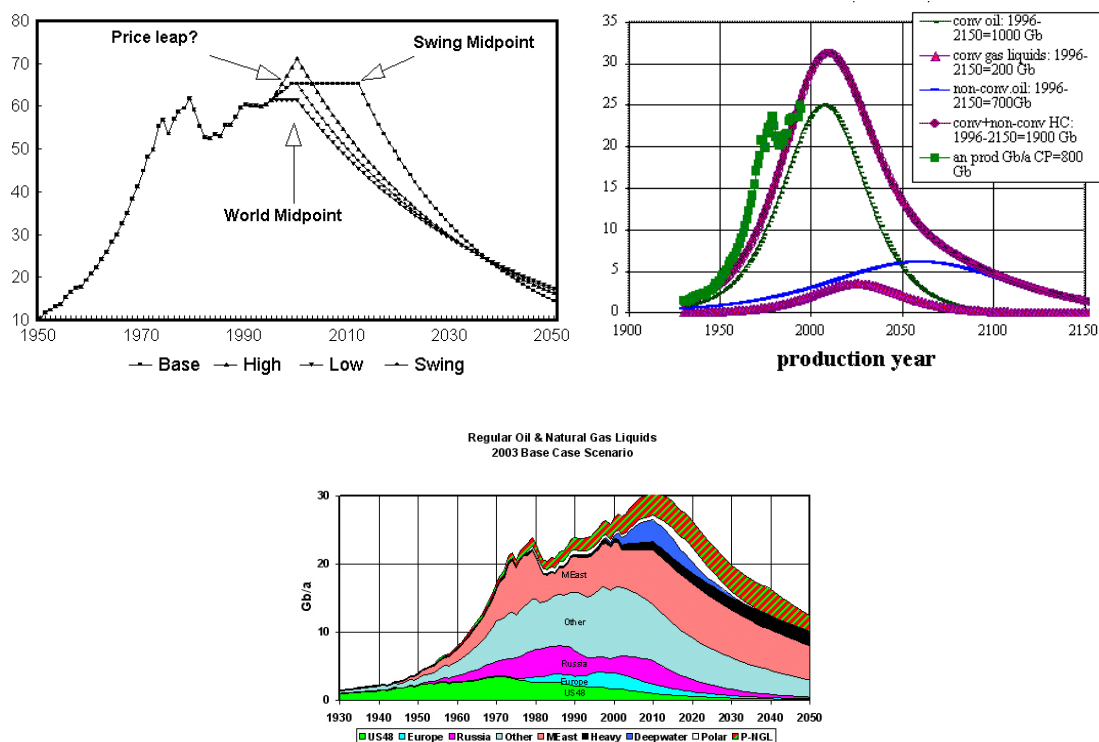


Figure 34. The global Peak Oil curve. Source: La Herrère.

There is a lack for world production statistics for natural gas. In the USA 400 cubic meters of natural gas are produced for each cubic meter of oil, with an energy content of about four 4/10 that of oil. Hence the energy from natural gas amounts to be about 40 percent of that of petroleum.

Interest in Hubbert work has been lately revived and generalized to global oil use in terms of what is designated as “The Hubbert Curve,” “The Curve of Peak Oil,” or “The Global Hubbert Peak.” Many versions exist of this curve generated by different authors using different perspectives, models and assumptions. Versions of this curve is shown in Fig. 34 using different assumptions but suggesting that the global Peak Oil would have occurred around 2015.

Some of Marion King Hubbert article’s points and prediction of a “delta function,” of oil production were:

“The consumption of energy from fossil fuels can thus be seen to be but a ‘blip’ rising sharply from zero to a maximum, and almost as sharply declining, and thus representing but a moment in the total of human history.”

“The release of this energy is a unidirectional and an irreversible process. It can only happen once, and the historical events associated with this release are necessarily without precedent, and are intrinsically incapable of repetition.”

“However, should cultural degeneration occur so that the available energy resources should not be utilized, the human population would undoubtedly be reduced to a number appropriate to an agrarian existence.”

“Among the inevitable characteristics of this future will be the progressive exhaustion of the mineral fuels, and the accompanying transfer of the material elements of the Earth from naturally occurring deposits of high concentration to states of low concentration dissemination.”

Marion King Hubbert suggested that nuclear energy would eventually replace the depleting fossil fuels reserves. In the 1956 paper: “Nuclear energy and the fossil fuels,” he states:

“It appears that there exist within minable depths in the United States rocks with uranium contents equivalent to 1,000 barrels of oil or more per metric tonne, whose total energy content is probably several hundred times that of all the fossil fuels combined.”

“The world appears to be on the threshold of an era which in terms of energy consumption will be at least an order of magnitude greater than that made possible by fossil fuels.”

On a time-scale spanning millennia, “the discovery, exploitation and exhaustion of the fossil fuels will be seen to be but an ephemeral event”.

“It will probably require the better part of another 10 or 15 years of research and development before stabilized designs of reactors ... are achieved,” but after that “we may expect the usual exponential rate of growth”.

That exponential growth rate did not materialize, preserving the existing uranium supplies for the long term.

7.23 EXPONENTIAL GROWTH AND DECAY

The effort is justified by the suggestion by psychologist W. A. Wagenaar that humans are incapable of understanding the true increase of an exponential function, probably because of their brain’s genetic wiring. They do their best in estimation by using linear functions that are accurate

for short time periods but then underestimate the true increase for extended time periods. This is so since a linear function is an approximation of the exponential whose expansion as a function of the time t is:

$$e^t = 1 + \frac{t}{1!} + \frac{t^2}{2!} + \frac{t^3}{3!} + \dots + \frac{t^n}{n!} + \dots, \forall t^2 < \infty. \quad (5)$$

When the value of the time t is much less than unity:

$$t \ll 1,$$

the higher order terms are small in magnitude. They can be ignored with only the first two terms are retained leading to an approximation as a straight line:

$$e^t \simeq 1 + t, \forall t \ll 1 \quad (6)$$

This suggests that the human brain is wired to think in terms of short time spans, and that the consideration of long time spans needs the power of intellect and mathematics.

7.24 MATHEMATICAL BASIS OF RESOURCE CONSUMPTION

We consider the yearly consumption rate of a given resource such as uranium, oil or coal in metric tonnes (1,000 kgs) per year:

$$R(t) \left[\frac{\text{metric tonnes}}{\text{year}} \right].$$

If we further consider that the rate of consumption of the resource grows a fixed fraction or percentage each year, this implies that the rate of change in the consumption rate is proportional to the consumption rate itself, we can thus write:

$$\frac{dR(t)}{dt} \propto_\ell R(t) \quad (7)$$

The proportionality symbol can be replaced by the equality sign if we use a proportionality constant k in Eqn. 7:

$$\frac{dR(t)}{dt} = +k.R(t) \quad (8)$$

where k is the fractional growth per year.

Separating the variables and performing a limit integration we can write:

$$\int_{R_0}^{R(t)} \frac{dR(t)}{R(t)} = k \cdot \int_0^t dt \quad (9)$$

where R_0 is the current consumption rate at $t = 0$.

The integration yields:

$$\ln \frac{R(t)}{R_0} = k \cdot t \quad (10)$$

Taking the exponential function of both sides reveals that the consumption rate will grow exponentially as a function of time as:

$$R(t) = R_0 \cdot e^{+kt} \quad (11)$$

where: $e = 2.718$ is the base of the natural logarithm function.

7.25 DOUBLING TIME, RULE OF 70, RULE OF 69, RULE OF 72 OF COMPOUND INTEREST

We are interested in the period of time T_d at which the consumption rate $R(t)$ will grow to twice its initial value or $2R_0$. Substituting into Eqn. 8 yields:

$$R(T_d) = 2R_0 = R_0 \cdot e^{+kT_d}$$

Canceling R_0 and taking the natural logarithm of both sides eliminates the exponential to yield:

$$\ln 2 = k \cdot T_d$$

from which the doubling time is given by:

$$T_d = \frac{\ln 2}{k} = \frac{0.6931}{k} \quad (12)$$

This suggests an alternate form of Eqn. 11 in terms of the doubling time as:

$$R(t) = R_0 \cdot e^{+\frac{\ln 2}{T_d} \cdot t} \quad (11)'$$

If we consider the percent growth per year P :

$$\begin{aligned}
 P &= 100.k, \\
 k &= \frac{P}{100}
 \end{aligned}
 \tag{13}$$

Substitution into Eqn. 12 for k from Eqn. 13 yields:

$$\begin{aligned}
 T_d &= \frac{\ln 2}{P} \cdot 100 \\
 &= \frac{0.6931}{P} \cdot 100 \\
 &= \frac{69.31}{P} \\
 &\approx \frac{70}{P}
 \end{aligned}
 \tag{14}$$

This is also the rule of 69 or the rule of 70 for continuous compounding in finance where it represents an investment's doubling time.

For periodic compounding of interest, it takes the form:

$$V(t) = V_0(1 + r)^t$$

where : $V(t)$: Future value

V_0 : Present value

t : Number of time periods

r : Interest rate per time period

If the investment has doubled:

$$\begin{aligned}
 V(t) &= 2V_0 = V_0(1 + r)^t \\
 2 &= (1 + r)^{t_d}, \forall V_0 \neq 0 \\
 \ln 2 &= t_d \ln(1 + r) \\
 t_d &= \frac{\ln 2}{\ln(1 + r)}
 \end{aligned}$$

Using the approximation:

$$\ln(1 + r) \approx r - \frac{r^2}{2}$$

Then:

$$t_d \approx \frac{\ln 2}{r - \frac{r^2}{2}} \approx \frac{\ln 2}{r} \approx \frac{0.6931}{r}, \forall r \text{ small}$$

For the percentage interest rate:

$$R = 100r,$$

$$t_d \approx \frac{100 \times 0.6931}{R} \approx \frac{69.31}{R} \approx \frac{70}{R}$$

It is interesting to notice in Eqn. 14 the ten/seven rule of thumb in the field of finance: “A 10 percent growth rate implies a 7 years doubling time, and a 7 percent growth rate implies a 10 years doubling time.” Sometimes it is referred to as the rule of 70. For instance, the purchasing power of a 10 years note would lose half its value at an inflation rate of 10 percent within $70 / 10 = 7$ years.

The choice of the rule of 72 is just a convenience, since 72 has many small divisors: 1, 2, 3, 4, 6, 8, 9 and 12:

$$t_d \approx \frac{72}{R}$$

The constancy of the doubling time implies that in one doubling time the growth rate will double in size, in two doubling times, it will quadruple in size, in three doubling times it will grow by a factor of $2^3 = 8$ times, and in n doubling times it will grow by a factor of 2^n times, or:

$$R(n) = R_0 \cdot 2^n \quad (15)$$

This equation is equivalent to Eqn. 11 but is expressed as a function of the number of doubling times n .

This suggests that exponential growth is characterized by a doubling process. A few doublings can lead quickly to quite large values.

7.26 THE CHESSBOARD PROBLEM: COMBINATORIAL EXPLOSION

Popular belief tells us that the game of chess had its origins in India and was invented by Sissa Ben Dahir, thousands of years ago when it was called as: Chaturang, later renamed in Arabic as: Chatarang. Over a period of time it spread to the Middle East and subsequently was introduced to Europe by the retreating crusaders and to other parts of the world. References about the game have been made as far back as in 600 AD.

Consider the parable or legend about the invention of the game of chess. The reward that the inventor of chess Sissa Ben Dahir is supposed to have asked from his King Shirham of India for whom he invented the game was one grain of wheat for the first square, two for the second, and doubling them on each subsequent square. The king agreed to the request, only to realize that all the wheat in the world would not be enough to pay the inventor. An estimate is that the

reward amounted to four trillion bushels, the world's wheat production for two thousand years. The king did find a simple way out of the deal, however. In a version of the story, the king had the inventor beheaded (Appendix II).

The total number S of grains of wheat to satisfy the demand on the chessboard becomes:

$$S = 2^0 + 2^1 + 2^2 + 2^3 + \dots + 2^{63} \quad (16)$$

Using the sum of the sequence:

$$1 + x + x^2 + x^3 + \dots + x^n = \frac{1 - x^{n+1}}{1 - x} \quad (17)$$

and identifying:

$$x \equiv 2, \quad n = 63,$$

yields for the number of grains of wheat:

$$S = \frac{1 - 2^{64}}{1 - 2} = 2^{64} - 1 = 18,446,744,073,709,551,615 \quad (18)$$

An interesting observation is that even though this odd number is based on the sum of powers of the digit 2, none of its twenty digits contains it.

The interesting fact is doubling a single grain of wheat a mere 63 times could amount to 500 times the entire yearly wheat harvest in the whole world.

This example shows that exponential growth in general leads to doublings, and these in turn can lead to large numbers in a very short time period.

Another story about the combinatorial explosion is attributed to philosopher John Stuart Mill. As a boy, he was alarmed to deduce that the finite number of musical notes, together with the maximum practical length of a musical piece, meant that the world would soon run out of melodies. The fact is that we are unlikely to have a melody shortage anytime soon because music is a combinatorial system. If each note of a melody can be selected from, say, eight notes on average, there are 64 pairs of notes, 512 motifs of three notes, 4,096 phrases of four notes, and so on, multiplying out to trillions and trillions of musical pieces.

Applied to language, the combinatorial explosion explains why we and our politicians never run out of words in speech or writing. Suppose we have ten choices for the word to begin a sentence, ten choices for the second word, yielding a hundred two-word beginnings, ten choices for the third word, yielding a thousand three-word beginnings, and so on. The number of sentences of twenty words or less is 10^{20} , or a hundred times the number of seconds since the birth of the universe.

7.27 PEAK FOOD, UNSUSTAINABLE POPULATION, MALTHUSIAN EXPLOSION

INTRODUCTION

Bacterial, insect, plant and animal populations including humans, tend to grow exponentially. The growth depends on the availability of a food supply and favorable environmental conditions. Once the food supply is exhausted, or the environment is rendered toxic from the wastes generated in the growth process, the growth is discontinued and the population is observed to suddenly crash.

As the world's human population reached the 7 billion mark at the end of October 2011, its tendency to grow faster than the food supply, keeping most people at the edge of starvation, was described by Thomas Robert Malthus (1766 - 1834), an ordained Anglican minister, in his 1798 book with editions in 1803, 1806, 1807, 1817 and 1826: "An Essay on the Principle of Population as It Affects the Future Improvement of Society."

Malthus's key thesis known as the "Malthusian Argument" was that:

"The power of population is indefinitely greater than the power in the Earth to produce subsistence for man. Population unchecked increases in a geometrical ratio. Subsistence increases only in an arithmetical ratio. A slight acquaintance with numbers will show the immensity of the first power in comparison of the second."

As explained by Harvard historian Niall Ferguson, humanity can increase like the geometrical doubling number sequence 1, 2, 4, 8, 16, which leads to an exponential growth effect, whereas its food supply can increase no faster than the linear number sequence 1, 2, 3, 4, 5. Humanity is better at reproducing itself than feeding itself.

Malthus suggested that there must exist: "A strong and constantly operating check on population," taking the two forms of "misery" as famines and epidemics and "vice" such as alcohol abuse, contraception and abortion. Malthus wrote: "The vices of mankind are active and able ministers of depopulation. They are the precursors in the great army of destruction; and often finish the dreadful work themselves. But should they fail in this war of extermination, sickly seasons, epidemics, pestilence, and plague advance in terrific array, and sweep off their thousands and tens of thousands. Should success be still incomplete, gigantic inevitable famine stalks in the rear, and with one mighty blow levels the population with the food of the world."

The historian Georges Lefebvre suggested that an increase in the price of a loaf of bread by 88 percent in 1798, due to a bout of bad weather, may have contributed to the onset of the French Revolution and the downfall of King Louis XVI.

There were famines in the 19th century in Ireland and India and wartime disruptions of the food supply in the 20th century. However, the continued growth of the human population, which is now about 6.5 billion, has been met by continuing increases in agricultural productivity.

Malthus's book inspired Darwin's idea of natural selection. Reading about the struggle for existence that Malthus predicted, Darwin wrote in his autobiography: "It at once struck me that under these circumstances favorable variations would tend to be preserved, and unfavorable ones to be destroyed. Here then I had at last got a theory by which to work."

HALE MALTHUS POPULATION GROWTH

In the Hale-Malthus model, the population increase is described by the rate equation that is similar to Eqn. 8 as:

$$\frac{dN(t)}{dt} = +rN(t) \quad (8')$$

$N(t)$ is the number of individuals at time t ,

r is the intrinsic rate of increase.

Upon integration it yields the same solution as Eqn. 11:

$$N(t) = N_0 e^{+rt} \quad (11)''$$

N_0 is the number of individuals at time $t=0$.

If the world population is about 6.5 billion persons and is growing at a rate of $P = 1.9$ percent per year. The doubling time from Eqn. 14 is:

$$T_d = \frac{69.31}{P} = \frac{69.31}{1.9} = 36 \text{ years}$$

which means that the world population will become $6.5 \times 2 = 13$ billion within 36 years, unless some environmental factors would control the growth rate. Possibly the available world resources, particularly fresh water and arable land, will reduce the growth rate. This is the basis of numerous apocalyptical theories such as the Hale Malthus model, and the Club of Rome's "Limits to Growth" study.

Some mathematical buffs proceed beyond 36 years, suggesting that at the present rate of growth, in 550 years the areal population density would be 1 person/m² on the dry land of the Earth excluding Antarctica. In 1620 years, the mass of people would equal the mass of the Earth; obviously a mere impossibility. This suggests that perpetual population exponential growth is unsustainable and we can confidently say: impossible.

PEAK GRAIN, FOOD PRODUCTION

As a modern saying goes, "We eat fossil fuels." In modern industrialized agriculture, grain is literally manufactured from oil. Fertilizers are made from natural gas and pesticides, farm machinery and shipping all depend on the use of oil. Modern farming has been described as using the soil as an inert medium to turn hydrocarbons as oil and natural gas into food.

If the hydrocarbon supplies are fully depleted and not gradually replaced by other forms of energy, the food production and distribution system would collapse followed by the world's population.

Peak Grain on a per capita basis may have occurred several years ago and the world grain stocks in 2007 were at a 53-day supply, their lowest level ever, according to the USA Department of Agriculture.

Lately, the world has turned to growing crops for fuel, placing even more pressure on its food supply. The pressures on oil and food are occurring at the same time.

The livelihood of large parts of the world such as the Arab countries will be unsustainable when fossil fuels wane. Their lives depend on desalinated seawater with the desalination plants consuming large amounts of natural gas and electricity.

DETRACTORS AND SUPPORTERS

Contemporaries of Malthus such as the economist Ricardo pointed out that most food supplies are derived from living organisms that reproduce geometrically like humans.

In the 1970s, Stanford University biologist Paul Ehrlich in his book “The Population Bomb,” predicted catastrophes to occur by 1990, which never materialized. He had a famous 1980 wager over resource scarcity with Julian Simon, a professor of business at the University of Maryland, which Simon apparently has won.

The field of Economics became known as the “Dismal Science” as it predicted so much gloom according to Malthus theory. Charles Dickens used Malthusian language in his book: “A Christmas Carol” where Scrooge considers that Tiny Tim is just a part of “The Surplus Population” who according to Malthus was doomed to oblivion.

The world escaped from Malthus’ prediction by a succession of revolutions in agriculture such as the “Green Revolution” and the modern introduction by bioengineering of the Genetically Modified Organisms (GMOs).

Niall Ferguson discusses the failures of Malthusian Theory:

“The world's population has increased by a factor of more than six since Malthus's time, passing the 6 billion mark not so long ago. Average life expectancy has risen worldwide from 28 to 67.

Yet the daily supply of calories for human consumption has also gone up on a per capita basis, exceeding 2,700 in the nineties. In France, on the eve of the Revolution, it was just 1,848. Since Malthus's day, the average human being's income has increased by a factor of more than eight.

Human beings have grown taller and bigger, too. The average British male stood 5ft 5in tall in the late 18th century. Today, his mean height is 5ft 9in. So abundant is food in the land of the free that more than a fifth of Americans are now classified as obese.

Since the fifties, the area of the world under cultivation has increased by roughly 11 per cent, while yields per hectare have increased by 120 per cent. In 2004, world cereal production passed the 2 billion metric ton mark.”

However he comes back with a description of its successful aspects:

“Yet these statistics don't disprove Malthus. As he said, food production could increase only at an arithmetical rate, and a chart of world cereal yields since 1960 shows just such a linear progression, from below one and a half metric tons to around three.

Meanwhile, vice and misery have been operating just as Malthus foresaw to prevent the human population from exploding geometrically.

On the one hand, contraception and abortion have been employed to reduce family sizes. On the other hand, wars, epidemics, disasters and famines have significantly increased mortality.

Together, vice and misery have ensured that the global population has grown at an arithmetic rather than a geometric rate. Indeed, they have managed to reduce the rate of population growth from 2.2 per cent per annum in the early sixties to around 1.1 per cent today.

The real question is whether we could now be approaching a new era of misery. Even at an arithmetic rate, the United Nations expects the world's population to pass the 9 billion mark by 2050.

But can world food production keep pace? Plant physiologist Lloyd T. Evans has estimated that 'we must reach an average yield of four tons per hectare... to support a population of 8 billion.' But yields right now are, as we have seen, just three tons per hectare. And a world of eight billion people may be less than 20 years away.

Meanwhile, man-made forces are conspiring to put a ceiling on food production. Global warming and the resulting climate change may well be increasing the incidence of extreme weather events as well as inflicting permanent damage on some farming regions.

It is not just British crops that are suffering this year. At the same time, our effort to slow global warming by switching from fossil fuels to biofuels is taking large tracts of land out of food production.

According to the OECD, American output of corn based ethanol and European consumption of oilseeds for biofuels will double by 2016. Only the other day, the executive director of the World Food Programme expressed anxiety about the unintended consequences of this huge shift of resources."

In addition, the per capita cereal production already reached its peak in the mid eighties, while the rising incomes in Asia are now increasing world food demand.

In the USA, the monetary authorities insist on considering only the core consumer price index excluding food and energy for planning and policy issues, suggesting that the inflation rate is just 2.2 percent. In fact food inflation is actually double that amount at 4.4 percent. Niall Ferguson suggests the following food items price inflation:

Cheese	4 percent
Steak	6 percent
Bread	10 percent
Fish	11 percent
Potato	10 percent

DISCUSSION

Malthus wrote about 200 years ago: "The great question now at issue is whether man shall henceforth start forwards with accelerated velocity towards illimitable, and hitherto unconceived improvement, or be condemned to a perpetual oscillation between happiness and misery."

With global warming, large areas of the globe such as Northern Canada and Russia may become cultivable; increasing the world's food supply. The melting permafrost areas of Alaska and Siberia could be used for growing crops.

Meanwhile, Malthusian theory is inspiring new “green” socio-political issues in the 21st century replacing Capitalism, Socialism and Marxism in the 20th century. Food and energy supplies, over population and global climatic change appear to be the really significant problems of the world.

Human creativity and innovation may continue developing sustainable energy and food production strategies for survival and saving the planet for its future generations.

7.28 SUSTAINABILITY OF MONEY AND CREDIT CREATION

INTRODUCTION

Energy production and money creation are closely interrelated. On the one hand energy is a source of wealth of nations, and on the other hand acquiring this wealth requires the creation of money to cheaply acquire it using the fiat currency system.

The Latin word “fiat” translates as “let it be done”. The value of money is dictated by government decree. National currencies in the world are fiat currencies. It has no real value except as being declared legal tender.

Fiat currencies have a long history of eventual failure. The Romans did not have paper money but they constantly decreased the amount of silver used in the denarius coin until the coinage became worthless.

China issued paper currency in the tenth century but eventually printed so much of it that hyperinflation occurred and their currency became worthless, even though its usage lasted for 400 years. Recent examples are the collapse of the Zimbabwe dollar and the Weimar Republic of Germany in the 1920s.



Figure 35. Fuel rationing coupons reportedly printed in the 1970s but never used.



Figure 36. Unavailability of gasoline.

Capitalism is characterized by innovation and risk taking. These contain the seeds of frequent rise followed by sudden collapse resulting in unpredictable crises. A pattern of excessive borrowing and money creation, weak regulation and leveraged investments are inevitably followed by monetary collapse. Boom and bubbles are preludes to the bust and crash. A cycle of inflation followed by deflation ensues.

Governments have granted themselves the power of creating money, whereas the banks have been given by those governments the privilege of forming capital, and earning interest on it, in return for financing the governments' debt to its citizens and to the foreigners. The concept that governments can organize debt into depreciating currency as a form of stealthy taxation, and that the banks can organize credit into capital, is unsustainable; ultimately leading to the periodical formation of bubbles that eventually collapse leading to the self-destruction of the monetary system and the prevailing economic system.

It is worthwhile to distinguish between currency and money, with the currency defined primarily in terms of interchangeability and fungibility, and money in terms of characteristics that give it lasting and intrinsic value. Because of its attributes, not only is gold the ultimate political metal, at the same time it is and has been viewed as man's ultimate form of money as well, above all else because of its scarcity. By definition, any viable currency needs to be durable, divisible, and portable. To be considered as money possessing intrinsic value within which one may hold wealth, it cannot be easily debased or debauched, so as to guard against this insidious form of confiscation and taxation.

Table 15. Currency and money properties.

Currency	Money
Medium of exchange	Medium of exchange
A unit of account	A unit of account
Portable	Portable

Durable	Durable
Divisible	Divisible
Fungible, Interchangeable	Fungible, Interchangeable
-	Store of value
-	Maintains value over long periods of time

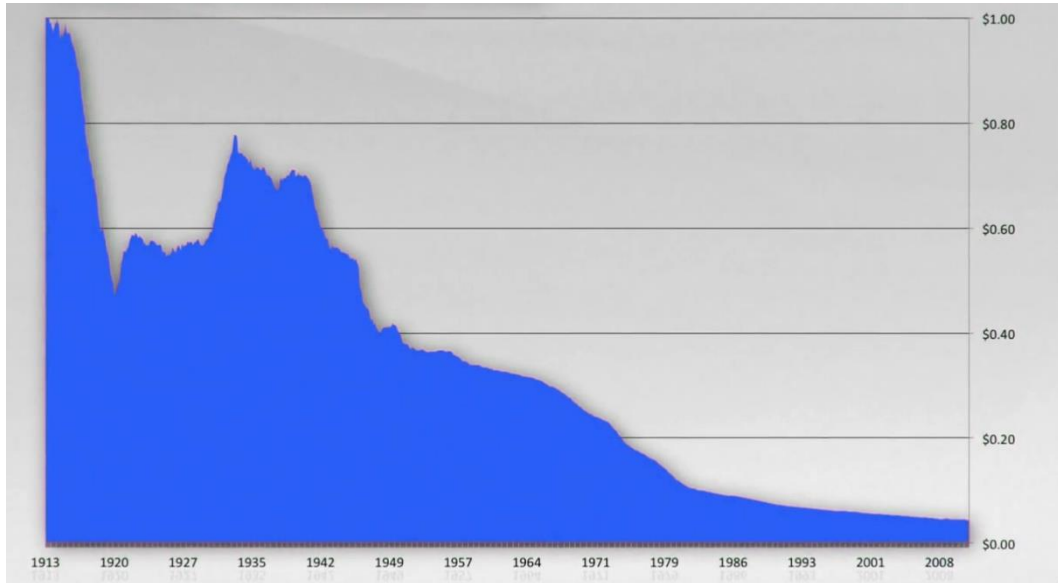


Figure 37. Dollar currency purchasing Power since 1913.

Table 16. Periods of currency inflation in different countries.

Country	Maximum monthly Inflation [percent]	Date
Argentina	196.6	1989-1990
Armenia	438.04	1993-1994
Austria	124.27	1921-1922
Azerbaijan	118.09	1991-1994
Belarus	53.4	1994
Bolivia	120.39	1984-1986
Brazil	84.32	1989-1993
Bulgaria	242.7	1997
China	4,208.73	1947-1949
Congo, Zaire	225	1991-1994
France	143.26	1789-1796
Georgia	196.72	1993-1994
Germany	29,525.71	1920-1923

Greece	11,288	1942-1945
Hungary	82.18	1923-1924
Hungary	1.295×10^{16}	1945-1946
Kazakhstan	57	1994
Kyrgyzstan	157	1992
Nicaragua	126.62	1986-1989
Peru	114.12	1988-1990
Poland	187.54	1921-1924
Poland	77.33	1989-1990
Serbia	3.09×10^8	1992-1994
Soviet Union	278.72	1922-1924
Taiwan	398.73	1945-1949
Tajikistan	78.1	1995
Turkmenistan	62.5	1993-1996
Ukraine	249	1992-1994
Yugoslavia	58.82	1990

FIAT VS. IRREDEEMABLE CURRENCY

There exists a subtle difference between a fiat currency and an irredeemable currency. In the case of fiat currency, creation is decided behind closed doors and does not need the endorsement of the open market. A fiat currency inevitably has a short life-span, as historically observed.

An irredeemable currency is different from a fiat one in that it is created openly, using collateral purchased in the open market. It has a longer life-span than a fiat currency. As long as an official check-kiting process between the Treasury and the Federal Reserve Central Bank remains misunderstood by the general public, an irredeemable currency may even prosper.

CONTROL OF THE ECONOMY, CENTRAL BANKING

In 1977, the USA Congress amended the Federal Reserve Act, outlining the Federal Reserve Bank new and improved mission in life:

“...long run growth of the monetary and credit aggregates commensurate with the economy’s long run potential to increase production, so as to promote effectively the goals of maximum employment, stable prices and moderate long-term interest rates.’

The Federal Reserve has been the USA’s central bank since 1913, but it is its third attempt at central banking. The First Bank of the United States was chartered in 1791 and lasted twenty years. Facing strong opposition by Jeffersonians who feared that the central banks were controlled by foreign interests and primarily benefitted large companies, it lost its re-charter by a single vote.

Debt caused by the War of 1812 led to the charter of the Second Bank in 1816, lasting until Jackson refused to re-charter it in 1836.

The Panic of 1907 led to the formation of the Federal Reserve System in order to stabilize prices, regulate banks, manage the money supply and create a single, unified paper currency, at

the time based on gold. Since then, the dollar has been inflated over 2,000 percent, diminishing the value of savings for Americans and foreigners holding assets denominated in dollars. According to John Stuart Mill (1806 – 1873) in his "On Credit Cycles and the Origin of Commercial Panics" in 1867:

“Panics do not destroy capital; they merely reveal the extent to which it has been destroyed by its betrayal into hopelessly unproductive works.”

The real purpose for the existence of the Federal Reserve Central Banking system is to maintain control of the economic system. Central Banks control the creation of money and credit and direct them to the beneficial use by their private banking owners, the politicians, and the elite ruling classes. It is the stealthy modern way of clipping coins by raising taxes to finance their favored social programs and wars by depreciating the value of the currencies held by both citizens and foreigners alike.

The reason for the existence of the Federal Reserve Bank is that simply directly printing money to pay debts, even when done by a legitimate government, runs the risk of being seen as such and opposed. Central banks provide a circuitous means of printing money to keep the public befuddled and indifferent. The Federal Reserve collects interest on the government securities it holds, but it gives most of it back to the Treasury. After deducting for its operating costs and other expenses, it pays its member stockholders banks a 6 percent dividend on the stock they hold in their reserve banks, which in 2010 amounted to \$1.5 billion.

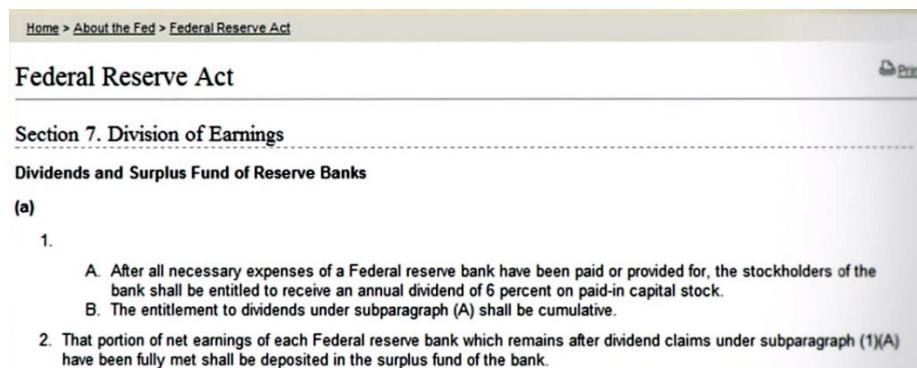


Figure 38. Payment of 6 percent from the Federal Reserve Central Bank to its bank stockholders.

By law, member banks must subscribe to stock in the Federal reserve bank of their district equal to 3 percent of their capital, at a fixed rate of \$100 per share, with another 3 percent subject to call of the Board of Governors. The remaining balance of the Fed's interest receipts, including interest from assets other than USA bonds, is remitted to the Treasury at the end of each fiscal year. In 2010, this amounted to \$79.3 billion. Thus by giving the Treasury all the revenue it receives after deducting for expenses and dividends, the Fed in effect is granting the government loans at nearly zero interest. As for the principal, the Fed simply keeps it on their books. It could demand payment from the government, but so far it has not.

Thus the government, in issuing bonds, is getting money for virtually nothing, then spending it, instead of increasing taxes. As kings of old times did when they literally ran the

printing presses to pay for expenses beyond what they collected in taxes, today's governments do the same but through the esoteric world of central banking.

Under stressful conditions, the central banks will not attempt to save the existing governments, which come and go. They exist to protect their shareholders: the largest banks. The secret is that the Federal Reserve cannot really control the economy at all. It can influence it. And the influence it has is all negative. By setting interest rates at any level other than that chosen by willing borrowers and lenders, the central banks distort the price of credit. And distorting prices always leads to problems: either shortages or surpluses. By fixing rates at low levels, the Federal Reserve is actually stealing from one group and giving to another. The middle class, savers, and working people lose wealth. Hedge fund managers and bankers gain. In the USA, great damage was done to the USA dollar currency which has been devalued since its inception. The end result is an insidious bottom-up transfer of wealth: the ruling elites get richer, while everyone else loses ground.

WEALTH CREATION

Two competing paradigms define wealth creation. The first paradigm defines wealth as the saved capital formed from investment in hard, tangible productive assets such as minerals mines, steel and wood mills, factories, farms, or ships, in addition to real intellectual property such as patents and manufacturing techniques.

The second paradigm suggests that wealth originates from the power of the state to redistribute assets that are already existent through the creation and manipulation of fiat currencies, tax policy and projects spending.

It is most plausible that true wealth creation is a hybrid of the two paradigms with a redistribution of real assets by the power of the state. Societies can function under a situation of balance between real wealth creation and its redistribution. Inevitably, an excess of redistribution of the previously created capital into wars and social programs creates an unsustainable situation. At some point the creation of true wealth is slowed down or totally stops and ceases to exist, leading to economic and social crises situations.

ORIGIN OF MONEY

Gold as "the sweat of the sun" and silver as the "tears of the moon" have served as currency and money for millennia. An old adage is: "Do not wait to buy gold, buy gold and wait." The Golden Rule goes as "He, who has the gold, rules."

Throughout human history many things have also been used as money. Cattle sheep, goats, horses or livestock in general, have been used as money in many societies, including Roman society and some contemporary grazing societies. This is the origin of the word "pecuniary" from the Latin word for a single head of cattle: "pecus."

Salt and vinegar have been used as money in ancient Rome, and this is the origin of the word "salary" since the Latin for salt is sal or salis. The North American Indians used sea shells as money and even cigarettes were used during WW II by soldiers on both sides of the conflict.

Ibn Khaldun, in *Al Muquaddimah* (The Introduction) circa 1379, described gold and silver as:

"And God created the two precious metals, gold and silver, to serve as the measure of value of all commodities. They are also generally used by men as a store or treasure. For although other goods are sometimes stored it is only with the

intention of acquiring gold or silver. For other goods are subject to the fluctuations of the market, from which they (gold and silver) are immune.”

According to Alan Greenspan, former USA Federal Reserve Bank president, on August 23, 2011:

"Gold, unlike all other commodities, is a currency ... and the major thrust in the demand for gold is not for jewelry. It is not for anything other than an escape from what is perceived to be a fiat money system, paper money, which seems to be deteriorating."

"Gold is a currency. It is still, by all evidence, a premier currency. No fiat currency, including the dollar, can match it."

On May 20, 1999, we was quoted as saying:

"Gold still represents the ultimate form of payment in the world. Fiat money in extremis is accepted by nobody. Gold is always accepted."

In "Gold and Economic Freedom," in Ayn Rand, ed., *Capitalism: The Unknown Ideal*, New York: Penguin Group, 1967, he states:

"An almost hysterical antagonism toward the gold standard is one issue which unites statists of all persuasions. They seem to sense - perhaps more clearly and subtly than many consistent defenders of laissez-faire - that gold and economic freedom are inseparable, that the gold standard is an instrument of laissez-faire and that each implies and requires the other."

"In the absence of the gold standard, there is no way to protect savings from confiscation through inflation. There is no safe store of value. If there were, the government would have to make its holding illegal, as was done in the case of gold. If everyone decided, for example, to convert all his bank deposits to silver or copper or any other good, and thereafter declined to accept checks as payment for goods, bank deposits would lose their purchasing power and government-created bank credit would be worthless as a claim on goods. The financial policy of the welfare state requires that there be no way for the owners of wealth to protect themselves."

"This is the shabby secret of the welfare statists' tirades against gold. Deficit spending is simply a scheme for the confiscation of wealth. Gold stands in the way of this insidious process. It stands as a protector of property rights."

About 2,500 years ago in the history of Rome, the mint where gold and silver pieces were struck was a sacred and inviolable place housed in the Temple of Juno Moneta; or "Juno the Vigilant," the wife of the god Jupiter. Juno was their advisor, or moneta. It guided them to victory in battle and made their resources last until they won. The silver coins that were minted by the Romans in 269 BC were called "moneta."

The English words "money," as well as "mint" derive from the Latin word "Moneta," the surname of Juno. The name of Juno the Vigilant, refers to the legend that Juno's sacred geese on the Capitolium saved the city of Rome from being sacked. With their loud cackling, they alerted

the sleeping town that enemy soldiers had scaled the walls under the cover of darkness and were about to slaughter its inhabitants.

The English word “money” has a connotation of vigilance to preserve life, freedom and liberty. The paper versions of money were initially credit notes for proper money, or “currency,” a word comes from the Latin “currere,” meaning to “run” or “flow.”

To finance the Third Reich, Nazi Germany went after the gold of Europe. Allied countries stored their gold offshore to keep it safe. In the first months of World War II, the gold of England and France was secretly shipped to vaults in Montréal, Ottawa and New York. Those ships made it safely to port, but throughout history, many were not so lucky. It is estimated that worldwide, 3 million shipwrecks loaded with treasure lie at the bottom of the oceans.

DOLLAR VALUE IN GOLD OR SILVER INCONVENIENT TRUTH

It is not the dollar price of gold or silver that is important. It is instead the gold or silver value of the dollar that is important. The uninformed general population invariably gets it backward, thinking that the USA dollar is the standard to which every valuable commodity is subject to.

The USA dollar currency is losing its value because the central banks have an unlimited supply of it at near zero percent interest. The only reason that the price of gold is low in terms of USA dollars is because the USA dollar is still considered as the global reserve currency and gold, silver and other commodities are priced in USA dollars.

At current prices, a dollar of currency is worth about 28 mg of gold and this is declining by the day. In 1913, when gold was priced at \$20.65 per ounce, one dollar was worth 1,506 mg of gold. A misunderstood notion is that it is not the dollar price of gold that is relevant. It is in fact the gold value of the dollar that is important.

Worldwide, almost all the gold is not available to the market in the form of jewelry and gold bars and is already owned by someone who will never sell it. The “float” or the amount available to the market is less than 1 percent of all the existing gold, the owners of which have held it for decades.

Informed individuals hold gold, silver and land to preserve their wealth over thousands of years. Why would they give up real wealth for a piece of paper that can be printed freely at little cost, that is worth only 28 mg of gold today, when they paid far more than that years ago.

Gold as “money” has proven superior to every other “currency” in the modern times, except the USA dollar which is essentially worthless already because the banks have an unlimited supply of them at a near zero percent “nominal” interest rate, and even worse at a negative “real” interest rate.

The USA abused its reserve currency status and exported its inflation to the rest of the world for years. As a consequence, the dollar is expected to be unseated as the reserve currency, and inflation and interest rates in the USA will soar as the world gradually figures out that there is not enough gold money reserves in the USA to back up the trillions of dollars of USA debt.

Gold should not be considered as an investment to make a paper dollar profit from it at some future time. Gold by itself is the profit that is gained when one converts a depreciating currency, into a store of value that has no debt attached to its ownership, and never had a question raised of its acceptance as an un-inflatable money in human history.

According to Steve Forbes, Editor-in-Chief of the Forbes Magazine, CEO of Forbes, Inc., and two-time USA Presidential candidate, having run in the Republican primaries in both 1996 and 2000:

“One of the things that really most of the economics profession does not seem to get is that money is simply a means for us to buy and sell with each other. It is like a claim check. You go to a restaurant, check your coat, the claim check has no intrinsic value, but it is a claim on the coat. Money is a claim on products and services. It has no intrinsic value. What it does, it is like a claim check on products and services. It works best when it has a fixed value.

Money measures value the way scales measure weight or clocks measure time or rulers measure space and length, and it works best when it is stable. The best way to get stable money, as we explained in our book ‘Reviving America,’ is precisely to link it to gold the way we did for a hundred and eighty years. It works. Gold is like a ruler. It has a stable value. When you see the price fluctuate, that means that it is the dollar's value that is fluctuating, people's feeling about it for the present and for the future. But gold is like Polaris. It is the North Star. It is fixed.”

Steve Forbes and Elizabeth Ames co-wrote the book titled: ‘Money: How the Destruction of the Dollar Threatens the Global Economy and What We Can Do About It,’ and proposed a modified gold standard:

“The twenty-first century gold standard would fix the dollar to gold at a particular price. The Federal Reserve would use its tools, primarily open market operations, to keep the value of the dollar tied at that rate of gold.”

Steve Forbes suggests:

“Gold is the best way to fix that value. The only role for the Fed, at least for now, would be to keep that fixed value and then deal decisively with the occasional panic, just as the British showed us a hundred and fifty years ago. If you have a panic where banks need the temporary liquidity, they go to the Fed with their collateral, borrow the money at above market interest rate, and then, as the crisis recedes, they quickly pay it back and it's done. So the Fed's role could almost be done by summer interns if they knew what they were doing, so it would not be the monster that it is today where the Fed tries to dictate where credit goes, what happens to the economy, etc. It's really bizarre and destructive.”

He comments on the 2 percent hidden tax imposed on USA households and strangers alike:

“One other example on that is Janet Yellen, the head of the Federal Reserve, says that we should have two percent inflation, which in her mind is seeing the prices rising two percent a year. If you take a typical American family making fifty thousand bucks a year; that means their costs would go up a thousand dollars a year, two percent of fifty thousand. Who gave her the authority to raise the cost

of living, which is an effective tax, a thousand dollars on a typical American family? Yet Congress, they just nod their heads. It's a travesty.”

ALGORITHMIC GOLD TRADING

The price of gold that is quoted on the commodity exchanges such as the Comex and other derivative exchanges is not influenced by "investors" demand at all. Instead, this price is practically determined by the whims of the High Frequency Trading (HFT) computers. These computers take their trading cues from signals completely unrelated to the fundamentals of gold supply and demand. The strategy typically involves using ultra-fast computer technology and placing computer servers close to exchanges to react to market data as quickly as possible before other trading platforms. Such trading has drawn increased attention from regulators since the May 2010 flash crash, when \$1 trillion of value was briefly erased from USA stocks. It is reported that 70 percent of the trades on the stock exchanges are now of the HFT category.

The single most important gold trading cue for the HFT algorithms appears to be the relationship between the USA dollar and the Japanese yen, commonly referred to as the trading pair USDJPY. The price of traded gold has a correlation coefficient of minus unity with the USDJPY spread. The exchange-traded price of gold is inversely proportional to the USDJPY spread.

The price of gold cannot appreciate while it is a basis for a fractional-reserve-like paper gold. The chief reasons for gold to have an enduring value is scarcity. However paper-gold does away with scarcity and so prevents gold from attaining a higher value. Gold cannot appreciate significantly while the generation of paper-gold is allowed to occur. Unless there is a legally mandated retreat to physical gold-only trading, it does not look like it is worth trading, since the game is rigged. Given the Japanese yen-USA dollar linkage, a trader might as well engage in currency trading between the two currencies.

GOLD SUPPLY

Gold is the most complex investment asset. It is half commodity, and it behaves as a commodity, but it is also half currency. It is the only asset that belongs to two asset classes, properly considered to be a financial asset as “money” and at the same time as a real asset “commodity”.

Pure gold is so malleable that it can be made into sewing thread and can be molded with the hands. One ounce of gold can be stretched to over 50 miles. According to poet George Gordon, Lord Byron in Don Juan:

“O Gold! I still prefer thee unto paper,
Which makes bank credit like a bark of vapor.”

The Enlightenment Period's French author, historian and philosopher with the pen name of Voltaire (François-Marie Arouet) is quoted as:

“Une monnaie papier, basée sur la seule confiance dans le gouvernement
qui l'imprime, finit toujours par retourner à sa valeur intrinsèque, c'est-à-dire zero,”

which translates into:

“A paper currency, based solely on confidence in the government that prints it, always ends up returning to its intrinsic value, which means zero.”

Voltaire advocated for civil liberties and freedom of religion. His writings indirectly inspired both the American and French Revolutions.

George Washington's 1786 critique to Thomas Jefferson of paper money in Virginia states:

“Paper money has had the effect in your state (Virginia) that it will ever have, to ruin commerce, oppress the honest, and open the door to every species of fraud and injustice.”

It is said that, even melted down, there would not be enough mined gold in the world to fill an Olympic swimming pool. Some claim that much of the gold held by the Bank of Canada, the Bank of England, the USA's Federal Reserve Central bank at the Bank of New York vault and at Fort Knox is gone and that for every 100 ounces of paper gold traded on the exchanges, there exists only one ounce of real, physical gold in the world.

The latest figure from Thomson Reuters suggests that the current world supply is 171,300 metric tonnes. It would fit into the Wimbledon Centre Tennis Court at a height of nearly 10 meters above ground. They suggest that there is another 52,000 metric tonnes to be mined, adding another 3 meters. The Gold Standard Institute believes that there is much more: 2.5 million metric tonnes. That would make a cube that towers 143 meters over the court.

Gold has been mined for a long time for over 6,000 years. Nobody really knows how much was mined in ancient times and what happened to it. King Tut Ankh Amen's coffin weighed 1.5 metric tonnes alone and some gold experts speculate that many other such treasures were ransacked by grave robbers and amateur self-proclaimed archaeologists alike. In some countries, like Columbia, gold is mined illegally and it is suspected that others hold reserves that are not publicly documented.

For the first time in history, the world's gold is not fully being recycled. It is currently used in such small quantities in electronics that it is not economic to recycle it. The British Geological Survey estimates that about 12 percent of the world's gold is simply being thrown away.

CURRENCY SYSTEMS

According to Salvatore Rossi, Chief of the Central bank of Italy, on September 30, 2013:

“Gold is unique among assets, in that it is not issued by any government or central bank, which means that its value is not influenced by political decisions or the solvency of one institution or another.”

One of the key currencies, financial assets, forms of savings, forms of money, for most of the past 5,000 years of human civilization has been gold. Just 160,000 metric tons of gold has ever been mined on Earth. If cast in the form of a cube it would just cover the size of a tennis court and its annual production would increase the size of the cube by 4 inches or 10 cms per

year. At \$950 per ounce, it is worth \$4.9 trillion. In comparison, the total amount of paper money in circulation as currencies, savings, deposits, money-markets and certificates of deposit (CDs) is worth \$60 trillion or approximately twelve times the value of the gold in existence.

The Greek philosopher Aristotle best defined the primary reasons why gold and silver are considered as money. A good form of money must be durable, divisible, consistent, convenient, and have value in and of itself. It functions as money and a store of value. Since 1913, the USA dollar has lost 96 percent of its purchasing power relative to gold. Gold has preserved its value. It is the only financial asset that is not simultaneously someone else's liability. It does not require the backing of any bank or government.

Anecdotally, at the time of Jesus Christ, an ounce of gold dressed a Roman citizen with his toga, a leather belt, and a pair of sandals. As of 2013, one ounce of gold still buys a good suit, a leather belt, and a pair of shoes. In 400 BC, during the reign of King Nebuchadnezzar, some scholars report that an ounce of gold bought 350 loaves of bread. An ounce still buys about 350 loaves of bread. In 1979, gold average price was \$306.68 per ounce. This bought an average-priced full-size bed. In 2012, an ounce of gold would still buy a nice full-size bed.

For a long period of time in Human history, true money was a coin made out of gold or silver. For lack of silver, 500 years or so ago in Sweden, people used heavy copper plates as money. The Swedes punished counterfeiters by cruelly melting down bad coins and pouring the molten metal down the throat of the perpetrator.

Gold has been superseded by different forms of monetary systems, some of them based on gold in some form or another. Gold fell about $(5.0 - 0.2) / 5.0 = 0.96$ or 96 percent from an estimated 4.5-5.0 percent of world private sector wealth in the late 1960s to roughly 0.2 percent of world financial assets by the early 1990s, and stayed low until the past few years, but by the end of 2008, gold's share of the global financial assets have tripled to around 0.6 percent.

GOLD AND SILVER STANDARDS

In 1717, Sir Isaac Newton, who was then master of the Royal Mint in London, established a new mint ratio between silver and gold, which effectively put Britain on a gold standard. During the Napoleonic Wars, the UK curtailed convertibility. This was reestablished in 1821 with the new £1 sovereign becoming the standard gold monetary coin of the realm, replacing the guinea.

As the UK returned to the gold standard in 1821, most European countries' currencies were either tied to silver or to a bi-metallic standard linked to both silver and gold. The currencies of Germany, Austria-Hungary, The Netherlands, Sweden, Denmark and Norway were silver based, whereas the currencies of France, Italy, Belgium and Switzerland were bi-metallic.

By 1873, all these countries, except Switzerland had abandoned their respective currency metal affiliation in favor of gold. The USA also tied the dollar to gold in that year. The Swiss franc was made convertible into gold in the following year. Thus, 1873 marks the emergence of the Classical Gold Standard. Each of these national currencies was fixed to the value of an ounce of gold. The dollar was set at \$20.67 and the sterling pound (£) was set at £4 and 5 shillings per gold ounce. Since silver was no longer a part of the currency mix its price fluctuated, strictly based upon supply and demand.

The Coinage Act of 1873 or Mint Act of 1873, 17 Stat. 424, was a general revision of the laws relating to the Mint of the USA. In abolishing the right of holders of silver bullion to have their metal struck into legal tender dollar coins, it ended bimetallism in the USA, placing the nation firmly on the gold standard.

By August 1971, President Richard Nixon cancelled the dollar's link to gold. The prices of both gold and silver became set by the market. The true respective values of gold and silver can only be assessed from that time.

On November 19, 1967 British Prime Minister Harold Wilson, following several assurances to the contrary, announced a 14 percent devaluation of the British pound. This relatively small devaluation of one single, non-reserve currency in November of 1967 turned out to be quite a spark in the monetary powder keg of the Bretton Woods gold exchange system and the London Gold Pool. Within weeks of the devaluation, the group of central bankers known as the London Gold Pool had to sell 1,000 tonnes of their own gold into the public market, 20-times the normal amount.

Once the gold price peg had been lifted, it began to rise from the artificial price base at which it had been held for so long. By January 1980, it had reached \$850.00 per ounce, which amounted to a gain of better than 2,400 percent in a little less than eight and a half years.

According to the U.S. Bureau of Mines, there were 9,000 operating gold mines in the USA by 1940. In Canada, there was a huge exploration boom, particularly along the Abitibi greenstone belt stretching from north/central Ontario into Québec. Many of the mines discovered and placed into operation along that belt in the 1930s are currently being explored and in some cases are being mined at this time.

As the world credit crisis unfolded following the 1929 stock market crash in New York, the desire to own gold and invest in gold mining companies was not only a North American phenomenon but an international one, since almost all countries were mired in an economic depression. Following the destructive stock bear market of 1929 to 1932, capital was very scarce and what remained flowed almost exclusively to the gold mining industry.

By 1933, twenty-five percent of Americans were unemployed and the government was desperate to get people back to work. Silver mining was an important activity in the USA and one of the most important in several western states. The senators in these states wielded considerable power and they induced President Roosevelt to introduce the Silver Purchase Act of 1934, which in effect nationalized the silver market, much as the earlier Gold Reserve Act had nationalized gold. All newly mined silver was sold to the Treasury; thus, the U.S. government set the price of silver within the United States. The initial purchase price was \$0.50 per ounce. In April 1935, the price was raised to \$0.7757. Later it was increased to \$0.90 and finally to \$1.29 per ounce, where it remained until silver was denationalized in 1963. Elsewhere in the world, including Canada, there was no official backing for silver; the price, outside the USA languished. Silver has not been a monetary metal since 1873 and in the case of Great Britain since 1717. Gold, on the other hand, despite the fact that all world currencies are fiat, still retains a monetary presence in as much as most central banks hold gold as a part of their reserves. At this time, some countries, principally China and Russia are substantially building their gold reserves. The predominant use for silver is industrial (53 percent); if photo usage is added to industrial, it increases the industrial demand for silver to 66 percent.

1. Fiat or decree currency system:

Fiat currency systems consist of currencies that are declared as legal tender by governments by an official sanction or decree with some or without commodity backing. "Fiat" is Latin for "so be it," or "let it be done," meaning money ordered into existence by a sovereign power.

The inherent worth of a fiat currency is negligible and its value is dependent on the confidence and its acceptance by the populace. Fiat currencies are inevitably over-printed are the predominant currency systems in the world today, even though all irredeemable fiat currencies, without exception, have been unsustainable and ended up on the garbage heap of history. Attempts at fooling all the people all of the time, to paraphrase USA President Abraham Lincoln, are deemed to failure.

2. Pure reserve gold and silver standard:

Under the pure one hundred percent reserve gold and silver standard, is commodity money issued in the form of hard gold and silver coins, or receipts, whether paper or electronic, issued in lieu of metal held in a money warehouse.

The amount of coinage in circulation plus the receipt money would be equal to the total mass of metal in the monetary system.

This system existed at the time of the Byzantine Empire in the form of gold “bezant” coins and was so much trusted that it was also adopted by the Islamic Empire. It does not exist today, yet is mistakenly referred to sometimes as the “gold standard.”

3. International classical gold standard:

The international or classical gold standard is actually a form of fractional money. One can redeem paper or electronic currency for a fixed amount of gold coinage. For 100 years, from 1815 to 1914, the USA and the Western world were on, essentially, a gold standard. The USA dollar remained stable over this period. Since 1913 the USA dollar has lost 97-98 percent of its purchasing power. The USA presidents James Madison, Thomas Jefferson and Andrew Jackson did not trust paper money.

MARKET MANIPULATION

An attempt to corner the gold market was tried by Jay Gould and “Big Jim” Fisk in 1869. That corner was broken when the USA Treasury Department unexpectedly sold large quantities of gold into the market after Fisk and Gould had been assured by insiders that the Treasury Department would not do so.

The Hunt brothers in Texas tried to corner the silver market in 1979 and 1980. That corner was broken by a combination of scrap silver flooding the market in the form of tea sets and silverware and changes in the exchange regulations that protected their members by increasing the margin requirements and hurt the Hunts brothers’ ability to maintain their leveraged futures positions.

USA’S GOLD CONFISCATION

The USA remained officially under the gold standard according to the Gold Standard Act of 1900 until President Fitzgerald Deleanor Roosevelt (FDR) outlawed and confiscated publicly-held gold in 1933.

Under that system, the monetary supply could still be inflated or pyramided upon the total base amount of metal, which is in principle exclusively possessed by the government.

According to this international classical gold standard, if all the citizenry decided to exchange their paper receipts at the same time, not enough gold would be available for everyone to redeem their receipts, and the country would go bankrupt.

When the USA executed the Gold Standard Act of 1900, the first step was for the government to procure a massive reserve amount of gold from Europe, so that the citizenry could be persuaded into thinking that their gold could always be redeemed in full. Not all people turned in their gold holdings to the government, and this led to hoarding and a black market.

Figure 39. Presidential Executive Order 6102 for the confiscation of gold, except for rare gold coins and jewelry by President Franklin Deleanor Roosevelt, May1, 1933. The dollar was 100 percent backed by gold at \$20.67/ounce. In 1935 the dollar was devalued by 75 percent to \$35/ounce providing the government with a cache of dollars that were still backed by gold to spend.

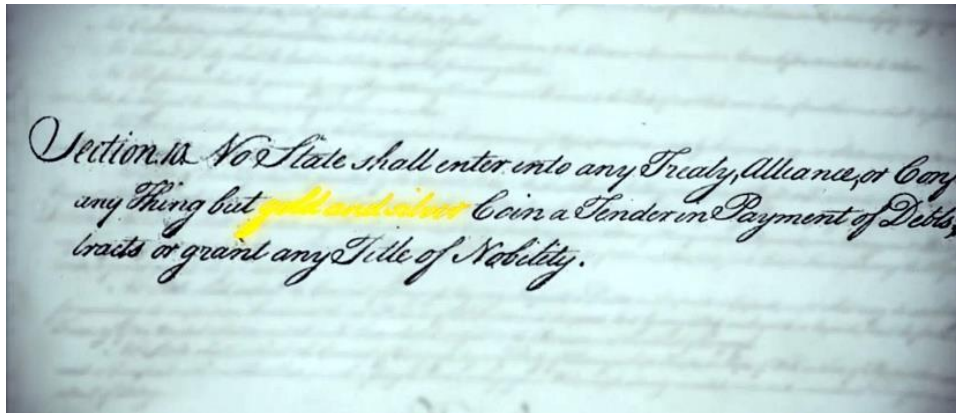


Figure 40. Gold and silver (in yellow) as “tender in Payment” in the USA Constitution.



Figure 41. Evolution of twenty and fifty dollars bills from 1905 to 1914. Gold Certificates issued by the USA Treasury in 1913 holding title to 2.41896 ounces of gold at the fixed rate of $\$50 / 2.41896 = \$20.67$ per troy ounce until 1933.

The American public was multiply bilked in the process. At the time, a \$20 gold coin contained \$20.67 worth of gold, but the public was handed only a \$20 paper bill. The American banks, who made the exchange, shipped those gold coins to the European banks from which they received the full value for $(20.67 - 20.00) / 20.00 = 0.67 / 20 = 0.0335$ or an instant 3.35 percent gain at the expense of the American public.

Seven months later, an executive order was issued, after the gold was confiscated that devalued the dollar currency and making the \$20 dollar gold coins worth \$35 in paper money, further bilking the American public to the tune of $(35.00 - 20.67) / 20.67 = 14.33 / 20.67 = 0.6933$ or 69.33 percent profit to the benefit of the European banks that acquired the confiscated gold coins.

The debasement of the currency affected the issued coins which were initially made out of copper and silver and had to be replaced with a cheaper metal substitute.

Prior to 1964, the USA quarters and dimes coins were composed of 90 percent silver. From 1965 to 1970 the half dollars coins were 40 percent silver clad over a copper-nickel or “cupronickel” mix. Now the quarters and dimes and half dollars have no silver in them at all. They are now entirely copper and nickel, but only enough to get a little more than 1/4 of their face value.

Prior to 1983, the USA pennies were 95 percent copper and 5 percent zinc. Starting in 1982 the pennies are made of 97.5 percent zinc with only 2.5 percent copper plating. The USA nickel or 5 cents coin has been cupronickel since 1946: 75 percent copper and 25 percent nickel with trace amounts of manganese.

Central banks use carrots rather than sticks to induce people to exchange their gold holdings for paper instruments and practically confiscate it in exchange for depreciating issued fiat currencies. According to Anand Singh, deputy governor of the Reserve Bank of India described in July 2012:

“Gold imports have been a substantial part of the current account deficit. The gold that already exists in the country can be brought out to satisfy the demand by devising financial instruments that can mimic the returns of gold.”

The Turkish government encourages people to store their gold in tax-free accounts at the banks, instead of at home. Just before the President Roosevelt’s gold confiscation, most Americans had already converted their gold into financial instruments responding to government propaganda describing gold transactions as “old-fashioned.” As very few Americans were using gold coins in their daily lives, they readily accepted the 1933 gold confiscation without protest.

In 1966 Alan Greenspan, later Chairperson of the USA Federal Reserve Bank, is quoted as: “In the absence of the gold standard there is no way to protect savings from confiscation through inflation. There is no safe store of value without gold. This is the shabby secret of the welfare statists versus gold. Deficit spending is simply a scheme for the hidden confiscation of wealth. Gold stands in the way of this insidious process that stands as a protector of property rights”.

4. Gold exchange standard:

Under a gold exchange standard, a country keeps no physical gold that can be redeemed. For reserves, only other hard receipt money from another nation that could ultimately be

redeemed in gold is kept. An example of this is that many European countries adopted the USA dollar as a hard currency immediately following World War I. Still, under this standard, a country can proceed to inflate its currency for as long as it can convince the citizenry and foreigners that the disparity between the pegged hard currency and their banknotes is acceptable.

5. Gold bullion standard:

Under the gold bullion standard, gold coins are never minted. Redemption in gold is only permitted in the case of large international transactions. The country's population is prohibited from ever possessing the actual gold.

SOUTH KOREA'S PATRIOTIC GOLD CONFISCATION, 1997

During the 1997 South East Asian Tigers banking crisis, the South Korean government led its people into giving up their gold by using the political angle of patriotism. The Korean government launched a "Collect Gold for the Love of Korea" campaign and recruited the help of three major Korean corporations, Samsung, Daewoo and Hyundai, to entice all Korean citizens into believing that if they did not turn over their gold to the government, they were "unpatriotic".

The South Korean won currency fell from an exchange rate of 800 won per USD to an exchange rate of 1,700 won per USD during this crisis. Over 100,000 citizens donated more than 20 metric tonnes of gold, with the exact amount remaining unknown today because the government stopped reporting official numbers after the donations ran in excess of 20 metric tonnes. In 2013, at a price of \$1,580 a troy ounce, those 20 tonnes represent more than \$1 billion of disappeared wealth.

Ordinary Koreans donated personal gold treasures, which have been melted down into ingots ready for sale on the international markets. South Koreans queued for hours to donate their best-loved treasures in a gesture of support for their beleaguered economy. Housewives gave up their wedding rings; athletes donated medals and trophies; many gave away gold "luck" keys, a traditional present on the opening of a new business or a 60th birthday. The campaign exceeded the organizers' expectations, with people from all walks of life rallying around in a spirit of self-sacrifice. According to the organizers ten tonnes of gold were collected in the first two days of the campaign.

South Korea's traditionally militant labor unions announced that they are willing to join a consultative body which is being set up to discuss the possibility of job losses alongside employers and politicians. Many migrant laborers faced the threat of being sent home. A stigma became attached to taking holidays abroad, or buying foreign-made luxury products.

INDIAN GOLD CONFISCATION

Indians, as one of the largest private holders of gold in the world, understand that gold is real money and that rupees are fiat currency. Even the poor in India will convert their rupees into gold or silver whenever possible. To stop gold buying by the Indian masses, the Indian government jacked up the import tax on gold from 1 percent in December of 2011 to 6 percent with a further increase to 8 percent by March 2013, a move that represents a 700 percent increase of the tax on gold in over a one-year period. The result was an increase in gold smuggling into India to avoid the imposed taxes.

In India, people have protected their wealth with gold over generations. For Indians, gold is an asset class that bridges inequalities by giving individuals a shot at protecting themselves against government savings confiscation policies. The government does everything in their power, with the Indian trade deficit as their excuse, to entice people to surrender their gold in return for some interest payment. The Indian government introduced a gold monetization scheme, import duties, documentation requirements for buying gold and campaigns to convince people to open bank accounts.

At the start of 1960, 1 gram of gold cost 5.37 Indian Rupees. On February 1st, 2016, 1 gram of gold cost 2,443.59 Indian Rupees excluding the premium stemming from the 10 percent import duty. The Indian Rupee as measured in gold has thus lost 99.8 percent of its value since 1960.

MECHANICS OF THE GOLD STANDARD

Gold is best considered as an asset and not as a currency that can be exchanged or traded for a corresponding amount of a cash currency or some barter products. A free-market 100 percent convertible gold standard possesses an inherent stabilizing negative feedback mechanism. The 2008-2012 unsustainable global monetary crisis was rooted in the chronic imbalance of payments caused by a destabilizing positive feedback mechanism inherent to the fiat money creation system that would not be possible under a gold standard. This is a major force behind the competitiveness loss and debt accumulation of chronic trade deficit countries like European GIIPS countries of Greece Ireland, Italy, Portugal and Spain as well as the USA.

As assumed by the economists Adam Smith and David Ricardo, it keeps debt levels at a limited level, balances international trade and conveys the verdict of the marketplace quickly to all producers and consumers. Borrowers can borrow only the amount of actual gold that lenders wish to lend, so there would not be an excess leverage in the system.

When a country exports goods and services more in value than it imports, it receives excess gold in payment, increasing up its gold and money supply and consequently its price levels. When a country imports more in value than it exports, it must send gold to pay for the excess, and its own gold and money supply declines and so then do its price levels. The excess exporter's prices rise and the excess importer's prices fall to the point that trade balances and gold flows normalize.

Countries and businesses that fall behind in terms of competitiveness get immediate incremental feedback from the market, and must make adjustments quickly to remain competitive in business long before such differentials become excessively large.

HISTORY OF THE GOLD STANDARD, THE "GOLDEN RULE"

The concept of "Golden Rule" underlies the value of fair play and civility in human relations: "do unto others what you want them to do to you." It has another less magnanimous definition, when gold possession is synonymous with both wealth and power. In versions of the "Golden Rule": "He who has the gold makes the rules," "The Golden Rule is really: Those who have the gold, rule."

Yet, governments of the world are united in opposing the use of gold as a currency since it undermines their option of stealthy taxation by inflating their fiat currencies. In the contemporary global economy, countries with a positive balance of payments acquire gold and

sooner or later, their currencies appreciate whilst the countries with a negative balance of payments see their currencies depreciate and they become de-facto economic slaves to their lenders in a subtle form of neo-colonialism.

In an April 2012 speech, Dr. Andreas Dombret, a member of the Executive Board of the Deutsche Bundesbank, the German central bank, offered the following sober assessment of the tensions and imbalances that exist between the northern and southern tier of the 17-member Eurozone:

“Exchange rate movements are usually an important channel through which unsustainable current account positions are corrected. In a monetary union, however, this is obviously no longer an option. Spain no longer has a peseta to devalue; Germany no longer has a deutsche mark to revalue. Other things must therefore give instead: prices, wages, employment and output.

The question now is which countries have to shoulder the adjustment burden. Naturally, this is where opinions start to differ. The German position could be described as follows: the deficit countries must adjust. They must address their structural problems, reduce domestic demand, become more competitive and increase their exports.”

The victorious troops in the medieval times were given 3 days to loot and sack a city of its gold and silver as a payment for their services. Kings faded out from history when they ran out of gold to pay their armies. King Charles V almost lost his war against the French in Italy when he ran out of gold to pay his mercenary troops. So, even though he proclaimed himself as being the protector of Western Christianity, to keep the loyalty of his soldiers, he promised to allow them to sack the city of Rome.

Following Japan, the UK suspended its gold standard on September 21, 1931, to help itself out of the Great Depression by inflating its currency. They were promptly followed by Germany in 1932, the USA in 1933, France in 1936, and Switzerland in 1936.

The USA on August 15, 1971, refused to exchange gold for foreign-owned dollars to stem its outflow to Europe, effectively killing the Bretton Woods monetary agreement following World War II.

The International Monetary Fund, IMF, as the global central banker of national central bankers started on June 2, 1976 the selling of 1,555 metric tonnes of gold; which was one third of its gold reserve with the stated purpose of: “To reduce the role of gold in the international monetary system.” It followed its gold sales by adding a Second Amendment to its Articles of Agreement eliminating gold bullion “as the common denominator of the post-World War II exchange rate system.” In May to November 1976, the USA Treasury carried out its own program by divesting 550 metric tonnes of its holdings.

President Ronald Reagan in the USA appointed on October 7, 1980, a Gold Commission to investigate the possibility of going back to the gold standard, and if so, at what exchange rate. The economists married-couple Milton Friedman and Anna Schwarz described its function as: “Served one paramount objective of its sponsors, promoted discussion of gold in the media, on television and among the public; a rallying cry for the faithful.” On March 31, 1982, the USA Gold Commission splits into a majority and a minority factions and issues its recommendations. The majority’s opinion in its report was that: “A return to the gold standard is not desirable.” Instead of a gold standard it recommends that: “The growth of the nation’s money supply be

maintained at a steady rate which insures long run price stability.” A minority report dissented from the conclusion and applauded the compromise action of the return of the USA Treasury to minting gold bullion coins for retail sales, but only from American produced gold and silver.

The UK government on May 7, 1999, sold half its gold reserve at 395 metric tonnes in line with most of the European nations, except for France and Germany. Initially, gold drops in dollar value by 12 percent in response to these sales even before the sales begins with a 2- month notice to the markets before the first sale; only to quadruple in price over the next 10 years.

A country can inflate its currency if it can persuade the populace and the foreigners that the disparity between gold and their currency holdings is reasonable.

TRADE INBALANCES

Nations had to settle up on their trade balances prior to 1971. When one country sold more goods to its trade partner than it bought from it, the country with the surplus ended up with an excess of the neighbor’s currency. This surplus currency was then presented to the deficit country to settle the account by a transfer of gold from the deficit country to the surplus country.

As the gold left the deficit country, it had a slowing-down effect on the deficit nation’s economy. Investors would cause the interest rates to rise or the central bank raised them. This resulted in slower economic growth and less spending, thereby balancing the outflow of funds to the trading partner.

This negative feedback self-correcting mechanism is a stabilizing factor. That stabilizing element was eliminated as a result of the debt accumulated by the USA in spending on the Vietnam War. French banks were active in Vietnam and tended to be the recipients of the mone which flowed to the Bank of France, the French central bank. The French, anticipating a problem with the dollar currency, proceeded to exchange their accumulated dollars into gold. The Nixon Administration responded by closing the gold window at the USA Treasury department in August of 1971. This was an actual default on its financial debt. It caused an increase in the price of gold, followed by a bust then a large boom. The USA citizens were lured into the debt trap. Their rich got richer; and their poor got poorer, and the middle classes joined the ranks of the poor. The manifestation of this change in the playing field is that between 1975 and 1992, the wealth of the richest one percent of the USA’s population rose from 22 percent of total national household wealth to 42 percent.

CLOSURE OF THE “GOLD WINDOW”, “LONDON GOLD POOL”

The London Gold Pool kept a lid on the gold price at \$35 per ounce in the 1960s until the gold price took off, causing its collapse. It took off because the physical gold market and the paper gold market went out of balance. More physical gold was being demanded at the then-prevalent \$35 per ounce price than the amount of the available metal. Physical gold and silver have no counterparty risk. Paper-gold and paper-silver have counterparty risk involving a daisy-chain of interlinked derivatives that are unsustainable and pose the risk of blowing up sooner or later. This did happen when the Lehman Brothers firm collapsed in the financial crisis of 2007-2008. The same situation is repeating itself at much higher gold price because inflation has caused the dollar to lose so much purchasing power since the 1960s.

The USA existed under that system from 1933 until the President Richard Milhous Nixon and his Secretary of State Henry Kissinger closure of the international “gold window” in 1971,

in response to France, Switzerland and other countries redeeming their surplus depreciating dollars into gold. He ended the gold-backed monetary system set up by the Bretton Woods Conference in 1944. The USA was in the process of inflating its money supply and depreciating its dollar currency to meet the soaring expenses of the Vietnam War and President Lyndon Johnson's Great Society. President Richard Nixon's administration was trying to exercise wage and price controls to check an increase in consumer prices of 4.9 percent in 1970. He initiated a decade of stagflation in the USA's economy. One of his publicized audio tapes as a result the Watergate scandal reveals him conspiring with his advisers to blame the fateful decision of closing the "gold window" on "speculators." This breach of contract negated a solemn promise of dollar to gold convertibility of five generations of USA Treasury officials and set the stage for a worldwide credit and debt bubble within an unsustainable system of unconstrained fiat paper money under control of privately owned central banks in collusion with the Treasury departments of the states exercising stealth taxation of the life savings of foreigners as well as their own citizens.. Since 1971, the USA added trillions of dollars to the world supply of currency and credit whilst only 58,000 metric tonnes of gold were mined from the ground.

On August 15, 1971, gold was pegged at the same level that it was in 1933 at \$35 per ounce. Forty years later, in August 2011 it reached \$1,900 per ounce implying an appreciation in 2011 of the value of gold relative to its 1971 value by a factor of $1,900 / 35 = 54.29$ or 5,429 percent within 40 years. From a different perspective, in 1971 one dollar would purchase $1/35$ oz of gold, whereas in 2011 it purchases $1/1,900$ oz. Thus the dollar decreased in value by a factor of $(1/35) / (1/1,900) = 1,900 / 35 = 54.29$. The gold appreciation is a dollar's depreciation by the same factor of 54.29. Another way of looking at the issue is that one dollar buys only $100 / 54.29 = 1.84$ cents worth of the gold it was able to buy in 1971, implying that the dollar in 2011 has lost $100 - 1.84 = 98.16$ cents, or 98.16 percent of its 1971 value.

The bulk of the world's gold holdings are stored in the vault of the New York's Federal Reserve Bank. This includes most of the deliverable gold (99.9 percent fine) owned by the Federal Reserve Bank as a trustee of the USA government's gold. The gold at Fort Knox, primarily coin melt (90 percent fine), is just 20 percent of the nation's gold.

According to the USA Mint, the 147.3 million troy ounces of gold at the military base at Fort Knox, Kentucky, "is held as an asset of the USA," in the most impregnable vault on Earth; built of granite and sealed behind a 22-tonne door, watched day and night by army units with tanks, heavy artillery and Apache helicopter gunships at their disposal. Since its construction in 1937, the treasure trove also includes the USA Declaration of Independence, the Gettysburg Address, 3 volumes of the Gutenberg Bible and the Magna Charta.

By the end of 2008, gold holdings of the Exchange Traded Funds, ETFs reached a record level of 1,090 metric tonnes. By July 2012, these holdings more than doubled, to 2,188 tonnes. Thus, ETF holdings exceeded those of China, Switzerland, Russia and many other large and important nations.

In the ETFs, individual investors hold more gold than quadruple the European Central Bank, ECB. Much of the USA government gold reserve dates from the national gold confiscation of 1933 under President Franklin Roosevelt. Roosevelt had a compliant Congress to do his bidding and even the Supreme Court backed him up. Many other countries of the world are currently buying gold as output from the gold mines. China is the world's largest gold-producing nation, and its central bank is buying and building reserves. Russia has a tradition of holding gold and is acquiring gold from its own mine output and via purchases on international markets. India is following the same uptrend. Small countries like Qatar, are adding to their gold reserves.

Table 17. Official national and market gold reserves, January 2013. Data: World Gold Council, IMF International Financial Statistics.

Country	Amount [metric tonnes]	Proportion of national foreign exchange reserves [percent]
USA	8,133.5	75.6
Germany	3,391.3	72.7
International Monetary Fund, IMF	2,814.0	-
Italy	2,451.8	72.2
France	2,435.4	69.2
Exchange Traded Funds, ETFs	2,814.0	-
China	1,054.1	1.7
Switzerland	1,040.1	10.5
Russia	969.9	9.8
Japan	765.2	3.2
Netherlands	612.5	59.2
India	557.7	9.9
European Central Bank, ECB	502.1	33.4
Taiwan	423.6	5.6
Portugal	382.5	90.3
Turkey	370.0	15.9
Venezuela	356.8	74.6
Saudi Arabia	322.9	2.6
United Kingdom	310.3	15.6
Lebanon	286.8	29.3
Spain	281.6	29.1
Austria	280.0	54.9
Belgium	227.5	39.4
Philippines	192.7	12.3
Algeria	173.6	4.7
Thailand	152.4	4.5
Singapore	127.4	2.6
Sweden	125.7	10.6
South Africa	125.1	13.1
Mexico	124.4	3.9
Kazakhstan	116.8	23.2
Libya	116.6	5.1
Bank of International Settlements, BIS	116.0	-
Greece	111.9	82.2
Korea	104.4	1.7

Romania	103.7	11.5
Poland	102.9	5.1
Australia	79.9	8.9
Kuwait	79.0	11.9
Egypt	75.6	25.8
Indonesia	73.1	3.5
Brazil	67.2	1.0
Denmark	66.5	4.0
Pakistan	64.4	25.7
Argentina	61.7	7.8
Belarus	51.7	30.9
Finland	49.1	23.5
Bolivia	42.3	16.3
Bulgaria	39.9	11.1
West African EMU	36.5	13.7
Malaysia	36.4	1.4

Table 18. Global gold Production, 2013.

Rank	Country, Region	Production, metric tonne / year
1	China	428
2	Australia	255
3	USA	227
4	Russia	220
5	Peru	150
6	South Africa	145
7	Canada	120
8	Mexico	100
9	Uzbekistan	93
10	Ghana	85
	World	2,770

A sensational story circulated that the USA government at the time of President Bill Clinton allegedly manufactured or bought some 1.3 to 1.5 million 400 oz, gold-plated, tungsten bars. Some 640,000 of these bars were allegedly stored at Fort Knox, and the balance of about 800,000 of them was sold or shipped to central banks and other parties, including central banks, around the world such as Hong Kong. Some of these fake bars were supposedly shipped from Ethiopia to South Africa and spotted by its central bank. A Chinese company that was in the business of making gold plated tungsten jewelry, and likely dozens of others around the world, were suspected to place a gold shell around a tungsten core to fool the uninformed public, but not the central banks. A story from Reuters in the December 22, 1983 New York Times reported on the arrest of five men in a hotel in Vienna, Austria. They had ten, fake, gold-plated, tungsten bars that they were evidently going to try to sell to unsuspecting buyers. These bars were stamped with numbers linking to some genuine gold bars stolen earlier. Many of the real bars have

identifying numbers from the mints to make it even more difficult to counterfeit and pass them. A story by Edward Durrell and Peter Beter questioned the presence of the USA gold supply at Fort Knox back in the 1970s. After this story came out on October 1, 2008, there was a surge of other articles that the gold at Fort Knox was not in fact there or that it was in fact owned or leased to the International Monetary Fund (IMF).

Senator Ron Paul from Texas; a once Republican presidential candidate, introduced a bill in April 2011 that would require an audit and a test of the 700,000 gold bars that make up the USA gold reserve. The Treasury Department objected on the basis that it would take 400 people working full time for six months to complete the task at a cost of \$15 million. During the cold war this issue came up. In 1951 Charles Tobey, a New Hampshire Republican senator demanded an inspection of the Fort Knox gold. In 1953 Congressman Carroll Kearns of Pennsylvania demanded a count of the gold. According to Time magazine, every year into the 1960s Congressman Kearns “has methodically offered a resolution demanding that a congressional delegation be dispatched to recount the gold buried at Fort Knox.”

It may be worth-noting that the interest on the USA national debt in just one year would be covered by all the USA gold at Fort Knox and other locations. Assuming an interest rate of just 1.5 percent, the interest on the USA national debt of \$14 trillion as of 2011 would be:

$$\$14 \times 10^{12} \times 1.5 / 100 = \$0.21 \times 10^{12}.$$

In comparison, the value of the gold at \$1,500 / oz would be equal to:

$$5,000 \text{ ton} \times 2,000 \text{ lb/ton} \times 16 \text{ oz/lb} \times 1,500 \text{ \$/oz} = \$0.24 \times 10^{12}.$$

The total amount of gold above ground is estimated at 140,000 tonnes which is 90 percent of the gold ever mined at 160,000 tonnes. Mine production is a limited new supply of 2,500 tonnes / year; becoming harder to find and more expensive to extract.

In 1999 the European central banks wished to lighten their gold holdings after 20 years of price declines. Their reserves were dominated by gold with 70-90 percent of their foreign exchange reserves in gold. The European central banks, wishing to minimize the adverse price impact of their own gold selling on their own reserve gold, collectively decided to create a formal and transparent framework for gold sales. On September 26, 1999, 15 European central banks signed the equivalent of a treaty then known as the “Washington Agreement” as they met in Washington DC during the annual IMF meeting. This would later be called the Central Bank Gold Agreement (CBGA) 1 with a 5-year duration.

It started out by stating that: “Gold will remain an important element of global monetary reserves.” They decided that these sales would not collectively exceed approximately 400 metric tonnes per year with a total of 2,000 metric tonnes. They similarly “agreed not to expand their gold leasings and their use of gold futures and options over this period.”

This was expanded by CBGA 2 on March 8, 2004 with Greece replacing the UK. The agreement increased the sales to 500 tonnes per year for a total of 2,500 tonnes until September 2009. Several countries joined the CBGA 2: Slovenia in December 2006, Cyprus and Malta in January 2008, and Slovakia in January 2009 expanding the number of signatories to 19 nations.

Over the decade period, Switzerland sold 60 percent of its reserve gold, the UK 51 percent, and Spain 46 percent. Total major CBGA central banks gold reserves fell by 25 percent or 3,867 tonnes. In comparison, in 1998, the total global gold reserves ran 33,536 metric tonnes. By the

end of 2008, they were down to 29,727 tonnes. The European CBGA selling and diversification into dollar denominated assets was responsible for the fastest decline in the official gold stockpiles. Yet, global investment demand increased at a faster pace than the central banks selling resulting in gold increasing in price rather than declining with an average gold price increase of 229 percent from about \$299/ounce to about \$900/ounce, even though it reached a bottom in early 2001.

Conspiracy theorists suggest that the central banks, in an effort to hold down the price of gold and hence hold up the value of their national currencies and bonds issues reached a third Central Bank Gold Agreement (CBGA 3) in August 2009 to sell up to 400 tonnes per year of sovereign gold. The Eurozone 19 national European central banks which include the European Central bank itself and Sweden's Riksbank and the Swiss National Bank have signed up to the plan. The International Monetary Fund, IMF is allowed to join as a signatory if it so wishes with its 3,217 tonnes of gold from which it wishes to sell 403 tonnes. The gold holdings of the 10 largest central banks is about 11,000 tonnes. The CGBA signatories as of 2009 hold 54.9 percent of their reserves in gold.

The top 5 European central banks in terms of gold holdings are Germany at 69.5 percent, Italy at 66.1 percent, France at 73.0 percent, Switzerland at 37.1 percent, and the Netherlands at 61.4 percent. The top 5 Asian central banks are China at 1.8 percent, Japan at 2.1 percent, Russia at 4.0 percent, Taiwan at 3.8 percent, and India at 4.0 percent.

The USA holds the largest gold reserves in the world acquired by the end of World War II from both victorious allies and defeated opponents, estimated at 8,133.5 metric tonnes or $8,133.5 \times 10^6$ gm / 31.103 (gm/ troy ounce) = 261.5 million ounces. Note that 1 troy ounce = 31.1034768 gm, whereas the avoirdupois ounce is 10 percent less at 28. 349523125 gm.

The USA's 261.5 million ounces of gold and a national debt around \$18 trillion. This is worth only about \$261.5 billion at a price of gold at \$1,000 per ounce. In 2006, the figure for the M3 dollar money supply was \$10.3 trillion, but since then the Federal Reserve central bank has stopped publishing its figures. It is thought it reached about \$15 trillion by 2009. For the national gold reserves to be worth the 2006 M3 figure, gold would have been worth about $\$10.3 \times 10^{12} / 8.1335 \times 10^9$ gm = \$1,266.37 / gm. At the 2009 value of the M3 it would be worth $\$15 \times 10^{12} / 8.1335 \times 10^9$ gm = \$1,844.22 / gm, or $(\$1,844.22 / \text{gm}) \times 31.103$ (gm/troy ounce) = \$57,360.77 / troy ounce. Each dollar of currency is thus backed by $1.0 / 1,844.22 = 5.4223 \times 10^{-4} = 0.54223 \times 10^{-3}$ gm or 0.54223 milligram of gold per dollar of currency. If the debt is considered to be fully backed-up with the gold reserves, the value of the gold comes out to be: $\$18 \times 10^{12} / 261.5 \times 10^6$ = \$68,833.652 per ounce. This estimate precludes other forms of money such as dollar denominated bonds and treasury bills and notes.

For comparison purposes, as of 2009, the world wealth comprised tangible and intangible assets. There exists \$1,600 trillion worth of derivatives, \$125 trillion worth of real estate and business assets, \$100 trillion worth of stocks and bonds secured by assets, \$65 trillion worth of government bonds, \$4 trillion worth of actual currency, but just \$2-4 trillion worth of gold and silver.

RECESSIONS AND DEPRESSIONS

The standard definition of a recession is two or more consecutive quarters of declining GDP and rising unemployment. Since a depression is understood to be something worse than a recession, investors think it must mean an extra-long period of decline. But that is not the case.

The best definition ever offered came from John Maynard Keynes in his 1936: “The General Theory of Employment, Interest and Money.” John Maynard Keynes said a depression is: “a chronic condition of subnormal activity for a considerable period without any marked tendency towards recovery or towards complete collapse.”

John Maynard Keynes did not refer to declining GDP; he rather talked about “subnormal activity.” It is entirely possible to have below trend growth in a depression. Weak growth does not provide enough jobs or staying ahead of the national debt. Before World War II, economic downturns commonly were referred to as “depressions.” A graph of the level of activity in a depression over time shows a dip in the economy that would later recover. The down part was referred to as “recession” and the up part as recovery. The Great Depression was one that was so severe that in the post-World War II era, economists came up with a euphemism for “depression.” They did not want to create the image of or remind people of the 1930s. They called economic downturns recessions, and most people think of a depression now as a severe recession.

The long-term growth trend for USA GDP is about 3 percent. Higher growth is possible for short periods of time. It could be caused by new technology that improves worker productivity, or it could be due to new entrants into the workforce. From 1994 to 2000, growth in the USA economy averaged over 4 percent per year during President Bill Clinton. For a three-year stretch from 1983 to 1985 during President Ronald Reagan boom, growth in the USA economy averaged over 5.5 percent per year. In contrast, growth in the USA from 2007 through 2013 averaged 1 percent per year. Growth in the first half of 2014 was worse, averaging just 0.95 percent. Thus the meaning of depression is not negative growth, but rather below-trend growth.

The Bureau of Economic Analysis and the National Bureau of Economic Research developed a formal depression definition. The traditional definition of recession is that of two consecutive quarters of inflation-adjusted contraction in GDP still is acceptable, despite recent refinements. Although there is no official consensus, a depression would be considered a recession where peak-to-trough contraction in the economy was more than 10 percent; a great depression would be a recession where the peak-to-trough contraction was more than 25 percent.

LONG DEPRESSION, 1873-1896

A banking crisis toppled Wall Street. Unemployment in New York City reached 25 percent of the work force. The 33rd president of the USA, Harry S. Truman advanced the most popular definition of a depression: “It is a recession when your neighbor loses his job; it is a depression when you lose yours.”

However, the Long Depression paved the way for the rise of modern industries such as the railroads, oil and steel and spawned a long period of innovation and industrial growth.

Around 1870 the USA’s population primarily lived in the countryside. By 1900, the economic geography had been transformed from a patchwork of farm plots and small mercantile towns to a landscape increasingly dominated by giant manufacturing factory cities like Chicago, Cleveland, Pittsburgh, and Detroit.

GREAT DEPRESSION, 1929-1946

This is the worst economic crisis that the USA has suffered. It became noticeable in December 1930 with the collapse of the Bank of the United States, a bank in New York not affiliated with the government. From over 31,000 banks in the mid-1920s, only about 15,000

banks survived by 1934. In 1933 over 4,000 banks failed. At this time a bank failure was almost always a total wipeout for its depositors since there was no federal deposit insurance until late 1934, and the initial coverage was just \$2,500. Depositors in the failed 16,000 failed banks of the 1920s and early 1930s lost their deposits.

The stock market crash in October 1929 was viewed by many as detached from the real economy. According to E. H. Simmons, President of the NY stock exchange, on January 26, 1930: "The psychological effect of the stock market on business is, I think, usually overemphasized. I do not think that the fall in security prices will cause any great curtailment in consumption, and the trade figures thus far available seem to bear out this view." Charles M. Schwab, Chairman, Bethlehem Steel Corporation on December 10, 1929 said: "Never before has American business been as firmly entrenched for prosperity as it is today. Steel's three biggest customers, the automobiles, railroad and building industries, seem to me to justify a healthy outlook....stocks have crashed but that means nothing to the welfare of business...wealth is founded on the industries of the nation, and while they are sound, stocks may go up and stocks may go down, but the nation will prosper."

By the spring of 1930, six months after the crash, over four million Americans were out of work: "Despite pledges to the government, the nation's business leaders saw no way to save themselves but to cut production. Some tried by cutting the work week to spread out available work among more laborers; others tried to keep their employees on by reducing wages. But the truth was that consumption had slumped tremendously. No one was buying, and more and more factories and businesses were closing their doors. During the spring of 1930 breadlines began to appear in New York, Chicago, and other American cities: long lines of patient, hopeless, humiliated men shuffling forward slowly to receive a bowl of watery soup and a crust of bread from charity kitchens, Salvation Army halls, and local relief agencies. In New York, the number of families on relief was 200 per cent greater in March, 1930, than it had been in October 1929.

The depression worsened bringing more and more Americans into the ranks of the unemployed, as business failures continued to multiply, adding to an increasing number of banking failures. However, waiting in the wings was a massive bombshell that would make everything that had occurred since 1929 seem trivial by comparison.

The year 1931 has been aptly termed the 'tragic year'. The crisis had its beginnings in the overextended Boden-Kredit Anstalt bank, which was the largest and most important bank in Austria and for that matter Eastern Europe. The bank had encountered serious financial trouble in 1929, "But various governmental and other sources had leaped to its aid driven by the blind expediency of the moment telling them that such a large bank must not be permitted to fail (sound familiar?). In October, 1929, therefore, the crumbling Boden-Kredit-Anstalt merged with the older Oesterreichische-Kredit-Anstalt, with new capital provided by an international banking syndicate including J. P. Morgan and Co., and Schroeder of England, and led by the Rothschild Bank of Vienna. The Austrian Government also guaranteed some of the Boden bank's investment.

In March 1931, Austria and Germany formed a customs union, in a world of increasing trade barriers (Smoot-Hawley) and restrictions. The French government hated and feared this treaty, which caused the Bank of France and lesser French banks to call in their short term debts from Austria and Germany. As a result, the Kredit-Anstalt suffered a run in mid-May. Once again there was a determined effort to prop it up; the Bank of England, the Austrian Government, the Rothschild Bank, the Bank of International Settlements and the Federal Reserve Bank of New York banded together millions of dollars in an effort to save the bank. Finally, at the end of May the Austrian Government pledged another \$150 million (U.S.) to the bank, but the Government's

credit was now worthless, and Austria soon declared national bankruptcy by quitting the gold exchange standard. This was the beginning of the end of the international monetary system based on gold. In September of that year Britain followed in Austria's wake declaring bankruptcy by taking the pound off gold. From that point, it was only a matter of time before the international monetary system collapsed. This was realized when the USA abandoned the monetary system in March 1933.

This was an international credit crisis, made principally in America. Not only had American banks lent copiously to American consumers and corporations during the roaring 20's, but they had also lent considerable sums abroad. For example, when the crisis hit, American banks held almost \$2 billion (U.S.) worth of German acceptances, and the Federal Reserve Bank of New York was on the hook for its share of the unsuccessful bail-out of the Kredit-Anstalt bank. When that bank failed, it was the start of the sovereign debt collapse, but in the U.S., corporate and consumer debt, principally mortgage debt, had already started to fail, leading to a rising tide of banking failures. Between 1929 and 1933, 10,000 U.S. banks were put out of business. The ongoing credit crisis of today is similar in many ways to the 1930s debt debacle. The principal exception to this comparison being that the debt bubble today is significantly greater than its 1930s counterpart and virtually the entire capitalist banking system is now at risk.

When the world credit crisis began in October 1929, there was first a flight from questionable securities into strong securities. The second phase saw an intense liquidation of inventories and commodities. The third phase involved the liquidation of commercial real estate, houses and farms, both through foreclosures and sacrifice sales at a fraction of prior values. The fourth stage was a flight from the banks into cash and gold (which ultimately caused the whole U. S. banking system to collapse) and the fifth and final phase was the flight from the dollar to gold. This had nothing to do with inflation of the currency or inflation fears; the crisis was one of deflation and debt liquidation. It was simply the recognition that gold is the only financial asset that is not someone else's liability and therefore, the only asset that cannot be defaulted and become worthless.

Following the 1929 stock market crash and the ensuing credit collapse, Donald Hoppe described the massive flight to gold in this way: "Foreigners cashed in not only their American stocks and bonds, but also their dollars and hauled American gold away by the boatload. Americans converted their paper dollars into bank deposits into gold coins and stashed them in mattresses, hid them in basements or attics or took them on one way trips to Bermuda or the Bahamas. By July of 1932, Treasury Secretary Mellon secretly informed President Hoover that the Treasury, the Fed and the banking system were being drained of gold at such an accelerating rate that a collapse of the gold standard was imminent, and if the USA went off gold the dollar itself could suffer a severe decline in the foreign exchange markets".

It was not only gold itself that frightened investors turned to as their ultimate safe haven asset, but it was also to invest in the companies that mined gold and even those that explored for the precious metal. In fact, following the stock market crash in 1929, what remained of capital flowed almost exclusively to gold and shares in gold companies both miners and explorers.

The Dow Jones Industrial Average reached a peak of 381 on September 3, 1929. By July 8, 1932, it had hit its floor of 41, a plunge of 89 percent in less than 3 years. The USA Gross Domestic Product (GDP) was \$103 billion in 1929. By 1933 it had fallen to \$56 billion, a decline of 46 percent. Accompanying the free fall in both the economy and the markets, the price levels were falling as well as the buying power and value of the dollar currency was rising rapidly. The Consumer Price Index (CPI) was at a level of 17.3 in September of 1929, and by March of 1933

had fallen to a level of 12.6. This 27 deflation represented a 37 increase increase in the purchasing power of a dollar.

The effect of this deflation was to increase the wealth and the standard of living of people who had substantial money in savings as cash, or fixed-denomination financial assets that had survived the economic turmoil, or the bonds of companies that did not default. For these individuals, all else being equal, their standards of living rose because they had the same number of dollars, and each dollar bought more than it had previously.

For most of the nation and the world, this increase in the value of a dollar was achieved at great cost. The reason behind the increase was that dollars had become scarcer for businesses and most individuals. The destruction of the banks and much of the financial markets had dried up access to money on attractive terms. Widespread unemployment meant fewer dollars available to buy goods and services, which drove down the prices, which is what dropped the Consumer Price Index.

The deflation was not independent of the plunge in the markets and economy, nor just a result of it. Instead, as most economists agree, this monetary deflation was actually a reason why the Great Depression got as bad as it did. Because there was not enough investor money, the source of funding for growing businesses was gone. Because they did not have enough money, consumers were not spending. And because there was not enough spending, businesses had to lay people off which resulted in a vicious circle further reducing consumer spending. The nation and the world became caught in a vicious deflationary cycle, which they could not break out of.

The Dow Jones Industrial Average, after reaching a high of 381 in 1929, dropped to 43 in 1932; an 89 percent fall. The money supply contracted by 30 percent and the velocity of money also declined as people held on to their money and did not spend it. Farm prices fell by 53 percent.

President Herbert Hoover is said to have done little to try and prevent the economy from sliding into depression yet he did pursue an expansionary policy. He had been an activist Secretary of Commerce under President Warren Harding and President Calvin Coolidge. He was in favor of government intervention and embraced central economic planning, which he called “economic modernization.” He increased government spending on public works projects, propped up weak firms, and bolstered wage rates and prices; all to no avail. President Herbert Hoover spent 13 percent of the GDP on various “stimuli” to combat the growing depression. Despite 3 1/2 years of vigorous government spending, the depression worsened and hit bottom by the time the next President Franklin Roosevelt was inaugurated.

President Franklin Roosevelt after he became president in 1933 launched the “New Deal” program. His progressive academic advisors believed that the government could run the economy better than the profit seeking businessmen that they viewed as scoundrels and blamed the free market economy for causing the depression. He established many bureaucracies and agencies, and issued acts such as the National Recovery Act or NRA Code Authority which established 700 state supervised trade associations that codified union privileges, stipulated regulations for wages and working hours and regulated qualities, prices, and distribution methods of what goods the Authority allowed to be produced. The Agricultural Adjustment Administration, AAA paid farmers to burn oats, plow under cotton, and kill millions of livestock in order to keep prices up. The Works Progress Administration, WPA made government the employer of last resort. The early New Deal “relief” programs the Civilian Conservation Corps, CCC and the WPA were transfer payments to otherwise unemployed and discontented individuals.

Between 1918 and 1939, American agriculture was in a state of persistent decline, because the end of the World War I reduced demand for USA exports, and because the substitution of the

tractor for draft animals freed up an enormous amount of land set aside for animal feed. The excess number of farmers had to be diverted to other occupations. World War II provided farmers with work in the wartime factories and in military service as government jobs. After the war, they took up new jobs, in a new economical paradigm with new industries and new professions.

The need for a shift in the existing USA social paradigm is exemplified by the following educational statistic: 50 percent of Americans do not accept nor understand evolution even as they live with numerous selected breeds of dogs and cats as “members of their families,” 54 percent believe in physic healing, 50 percent in extrasensory perception, 42 percent in haunted houses, 38 percent in ghosts, 34 percent in telepathy, 33 percent in extraterrestrials, 28 percent in astrology, 28 percent in communication with the dead, and 25 percent in reincarnation. Each American generation needs a justified or unjustified preemptive foreign war that is usually easy to start but hard to end, to learn and correct their misconceptions, as well as their leaders, about the facts and subtleties of their own constitution and history as well as world geography, and culture.

World War II was an unmitigated disaster for most of the world occurred. From the islands of Japan to the desert sands of Northern Africa, from Paris Stalingrad, the devastation seemed unrelenting.

The Gross National Product, GNP dropped 31 percent. International trade fell by two thirds. The unemployment rate climbed to 25 percent. The Great Depression lasted for 17 years, through World War II until 1946. The war led to job creation and dropped the unemployment rate to 1 percent with 10 million men drafted into the military. However, as stated by economist Ludwig von Mises: “War prosperity is like the prosperity that an earthquake or plague brings.” The cure was worse than the disease. With the advent of more energy intensive weaponry; measured by civilian and military deaths, World War II was more devastating than World War I with 72 million deaths compared with an earlier 16 million deaths.

President Franklin D. Roosevelt was inaugurated on March 4, 1933. He came into office with a mandate and agenda to stop the Great Depression, and that meant breaking the back of the deflationary spiral. His actions were swift, beginning with a mandatory 4-day bank holiday imposed the day after his inauguration. Five days after Roosevelt took office, on March 9, 1933 the Emergency Banking Relief Act was passed by the USA Congress. This was the first in a series of executive orders and bills that would take place over the following weeks and year, and would cumulatively take the United States government off the gold standard – and would also effectively confiscate all investment gold from USA citizens at a 41 percent mandatory discount. Prior to this time from 1900 to 1933, the USA government had been on a gold standard, and had issued gold certificates. In a matter of days in March of 1933, there would be a radical change would repeal the gold standard, and effectively make the use of gold as money illegal in the USA.

In the depths of depression, and at the height of a deflationary spiral, the government successfully broke the back of deflation within one week. In the midst of deflationary pressures far greater than what we are seeing today, the government not only stopped the deflation, but reversed it with inflation. Indeed, by May of 1933 within two months after the currency rules were changed, the monthly rate of inflation hit an annualized rate of 10 percent, and even hit a 40 percent annualized monthly rate by June of 1933.

The Great Depression is thought to have been caused by the inability of the private sector to repay the debts it incurred during the “Roaring 1920s,” just as the economic crisis of 2008 was caused by the inability of the private sector to repay the debts it incurred between 1995 and 2008.

Printing money and preventing a contraction of the money supply does not change the fact that the private sector cannot repay its debts.

Business cycles follow a similar pattern. At the beginning of the cycle, bank lending picks up, causing an improvement in economic activity. As the credit cycle expands, businesses invest more and hire more workers. Asset and commodity prices rise. As the firms' profits expand, the banks deposits grow. This results in still more credit growth since deposits provide more funds for the banks to extend more credit. These positive factors reinforce one another for a number of years and the economy enters a boom period. However, excessive investment leads to gluts and falling product prices, while overly inflated asset prices become unaffordable and they begin to fall. Falling product and asset prices lead to business distress and insolvencies. Business failures lead to bank failures and to the disappearance of the savings and deposits. Credit contracts and the economy now enters a state of prolonged recession.

BANKING CRISES AND CURRENCY COLLAPSE, 2008-2011

In the 1930s there were two banking crises. The first crisis lasted from September 10 to December 16, 1930 and the second from February 24 to October 5, 1931. The stock market bottomed after a gold drain and a currency crisis from March 8 to July 8 1932.

The first banking crisis of the 1930s took stocks to a 59 per cent discount from the 1929 peak; the second banking crisis left stocks down 77 per cent; and in the final currency crisis stocks bottomed down by 89 percent.

The Federal Reserve central bank reacted swiftly by reducing the discount rate. However, it did not pump money into the banking system and took no further meaningful action until the summer of 1931.

Over the period of August 1931 to January 1932 1,860 banks with deposits of \$1.5 billion suspended operations.

PHENOMENOLOGY OF A DEPRESSION

A depression can be defined as a period of 5-10 years of economic stagnation or outright contraction as a corrective phase of an unsustainable earlier exponential growth expansion. Two prerequisites are generally advanced for a peace-time depression. The first, though an unnecessary prerequisite, is a massive expansion of credit based on fractional reserve banking supported by a powerful central bank. The second is far reaching attempts by governments to prevent the corrective process from taking its natural course.

Mark Twain said: "History does not repeat but it does rhyme." Further: "It ain't what you don't know that gets you into trouble; it's what you know for sure that just ain't so." A real estate unsustainable boom followed by a 50 percent crash of the stock market in late 1929, much like the unsustainable subprime real estate mortgage boom followed by a stock market crash in 2008; about a human generation of 79 years later. Bernard Baruch, a famous speculator once said: "The main purpose of the stock market is to make fools of as many men as possible."

Depressions are associated with a major societal buildup in the extension of credit and its mirror image, the assumption of debt. Credit expansion continues as long as there are those willing to lend and borrow and there is the general ability of borrowers to pay both interest and principal. These components depend upon whether both creditors and debtors have confidence that debtors will be able to pay, and the trend of production, which makes it either easier or harder

in actuality for debtors to pay. So long as confidence and productivity increase, the supply of credit tends to expand. The expansion of credit ends when the desire or ability to sustain the trend can no longer be maintained. The supply of credit contracts as confidence and productivity decrease.

The social mood trend changes from optimism to pessimism when and if creditors, debtors, producers and consumers change their respective primary orientation from expansion to conserving capital. As creditors become more conservative, they reduce their lending. As debtors and potential debtors become more conservative, they borrow less or not at all. As producers become more conservative, they reduce expansion plans. As consumers become more conservative, they save more and spend less. These behaviors result in the reduction of the velocity of money, or the speed with which it circulates to make purchases, thus putting downside pressure on prices.

A rising debt level requires so much energy to sustain, in terms of meeting interest payments, chasing delinquent borrowers and writing off bad loans, that it slows overall economic performance. When this burden becomes too great for the economy to support, the trend reverses causing reductions in lending, spending, and production which, in turn, cause debtors to earn less money with which to pay off their debts, so defaults rise.

Defaults and fear of defaults exacerbate the new trend in psychology, which in turn causes creditors to reduce lending further. A downward spiral begins, feeding on pessimism just as the previous boom fed on optimism. The resulting cascade of debt liquidation is a deflationary crash. Debts are retired by paying them off, by restructuring, or by default. In the first case, no value is lost; in the second, some value disappears; in the third, all value is liquidated. In trying to raise cash to pay off loans and generate liquidity, borrowers sell all kinds of assets into the market: stocks, bonds, commodities and real estate; causing their prices to plummet.

BLACK HOLE OF DEFLATION

Paul Krugman, economist and New York Times columnist, described deflation as:

“The economy crosses the black hole’s event horizon: the point of no return, beyond which deflation feeds on itself. Prices fall in the face of excess capacity; businesses and individuals become reluctant to borrow, because falling prices raise the real burden of repayment; with spending sluggish, the economy becomes increasingly depressed, and prices fall all the faster.”

Deflationary forces temporarily crash the financial system, and eventually central bankers and governments inflate currencies, possibly to hyperinflationary levels in their reaction. Gold prices go into the stratosphere, perhaps \$5,000 per ounce. The ultimate gold price in a hyperinflationary scenario is unpredictable since hyperinflationary forces feed upon themselves and destroy purchasing power unpredictably.

Gold reached nearly 100 trillion Weimar Marks per ounce in 1923. Gold, if currently priced in 1945 Argentina pesos would be over 10,000 trillion 1945 pesos per ounce. Hyperinflation is a destructive, and unpredictable process, even for a reserve currency.

PROGRESSION OF THE GREAT DEPRESSION

A Wall Street collapse started the Great Depression in 1929, but the causes were a monetary base expansion in the 1920s, the cessation of this expansion in 1929, the governments' raising of tariff and trade barriers in 1930 all over the West, and the collapse of the Austria's Credit Anstalt Bank in 1931.

In 1928, the Federal Reserve Central Banks of the world started the process of pricking a speculative bubble which they fueled with monetary expansion during the earlier decade. In February 1928, the discount rate stood at a low level of 3.5 percent and it was raised until it reached the level of 6.0 percent in August 1929. The world economies consequently faltered and the stock markets crashed in October 1929.

The world was forced into a deflationary period where credit levels were no longer sustainable. In the following 1930 year, as the stock market declined and deflation took hold both corporate and treasury bonds rallied as their yields declined reflecting a slowing economy. In September 1930, corporate yields started to rise despite deflation becoming more entrenched. The interest rates rose due to concerns about the solvency of the corporations underwriting those bonds. Government treasuries, on the other hand, continued to increase for another year, until the banking crisis of May 1931 triggered by the failure of the Credit Anstalt Bank in Austria.

This prominent event converted the economic contraction into the Great Depression. At this point, even USA Treasury yields began to rise due to solvency concerns. Long-term treasury yields rose 35 percent over the next 10 months peaking during the banking crisis of 1932. The price of gold was then increased by 70 percent to counter deflation and a bull market in gold stocks ensued, being fueled by both a higher gold price and lower input costs.

The Great Depression was described in John Steinbeck's 1939 novel: "The Grapes of Wrath," describing the migration of drought stricken Oklahoma farmers to work as farm workers in California.

Following President Edgar Hoover, on March 4, 1933 at the height of the Great Depression, President Franklin Delano Roosevelt is inaugurated as the USA's 32nd president. In his famous inaugural address he outlined his own "New Deal" program following in the path of his predecessor and proclaimed to the American people that "The only thing we have to fear is fear itself."

SCHUMPETER'S CREATIVE DESTRUCTION

Recessions are the bad investments and debt liquidation phase following the inflationary phase in the inventory cycle.

Economist Joseph Schumpeter described the Great Depression: "People for the most part stood their ground, but the ground itself gave way beneath them." He also describes a recession as: "Creative destruction." Analogous to a forest fire, it returns nutrients to the soil from the dead wood debris and fosters new growth and revival.

He reasoned that bad investments or "malinvestments" are mistakes that take resources out of the self-perpetuating economy, slowing economic growth. Once enough malinvestments are eliminated, the economy is capable of growing again through creative destruction. In the process, some industries are burned down and eliminated for the benefit of new ones rising from their ashes like the Greek mythology's Phoenix bird.

Whereas recessions are a natural feature of the inventory cycle, depressions are a natural feature of the larger economic cycle, and should be allowed to run their course; for the economy to change its whole business plan to shed out its structural excesses and become empowered with

new antlers. The Great depression of the 1930s lasted about 20 years, ended with World War II and moved the USA from a capital investment savings economy to a consumer debt economy model. Another depression, hopefully without a major war, could switch it back into a capital investment economy.

CURRENCY COLLAPSE BENEFITS

The evidence shows that currencies collapses are beneficial. Free market economies are robust enough not to require the intervention of politicians and bureaucrats in order to operate. When they occasionally stumble and fall, it is healthy for them since this how they shake off the parasites off their bodies.

Currency collapses tend to spur a resumption of economic growth rather than fueling a decline in gross domestic product, according to the Bank for International Settlements (BIS) based in Basel, Switzerland. Currency collapses are associated with permanent output losses of about 6 percent of GDP, on average, though the drop tends to appear beforehand. This suggests that it may not be the currency collapse that reduces output, but rather the factors that led to the depreciation.

To gain a full understanding of the implications of currency collapses on economic activity it is important to carefully examine the full circle of events surrounding the episode. The positive effects of a weaker currency on GDP, including making local products cheaper than imported goods, may outweigh the negative ones, such as rising inflation.

The expenditure method for the calculation of the GDP is:

$$\begin{aligned}\text{GDP} &= \text{private consumption} \\ &+ \text{gross investment} \\ &+ \text{Government spending} \\ &+ (\text{exports} - \text{imports}).\end{aligned}$$

The government spending is actually counted as a net positive value when calculating the size of the economy even though involves activities from which the overall economy might be no better off at all. In fact, the best that governments can do is redistributing wealth; not creating it.

Currency collapses occur when the annual exchange rate drops by about 22 percent, according to the BIS, which identified 79 such episodes, more commonly in Africa than in Asia or Latin America since 1960.

FIAT CURRENCIES AND GOLD STANDARD

The International Monetary Fund, IMF, was constituted in 1945 as the organization mandated to implement the Bretton-Woods global monetary system. Its founding articles established gold as the core unit of value. Since then the IMF has written gold out of its articles and even banned currencies backed by gold.

The Austrian economist von Mises wrote that true “money” had to survive the regression test. This means that it must be established whether or not “money” had value before it was used as “money.” Otherwise, it is only a “money-substitute” which ultimately depends for its value on just confidence. Paper currencies do not survive the regression test for money, for they were

historically initiated as money-substitutes for gold or silver and over time were stripped of their promised convertibility to depend for their value on confidence.

A popular argument against having gold as money is that a gold-based monetary system would be inflexible, and that a dynamic economy requires a flexible or an elastic form of money. Under a gold-based monetary system the supply of money could not be arbitrarily expanded by central banks and governments. As a result of a flexible official money policy, the total debt in the USA economy, defined as government, trust funds, household, business and financial sector domestic and foreign, was 185 percent on the national income at \$21 trillion around 1957 to the early 1970s; but by 2008 the total debt has grown by \$36 trillion to 500 percent of the national income at \$57 trillion.

In the early twentieth century up until 1914, the USA and most European nations were under the international classical gold standard. China operated under an international classical silver standard. The USA instituted the central bank Federal in 1914 via the Federal Reserve Act of 1913.

Gold has been demonized as a financial asset; called a “barbaric relic” by economist John Maynard Keynes. A Bank of England official describes gold in Ian Fleming’s 1959 James Bond movie *Gold Finger* as: “Fear, Mr. Bond, takes gold out of circulation and hoards it against the evil day. In a period of history when every tomorrow may be the evil day, it is fair to say that a fat proportion of the gold dug out of one corner of the Earth is at once buried again in another corner.” That is; gold is dug out from the entrails of the Earth to be then reburied in bank vaults or individuals’ safes.

In 1921, Lenin wrote in the *Pravda* Russian newspaper in an article about the “Complete Victory of Socialism,” that: “I think we shall use gold for the purpose of building public lavatories in the streets of some of the largest cities in the world.”

On the other hand, Bernard Baruch (1870-1965) said: “Gold has worked down from Alexander’s time. When something holds good for 2,000 years, I do not believe it can be so because of prejudice or mistaken theory.”

The fact still remains that it is also adorned as investment jewelry constituting a financial asset, a store of wealth and savings account in countries without a formally organized banking system such as South East Asia, particularly India, and the Middle East.

In 2006 gold represented 0.2 percent of the world’s wealth and 0.4 percent at the end of 2007. After the financial meltdown and wealth destruction of 2008 it is estimated at 0.6 percent.

HYPERINFLATION AS A PRELUDE TO WAR

To finance World War I, France, Holland, Germany, Britain, Belgium, and Italy broke out of the international classical gold standard and issued paper currency to finance their military spending deficits. The four-year long war would have only lasted a few months if these countries had remained on the international classical gold standard or their paper debt been refused by other countries such as the USA.

As a result of the inequities of the Versailles Treaty and the Armistice in 1919 following World War I, and the exorbitant war reparations imposed on Germany, the Weimar Republic hyperinflation of 1923 was instigated to repay Germany’s debt with a deflated currency. In revenge, the gold reparations imposed on Germany were set as the same amount as the Germans imposed upon France after the Prussian/French war. Germany was placed under considerable stress in the 1920s and the 1930s, and became the subject to a starving blockade by the English

Navy. With no further defenses left, Germany was stabbed in the back and forced to take the blame for the war and to pay the cost of war reparations. In addition, Germany had wasted its capital in the trenches of Verdun and the Somme during World War I.

Germany could barely feed its population, let alone pay billions in gold in compensation to her former enemies. When Germany failed to make the payments, the French invaded and seized the richest and most productive industrial area of Germany, the Ruhr Valley. The war reparations were never fully paid by Germany.

The situation was an impossible one with the French and British themselves owing large sums of war debt to the USA. They expected that the payments by Germany would balance their accounts. However, Germany's war debt was far beyond what it could pay and could not default and declare bankruptcy in the way that debtors who own too much typically do. In hindsight, had not the war reparations been set at an unbearable level, Germany, France and the UK could have reached an agreement on forgiving the debt. Germany could have been joined the company of nations and World War II might have been avoided. The allies were too eager to assign the guilt to Germany, and practically forced Germany into a defensive, xenophobic and ultimately delusional position by bringing the National Socialists or Nazis to power, seeding the seeds for World War II.

Germany, Russia, Poland, Austria, and other countries suffered greatly from the apparently only way out: the Weimar Republic hyperinflation. It was eventually suppressed by the introduction of the Rentenmark; a currency backed up by mortgaged land and industrial goods. The rate of the Rentenmark to the earlier Papier-mark was 1:1 trillion.

A problem in Germany was the low productivity of its farmland due to a lack of investment in the farm sector. In the 1930s, about 9 million people worked in farms in Germany, compared to more than 10 million in the USA, which had 7 times as much arable land. The birth rates fell in half, from the 1870s to the 1920s in Germany. In 1933, a law created a legal entity called an "Erbhof," as a farm that could not be bigger than 125 hectares and could not be sold nor mortgaged, and had to be passed from father to son. The advantage is that the government freed the farmers from much of the burden of debt. The disadvantage was that the farmers could not finance expansion, purchase new equipment or capital investment in the family farms.

The disastrous solution was to invest in a war machine in the Wehrmacht then use it to seize farmland from Germany's neighbors in Poland, the Ukraine and Russia in imitation of what the English, the French, the Spanish, the Dutch and the Russians had done during the colonial era. They had each seized large territories, exterminated of the people who lived on them, used the survivor as cheap slave labor, and converted them into cellar that would feed their own people, much like the earlier Roman Empire. The British colonized North America, Australia, India and Egypt, the Spanish took South America, the French occupied large areas in Africa, north and south of the Sahara Desert and the Middle East, the Russians took over most of the Eurasian landmass. The French and the British had taken over the German colonies in Africa and South East Asia after World War I, so Germany turned its sight toward its immediate neighbors.

Germany's shifted its investment from food production to war production; another unsustainable process. By 1938, fully 19 percent of its national output was directed towards the military, compared to just 2 percent in the USA. In the late 1930s all of Europe followed the German example, which rose to 23 percent, spending an elevated percentage of their output just for unproductive military expenditures, with France at 17 percent and the UK at 17 percent.

Unintended consequences appeared, forcing Germany to impose price controls to control soaring prices for limited supplies of food. A system of substitution was created in 1935 with

bread flour diluted with corn meal and potatoes starch. Hoarding and shortages prevailed, forcing food rationing for an entire population from 1935 until after the end of World War II. Reducing the spending on the military was not possible due to ideological reasons, even as Germany was going broke and falling into the World War II disaster. According to German Air Force Marshall Herman Göring:

“No end of the rearmament is in sight. The struggle which we are approaching demands a colossal measure of productive ability. The only deciding point in this case is victory or destruction. If we win, then business will be sufficiently compensated. It is entirely immaterial whether in every case new investment can be amortized. We are playing for the highest states. All selfish interests must be put aside. Our whole nation is at stake. We live in a time when the final battles are in sight. We are already on the threshold of mobilization and are at war, only the guns are not yet firing.”

On the side of the World War I victors: the USA, UK, France, and Italy; the USA ended up with a large horde of gold. American Federal Reserve Bank chairperson Benjamin Strong massively inflated the dollar currency to help prop up the Bank of England's gold bullion standard, without a clear perceived benefit to the USA.

A Great Inflation took place over the period 1921-1929 and the American monetary supply was inflated by 62 percent, or a 7.7 percent annualized rate. The central bank of the USA, the Federal Reserve, had to stop the gushing river of credit at the end of 1928, by restricting the money supply. This preceded the stock market crash of 1929, as well as collapses in farm prices and commerce and a deflationary spiral.

In 1931 an intervention by J. P. Morgan, the Rothschild Bank, the Bank of England, the Bank of International Settlements (BIS), and the Federal Reserve Bank of New York attempted to avert the collapse of Kredit-Anstalt, Austria's mega bank. The attempt failed when France called in its loans issued to Germany and Austria, which had formed a customs and trade union on March 21, 1931.

A trade collapse in Europe crossed the Atlantic, when the Federal Reserve and many American banks, which had bought up German debt that plummeted in value, found that their capital had collapsed.

Germany and Austria tried desperately to cling to their international gold exchange standard. On September 21, 1931, the Bank of England abruptly left its gold bullion standard to avoid a wave of speculative attacks on the Sterling Pound, and depreciated the British Pound, causing massive losses to the French banks. Markets and trade froze up, and bank runs and panics took place everywhere.

In the USA, President Edgar Hoover began initiated a government assisted economy referred to the “New Deal,” to provide employment and avoid street rioting for food and a possible societal collapse.

President Franklin Deleanor Roosevelt ended the international classical gold standard. On March 5, 1933, he asked the American public to return their gold coinage to the banks. With a low rate of compliance, on April 5, 1933, he then made the private ownership of gold illegal and demanded that all remaining gold be surrendered to the government. In addition: “All safe deposit boxes in banks or financial institutions have been sealed... and may only be opened in the presence of an agent of the IRS.”

Interestingly, President Roosevelt reintroduced the gold standard back on January 1, 1934, and fixed the statutory price of gold at \$35 per ounce “in the interest of the national economy,” a price that was observed until 1971 as it was also incorporated into several international treaties. This move succeeded in stabilizing the interest rates over that period. We should here note that a stable interest rate structure is not to be confused with a falling one. The stable one is a great blessing; whereas the falling one is a great scourge. It took 36 years after 1971 to find out what the difference is. Falling interest rates, with a lag, mean falling prices, falling employment, serial bankruptcies, and simultaneous erosion of the productive and financial capital, deflation and depression.

Economist Milton Friedman and his spouse Anna Schwartz wrote in their book: “A Monetary History of the United States, 1867-1960,” that President Roosevelt devalued the dollar from \$20.67 to \$35.00 per troy ounce of gold to partially account for all of the inflation that had occurred since 1914. Those who were forced into giving their gold to the banks in March and April now realized a whopping 70 percent loss of their purchasing power, which had been appropriated by the FED. Those who retained their gold were now conveniently branded as outlaws, and unable to legally use their gold as a currency.

After President Roosevelt confiscation order was passed, only about 20 percent of the outstanding gold coinage was turned in, the rest was hoarded and disappeared from circulation. This had an international effect because, for either ignorance or willing compliance by foreign governments, they did not devalue their currencies against gold at the same time, in 1935. So a gold trader could buy gold at the old price of \$20 outside the USA, in foreign currencies sell it to the USA for \$35 an ounce. The USA managed to acquire a hoard of over 26,000 tonnes of gold ahead of the outbreak of World War II in 1939.

Massive unemployment reaching 25 percent in 1933 started the USA’s Great Depression of the 1930’s, which was eventually remedied by the start of World War II in 1942, providing full employment toward the war production effort. The boom of 1942 assisted the USA in achieving great wealth and power, but caused destruction to Europe and the rest of the world. Even though when the war ended, government debt was 120 percent of gross domestic product, the rapid growth and prosperity in the 1950-1960 period quickly reduced the debt through increased tax receipts.

It is largely not well known that the American citizenry was not permitted to own gold coins and bars until 1975.

WEALTH CREATION: INTERNATIONAL RULING AND BANKING DYNASTIC FAMILIES

THE DE MEDICIS BANKING FAMILY

Plato in ancient Greece, 2,400 years ago, envisioned a world made up of ten dynastic families who would be the powerful rulers in the gold classification in his ideal society. These ten rulers would come to power and stay in it based on inherited rights and privileges. The class of ten “gold rulers” would be supplemented and protected by a larger group of “silver rulers.” The gold and silver rulers would be the “haves” in the world society who would own and control almost all of the wealth and power in the world. The third category of “bronze workers” are the peon workers and cannon fodder class, supporting the gold and silver masters. It is this bronze

category of workers who are to be the “have-nots” in Plato’s hypothetical society of happiness and joy where the gold rulers love and care for the underlings which they rule over and dominate.

Three closely associated sources of acquisition of great wealth exist in the world today: the grain trade, the energy business, and international finance. Their influence and power transcends national boundaries and political persuasions. According to an opinion attributed to Napoleon Bonaparte, Emperor of France, 1815: “When a government is dependent upon bankers for money, they and not the leaders of the government control the situation, since the hand that gives is above the hand that takes... Money has no motherland; financiers are without patriotism and without decency; their sole object is gain;” after all, they financed his enemies into defeating him.



Figure 42. Napoleon Bonaparte, Emperor of France, 1815.

American investor Warren E. Buffet buried a little nugget as a perverse dig at bankers in his 2010 annual letter to the Berkshire Hathaway Company regarding the perverse incentive system for bankers for advice on mergers and acquisitions: “Don’t ask the barber whether you need a haircut.” In his 1989 letter to shareholders he famously wrote about the “institutional incentives” which describes how an entire organization can rise up to help a boss justify some deal he is inclined to do, regardless of its merit.

The financial dynasties are similar to, but much longer-lived than the ruling royalty and dynastic monarchies that dominated Europe for centuries such as the De Medicis in Florence, the Hohenzollerns of Prussia, Romania and Germany, the Romanovs of Russia, the Hapsburgs of Austria and the Ottomans of Turkey, as well as the House of Windsor in the UK, the Hashemite House in Jordan, the House of Al Saud in Saudi Arabia and the House of Al Sabbah in Kuwait. One can extend the analogy from the royal families to the political shorter-lived inherited republics ruling families of Bush in the USA, and Al Assad in Syria.

The Hohenzollern dynasty in Prussia/Germany, with its stable constitutional monarchy, and the ancient Habsburg dynasty of Austria-Hungary with its multinational central European empire, were eventually swept away. Europe's leading states shared not only the same Western cultural foundations, but most of the continent's reigning monarchs were related by blood: England's King George was, through his mother, a first cousin of Tsar Nicholas of Russia, and, through his father, a first cousin of Empress Alexandra. Germany's Kaiser Wilhelm was a first cousin of the German-born Alexandra, and a distant cousin of Nicholas.

The acquired wealth gets inherited, leading to economical and banking dynasties such as the traditionally Anglo-Saxon international banking institutions of J. Pierpont-Morgans and the Rockefellers-Roggenfelders in the USA, the Rothschilds in the UK and France, the Lamberts in Belgium, the Oppenheimers, the Bronfmans in Canada, the Lazards Frères in France, and the Warburgs in Germany. The central banks such as the Bank of England, the Bank of France and the Bank of Germany were not originally owned by their respective governments, before being nationalized, as their names insinuate, but were privately owned monopolies granted to their owners by the kings and heads of state, in return for a partial shares-ownership and loans to finance social programs or internal and external war campaigns. Investment, international or merchant bankers also formed durable systems of privately owned international cooperation and influence.

The Medici Bank (1397-1494) in Florence, Italy was in the late 14th century one of the most important and wealthy institutions in Italy and Europe. It introduced the double entry book-keeping system of credits and debits used in accounting to our day. The wealth of the Medici family originated in the textile wool and silk trades, in alum as a coagulant for water purification and as a dye fixer for wool and merchant vessels and in large land holdings. At some time, the currency issued by the Medicis was accepted in Europe in preference to other currencies. The demise of the bank started with lending to secular rulers who were notorious for their delinquencies such as Edward IV of England who was unable to repay his loans used to launch the War of the Roses. It ended with heavy leverage, fraud by its principals and by the invasion in 1494 of Charles VIII from France of Italy.

The Medici's gained control of governments in various Italian regions and, later, even assumed the papacy. The Medici appointed family members as princes in lands afar and assured their protection by the Medici-controlled Vatican. It was a common practice of Florence banks to hold as small as 5 percent of their deposits in reserve. Like in modern days, such an unsustainable practice may have been the reason for their sudden dissolution and collapse.

John D. Rockefeller built his family's fortune with the Standard Oil Company. Just before the crash of 1929, Rockefeller and other investors: J. P. Morgan, Joseph F. Kennedy and Bernard Baruch shifted their stock holdings into gold, acquiring great wealth. Andrew Carnegie made a fortune in the steel business. Frederick Weyerhaeuser made his family's fortune in timber, land and saw mills. Andrew Mellon and his brother Richard Mellon branched from banking into oil, steel, aluminum and coal.

THE CURRENCY ACT, USA WAR OF INDEPENDENCE

The American Colonies during the period 1750-1764 issued the "Colonial Scrip," as an interest-free currency. Around 1762, Benjamin Franklin, acting as the colonies' representative in Britain, argued:

“You see, a legitimate government can both spend and lend money into circulation, while banks can only lend significant amounts of their promissory bank notes, for they can neither give away nor spend but a tiny fraction of the money the people need. Thus, when your bankers here in England place money in circulation, there is always a debt principal to be returned and usury to be paid. The result is that you have always too little credit in circulation to give the workers full employment. You do not have too many workers, you have too little money in circulation, and that money which circulates all bears the endless burden of unpayable debt and usury.

In the Colonies, we issue our own money. It is called Colonial Scrip. We issue it in proper proportion to make the products pass easily from the producers to the consumers. In this manner, creating ourselves our own paper money, we control its purchasing power, and we have no interest to pay to no one.”

The “Currency Act” was issued on November 15, 1763 by King George III of England requiring the American colonists to use and pay interest only on currency notes issued by the Bank of England. The USA fought the American Revolution or War of Independence for freedom from The Currency Act.

According to the writings of Benjamin Franklin:

“The refusal of King George the Third to allow the colonies to operate an honest money system which freed the ordinary man from the clutches of the money manipulators was probably the prime cause of the revolution.”

“The colonies would gladly have born the little tax on tea and other matters had it not been the poverty caused by the bad influence of the English bankers on the Parliament which has caused in the Colonies hatred of England and the Revolutionary War.”



Figure 43. Benjamin Franklin.



Figure 44. Interest bearing note in 1764 from the Bank of England.



Figure 45. King George III painting by Sir William Beechey.

The USA Government took steps to keep the bankers from holding office in the new government. As signed by first president George Washington at the Third Congress of the United States Senate on December 23rd of 1793:

“Any person holding any office or any stock in any institution in the nature of a bank for issuing or discounting bills or notes payable to bearer or order, cannot be a member of the House whilst he holds such office or stock.”

LONDON GOLD FIX

In the past, each day, representatives of four London banking firms: Samuel Montagu, Sharp Pixley, Johnson Matheson and Mocatta and Goldsmitt, used to have the privilege of meeting to set the global price of gold at the London office of the N. M. Rothschild and Company Bank. Although the official London Gold Pool disbanded in 1968 when it suffered massive outflows of bullion trying to frustrate free market forces that were manifesting themselves as insatiable demand for the metal, there are claims that a second London Gold Pool is covertly operated.

The London fix is the price upon which contracts in gold the gold industry are based throughout the world. The participants cover all the professionals in the industry together with wealthy speculators. These include mining companies, jewelers and central banks. The “Fix” is set twice daily after a telephone call between the five gold bullion banks; Barclays Plc, Deutsche Bank AG, Bank of Nova Scotia, HSBC Holdings Plc and Société Générale SA., who also are linked by phone to their clients, weigh up a balance between the demand and supply that comes to them and fix the price at that balance. Then all the deals done at that Fix are executed at that price. About 90 percent of the global physical demand and supply pass through that market.

The “Fix” is no longer conducted in an actual meeting but by conference call. The bullion banks’ representatives communicate with their trading floors and with each other during the conference call to find the clearing price at which all buying interest and all selling interest is balanced. When this price is determined the price is said to be “fixed”. This is exclusively a physical gold market activity. It is balancing the number of bars of gold for sale with the number of bars demanded for purchase at a particular price. The fix is divided into a morning am-fix at an upped price at which the banks are usually selling at a high price and an afternoon pm-fix at a lowered price at which they are buying gold that is offered to them by the central, bullion and investments banks acting as agents of Western governments wishing to defend their currencies by manipulatively suppressing the price of gold and hence defending the value of their currencies.

Other governments take advantage of the gold suppression scheme by increasing their gold reserves as a backup to their own currencies. For instance, on April 24, 2009, China announced that it accumulated 454 tonnes of gold over a five years period, approximately doubling its reserves to 1,054 tonnes. Saudi Arabia is reported to have followed a similar course.

A source of this gold is 346 tonnes of gold that were part of a historically large swap arrangement, in the first three months of 2010, between the Bank for International Settlements (BIS) and more than ten bullion banks that is suspected as a bail-out for the bullion banks concerned. This is in addition to about 15 tonnes of gold being sold surreptitiously by the International Monetary Fund (IMF) each month, supposedly to purchase income-producing interest-yielding securities.

The international banking dynasty founded by Mayer Amschel Rothschild (1744-1812), Baron de Rothschild, is reported to have its origin from a country called Khazaria that consisted of the land mass locked between the Black Sea and the Caspian Sea, which is today predominantly occupied by the state of Georgia. The Khazars under the instruction of their king, historically converted to the Jewish faith in 740 AD and have come to be known as the Ashkenazic (German) Jews of Germany and Eastern European origin in contrast to the Sephardics who are of the Spanish and the Middle Eastern regions origin. Jacob Rothschild, the fourth baron Rothschild carries out the banking tradition as a backer of Agrifirma, a company investing in the much-needed remediation of the soil of degraded vast tracts of pastureland in Brazil into productive farmland.

THE ROTHSHILDS BANKING DYNASTY



Figure 46. Unity, Integrity, Industry. Baron de Rothschild Arms, 1822. Austrian eagle and hand holding arrows symbolize strength through solidarity and unity.

According to the books, Baron Nathan de Rothschild said in 1810: “Buy on the cannons, sell on the trumpets.” The phrase has parsed into: “Buy when there is the blood in the streets.” In another famous, probably fabricated, the attribution to the Baron de Rothschild is: “Buy when there is blood in the streets, even if the blood is your own,” and its milder form: “Buy straw hats in the winter.”

One often quoted, anecdotal example of wealth creation is attributed to the Lord, in England, Baron, in France, de Rothschild (1744-1812), founder of the prestigious de Rothschild European banking dynasty. He was quoted as saying: “Let me issue and control a nation’s money and I care not who writes the laws.” In another version, at a party in his mansion he would have stated: “I care not what puppet is placed upon the throne of England to rule the Empire on which the sun never sets. The man that controls Britain’s money supply controls the British Empire, and I control the British money supply.”

Born as Mayer Amschel Bauer-Elhanan in Frankfurt, Germany in 1744, he adopted the prestigious name of de Rothschild, meaning a ‘Of the red sign’ or ‘Of the red shield’ in German (Rot: Red, Schild: Sign) and French (Rouge: Red, Signe: Sign)), bringing the initially goldsmith establishment and now prestigious international banking house of de Rothschild into global and historical prominence. He hung the figure of an eagle on a red shield over his coin dealer shop door as advertisement of his business. It is also used as the official coat of arms of the city of Frankfurt, Germany. Rothschild added to it an arm holding five golden arrows in reference to his five sons.

His five sons spread and established the international House of Rothschild banks in Frankfurt, Germany; London, England; Paris, France; Vienna, Austria and Naples, Italy. The two most famous sons were Nathaniel de Rothschild in London and James de Rothschild in Paris. They remained in touch with each other by using a communication system based on carrier pigeons during the early 19th century Napoleonic War between England and France, cleverly surviving and hedging their bets by sometimes financing both sides of the conflict.

URBAN LEGEND: BATTLE OF WATERLOO, 1815

Nathaniel de Rothschild in London has associated with him an urban legend. He is alleged to have arranged to be informed by carrier pigeons about the victory of Duke Wellington over Napoleon Bonaparte directly from the battle field at Waterloo in 1815 when an alliance of Britain, Austria, and Germany defeated the French army led by Napoleon Bonaparte. The House of the Rothschilds had accumulated vast amounts of gold, used to pay soldiers and mercenaries, having predicted a lengthy war with Napoleon. The defeat of Napoleon Bonaparte would have meant for them a financial disaster as the price of gold would plummet with no more soldiers and mercenaries to be paid in kind. The patriarch of the family Nathaniel de Rothschild ingenuously turned the strategic error into an advantage by swiftly buying bonds which had been depressed in price and selling their gold, making the equivalent of one billion of today's dollars in profit. As he expected, the gold price fell and bonds recovered their prior value as the British government stopped issuing them to finance the war.

In a more detailed, less credible second version of the urban legend, it is alleged that he was present in person and witnessed the battle at Waterloo. When he became convinced that Napoleon was losing the battle, he rushed back to Brussels, Belgium. At the shore city of Ostend, he tried to hire a boat to England, but because of a then raging storm, no fisherman was willing to take his boat out on the high seas. Nathaniel de Rothschild offered 500 francs, then 700, and finally 1,000 francs for renting a boat from a fisherman. A boatman finally agreed: "I will take you for 2,000 francs; then at least my widow will have something if we are drowned." Despite the storm, they safely crossed the English Channel. The next morning, Nathaniel de Rothschild was at his usual post at the London Exchange. Everyone noticed how pale and exhausted he looked. Suddenly, he started selling, dumping large quantities of securities. Panic immediately swept the Exchange. Nathaniel de Rothschild and all of his known agents continued to throw securities onto the market. The watching public, acting like lemmings, followed him into a selling frenzy, knowing about his savvy and believing that he was privy and had prior knowledge of some incoming bad news from the war front. At the same time he was quietly buying up all securities by means of some secret agents who worked for him. In a single day, he had gained nearly a million sterling pounds, giving rise to the saying: "The Allies won the Battle of Waterloo, but it was really Rothschild who won."

Yet another unreliable version of the urban legend suggests that by dumping Consols on the London Exchange after the Battle of Waterloo, in a pretended panic, he secretly then bought them back from other holders at a low price, and became the largest holders of the Consols, and thus won control of the Bank of England in 1815. The Consols, for Consolidated Fund, of the Bank of England are bonds which could never be redeemed but paid a constant rate of return in perpetuity. They do not possess a rollover risk, since they cannot be redeemed. The Bank of England was privately owned since its inception in 1694 until it was nationalized in 1946.

In yet another even less credible version of the urban legend, one of Rothschild's couriers was a man named Rothworth. When the outcome of the Battle of Waterloo was won by the British, Rothworth took off for the English Channel and was able to deliver this news to Nathan Mayer Rothschild, a full 24 hours before Wellington's own courier.

The Rothschilds profits during the Napoleonic Wars financed their later stock speculations. Under Metternich in Austria, after hesitation, he agreed to accept financial advice from the House of Rothschild.

Regardless of the unreliable urban legends accounts, by smartly accumulating what the gullible public was selling at dirt cheap prices, Nathaniel de Rothschild amassed a huge fortune for his banking dynasty before the good news about Wellington's victory over Napoleon reached

London by ordinary means. He effectively ended-up owning a great portion of the wealth of the British Empire. As an honor, he was knighted, with his descendants holding the title of Lords ever since in England, while his cousins held the title of Barons in France and Europe.

Rumors exist that the great feat was repeated later during the American Civil War. August Belmont acted as an associate of the Rothschilds Bank in the Northern States, while Judah P. Benjamin and the Erlangers, operated in the Southern States.

BANKING HISTORY IN THE USA

The original Constitution of the USA, written and ratified by the founding fathers in 1788, established the USA as a "Constitutional Republic" because they were opposed to having a "Democracy." One can reference Amendment 14, section 4 of the Federal Constitution:

"The validity of the public debt of the United States, authorized by law, including debts incurred for payment of pensions and bounties for services in suppressing insurrection or rebellion, shall not be questioned ..."

A "Constitutional Republic" is a state where the head of state and other officials are elected as representatives of the people, and must govern according to an existing constitutional law that limits the government's power over its citizens. In a Constitutional Republic, executive, legislative, and judicial powers are separated into distinct branches and the will of the majority of the population is tempered by protections for individual rights so that no individual or group has absolute power. The fact that a constitution exists that limits the government's power makes the state constitutional. That the head of state and other officials are chosen by election, rather than inheriting their positions, and that their decisions are subject to judicial review makes a state republican.

The Framers of the USA Constitution worried about the direct and pure form of democracy. They feared that the emotional decisions taken by the populace; which is called unrestricted Majority Rule; may violate the individual rights and elect a popular charismatic despot or tyrant. They preferred the Republic form of government in which the people choose individuals to represent them and transform their will into rational and reasonable decisions. After several amendments to the USA constitution, the USA became a democratic republic or a representative or liberal democracy.

At this time, people could not read or write and were also poorly informed on matters of the day because there was no public media. Thus the framers of the USA Constitution felt that the election of the President of the USA should not be left to the population at large and must be placed in the hands of an elite few who knew the candidates and what each one represented. They formed the Electoral College which is a body appointed by the parties and not elected by the electorate. On or before October 1 of the presidential election year, each party's presidential nominee must file a list containing the names, addresses, and telephone numbers of the 55 electors pledged to him/her. The executive branch as the President is elected by the Electoral College. The states send representatives to the Electoral College. It is stipulated that whichever candidate had the most votes is the one that the candidate votes for. However he is not obligated to vote according to the popular vote. Presidents were elected by Electoral College votes that were contrary to the highly visible, yet not necessarily obligating, crowd-pleasing popular vote.

The Founders “were concerned that a largely uneducated American population was not qualified to select a President. The Electoral College, as such, is intended to act as a buffer in case the people got it wrong.” The popular vote for president is actually a state contest. People in a USA presidential election are casting their vote for the electors in their state. The popular vote of an individual state recommends, but does not obligate, how the electors of each state will vote in the Electoral College. Each state has a specific number of electors that is based on the size of its population. California, for instance, has 55 electors while Rhode Island has 4. Whichever presidential candidate wins the popular vote of a state, each of that state's electors is pledged, but not obligated, to vote for that candidate in the Electoral College. While this is what is hoped to happen, there is no federal law that specifically mandates that an elector has to follow this rule. An elector could vote for a candidate that did not win the state's popular vote.

A “faithless elector” is one who votes for someone other than the pledged candidate. While there is no federal law, there are state laws with 24 states with a law on the books concerning this situation. With the exception of Michigan, these laws deal with such an infraction after it happens. Michigan can void the vote of a faithless elector. In order to win the Presidency, a candidate needs to win the majority of electoral votes available. As of 2014, there are 538 electors, meaning that a presidential candidate needs to capture at least 270 votes to win.

Each party determines its own method for selecting its electors. In the Democratic Party, each congressional nominee and each USA Senate nominee, as determined by the last two elections, designates one elector. In the Republican Party, the nominees for Governor, Lieutenant Governor, Treasurer, Controller, Attorney General, Secretary of State, USA Senate at the last two elections, Assembly Republican leader, Senate Republican leader, all elected officers of the Republican State Central Committee, national committeemen/women, President of Republican County Central Committee Chairmen's Association, and chair or President of each Republican volunteer organization officially recognized by the Republican State Central Committee (RSCC) shall be electors. USA Senators, Representatives in Congress and persons holding office of trust or profit of the USA may not be electors. Any additional vacancies shall be filled by appointment of the chair of Republican State Central Committee according to Republican State Central Committee bylaws. Republican State Central Committee Chair must file the list with the Secretary of State by October 1 of the presidential election year. In the American Independent, Green and Libertarian party electors are nominated at their state convention and the state chair certifies their names and residence addresses to the Secretary of State. In the Peace and Freedom Party electors are nominated at their state convention. Electors shall be 50 percent women and 50 percent shall be men. The party chair certifies the list to the Secretary of State.

Grover Cleveland lost to Benjamin Harrison despite having won the popular vote in 1888. It was not even close in the when it came to the electoral vote. This is a point that has sparked debate about the unfairness of the antiquated and elitist Electoral College that considers the USA population as illiterate and incapable of making an educated choice of a president, as well as the advantage that it coveys to the larger-population states over smaller ones.

While it has only happened once, it is possible to win both the popular and electoral vote and still lose the election. Such was the case with Andrew Jackson in 1824 who led over the other candidates in the race. However, he did not have a majority of the overall electoral votes and therefore was not a declared winner. If a majority vote is not achieved in the Electoral College, then the matter goes to the USA House of Representatives that convenes and votes for a President.

The USA Constitution mandates the basis of the Electoral College. To modify the election process it would take a Constitutional Amendment. This has been tried multiple times without

success. To pass a Constitutional Amendment, 2/3 of each chamber of Congress must pass the measure, as well as ratification by 3/4 of the states.

Starting with the Bank of England in 1694, bankers were allowed to lend "money" which they created out of thin air, as long as the debts were backed by taxes. The 14th Amendment included section 4 in 1868 expressly with the purpose of preventing this situation. The early American colonies prospered by issuing their own "scrip," or paper money, but the States controlled its purchasing power, and there was no interest to pay anyone. Such a system was designed to facilitate trade and industry to make products pass easily from the producers to the consumers.

England demanded that the colonies pay her only in gold and silver and instructed the colonies to stop issuing their own scrip. This took away the Colonies' ability to finance themselves, and it created immediate unemployment. The primary reasons for the Revolutionary War was to cut the ties with King George III of England and avoid "taxation without representation."

FIRST BANK OF THE UNITED STATES, WAR OF 1812

The First Bank of the United States was allowed to be established in Philadelphia as the then capital of the USA by private banking entities because the government had accumulated debt from the Revolutionary War, and each state had a different form of currency. Alexander Hamilton conceived of the bank to handle the large war debt and to create a standard form of the currency replacing coins and bills issued by the different states' banks.

The First Bank's charter was drafted in 1791 by the Congress and signed by President George Washington. By the end of its twenty year charter, the First Bank of the United States had ruined the nation's economy, while enriching the bankers. Congress refused to renew the charter and signaled their intention to go back to a state issued value based currency on which the people paid no interest at all to any banker. This caused a threat from Nathan Mayer Rothschild against the USA Government: "Either the application for renewal of the charter is granted, or the United States will find itself involved in a most disastrous war."

The USA Congress still refused to renew the charter for the First Bank of the United States, whereupon Nathan Mayer Rothschild responded: "Teach those impudent Americans a lesson! Bring them back to colonial status!" In 1811, President James Madison and the USA Congress opted to abandon the bank and not renew its charter.

The British Prime Minister, Spencer Perceval was opposed to war with the USA, primarily because the majority of England's military might was occupied with the ongoing Napoleonic wars in Europe. Spencer Perceval was concerned that Britain might not prevail in a new American war, a concern shared by many in the British government. Spencer Perceval was and replaced by Robert Banks Jenkinson, the 2nd Earl of Liverpool, who was fully supportive of a war to recapture the colonies.



Figure 47. Bank of the United States notes.

Financed at little interest by the Bank of England, Britain provoked the war of 1812 to recolonize the USA and to cause the United States to fall into a large war debt to be forced to accept a new private central bank.

SECOND BANK OF THE UNITED STATES, PRESIDENT ANDREW JACKSON

The plan worked in that even though the War of 1812 was won by the USA, Congress was forced to grant a new charter for another private bank issuing the public currency as loans at interest, the Second Bank of the United States.



Figure 48. Note from the Second Bank of the United States.

The USA was tied into debt, unemployment, and poverty. In 1832 President Andrew Jackson campaigned for his second term as President under the slogan: "Jackson And No Bank!" He succeeded in blocking the renewal of the charter for the Second Bank of the United States. From the minutes of the Philadelphia committee of citizens sent to meet with President Jackson

in February 1834, according to Stan V. Henkels in his “Andrew Jackson and the Bank of the United States” (1928) quoted Andrew Jackson:

“Gentlemen! I too have been a close observer of the doings of the Bank of the United States. I have had men watching you for a long time, and am convinced that you have used the funds of the bank to speculate in the breadstuffs of the country. When you won, you divided the profits amongst you, and when you lost, you charged it to the bank. You tell me that if I take the deposits from the bank and annul its charter I shall ruin ten thousand families. That may be true, gentlemen, but that is your sin! Should I let you go on, you will ruin fifty thousand families, and that would be my sin! You are a den of vipers and thieves. I have determined to rout you out, and by the Eternal, (bringing his fist down on the table) I will rout you out!”

President Jackson became the only American President to actually pay off the National Debt. Shortly after he ended the Second Bank of the United States’ charter, there was an attempted assassination which failed when both pistols used by the assassin, Richard Lawrence, failed to fire. Lawrence later said that with Jackson dead, “Money would be more plenty.”

Following the loss of its charter, the Second Bank of the United States tried to operate as a normal bank, but failed after 5 years.

President Zachary Taylor opposed the creation of a new Private Central Bank, owing to the historical abuses of the First and Second Banks of the United States: “The idea of a national bank is dead, and will not be revived in my time.” Taylor died on July 9, 1850 after eating a bowl of cherries and milk rumored to have been poisoned. The symptoms he displayed are consistent with acute arsenic poisoning.

President James Buchanan opposed a private central bank. During the panic of 1857 he attempted to set limits on banks issuing more loans than they had actual funds, and to require all issued bank notes to be backed by Federal Government assets. He was poisoned with arsenic and survived, although 38 other people at the dinner died.

PRESIDENT ABRAHAM LINCOLN, GREENBACKS CURRENCY

Decades later, without a central bank, the United States suffered the Civil War, and President Abraham Lincoln was president. President Abraham Lincoln initially had no intention of ending slavery because he knew it was vital to the South's economy and its cotton-exporting industry:

“I have no purpose, directly or indirectly to interfere with the institution of slavery in the States where it now exists. I believe I have no lawful right to do so, and I have no inclination to do so. My primary objective is to save the Union, and it is not either to save or destroy slavery. If I could save the Union without freeing any slave, I would do it.”

President Abraham Lincoln needed money to finance the war and he was offered loans from the European bankers at the usury level of 30 percent. He decided to issue USA "Greenback"

dollars from the Treasury, at no interest cost. The name originates from the fact that the backs of the dollars were printed in green ink.



Figure 49. Lincoln Greenback currency.

The London Times responding to Lincoln's decision to issue government Greenbacks to finance the Civil War, rather than agree to private banker's loans at 30 percent interest wrote:

"If this mischievous financial policy, which has its origin in North America, shall become endured down to a fixture, then that Government will furnish its own money without cost. It will pay off debts and be without debt. It will have all the money necessary to carry on its commerce. It will become prosperous without precedent in the history of the world. The brains, and wealth of all countries will go to North America. That country must be destroyed or it will destroy every monarchy on the globe."

In 1872, New York bankers sent a letter to every bank in the United States, urging them to fund newspapers that opposed government-issued money. According to Lynn Wheeler in "Triumphant Plutocracy; the story of American public life from 1870 to 1920":

"Dear Sir: It is advisable to do all in your power to sustain such prominent daily and weekly newspapers... as will oppose the issuing of greenback paper money, and that you also withhold patronage or favors from all applicants who are not willing to oppose the Government issue of money. Let the Government issue the coin and the banks issue the paper money of the country... [T]o restore to circulation the Government issue of money, will be to provide the people with money, and will therefore seriously affect your individual profit as bankers and lenders.

It will not do to allow the greenback, as it is called, to circulate as money any length of time, as we cannot control that.

Slavery is likely to be abolished by the war power, and chattel slavery destroyed. This, I and my European friends are in favor of, for slavery is but the owning of labor and carries with it the care for the laborer, while the European plan, led on by England, is for capital to control labor by controlling the wages. This can be done by controlling the money.”

Much of Europe supported the Confederacy against the Union, with the expectation that victory over Lincoln would mean the end of the Greenback. France and Britain considered an outright attack on the USA to aid the confederacy, but were held at bay by Russia, which had just ended the serfdom system and had a state central bank similar to the system the United States had been founded on.

Left free of European intervention, the Union won the war over the Confederacy, and President Abraham Lincoln announced his intention to go on issuing Greenbacks. President Abraham Lincoln was assassinated by a lone gunman on April 14, 1865.

Following Lincoln's assassination, the Greenbacks were pulled from circulation and the American economy became based on bank notes borrowed at interest from the private bankers. Tsar Alexander II, who authorized Russian military assistance to President Abraham Lincoln, was the victim of multiple assassinations attempts in 1866, 1879, 1880, until his assassination in 1881.

In April of 1866, the USA Congress passed the Contraction Act. Its only purpose was to retire the circulating interest-free "Greenbacks." In 1866, there was \$50.46 per capita of money in circulation. Over the next 20 years, the per capita money in circulation was contracted to under \$7 per capita, a 760 reduction decline in the buying power. Congress then passed the Coinage Act of 1873 that ceased the minting of silver dollars.

President Ruthford B. Hayes borrowed from the European banking system in 1878, restoring to it the control of the USA economy it had lost under President Andrew Jackson.

PRESIDENT JAMES A. GARFIELD

President James A. Garfield was elected in 1880 on a platform of government control of the money supply:

“The chief duty of the National Government in connection with the currency of the country is to coin money and declare its value. Grave doubts have been entertained whether Congress is authorized by the Constitution to make any form of paper money legal tender. The present issue of United States notes has been sustained by the necessities of war; but such paper should depend for its value and currency upon its convenience in use and its prompt redemption in coin at the will of the holder, and not upon its compulsory circulation. These notes are not money, but promises to pay money. If the holders demand it, the promise should be kept.

By the experience of commercial nations in all ages it has been found that gold and silver afford the only safe foundation for a monetary system. Confusion has recently been created by variations in the relative value of the two metals, but I confidently believe that arrangements can be made between the leading commercial nations which will secure the general use of both metals. Congress should provide that the compulsory coinage of silver now required by law may not

disturb our monetary system by driving either metal out of circulation. If possible, such an adjustment should be made that the purchasing power of every coined dollar will be exactly equal to its debt-paying power in all the markets of the world.”

President James A. Garfield was aware of how the banking system was manipulating the money supply and openly opposed it:

“Whoever controls the volume of money in any country is absolute master of all industry and commerce. When you realize that the entire system is easily controlled, one way or another, by a few powerful men at the top, you will not have to be told how periods of inflation and depression originate.”

Two weeks after making this statement President James A. Garfield was assassinated by a lone gunman rejected from a government job on July 2, 1881, and died of his wounds a few weeks later.

A depression in the USA occurred in 1894 as a result of a planned contraction in the money supply. According to a memorandum issued by the American Bankers Association (ABA), three years prior to the depression in 1891:

“On September 1, 1894, we will not renew our loans under any consideration. We will demand our money. We will foreclose and become mortgagees in possession. We can take 2/3s of the farms west of the Mississippi, and thousands of them east of the Mississippi, as well, at our own price. Then the farmers will become tenants, as in England.”

PRESIDENT WILLIAM McKINLEY

In 1896, President William McKinley was elected in the middle of a depression-driven debate over gold-backed government currency versus bank notes borrowed at interest from private banks. McKinley favored gold-backed currencies and a balanced government budget which would free the public from accumulating debt:

“Our financial system needs some revision; our money is all good now, but its value must not further be threatened. It should all be put upon an enduring basis, not subject to easy attack, nor its stability to doubt or dispute. Our currency should continue under the supervision of the Government. The several forms of our paper money offer, in my judgment, a constant embarrassment to the Government and a safe balance in the Treasury.”

President William McKinley was shot by an out-of-work anarchist on September 14, 1901, in Buffalo, New York, and died a few days later. He was succeeded in office by President Theodore Roosevelt.

FEDERAL RESERVE BANK, PRESIDENT WOODROW WILSON, “THIRD” BANK OF THE USA

In 1910, Senator Nelson Aldrich, Frank Vanderlip of National City (Citibank), Henry Davison of Morgan Bank, and Paul Warburg of the Kuhn, Loeb Investment House met secretly

on Jekyll Island, Georgia, to formulate a plan for a USA central bank, and created the Aldrich Plan, which called for a system of fifteen regional central banks, openly and directly controlled by Wall Street commercial banks. These banks would have the legal ability to create money out of thin air and represented an attempt to create a new Bank of the United States. Public reaction was swift, and due to the intense public opposition to the Aldrich Plan, the measure was defeated in the USA House of Representatives in 1912.

1913 proved to be a transformative year for the nation's economy, first with the passage of the 16th "income tax" Constitutional Amendment.

In 1913, the Private Central Bankers of Europe, met with their American financial counterparts again on Jekyll Island, Georgia to form a new banking cartel with the express purpose of inducing the USA to accept a private central bank, with the aim of placing complete control of the USA money supply once again under the control of private bankers. Owing to hostility over the previous banks, the name was changed from the Third Bank of the United States to "The Federal Reserve" system in order to grant the new bank a quasi-governmental image, but in fact it is a privately owned bank.

Later that same year, and unwilling to risk another questionable amendment, Congress passed the Federal Reserve Act over the Christmas holiday of 1913, while members of Congress opposed to the measure were at home. Even though the USA Constitution explicitly vests Congress with the authority to issue the public currency, it does not authorize its delegation, and thus should have required a new Amendment to transfer that authority to a private bank.

Congress passed the law, and President Woodrow Wilson signed it as he promised the bankers he would in exchange for generous campaign contributions. President Woodrow Wilson later regretted that decision in 1919: "I am a most unhappy man. I have unwittingly ruined my country. A great industrial nation is now controlled by its system of credit. We are no longer a government by free opinion, no longer a government by conviction and the vote of the majority, but a government by the opinion and duress of a small group of dominant men."

The Federal Reserve Act was passed on December 23, 1913. Along with the Federal Reserve Act came the Income Tax Act. The next year, 1914, the World War I started.

Thomas Edison commented on debt creation:

"People who will not turn a shovel full of dirt on the project nor contribute a pound of material, will collect more money from the United States than will the People who supply all the material and do all the work. This is the terrible thing about interest. But here is the point: If the Nation can issue a dollar bond it can issue a dollar bill. The element that makes the bond good makes the bill good also. The difference between the bond and the bill is that the bond lets the money broker collect twice the amount of the bond and an additional 20 percent. Whereas the currency, the honest sort provided by the Constitution pays nobody but those who contribute in some useful way.

It is absurd to say that our country can issue \$30 million in bonds and not issue \$30 million in currency. Bonds are promises to pay, but one promise fattens the usurers and the other helps the people.

If the currency issued by the People were no good, then the bonds would be no good, either. It is a terrible situation when the Government, to insure the National

Wealth, must go in debt and submit to ruinous interest charges at the hands of men who control the fictitious value of gold.”

Some people argued that without the Federal Reserve central bank, the USA could issue its own money through its Treasury, as it is assumed to do under Article 1, section 8, of its Constitution, without incurring interest on the created money:

“Congress shall have the power...To coin Money, regulate the Value thereof, and of foreign Coin, and fix the Standard of Weights and Measures.”

The present situation is that with a USA debt at \$17 trillion and the annual interest on the debt at 5 percent, the USA government pays its Federal Reserve Banks as well as foreign banks $\$17 \times 10^{12} \times 0.05 = \$850 \times 10^{12} = \$850$ billion per year. President John F. Kennedy decided to issue silver certificates by the USA government as a non-interest bearing money. President John F. Kennedy was assassinated by a lone gunman on November 22, 1963, to be succeeded by his vice-president Lyndon Baines Johnson. President Lyndon B. Johnson's cancelled the issuance of President John F. Kennedy's silver certificates.

President Ronald Reagan promised to reduce the size of the federal government, and thus reducing the cost of government. There was an attempted assassination attempt on President Ronald Reagan by a lone gunman on March 30, 1981.

At the time of the Civil War, an attempt was made to establish a privately-owned central bank in the USA, but it was blocked by President Abraham Lincoln. In this attempt, the Rothschild Bank in London allegedly sent a letter to its New York agents saying:

“The few who understand the system will either be so interested in its profits, or so dependent on its favors that there will be no opposition from that class, while on the other hand, the great body of people, mentally incapable of comprehending the tremendous advantages that capital derives from the system, will bear its burdens without complaint, and perhaps without even suspecting the system is inimical to their interests.”

On the opposite line of thought Henry Ford, the automobile manufacturing magnate, was quoted as saying:

“It is well enough that people of the nation do not understand our banking and monetary system, for if they did, I believe there would be a revolution before tomorrow morning.”

Earlier on, Thomas Paine wrote in his “Dissertations on Government”:

“When an assembly undertakes to issue paper as money, the whole system of safety and certainty is overturned, and property set afloat. Paper notes given and taken between individuals as a promise of payment is one thing, but paper issued by an assembly as money is another thing. It is like putting an apparition in the place of a man; it vanishes with looking at it, and nothing remains but the air.”

President James Madison distrusted the banking system:

“History records that the money changers have used every form of abuse, intrigue, deceit, and violent means possible to maintain their control over governments by controlling money and its issuance.”

During World War I, the Rothschild associates were granted prominent positions in both the USA and German governments. Paul Warburg was the chairperson of the Federal Reserve in the USA, and his brother Félix Warburg was a senior partner with the Lehman Brothers Kuhn Loeb and Company firm on Wall Street. Another brother, Max Warburg was running the Frankfurt, Germany, branch of the Rothschild banking empire and eventually took over the German Secret Service. In an irony of fates, during the peace talks after the war, Max Warburg was part of the defeated German delegation, while his brother Paul Warburg was on the victorious American one.

The contemporary financier Warren Buffet managing the prestigious Berkshire Hathaway financial holdings company repeated the same key maxim of wealth accumulation in the USA:

“A simple rule dictates my buying: Be fearful when others are greedy, and be greedy when others are fearful.”

In a different version:

“We simply attempt to be fearful when others are greedy and to be greedy only when others are fearful.”

GOVERNMENT AND BANKING SYMBIOSIS IN ENGLAND

The British Empire’s continued reign as the world’s most powerful empire since the Roman Empire, ceased to depend on occupying troops and military bases and resorted instead to controlling the economies of other nations through the Bank of England at Threadneedle Street, EC2 London.

In 1694 the British Parliament passed a law that is described by some as a Faustian pact struck by the British Bankers with King William of England to bail him of his debts and to finance a war with France. Johann Wolfgang von Goethe’s Faust is a mythical German alchemist who made a “Faustian pact” with the devil, hence the meaning of compromising on principles for fleeting gains.

The money lenders at this time became the contemporary banking establishments and acquired enormous wealth and power in return for providing the king with unlimited power to wage and finance wars and to maintain control on the far reaches of the empire. In the deal, the bankers acquired the right from the king to start the most profitable enterprise of coining currency.

With the backing of the state, they then went on coining “credit” which became the accepted coin of the realm. In Latin, a “creditum” is a loan or thing entrusted to another. The Latin word for “to entrust” or “to believe” is “credere.” The word “creed” also has similar origins to the concept of “belief” or “trust.”

The British bankers gained power in England by placing King William of Orange on the throne. He repaid the favor from his backers by ordering the British Treasury to borrow 1,250,000 sterling pounds from the bankers. He issued them a Royal Charter for the Bank of England, which permitted them to consolidate the National Debt, which had just been created by the loan, and to secure payments of interest and principal by direct taxation of the people. The Charter forbade private goldsmiths to store gold and to issue receipts, which gave the stockholders of the Bank of England a currency issuing monopoly. The goldsmiths also were even required to store their gold in the Bank of England vaults. Not only had their privilege of issuing a circulating medium been taken away by government decree, but their fortunes were turned over to those who had replaced them.

The Bank of England was initially a society of 1,330 persons including the King and Queen with 10,000 pounds of stock, the Duke of Leeds, Duke of Devonshire, Earl of Pembroke, and the Earl of Bradford, and other anonymous holders.

By 1698 the British Treasury owed 16 million sterling pounds. By 1815 through the magic of compounding interest, the debt had grown to 885 million pounds, in addition to the financing of the successful Napoleonic Wars, and the failed war to retain the American colony.

The Bank of England, established in 1694, was supposedly nationalized in 1946, yet it mysteriously trades as a private company and is listed on credit agencies lists.

Paper debt based currency coined by the Bank of England replaced the gold and silver coins circulating as money at the time. With people depositing their savings in gold and silver at privately owned, but government sanctioned banks, with the Bank of England as their central bank, the banks were granted the right to make loans at the magnitude of ten times their actual deposits and handsomely profit by charging interest on those loans. The central bank made vast sums of credit available to the banks to finance the government's expenditures instead of imposing taxes on the populace. The credit inevitably became debt, showing as an entry on the banks ledger books that they could then lend ten times in magnitude and profit by earning interest on it.

Once central banking was introduced by the Bank of England, the global relationship between the East and the West shifted dramatically. The UK was able to fund its navy and military with debt-based currency, and through imperialism; ruled much of the world.

The process of exponential growth in currency and credit creation being eventually unsustainable, by 1870, the UK's balance of trade went negative and its treasury had difficulty paying the bills of the British Navy and the bankers noticed the new situation.

America gained its independence from England in 1775, and by 1791, Alexander Hamilton at the behest of the European bankers established the First Bank of the United States as a central bank along the same line of organization of the Bank of England.

In 1913, the European bankers extended their operations to the USA by establishing the Federal Reserve System, as an analog of the Bank of England. As a consortium of private European and American banks, it would issue the same debt based currency in the USA as had the Bank of England in Britain and the bankers would extend their power and influence in the USA as they had in the UK and Europe.

The Federal Reserve as a central bank was presented to the public as a way to protect the people from the "greedy bankers." However representatives from the banking giants J.P. Morgan, the First National Bank of New York, the National City Bank of New York, and Kuhn, Loeb and Company are reported to have met at Jekyll Island, Georgia in 1910, and planned the creation of the Federal Reserve. They gathered under the disguise of going duck hunting, their main interest

was not to protect their own power and wealth. The name "Central Bank" was avoided, and it was decided to promote the plan as a "Regional Reserve" system with four (later twelve) regional branches in different parts of the country. The New York bank came to dominate the twelve regional branches.



Figure 50. Jekyll Island Club retreat, Georgia, USA.

As Congress desired to adjourn for Christmas, the "Federal Reserve Act" was passed on December 22, 1913 by a vote of 298 to 60 in the House, and in the Senate by a majority of 43 to 25. The Federal Reserve controls the money supply and interest rates, and thereby manipulates the entire economy-creating inflation or deflation, recession or boom, and biasing the path of the stock market up or down. In fact, the Federal Reserve does not issue money, instead it prints fiat currency. The fiat currency has no value other than what the markets perceive, with the implication that it is considered by some as a confidence game.

The essence of the modern banking system operation is described by Josiah Stamp (1880-1941), President of the Bank of England in the 1920s and the second wealthiest person in Britain then, at a Commencement address at the University of Texas in the USA in 1927:

"Banking was conceived in iniquity and was born in sin. The Bankers own the Earth. Take it away from them, but leave them the power to create deposits, and with the flick of the pen they will create enough deposits to buy it back again. However, take it away from them, and all the great fortunes like mine will disappear, as they ought to in order to make this a happier and better world to live

in. But, if you wish to remain the slaves of bankers and pay the cost of your own slavery, let them continue to create deposits.”

In its early days, the Federal Reserve central bank maintained the gold standard. This forced it to maintain tight money even in 1931, within the period of the Great Depression. This may have been a mistake. The gold standard is thought to have led to ruinous deflations. As the gold reserves contracted, so did the money supply. The USA experienced more banking panics in the years without a central bank than any other industrial nation, often when people feared for the quality of the fiat currency in 1837, 1839, 1857, 1873 and 1907.

An alternative to gold, and to the Federal Reserve central bank, was suggested by economist Milton Friedman. One lets a computer algorithm govern the money supply. John Taylor, a former Treasury official, derived the so-called Taylor Rule, which the Federal Reserve and its 200 economists agrees with. The problem with a formula and also its virtue is its lack of flexibility.

Another alternative is that the dollar could be backed by a basket of currencies: euros, pounds, yen and yuans. This would require that each of the financial powers commits to a targeted rate of inflation at say, 2 percent per year. This system is not very different from the present system. The USA's currency is a fiat money that is convertible into foreign exchange and regulated with the intent of not too quickly depreciating) the dollar's purchasing power.

An act of Congress in 1978 ascribed to the Federal Reserve a dual mission: protecting the value of the dollar and promoting long-term growth and employment. This differs from Europe's and other central banks. Banking purists would like to abolish the institution which makes them the financial equivalent to strict constitutionalists.

CRASH OF 1929-1932

The Federal Reserve Bank made its first policy blunder in making cheap currency overly plentiful in the early 1920s, which encouraged a speculative bubble in the stock market. By 1928, the Federal Reserve Bank recognized its error and instead of gradually slowing down the currency creation process, it engineered a slam on the monetary brakes and started raising interest rates, paving the way for the great 1929 stock market crash. Adding fuel to the fire, it continued its tight currency policy while the USA government actually raised taxes and thereby greatly exaggerated the Great Depression of the 1930s.

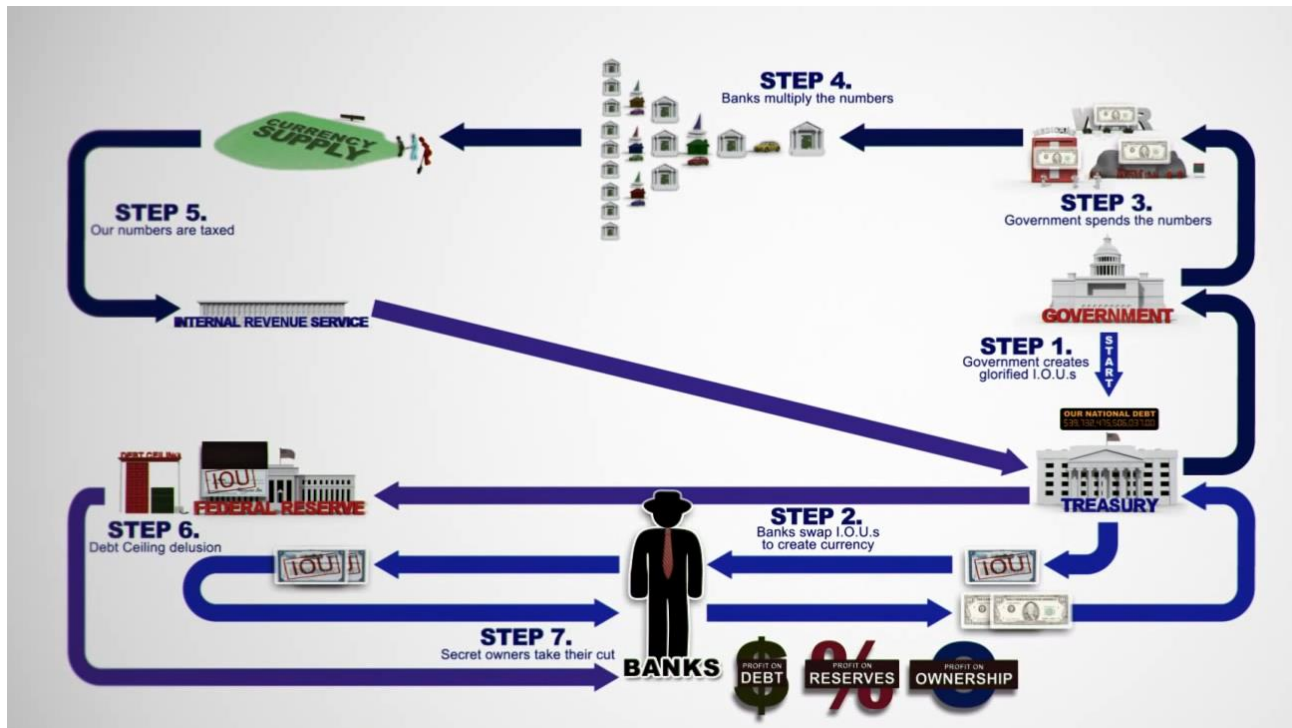


Figure 51. Currency creation process by central banks and government treasury departments.



Figure 52. USA treasury saving bond.

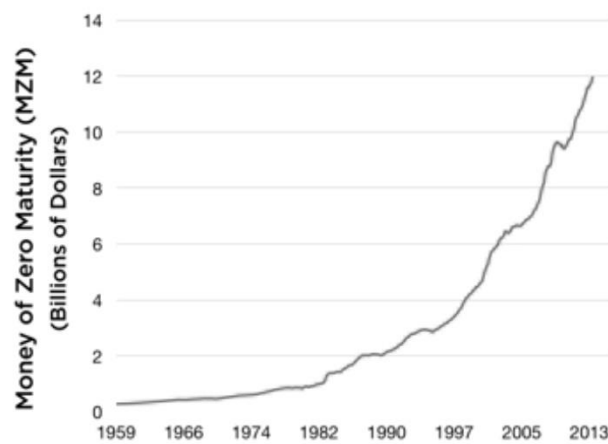


Figure 53. USA Money supply growth.

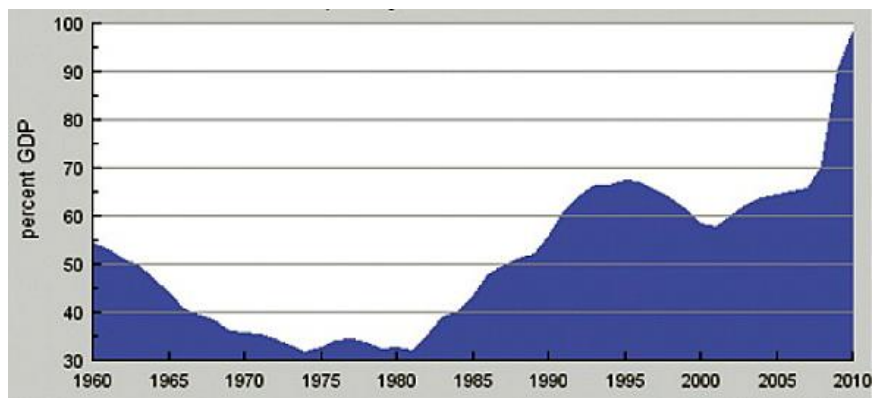


Figure 54. USA debt to GDP ratio.

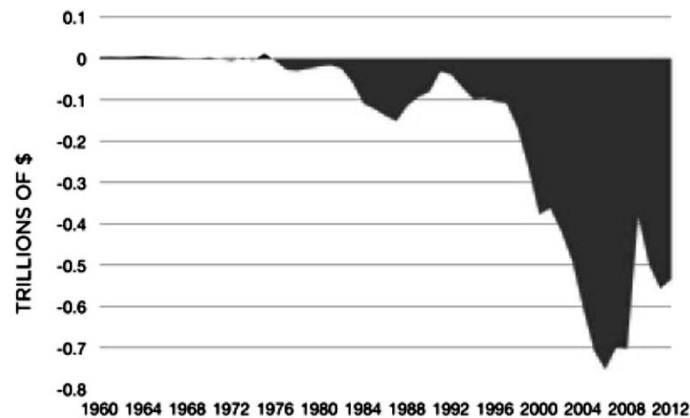


Figure 55. USA trade deficit. Source: USA Census Bureau.

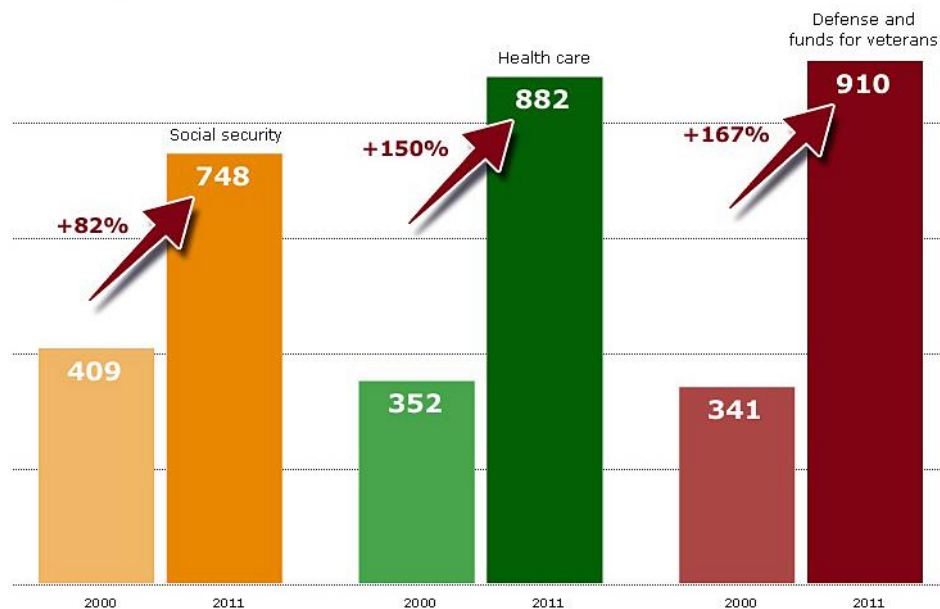


Figure 56. Growth in the components of the USA deficit in billions of dollars. Source: USA Government.

The exponential growth bubble became unsustainable on September 3, 1929 when the Dow Jones Industrials stock index reached a peak at 381.71. On October 28-29, 1929, it fell from 301 to 230 with a loss of value of $(301 - 230)/301 = 0.2359$ or 23.59 percent within two days. It reached a presumed low of 198.69 which is a fall of $(301 - 198.69) / 301 = 0.3399$ or 34 percent on November 13, 1929. It went on a roller coaster to rally from this bottom through what is referred to as a sucker rally or bear trap rally to 294.07 by April 17, 1930 for an increase of $(294.07 - 198.69) / 198.69 = 0.48$ or 48 percent. This rally proved illusory as it collapsed to a low value of 41.22 by July 8, 1932, for an evaporation of wealth of $(381.71 - 41.22) / 381.71 = 0.8920$ or an unprecedented 89 percent from its 1929 high. It took until November 1954 to recover

back its value to its 1929 highs or $(1954 - 1929) + 1 = 26$ years; primarily through currency inflation.

To add further injury, governments impose taxes on effectively non-existent income. Such a process is known to economists as "inflation taxes", and during times of high inflation, they can be devastating to savings and pensions.

CREDIT AND DEBT WEALTH FALLACY

The attractiveness of credit is its ability to induce the debtor into believing that it is real money. In fact credit and debt are two sides of the same coin that substituted for gold and silver in an arrangement that served bankers and governments, at the expense of producers and savers.

The rest of the world as producers and savers came to grasp the obvious reality of the situation where debt and credit are pictured to the ignorant as money. The rapid fluctuations in the price of petroleum became a reflection of the unwillingness of the oil producers to exchange their limited supply of petroleum for an unlimited and continually diluting supply of paper currency.

The 21st century, unless the course is corrected, witnesses the USA repeating the unsustainable approach that the UK had adopted one century earlier to finance its "wars of choice." In 1970, the USA's balance of trade turned negative and repeating the UK's experience, its political and religious activism supported by ideological military adventurism across the globe, squandered most of its national wealth and transferred it to the producer and saver nations such as Japan and China.

As of 2008, the USA's government financing gap was about \$57 trillion with the federal government's official national debt increasing at the rate of \$1.5 billion per day. Comparison with the combined net worth of all USA households which is \$56 trillion, excluding government property, shows that the USA had more liabilities than assets from an accounting perspective.

Table 19. USA Federal Budget cut deal to raise the debt limit, 2012.

Budget item	Debt magnitude [\$ Trillion]
Total Federal debt	14.0000
Federal income	2.1700
Federal spending	3.8200
New debt	1.6500
Amount cut (1 percent of total budget)	0.0385

As of 2008, each USA household's share of the national promised liabilities and debt amounted to \$546,668, of which \$55,000 was added in 2008 alone; more than the median household median income. It breaks down as follows:

Table 20. Share of national debt of USA households.

Promised liabilities and debt Item	Debt magnitude [\$]	Percentage
Medicare	284,288	52.0
Social Security	160,126	29.3

Federal debt	54,537	10.0
Military retirement	29,694	5.4
Civil servant retirement	15,851	2.9
Other	2,172	0.4
Total	546,688	100.0

Table 21. Composition of debt of 10 largest economies as a percent of Gross Domestic Product (GDP) at Q2, 2011.

Country	Households	Nonfinancial Corporations	Financial Institutions	Government	Total
Japan	67	99	120	226	512
UK	98	109	219	81	507
Spain	82	134	76	71	363
France	48	111	97	90	346
Italy	45	82	76	111	314
South Korea	81	107	93	33	314
USA	87	72	40	80	279
Germany	60	49	87	83	278
Australia	105	59	91	21	277
Canada	91	53	63	69	276

Table 22. Increase in the youth's unemployment in the European Union (EU).

Country	Unemployment rate March 2012 [percent]	Unemployment rate March 2011 [percent]
Bulgaria	32.8	26.7
Portugal	36.1	27.6
Denmark	15.1	13.7
Ireland	30.3	28.7
Cyprus	28.8	18.8
Hungary	28.8	25.4
Netherlands	9.3	6.9
Poland	26.7	25.7
Slovenia	16.5	16.3

Government obligations generated in 2008 amounted to \$6.8 trillion bringing the total debt to \$63.8 trillion. Only the 10 percent USA Federal debt is real debt. The rest are unsustainable unfunded liabilities and promises to pay that can be inflated out, and will most probably, be reneged on.

UNSUSTAINABILITY OF FIAT PAPER CURRENCIES

The first historical use of paper currency is thought to have started in 140 AD after China first manufactured modern paper in 105 AD.

Paper currency was first officially used in China during the Tang Dynasty (618-907 AD). It appeared at Tabriz in Persia around 1294, then India and Japan in the period 1310-1331. When

Marco Polo visited China (1275–1292 AD), he reported in his “Travels” about the Mongol Emperor of China Kublai Khan, the grandson of Genghis Khan:

“You might say that (Kublai Khan) has the secret of alchemy in perfection. The Khan causes every year to be made such a vast quantity of this money, which costs him nothing that it must equal in amount all the treasure of the world.”

In another version:

“In this city of Kanbula is the mint of the Grand Khan, who may truly be said to possess the secret of the alchemists, as he has the art of producing paper money. When ready for use, (the Khan) has this paper cut into pieces of money of different sizes ... (and) the coinage of this paper money is authenticated with as much form and ceremony as if it were actually of pure gold or silver. This paper currency is circulated in every part of the Grand Khan’s dominions, nor dares any person, at the peril of his life, refuse to accept it in payment. With it, in short, every article may be procured. All his majesty’s armies are paid with this currency, which is to them of the same value as if it were gold or silver. Upon these grounds, it may certainly be affirmed that the Grand Khan has a more extensive command of treasure than any other sovereign in the universe.”

What eventually ensued from the unsustainable situation was:

“Population and trade had greatly increased, but the emissions of paper notes were suffered to largely outrun both. All the beneficial effects of a currency that is allowed to expand with a growth of population and trade were now turned into those evil effects that flow from a currency emitted in excess of such growth. These effects were not slow to develop themselves. The best families in the empire were ruined, a new set of men came into the control of public affairs, and the country became the scene of internecine warfare and confusion.”

After repeat devaluations and fresh paper issues, a final collapse occurred in the late 15th century, by which time the 1448 Ming note was worth just 0.3 percent of its face value. After 600 years, China abandoned paper money around 1455 as a result of hyperinflation.

The kingdom of Persia repeated the same history after a harsh winter in 1294 AD when thousands of cattle and sheep died in today’s country of Kazakhstan. This emptied the king’s treasury of the needed tax revenues. The king responded by printing great quantities of “chao”, a Chinese word for the paper money first invented almost three centuries before. On August 13, 1294 a proclamation imposed the death penalty on all who refused to accept the new currency. Trade came to a complete standstill within two months when people stopped buying and selling altogether.

In Europe, by 1633, the English goldsmiths’ certificates which were used as receipts to reclaim gold deposits of the public with them were also used as proofs of the ability to pay. The Bank of Sweden was founded in 1656 with a charter allowing it to accept deposits, issue bills of credit and grant loans and mortgages. In 1660, the English goldsmiths’ receipts became an

alternative to handling coins by both depositors and borrowers, even across national borders. The Bank of Sweden issued the first bank notes in 1661 that became known as the “paper daler.”

In 1932, Argentina had the 8th largest economy in the world before its currency collapsed as a victim of inflation. In 1992, Finland, Italy, and Norway experienced currency shocks that spread throughout Europe. In 1994, Mexico went through the “Tequila Hangover,” which sent the peso tumbling and spread economic hardships throughout Latin America. In 1997, the Thailand’s baht currency fell through the floor and the effects spread to Malaysia, the Philippines, Indonesia, Hong Kong, and South Korea. The Russian ruble was devalued in 1998 and caused a recession in Russia.

Since 1914, the USA has been involved in 16 military conflicts. It has engaged in some military action in 44 of the previous 93 years. Military conflicts are primarily financed through monetary and currency inflation. Accordingly, the value of the dollar currency has so far depreciated through dilution by 92 percent of its initial 1913 issuance value.

CURRENCIES DEBAUCHEMENT

Inflation by currency devaluation is an insidious and cold form of expropriation and indirect theft of the assets and savings held by their citizens as well as foreigners adopted by the rulers throughout history. It results in a redistribution of wealth from the bottom rungs of the societal ladder to the top rungs. Gradual inflation has a numbing effect, insidiously impoverishing the lower and middle classes, and they do not notice it coming. The history of currencies is one of almost continuous devaluations.

In the 4th century BC, Dionysius, the tyrant of Syracuse went broke. He responded by collecting all coins and then re-minting them, turning one drachma into two. He then returned half of the new coins to the people and used the other half to pay his debts.

Upon the introduction of paper currency, monetary value could be manipulated even more easily. Now all it took was a money-printing press, in fact computer entries, to inflate the money supply and devalue the currency. This was how the German Reich, overwhelmed with war debts and reparation claims after 1918, averted national bankruptcy, albeit at the cost of galloping inflation. The trauma of 1923 is still felt in Germany to this day.

The father of Queen Cleopatra of Egypt run up huge debts. What Queen Cleopatra followed as a way out was to stop issuing gold and silver coinage and only issued bronze coins. By debasing the currency, she eliminated the debt by paying for it with a debauched currency: bronze instead of gold and silver.

The Roman Empire remained on a bimetallic standard of gold and silver for hundreds of years. The aureus gold coin was popularized by Julius Caesar. The denarius silver coin was used in the daily transactions. On that solid gold and silver standard, Rome ascended to the height of its power.

Hubris eventually prevailed as massive spending on welfare and wars occurred. The populace was provided with “bread and circuses.” Cicero in 55 BC described the situation as:

“The budget should be balanced, the treasury should be refilled, public debt should be reduced, and the assistance to foreign lands should be curtailed lest Rome become bankrupt. People must again learn to work, instead of living on public assistance.”

At the time of Julius Caesar during the first century the gold aureus coin contained 8 grams of pure gold. By the second century it was devalued to 6.5 grams, and at the beginning of the fourth century it was replaced by the 4.5 gram solidus.

A day's wage for a typical Roman laborer was one silver denarius. The denarius was initially a 4.5 gram silver coin and stayed that way for centuries under the Roman Republic. As Rome turned into an empire it needed to spend on its wars and conquests. Base metals, such as copper and bronze were blended into the silver of the denarius. During the first century, the denarius contained over 90 percent silver. By the end of the second century the silver content had fallen to 70 percent. A century later there was less than 5 percent silver in the coin and by 350 AD it was all but worthless with an exchange rate of 4.6 million to a gold solidus or 9 million to the original gold aureus.

The population of Rome followed the economic decline associated with hyperinflation through the devaluation of its gold and silver currency. It reached a peak of about 1 million inhabitants during the first century and maintained that level until the end of the second century. It then began to slowly decline throughout the third century and precipitously decreased throughout the fourth century. By the fifth century, only 50 thousand people remained in Rome.

As of 2008 there existed 176 different currencies worldwide. Some currencies are not widely circulated such as the unofficial currencies of the Isle of Man which is a British Crown dependency but is not part of the UK or the European Union, Guernsey and the Bailiwicks of Jersey, which are also British crown dependencies.

Because of their inherent exponential growth and inflation, currencies currently in circulation do not survive for too long and have a median age of 37 years. The dollar of Zimbabwe was in a hyperinflationary stage in 2009 before it eventually collapsed.

The longest surviving currencies have been the Sterling pound, inception in 1694, Scotland pound started in 1727 but not recognized outside its issuing region, and the USA dollar started in 1792, the Netherlands guilder (1814) and the Swiss Franc (1825).

Originally, in 1560, the British pound was equivalent to one troy pound of sterling silver; hence the name "pound." "Sterling" silver is itself 92.5 percent pure silver with 12 troy ounces in a troy pound. Queen Elizabeth I and her advisor Sir Thomas Gresham; of Gresham's Law fame where: "Bad money displaces bad," established the new currency after the Great Debasement of 1543-1551 when King Henry VIII financed his wars with both Scotland and France. Paper Sterling pound banknotes were issued after the establishment of the Bank of England in 1694. It took 86.2 Sterling pounds to pay for a troy pound of silver in February 2007, which is a dilution for the Sterling pound holders of: $(86.2 - 1.0) / 86.2 = 0.9884$ or 98.84 percent.

The USA dollar fared just slightly better, being initially pegged to gold rather than silver. The USA Mint Act of 1792 pegged the dollar at 24.75 grains of gold. An ounce of gold contains 480 grains, suggesting that the initial dollar was pegged at $24.75 / 480 = 0.051562$ ounce of gold or that an ounce of gold would initially cost $1.0 / 0.051562 = 19.394$ dollars. As of 2010, an ounce of gold sold for about 1000 dollars for a dilution of $(1000 - 19.394) / 1000 = 980.606 / 1000 = 0.9806$ or an astounding 98 percent drop in value.

INFLATION MANIFESTATIONS

To American economist Milton Friedman, the central message of the so-called monetarist, is that if the volume of money is expanded while the supply of goods remains unchanged, inflation

will be the inevitable outcome. Milton Friedman said: "Inflation is always and everywhere a monetary phenomenon."

Inflation can also be triggered by rising costs. For instance, when workers succeed in their demands for higher wages and improved working conditions, or as the prices of imported commodities rise as happened in 1973, when an increase in the price of petroleum raised the overall price level.

Psychology and perception play an important role in the process. When people lose their faith in the banking system, governments and fiat currencies, and question their stability, a dangerous inflation dynamic develops as a result.

GRESHAM'S LAW IN THE PAST

Gresham's Law is named after the sixteenth century financier Sir Thomas Gresham who was an advisor to Queen Elizabeth. In its most simple form, Gresham's Law is often stated as: "bad money drives out good", and it is not a mere historical curiosity. Gresham's Law is alive and kicking in many countries all around the world.

The sovereigns had a practice of clipping silver and gold coins with a tiny quantity of their metal shaved off the edge every time they passed through government hands. Otherwise, they would be minted with a lower precious metal content than their stated face value. This enables the monetary authorities to produce more coins for the same amount of metal, increasing the government's spending power in raising and equipping its armies and financing its war machine.

A net result was that coins with identical face values did not necessarily hold the same commodity value. This led to the interesting phenomenon of when people knew there were both 'good' and 'bad' coins floating around, they tended to spend the bad and hoard the good ones. All the good money disappears into hoards. The only money that remains in circulation would be the bad money. Hence: "bad money displaces good."

MARKET MANIPULATION, "BANGING THE CLOSE," "TAPE PAINTING"

The market manipulation techniques of "banging the close" and "tape painting" in the commodity markets are illegal in principle, yet they are actionable politically only when the attempted price manipulation is upward.

Market manipulation that suppresses commodity prices is not actionable politically; since it is a world governments' policy that is implicitly implemented through the great investment banks in association with the central banks that effectively act as government agents.

The policy was first discerned by the British economist Peter Warburton in his 2001 essay: "The Debasement of World Currency: It Is Inflation, But Not as We Know It," where he wrote:

"Last November I estimated the size of the gross stock of global debt instruments at \$90 trillion for mid-2000. How much capital would it take to control the combined gold, oil, and commodity markets? Probably no more than \$200 billion, using derivatives.

Moreover, it is not necessary for the central banks to fight the battle themselves, although central bank gold sales and gold leasing have certainly contributed to the cause. Most of the world's large investment banks have

overtraded their capital so flagrantly that if the central banks were to lose the fight on the first front, then their stock would be worthless.

Because their fate is intertwined with that of the central banks, investment banks are willing participants in the battle against rising gold, oil, and commodity prices.”

CURRENCIES DEMISE, THE STATE GIVES AND THE STATE TAKETH

There are 599 currencies that were created but no longer in circulation with a median age of 15 years.

They were destroyed by over-issuance; have been devalued, eliminated by military liberation, regime change, conquest, invasion, occupation, renamed or converted to other currencies.

Monetary unions, dissolution or other reforms, such as the creation of the European Union and the creation of the Euro in 1999 or the USA dollar in 1792, led to the dissolution of about 184 currencies.

The independence of former colonial entities led to reforms and the renaming of their currencies, eliminating 94 currencies in the process.

Acts of war and invasion, liberation and regime changes eliminated 165 currencies. World War II saw the extinction of 95 currencies as national boundaries were redrawn according to the whims and interests of the victors into spheres of influence.

A government saddled in debt to its own citizens and to foreigners has no choice and finds itself compelled to adopt the time honored method used by short lived banana republics and longer established nations like France, Germany as well as the UK and the USA, by repaying off the debts with a diluted over issued currency. This process of hyperinflation has destroyed 156 currencies. “The state gives and the state takes.”

Long term USA Government Bonds showed a peak in rates around 1815 corresponding to the War of 1812-1814. The bond rates fell for about 15 years to 1830 and then rose from roughly 1830 to another peak around 1862 at the time of the Civil War. Then a very long decline over 39 years occurred as rates did not bottom until about 1901. Rates then rose for another 19 years until 1920 around World War I. The next down cycle lasted roughly 20 years until 1941, bottoming as World War II started. A long rise in rates from 1941 until 1981 culminated as a result of the Vietnam War. These long term rates are positively correlated with inflation that is boosted by the resultant spike in the demand for financing to help pay for the wars’ expenses. As of 2009 the Iraq war had cost the USA \$587 billion and was still rising. The war on terrorism in Afghanistan and elsewhere was an extra cost. This was resulting in multi-trillion dollar budget and trade deficits and currency inflation instead of taxation for the foreseeable future.

According to the French poet Voltaire (1694-1778): “Paper money eventually returns to its intrinsic value: zero.”

GREAT WAVE THEORY, DEEP CHANGE, HUBRIS AND THE GODDESS NEMESIS

According to David Hackett Fisher, in his book: “The Great Wave, Price Revolutions and the Rhythm of History,” waves of rising prices have interrupted long periods of stability

throughout history. The great waves are often accompanied by unexpected disasters, extreme social upheaval and inevitably end in economic collapse.

Great waves last from 80 to 120 years and their appearance spells the end of epochs and eras. Great waves marked the end of the feudal era, as it did the end of the renaissance and the enlightenment periods. The current great wave that began in 1896 will supposedly end the era of “Victorian equilibrium”, an era that began with the reign of England’s Queen Victoria.

The present era could be called “the era of debt-based paper money and credit” for debt-based paper money and credit was the foundation of Queen Victoria’s British Empire, which is in its final stages of dissolution and collapse.

The current great wave of rising prices would have begun in 1896. Lasting from 80 to 120 years and culminating in economic collapse, this great wave would presumably collapse between the years 1976-2016, presumably corresponding to the attainment of Peak Oil. Peak Oil production has been presumably reached in 2006, with 2016 as a crisis level where demand would exceed supply.

According to Fisher, this great wave differs from preceding waves in the following way:

“The great inflation of the twentieth century differed from every price-revolution that had preceded it. Its velocity, mass, and momentum were greater than those that came before.

Every period of the past has been a time of change. The world is always changing—but not always in the same way. We shall find empirical evidence of distinct ‘change-regimes’ in the past that were often highly dynamic, but stable in their dynamism. Sooner or later, even the strongest of these change-regimes broke down in moments of what might be called ‘deep change.’ When it did so, one system of change yielded to another. Deep change may be understood as a change in the structure of change itself. In the language of mathematics, deep change is the second derivative. It may be calculated as a rate of change in rates of change.

We have been living through a period of ‘deep change,’ when one ‘change regime’ yields to another. In periods of deep change, understanding lags behind the movement of events. In the United States problems of economic understanding have been compounded by the effects of economic prosperity. The Greeks called it hubris, and thought that it always ended in the intervention of the goddess Nemesis. That lady makes her appearance when wave-riders begin to believe that they are wave-makers, at the moment when the great wave breaks and begins to gather its energy again.”

GRESHAM’S LAW IN MODERN TIMES

Gresham's Law is usually summed up as: “bad money drives out good money.” A king in the olden days, and a government in contemporary times, needing money to raise an army to fight his opponents cannot raise taxes on their subjects without creating discontent and perhaps inciting revolt. Instead, they might resort to minting coins with half an ounce of gold and force merchants and the public, under penalty of execution, to accept them as though they contained one ounce of gold.

Each ounce of the king's gold could now be minted into two coins instead of one, so the king now had twice as much “money” to spend on paying mercenaries, building castles and

raising armies. As these legally overvalued coins circulate, the coins containing the full ounce of gold would be pulled out of circulation and hoarded by the public.

This occurred in the USA in the mid-1960s when the government began to mint subsidiary coinage out of copper and nickel rather than silver. The copper and nickel coins were legally overvalued, the silver coins undervalued in relation, and silver coins vanished from circulation and were hoarded for their more valuable silver content.

These actions give rise to the most pernicious effects of inflation. Most of the merchants and peasants who received the devalued currency felt the full effects of inflation, the rise in prices and the lowered standard of living, before they received any of the new currency. By the time they received the new currency, prices had long since doubled, and the new currency they received would give them no benefit.

SILVER AND GOLD STANDARDS, THE WIZARD OF OZ PARABLE

Silver and gold were used as currency around the world until the late 1800's when Germany stopped using silver as currency, and silver began to be demonetized as nations switched to the gold standard.

The UK operated under the gold standard for about one hundred years from 1816 to 1914. People traded, invested, and traveled so widely that the phrase was coined that “the sun never sets on the British Empire.” The pound sterling became the dominant international currency and the capital city of London was positioned as the leading international banking center of the world. Women across the globe wore jewelry as necklaces and bracelets made of gold sterling pound coins. Respect and protection of private property and freedom to trade and travel reached heights never attained before.

George Bernard Shaw in 1928 was quoted as saying: “If you have to choose between trusting the natural stability of gold, and the honesty and intelligence of members of the government, with due respect for these gentlemen, I advise you, as long as the capitalist system lasts, to vote for gold.”

SILVER PROPERTIES

Silver enjoyed a monetary status almost equal to gold in the USA in the post-Civil War period up to the 1960s when the once common USA silver certificates currency was phased out. It was removed from the American money system under President Lyndon Baines Johnson around 1965. The argument was that silver was useful for silverware and jewelry, but not as a currency.

Silver as a finite resource is the element with the highest electrical conductivity above gold and copper. The advent of digital cameras has not made silver obsolete. A 2009 report by the USA's Department of the Interior's Geological Survey (USGS) states:

“The physical properties of silver include ductility, electrical conductivity, malleability, and reflectivity. The demand for silver in industrial applications continues to increase and includes use of silver in bandages for wound care, batteries, brazing and soldering, in catalytic converters in automobiles, in cell phone covers to reduce the spread of bacteria, in clothing to minimize odor, electronics and circuit boards, electroplating, hardening bearings, inks, mirrors, solar cells, water purification, and wood treatment to resist mold. Silver was used

for miniature antennas in Radio Frequency Identification Devices (RFIDs) that were used in casino chips, freeway toll transponders, gasoline speed purchase devices, passports, and on packages to keep track of inventory shipments. Mercury and silver, the main components of dental amalgam, are biocides and their use in amalgam inhibits recurrent decay.”



Figure 57. USA ten dollars silver certificate.



Figure 58. Fifty dollars gold coin.



Figure 59. USA 100,000 dollars gold certificate.

The estimate of total silver production since the dawn of human civilization amounts to 46-53 billion ounces; about 11 times the figure for gold. Unlike gold, it is depletable, being consumed in different applications. There is currently far less available silver in the world than gold. If priced based on its occurrence relative to gold, it would be priced at \$125 per ounce. If it were priced based on its availability it would be around \$2,000.

GRESHAM'S LAW

Benjamin Franklin suggested the use of land or homes as physical backings to the currency. There is comfort for a wage earner in knowing that what he earns today will retain its purchasing power in the future. The same silver dime that bought a loaf of bread in the 1960's can still buy a loaf of bread with its precious metal content, which was worth about \$1.00 around 2009. An ounce of gold has always been about evenly exchangeable for a tailored men's suit, which was around 2009 about \$800. Meanwhile, since the creation of the USA Federal Reserve central bank, the dollar as a fiat currency has lost 98 percent of its purchasing power. The erosion of purchasing power accelerated after it was decoupled from gold in 1971.

In this regard Gresham's Law applies: "Bad money drives out good." This suggests that if someone is forced or willing to accept bad money, it is to one's advantage to pass it along to him in exchange for something of value. Any good money people have, they will hoard and not pass around, driving it out of circulation.

The Democratic Party in the USA in the late 1800's supported silver as currency, while the Republicans supported only gold as currency. The Democrats were perceived as inflationist on the side of debtors and the masses of people, while the Republicans supported creditors, such as banks and businesses. This old perception amazingly still persists to this day.

THE WIZARD OF OZ ALLEGORY

Lyman Frank Baum wrote the original book: “The Wonderful Wizard of Oz,” published in 1900. He caricatured the gold and silver debate and the book was an allegory about life and political populism in the USA in the 1890s period.

Author Lyman Frank Baum was wealthy, and heir to family funds that came from the 19th-century petroleum fields discovered in Pennsylvania. He wrote about the concept of a debased currency. In the book title, Oz stands for ounces. The Emerald City of Oz was a city of gold, but it was substituted for by emerald when the Metro-Goldwin-Mayer (MGM) Studios turned it into a movie in 1939. The yellow brick road is a metaphor for gold. Dorothy’s slippers were made of silver in the book, but changed into ruby in the movie.

The Tin Woodman represented the urban workers of America, who were left out in the cold by the forces of banking capitalism. The Scarecrow that had no brain stood for the farmers; that was what East Coast snobs unfortunately perceived of them. The Cowardly Lion represented politician William Jennings Bryan, who made good speeches, but could not stand up to the entrenched interests. The Wizard of Oz himself was smoke and mirrors, representing the political classes as charlatans, who promised much but delivered little. The book was constructed around the premise that things are not necessarily what they are made to appear to be, and that the common people are more astute than the ruling elites think.

The original story of the Wizard of Oz is interpreted as a parable of the battle between the silver and gold proponents. The ruby shoes that Dorothy wore in the movie were originally silver shoes in the book that would set everything right again, and end the fantasy of the yellow brick road which was a symbol of the gold standard. This gold standard was backed up by nothing more than a funny man in an Emerald City symbolizing green paper money. He was a fake wizard, making loud scary noises behind a curtain and issuing, upon demand, paper certificates for every occasion and purpose.

The USA reportedly has 260 million ounces of gold reserves stored at Fort Knox, Kentucky and in the vaults of the Federal Reserve banks; the largest in the world. During World War II, a part of the USA industrial production was directed for a lend-lease program in which goods were sold to allies for payment after the war in gold.

With an M3 money supply of about \$12 trillion, this means that for the money supply to be backed by gold under a gold standard, initially required by the USA Constitution, it would be priced at $12 \times 10^{12} / 260 \times 10^6 = \$46,153.84$ per ounce compared with about \$700-1500 per ounce as of 2008-2013.

According to Jason Hommel: “Today’s Democrats have morphed into a party that still supports inflation, but via higher government domestic spending programs. And most of today’s Republicans have morphed into a party that tries to defend the value of the dollar by waging war on nations that think of selling oil for euros instead of dollars.”

SILVER THURSDAY, SILVER BUBBLE RISE AND COLLAPSE, 1980

Panic selling in the silver trading pits of Chicago on March 27, 1980 spilled over to the stock and all commodities market and this date became known as “Silver Thursday.”

In 1973 the Hunt family of Texas was the richest family in the nation. In 1979, as a hedge against rising inflation, the two Hunt brothers: Nelson Bunker and William Herbert, accumulated the control of a hoard of 250 million ounces of silver, about half of the world’s supply, because USA’s private citizens at that time were prohibited from legally owning gold.

In 1973, the price of silver was \$1.95 / ounce. In early 1979 it had risen to \$5 / ounce and by early 1980, with increasing inflation, it reached the \$54 / ounce range.

The Hunt brothers with some rich Middle Eastern investors accumulated their hoard in the form of futures trading contracts. In the 1970s a 5,000 ounces silver futures contract required a margin, or a trading deposit with a broker of \$2,000. If the price of silver increased from \$5 / ounce to \$50 / ounce, the futures contract would increase in value by $(\$50 - \$5) \times 5,000 = \$45 \times 5,000 = \$225,000$. This is an outstanding return on the initial investment as margin deposit of: $(\$225,000 - \$2,000) / \$2,000 = \$223,000 / \$2,000 = 111.5$ times or 11,150 percent on the initial investment.

The rise in the price of silver attracted media attention. The chairperson of the famous jewelry store Tiffany & Co. ran a full page ad in the New York Times newspaper stating:

“We think it is unconscionable for anyone to hoard several billion, yes billion, dollars worth of silver and thus drive the price up so high that others must pay artificially high prices for articles made of silver from baby spoons to tea sets, as well as photographic film and other products.”

The Hunt brothers and their partners did not acquire physical silver but used leverage in the form of futures contracts. The trading rules on futures contracts are set by the trading exchanges. The Hunt brothers played by these rules and never thought they could be changed. They also traded against the exchange members who control these exchange rules and the large investment banks who are investors in the Federal Reserve central bank. This is what happened: the New York Metals Market Commodity Exchange, Comex and the Federal Reserve Bank ruled out that “no new buying could enter the market and the only trades accepted were for liquidation of long positions.”

The lack of buying meant there were more sellers than buyers and the silver price began collapsing. In addition, trading on margin is a double-edged sword. The leverage of margin trading generates large profits as the market goes as a trader expected, but also generates huge losses if the market goes against his position. In the last case, margined positions in the market become nightmares as they generated “margin calls” where the brokers require an increase in the initial margin deposit. The brokers, knowledgeable about the situation, grab the opportunity and usually take an opposite short position against the long position holders. As the margin calls cannot be met, the brokers close the margined positions at the lower market prices, making huge profits at the expense of their customers who are unable to meet their margin calls.

The declining market price of silver triggered a \$100 million margin call to the Hunt brothers on March 27, 1980. As expected, they did not have the required funds and could not meet the margin call. They faced a potential loss of \$2 billion and were forced to dump so many silver contracts into the market that the price fell from \$21.62 / ounce to \$10.80 / ounce. On that day each silver futures contract lost \$54,100 of its previous value. The loss of about \$1 billion by the Hunt brother was a profit to the traders, brokers and investing banks who held the short positions against them.

The collapse of the silver market caused large losses in stocks and the other commodities markets. The Hunt family had other holdings in oil fields, sugar plantations, real estate and even electrical utilities in Mexico. Their wealth survived, albeit at a lower level. It was \$5 billion in 1980 and was reduced to \$1 billion in 1988.

To add insult to injury, the Hunt brothers were found responsible for civil charges of conspiracy to corner the market in silver, forcing them to declare bankruptcy to protect whatever was left of their wealth from being transferred from their hands in Texas to the hands of the New York traders, brokers and investment bankers.

In June 1982, at a low point in the USA economy since the Great Depression, silver prices hit a bottom of \$4.98 / ounce down from the top of \$50 /ounce; a decline of $(50 - 4.98) / 50 = 45.02 / 50 = 0.9004$ or 90.04 percent. They have been steadily increasing since then as a second alternate currency after gold, as the values of the paper currencies undergo a continuous debauchement.

CENTRAL BANKING IN THE USA, FEDERAL RESERVE BANK

The USA succeeded Great Britain as the prominent world power and adopted an analogous system applying it with less restraint in creating its great wealth and power. On Friday, December 23, 1913, under President Woodrow Wilson, the all-powerful privately owned central USA Federal Reserve Bank, or the Fed in short, was created in the dead of the night as the central banker counterpart of the Bank of England. A small group of bankers astutely passed the corresponding bill through at an opportune time just before Christmas Eve, when many, in an almost deserted Congress, were absent. They smartly used the word “Federal” in its name to make it appear as a part of the Federal Government. The only truly “Federal” aspect of it is a figure-head entity whose 7 members are nominated by the bankers but appointed by the President of the USA designated as the Board of Governors.

The Board of Governors members give speeches every once in a while which get little coverage, they receive little criticism and possess little power. Members of the Board of Governors are appointed by the President of the USA. Their organization's Web address ends in .gov. Legally, the Board is in charge of the entire system. This is a convenient myth for public consumption. Operationally, the Board acts as the mouthpiece of the New York Federal Reserve Bank. The New York FED is the most important private economic organization in the world. The main spokesman for the FED is the Chairman of the Board of Governors. He is legally the agent of Congress. He is operationally the barrier between Congress and the New York Federal Reserve Bank. This is how all USA government agencies work, and the Board of Governors is a government agency. The head of every cabinet-level department is appointed by the President and confirmed by the Senate. He serves at the convenience of the President. He imposes the President's wishes on the bureaucracy.

Members of the FED's Board of Governors are appointed for 14-year terms:

“The full term of a Governor is 14 years; appointments are staggered so that one term expires on January 31 of each even-numbered year. A Governor who has served a full term may not be reappointed, but a Governor who was appointed to complete the balance of an unexpired term may be reappointed to a full 14-year term.”

“Once appointed, Governors may not be removed from office for their policy views. The lengthy terms and staggered appointments are intended to contribute to the insulation of the Board – and the Federal Reserve System as a whole – from day-to-day political pressures to which it might otherwise be subject.”

There is no industry-related agency of the U.S. government that is more insulated from politics. Therefore, there is no agency that is more completely under the domination of the industry that it is supposed to control. The USA society is a bankers' society. The supreme mark of this is the openly announced independence of the Federal Reserve from politics. No other agency of government has publicly claimed this degree of independence from politics, which means independence from the voters. This undemocratic arrangement is presented as being “for the good of the people.” The fact that the arrangement is a flagrant violation of democracy is not mentioned in polite circles. The USA elected officials are not the operational agents of the voters in matters of banking.

The Federal Open Market Committee (FOMC) possesses the real power. Every eight weeks, the FOMC makes decisions in closed-door sessions that affect the whole world economy. Officially, the Board of Governors is the government's only source of indirect control over the FOMC, which is made up of the presidents of the regional Federal Reserve banks, who in turn are appointed by the regional FED banks, which are privately owned.

The Federal Reserve Bank is an institution owned by the stockholding member banks. The USA government does not even own a single dollar's worth of stock in it. Its formal stated duty is to fight inflation and maintain full employment. However its unofficial unstated goal is to protect its large member banks from insolvency by providing them with bailout funds. Yet, the government does give the Federal Reserve System the use of its billions of dollars of credit, and this gives the Federal Reserve its characteristic of a central bank, the power to issue currency on the government's credit. The Federal Reserve Bank and the USA Treasury possess the privilege to issue promises to pay which they are neither capable nor willing, nor intending to ever honor.

The USA had a primitive central bank, conceived by Alexander Hamilton, but President James Madison let its charter lapse in 1811. A second such bank became the target of President Andrew (Andy) Jackson, who viewed it as a “hydra” and a “curse” upon the nation. He called the bankers a “net of vipers,” and specified that “I killed the bank” be the epithet to be written on his grave. President Andrew Jackson sought to decertify the bank and, in 1836, succeeded. The following year, the USA plunged into a serious financial panic.

The USA does not have Federal Government notes, nor does it have gold certificates as a currency. Instead, the USA has Federal Reserve Bank notes, issued by the Federal Reserve Banks, printed by private entities in Europe and the USA for private profit. The money of the Federal Reserve Banks is money they created. When they buy government securities they create reserves. They pay for the government securities by giving checks on themselves, and those checks come to the commercial banks and are deposited by them in the Federal Reserve Banks, and then money exists which did not exist before. Money is created out of the right bestowed upon them to issue credit money.

The Federal Reserve Board has the power to perform open market operations. They are the single most important instrument to control the quantity of money and the amount as well as the cost of credit. Credit is synonymous with money, since most of the transactions in the USA are in the form of bank credit or bank deposits.

INCREASING THE MONEY SUPPLY

The controller of the money and banking system in the USA is the Federal Reserve Board, approved for appointment by the President. The Federal Reserve Act gives to the Federal Reserve Banks, run by the Federal Reserve Board, the monopoly of the issuance of paper money, and

requires the nation's commercial banks to keep their reserves at the Federal Reserve Bank. The commercial banks are then allowed to create money in the form of demand deposits, or checking accounts to some multiple, say 1:10 on top of their total reserves.

If the total bank reserves at the Federal Reserve Bank are \$10 billion, the banks are allowed to create and lend out up to \$90 billion more, until their checking accounts total \$100 billion. The banks are eager to do so. If the bank reserves increase by another \$1 billion, they will create \$10 billion in new money in the economy.

The key leverage in the creation of new money and the expansion of the money supply is the total of bank reserves. These are under the control of the Federal Reserve Board itself, which keeps seeing to it that bank reserves increase at a chosen rate that results in a specified rate of inflation, say 2 percent.

The Federal Reserve Bank does this by going into the "open market" and performing "open market operations" by buying assets. It does not matter what kind of assets the Federal Reserve Bank decides to buy. If the Federal Reserve Bank buys any asset from a member of the public, the total bank reserves increase by the same amount, and the total money supply increases by 10 times that amount.

The Federal Reserve Bank prefers to purchase existing USA government bonds and other securities. If the Federal Reserve Bank buys \$10 billion worth of USA government bonds from private favored bond dealers, the total bank reserves will increase by \$1 billion and the money supply as a whole by \$10 billion.

MONETIZING THE DEBT, QUANTITATIVE EASING, QE, CURRENCY DEBASEMENT

Currency debasement is a term derived from the Roman Empire's practice of hollowing out gold coins and filling them with base metals such as copper.

"Monetizing the debt" and "Quantitative Easing" are code words and euphemisms within the banking system for printing-press new money creation. It is a new christening of the old terminology of currency "debasement" in English or "débauchement" in French. In this case, the Federal Reserve central bank buys treasury debt directly by simply creating a ledger transaction, effectively adding to the money supply. The aim is to increase the amount of deposits in private banks so that, by way of deposit multiplication, they can increase the money supply by increasing debt and lending.

Quantitative Easing impacts the economy by artificially pushing up stock prices and by helping to fund the government's trillion dollar budget deficits at low interest rates. Higher stock prices create a wealth effect that encourages consumption and supports aggregate demand, just as government deficit spending supports aggregate demand.

These "stimuli" produce an effect so long as the printing press continues to run. When the Federal Reserve central bank stops creating money and buying assets, asset prices fall, wealth evaporates, spending slows down and the economy slides back into recession.

The events of the 2008-2010 financial crisis exemplify the situation. On March 31, 2010 the Federal Reserve Bank ended a first round of Quantitative Easing during which it had created and spent more than \$1.7 trillion buying "toxic" valueless financial assets from its distressed member banks. Six weeks later, the stock market underwent a "flash crash." By July 2010, the Standard and Poor 500 stocks index lost 15 percent of its value, destroying \$1.5 trillion in wealth within a three months period. The economic indicators took a sharp turn for the worse during the

summer of 2010 and concerns grew that the economy was sliding back into a second recession. The Federal Reserve Bank started a new round of money creation and quantitative easing designated as “QE 2, probably to be followed by “QE 3” if necessary. The markets and the economy rebounded in response.

The USA economy is dependent on the stimuli provided by paper money creation. Stock prices, bond yields, retail sales and employment move up and down in line with the Federal Reserve Bank program of liquidity injections.

When governments create money to support their deficits, there are undesirable side effects:

1. In addition to causing asset price inflation, printing money causes food price inflation as well, putting at risk the lives of many 2 billion people who live on less than \$2 per day worldwide.
2. It contributes to the deindustrialization of the USA as it shifts economic activity from healthy manufacturing and production to services and consumption paid for with capital gains on unsustainably inflated asset prices.
3. It rewards the banking industry for activities that fundamentally damage the health of the economy. When the Federal Reserve Bank interferes to prevent the money supply from contracting by implementing measures that prevent the private sector from defaulting on its debt, it is certain that bankers will pump more and more credit into the economy and profit handsomely in the process.
4. The creation of money causes the currency to lose value relative to other currencies and hard assets like gold and land.
5. The driving economic growth by paper money creation is not sustainable and ends with internal social dislocations or foreign wars that are instigated to distract the populace.

On November 8, 2002, then USA Federal Reserve Governor Ben Bernanke gave an address on the occasion of the economist’s Milton Friedman’s 90th birthday in which he described the Monetary Theory of the Great Depression which Milton Friedman and associate and wife Anna J. Schwartz had developed in the early 1960s. Ben Bernanke concluded the speech with the following words: “I would like to say to Milton and Anna: Regarding the Great Depression. You are right; we (the Federal Reserve) did it. We are very sorry. But thanks to you, we would not do it again.”

In 2002 he gave an address which earned the title of “Helicopter Ben”:

“The USA government has a technology, called a printing press (or, today, its electronic equivalent), that allows it to produce as many USA dollars as it wishes at essentially no cost. By increasing the number of USA dollars in circulation, or even by credibly threatening to do so, the U.S. government can also reduce the value of a dollar in terms of goods and services, which is equivalent to raising the prices in dollars of those goods and services. We conclude that, under a paper-money system, a determined government can always generate higher spending and hence positive inflation. ”

The reality is that Federal Reserve did not cause the Great Depression; it was excessive debt creation. The adoption of this explanation as the cause of the Great Depression, the Federal Reserve Bank, under the leadership of two consecutive chairpersons: Alan Greenspan and Ben Bernanke, pursued a successive series of inappropriate policies that have ballooned debt and exasperated the excessive debt situation.

It should not be forgotten that the Federal Reserve was created by bankers for the benefit of their banks. From the perspective of the banking industry, the Federal Reserve Bank has benefited its owners' banks.

A central bank can carry out the process of quantitative easing by using newly created money to buy Treasuries in the open market, or by lending the new money to deposit-taking institutions, or by buying assets from banks in exchange for currency, or any combination of these actions. This action has the effect of reducing interest yields on government bonds as well as reducing the inter-bank overnight interest rates and thereby encourages banks to loan money to higher interest-paying bodies. Such a process is inflationary and leads to a debasement of the currency. Other than default, this is the process for governments to repay their debt to their citizens as well as foreigners. As of 2009, the USA debt was \$60 trillion with a Gross Domestic Product of \$14 trillion, and short of default, the only way to extinguish the debt is through monetary inflation. The analogy here is that governments borrow money when it buys a loaf of bread, and repay it when the same amount of money is worth only just a slice of the loaf of bread. Monetary inflation is the debtor's best friend, making the debt easier to service and repay. On the other hand, it goes against the interest of savers and creditors.

The USA government deficits are larger every year. The total official national debt is not only increasing each year but also that the rate of increase is accelerating. Since October 1st 2000, the national debt has increased about 9.1 percent per year, but since October 1st 2007 it has increased 12.2 percent per year. This is only the official debt and does not consider the net present value of unfunded Social Security, Medicare, Medicaid, and government employee pensions and liabilities. The total unfunded liability is approximately \$100 Trillion to \$230 Trillion and the annual increase is \$7 – \$11 Trillion. For comparison, the entire USA GDP is about \$15 Trillion per year.

The process of quantitative easing is essentially legal counterfeiting. Central banks buy their own sovereign bonds with money they create electronically. Why this monetization is allowed depends on the theory that at the first signs of inflation caused by the process, the banks will sell the bonds that they had purchased, draining excess liquidity from the system with the money absorbed back from the economy, reducing inflation. What is likely to occur is that with the selling of bonds, their price would collapse, being sold worldwide, and tangible assets such as commodities hoarded instead. An oversupply of dollars would occur, leading to a depreciation of the currency. In fact, an inverse relationship between the value of the dollar and petroleum, gold and even commodity stocks exists in the financial markets.

When the Federal Reserve runs out of ammunition in decreasing interest rates all the way to the zero percent level as happened in December 2008, where its member banks could borrow funds interest free and then invest it in treasury bonds at an interest rate of say 3 percent for a risk-free profit, it can use the ultimate weapon of “monetizing the debt.” As the Federal Reserve banks buy Treasury Bills or securities in the open market, they increase the volume of the money in circulation and decrease its cost or the underlying interest rate. They are then able to keep the rate of consumer price inflation above zero so as to encourage people to spend their money before the future anticipated higher prices, rather than wait for lower prices. The spending is supposed to be the magic that gets the consumer economy going again. When the Federal Reserve banks sell securities they suck up the excess liquidity and decrease the amount of money and increase its cost or the interest rate.

“Quantitative Easing” or “Credit Easing” describes the Federal Reserve action of last resort in which it buys troubled assets from its member banks in view of protecting them from

“destabilization” and improving their balance sheets. The banks thus increase their reserves. If they were to maintain the same loan-to-reserve ratio, they would have to lend out more money. But when the Federal Reserve purchases assets from the banks, it does not borrow the money; it creates it out of thin air.

Whereas in the USA the Federal Reserve is a private institution, in other countries such as Canada, the central bank, Bank of Canada, is an agent of the Canadian government.

Another twist is that there does not exist any reserve ratios restrictions on the creation of dollar denominated debt in the British banking system, such that a \$1 million bona fide credit coming from the USA to a British bank in London, the Bahamas, or the Cayman Islands, can be turned into say \$20 or a \$100 million in dollar denominated credits. This provides a back door control for the UK banking system on the USA currency.

In 2013, at its 100th anniversary, the USA Federal Reserve Bank enjoyed its 100th anniversary, having been formed in secrecy in 1913 at Jekyll Island, off the coast of the state of Georgia by a group of astute bankers. By 2007, its balance sheet had grown to \$800 billion. Under its latest QE program it printed \$1 trillion of currency per year. This corresponds to printing about 100 years' accumulation of past currency into new currency every 12 months.

President Franklin Roosevelt made the famous comment that: “If we borrow funds, then we owe it to ourselves.” The modern justification by a Federal Reserve official is that: “As long as we can afford to pay the interest on the debt, it will be OK.”

EXAMPLE

In contrast to banks which need deposits to be able to expand the money supply, the Federal Reserve Central bank does not. It conducts open market operations by buying any type of assets such as treasury bills or debt instruments. To expand the money supply:

1. The Federal Reserve Open market Committee (FOMC) purchases \$100 billion in Treasury Bonds.
2. The Federal Reserve writes a check on itself for \$100 billion. The result is that the money supply is expanded by \$100 billion.
3. The \$100 billion dollar check goes to a select government bond dealer such as Goldman Sachs or J. P. Morgan Chase in exchange for the \$100 billion in Treasury bonds. This results in an expansion of the money supply by \$100 billion.
4. The dealer deposits its \$100 billion Federal Reserve check in a commercial bank. This expands the money supply by \$100 billion.
5. The fractional reserve effect enter into play with \$100 billion dollar circulating in the banking system as \$100 billion in deposits and at a reserve ratio of 10 percent into loans according to Eqn. 23 in the amount of:

$$\$100 \times \frac{1}{0.10} = \$1,000 \text{ billion} = \$1 \text{ trillion.}$$

REPAYMENT OF MONETIZED DEBT

Monetized debt is meant to be ever repaid. New debt is planned to be issued to roll over the existing debt and kick the can down the road. It cannot be repaid back without fully a 99

percent contraction of the money supply with just a 1 percent reserve ratio for the banks. A serious contraction in the money supply would ensue.

The central banks are in the habit of replacing paid-off debts with new ones. All central bankers have known this ever since 1900. The central banks' purchase of debt creates an economic addiction. The investors in bank debt believe that this will not happen and that they will be eventually repaid. They believe that there will be no contraction of the money supply.

If there were a serious contraction in the money supply, this would recreate the Great Depression's first phase in 1930-33. Then it would further contract. Runs on the banks would ensue. Most banks would fail. Almost all debt instruments like bonds would become worthless. No one could repay them anyway.

This is the reason why the USA Congress created the Federal Deposit Insurance Corporation (FDIC) in 1934: to stop the runs on the banks, and therefore to avoid the contraction of the money supply.

CONTROLLING ENTITIES

The real controlling entity was created as the Federal Open Market Committee (FOMC) to make the key decisions for the central bank. The seven member Board of Governors was appointed with its constituents as members of the FOMC. All 12 participating private regional banks are full participants in all FOMC meetings, discussions, plans and activities, although only 5 of these private bankers can vote on the Fed actions at the FOMC meetings. While the private bankers are in control of the 12 member banks, they also possess de facto control of the seven member board of governors whose terms extend for 14 years, and they cannot be removed except in case of personal misconduct.

By providing the government an unlimited supply of money, the Fed would always buy any USA Treasury bills, notes, bonds or paper which could not be sold to the public. This is called “monetizing the debt” when the Treasury Department transfers stock interest-bearing paper to the Fed in exchange for Fed money or bank credits. This makes the Fed one of the largest holders of USA debt receiving a large inflow of interest annually. The Fed transfers any unspent sums of interest back to the Treasury at the end of the year. This is done annually; thus one can claim that the Fed is not out to make money on its own operations or from interest on USA paper. However, there was neither intention nor need for the Fed to be a money making operation by itself. It does not need to make money because it was created for other purposes. The Fed would do things and carry on its buying and selling options in ways that benefit its owner banks. It does not need to make money in its buying and selling operations in the various financial markets because it already has essentially unlimited supplies of its own money and can issue this money in a virtually unchecked and unverified manner since its operations are carried out in secret and there is no checking or auditing of what it does.

FRONT-RUNNING, CHECK-KITING, PRE-EMPTING

“Wildcat banking” was practiced in Scotland in the 17th century when a coach hired by the banks and carrying gold would be “front-running” the coach that would be carrying the bank inspectors from one bank they were inspecting to the next one.

“Check-kiting” is the name for a similar conspiracy between two or more banks, to tap the float or the mass of checks in the process of clearing. A conspiring bank sends to another bank

third-party checks that lack any backing whatsoever. They cover the liability of an unbacked check by crediting the other back and forth.

The process of check-kiting proceeds as follows:

1. The Treasury Department issues debt which it has neither the intention nor the means ever to repay.
2. This debt is used as “backing-up” for Federal Reserve central bank notes and deposits, which the Federal Reserve itself has neither the intention nor the means ever to redeem.
3. When the Treasury Department debt matures, it is paid in Federal Reserve credit issued on the collateral security of new Treasury debt.
4. When Federal Reserve credit is presented for redemption, the Fed offers interest-bearing Treasury debt in exchange.

Neither the Treasury Department debt, nor the Federal Reserve credit is issued in good faith. They are both issued in order to mesmerize the populace. The goal is to cover up governments’ deficit spending on social programs and wars by a process of depreciating the circulating currency rather than the unacceptable increase in taxation.

The open market operations of the Federal Reserve Bank make bond speculation risk-free, which explains the perpetual bull market in bonds. Bond speculators, knowing that the Federal Reserve needs to buy bonds in order to keep the money supply growing, front-run or pre-empt the Federal Reserve’s open market operations. They buy the bonds beforehand, and pocket risk-free profits when they sell them back to the Federal Reserve. Speculators will allow the bond price to fall only so much. They show up later as buyers for another ride of the escalator upstairs.

When the Federal Reserve wants to create inflation, it keeps buying bonds and sanitizes the process by calling the practice “Quantitative Easing, QE.” Pumping up the money supply through unlimited bond purchases by the central bank is hoped to bring about rising prices. It is doubtful that a higher price level will ever be achieved in this way. However, bond speculators have a field day and are given the opportunity to make risk-free profits.

OPERATIONAL SECRECY, PLUNGE PROTECTION TEAM, MARKET CONTROL UNIT, WORKING GROUP ON FINANCIAL STABILITY

Although the Fed carries on its operations in secret and it is never independently checked or audited by anyone, the Fed chairman does occasionally testify before the USA Congress on what the Fed is doing.

The USA transferred most of the USA gold reserves supply to the Fed. The Fed participates in the buying and selling of gold, silver and other commodities as desired with the goal of controlling the value of the dollar currency.

Foremost, the Fed has complete power and authority to control USA interest rates at all levels and to be able to make money available to whomever it chooses at a given point in time. By controlling interest rates, it is an acknowledged fact that the Fed can enter and participate in the buying and selling of USA notes, bonds and bills. The Fed enters the markets and either buys or sells USA or other paper to control the interest rate level.

The Fed and the Treasury collaborated in creating the “Exchange Stabilization Fund” to use a vast sum of Federal Reserve Notes to influence, control and participate in the currency markets. The Fed and the Treasury can enter the different currency markets around the world to control the value of various foreign currencies.

President Ronald Reagan reportedly issued executive order 12631 on March 18, 1988, establishing a “Working Group on Financial Stability,” known as the Market Control Unit or the Plunge Protection Team (PTC) to protect the USA’s economy.

It is composed of:

1. The Secretary of the Treasury or his designee as a Chairperson of the Working Group.
2. The Chairman of the Board of Governors of the Federal Reserve System or his designee.
3. The Chairperson of the Securities and Exchange Commission or his designee
4. The Chairperson of the Commodity Futures Trading Commission or his designee,

This unit operates in collaboration with the stock and commodities market-makers and brokers on the major exchanges to buy or sell certain stocks, bonds, currencies and commodities at certain times to prevent any major collapse of the markets. In 2008, the short selling of a list of domestic as well as foreign financial institutions was banned, to stabilize the declining values of their stocks. When the market goes up or down, the insiders to the plunge protection team collect big winnings for their firms, eventually to be turned out into substantial personal fees and bonuses.

The Fed can establish banking reserve requirements which determine how much money banks can loan out to customers and the discount rate which is an important barometer governing USA interest rates.

As a backup for its member banks, the Fed stands ready to accept discounted notes and paper from banks in an emergency such as a run on a local bank. The bank can come to the Fed and get some immediate money to bail itself out.

The Fed has the power to establish margin requirements in the stock and commodity markets and to act as a clearing house for many checks drawn on USA banks.

SEIGNIORAGE, USA TREASURY AND FEDERAL RESERVE PARTNERSHIP

Seigniorage is the revenue generated for a government through monetary expansion.

An interesting aspect of the Fed operation is that the USA Treasury would print all of the paper money wanted by the Fed and charge the Fed for the cost of printing it.

Seigniorage is the revenue derived from the face value of a currency minus its production cost. If it costs five cents to produce a new dollar bill, then the net revenue is 95 cents. Larger denominated bills are thus more profitable.

A knowledgeable description of seigniorage is given by Federal Reserve Chairperson Ben Shalom Bernanke, earlier a Professor at Princeton University, when he answers the question of whether government budget deficits can lead to an increase in the money supply:

“The link is the printing of money to finance government spending when the government cannot (or does not want to) finance all of its spending by taxes or borrowing from the public. In the extreme case, imagine a government that wants to spend \$10 billion (say, on submarines) but has no ability to tax or borrow from the public. One option is for this government to print \$10 billion worth of currency and use this currency to pay for the submarines. The revenue that a government raises by printing money is called seigniorage.”

The Federal Reserve is a private monopoly that represents the interests of the USA banks through the 12 regional banks which are also owned and managed by private bankers. It primarily

defends the interests of the banking system, and secondarily the broad economic interests mandated by the USA Congress.

The miracle of modern-day fiat currencies depends on a partnership between the Treasury and the Federal Reserve central bank. The process depends on their accepting and exchanging each other's irredeemable promises to pay. This scheme depends on a continuous supply of investors or speculators willing to temporarily assume a risk, with the hope that they would themselves pass it on to the newcomers in the game and run away with their winnings before the system collapses. Evidently, the supply of risk takers is substantially large, but it is nevertheless finite. The system collapses regularly when it runs out of a supply of new fools entering the system.

After President Woodrow Wilson signed the Federal Reserve Act into law in 1913, he had second thoughts and reportedly said:

“I am a most unhappy man, I have unwittingly ruined my country ... a great industrial nation is now controlled by its system of credit ... the growth of the nation, therefore, and all of our activities are in the hands of a few men.”

President Dwight Eisenhower stated that the Federal Reserve Bank was an “independent” agency not under the control of the USA president.

CONSPIRACY THEORIES, PRESIDENT JOHN F. KENNEDY'S ASSASSINATION

In his book *Crossfire*, Jim Marrs suggests that the motive for the assassination of President John F. Kennedy was to stop the implementation of Executive Order 11110, which was a measure designed to curtail the power of the Federal Reserve by replacing the Federal Reserve Notes with Silver Certificates. It is often suggested that President Lyndon B. Johnson revoked the order when he came to power. In fact, the Order remained on the books until President Ronald Reagan issued Executive Order 12608 on September 9, 1987.

The privately-owned Federal Reserve Bank system charges the government interest on the purely fiat currency that is generated in conjunction with the banking system. The USA government could issue its own interest-free currency through its Treasury Department, as it did prior to the Federal Reserve Act of 1913, and not have to pay interest on the currency issued. One of the largest expenses of the USA federal government is the interest on the debt owed to a foreign and nationally privately owned entity that controls this country's own money.

President John F. Kennedy is reported to have become unsatisfied with the Federal Reserve Bank policy and ordered the issue of USA Notes by the USA Treasury Department to be printed as a substitute for the Federal Reserve Notes issued by the Federal Reserve Bank. The issuance of these USA Notes by the treasury was temporary and was ceased shortly after his assassination by his successor President Lyndon B. Johnson.



Figure 60. John F. Kennedy “United States Note,” was backed by silver, issued by the Treasury Department as: “this note is legal tender for all debt, public and private.” Five billion issued dollar were later withdrawn from circulation.

Specifically, on June 4, 1963 USA President John F. Kennedy issued Executive Order 11110 which delegated to the Secretary of the Treasury the president's authority to issue silver certificates under the Thomas Amendment of the Agricultural Adjustment Act. The wording of this Order was: “issue silver certificates against any silver bullion, silver, or standard silver dollars in the Treasury not then held for redemption of an outstanding silver certificates, to prescribe the denominations of such silver certificates, and to coin standard silver dollars and subsidiary silver currency for their redemption”. In a different version of the story, a month before his assassination, President John F. Kennedy invoked a little-known provision of federal law, authorizing him to issue genuine USA currency paper money in the form of Two Dollar Bills.

President John F. Kennedy was trying to circumvent the Federal Reserve Bank monopoly on printing money and tried to reinstate a debt-free currency that would directly compete with the debt-based fiat money.

On November 22, 1963, 6 months after signing this Presidential Order, President John F. Kennedy was assassinated in Dallas, Texas and Vice President Lyndon B. Johnson never followed through with President John F. Kennedy's Presidential Order. In 1965 then President Lyndon B. Johnson signed a bill to end all silver coinage in the USA and thus President John F. Kennedy's dream of an open and honest USA currency died with him.

Other outlandish and implausible conspiracy theories were advanced about the motives for the assassination of President John F. Kennedy:

1. In his book “A Celebration of Freedom: JFK and the New Frontier” author William Lester says that CIA documents released to him under the freedom of information act reveal Kennedy demanded to be shown confidential documents about UFOs just 10 days before his assassination. Alien enthusiasts have suggested that the documents add weight to the claim that President John F. Kennedy was killed to stop him from discovering the truth about UFOs.
2. Conspiracy theorists often point to a film that recorded the assassination by Zapruder, in particular frames 312-317 which show a puff of smoke next to the left side of President John F.

Kennedy's head. Theorists argue that as neither President John F. Kennedy nor his spouse Jackie Kennedy are smoking a cigarette, the smoke must have been caused by some explosive reaction. The suggestion is that First Lady Jackie Kennedy took part in a conspiracy that involved Texas Governor John Connally, maybe because of President John F. Kennedy extra-marital affairs. There is no real evidence for this except a sketchy interpretation of the Zapruder film.

3. In "Who Shot JFK?: A Guide to the Major Conspiracy Theories" (1993) by Bob Callahan and Mark Zingarelli, it is suggested that Lee Oswald shot JFK because of a psychological problem caused by his addiction to refined sugar. The theory appears to be largely based on the fact that Oswald drank a sugary beverage (Coca-Cola) immediately after the shooting.

4. An idea that first floated in DC Comics' 100 bullets, is the theory that baseball player Joe DiMaggio was behind the killing. The theory has gained traction with conspiracy theorists who suggest that the talented sportsman wanted to kill President John F. Kennedy in revenge for his allegedly ordering the death of his former wife actress Marilyn Monroe, with which both President John F. Kennedy and his brother Attorney General Robert Kennedy had affairs. There appears to be little or no evidence to support this theory.

5. According to two books by Scottsdale attorney, Craig Zirbel, only vice president Lyndon B. Johnson, had the motive, the means and the opportunity to mount a conspiracy against the president. The books suggest that President Lyndon B. Johnson political and personal issues with President John F. Kennedy, along with a desire to become president before he got too old, prompted his involvement in the killing of the President.

6. Lyndon B. Johnson was allegedly a member of the Freemasons as was Warren Commission appointee, President Gerald Ford. This has led to the suggestion that the Freemasons secretive organization was involved in the killing. There is no evidence of this either.

7. The Umbrella Man, identified as Louie Steven Witt, serves as an example to conspiracy theorists about the often benign reasons unusual things happen at significant historical events. Louie Steven Witt was captured on the Zapruder film of the assassination and several other pieces of footage standing by the Stemmons Freeway sign within Dealey Plaza in Dallas, Texas. What is unusual about Witt is that he was holding a large black umbrella on a completely dry day. Some suggested this was a signal to shooters, but it was later revealed he was holding the umbrella as a protest against President John F. Kennedy's father's support for Nazi-appeasing British Prime Minister Neville Chamberlain, who was often seen with a trademark black umbrella. Some even suggested the Umbrella Man was the actual assassin and he had used the modified umbrella to fire at President John F. Kennedy.

8. In his 1992 book "Mortal Error: The Shot That Killed JFK," Bonar Menninger, suggests that Kennedy was actually killed by a fatal shot fired accidentally by Secret Service agent George Hickey, who was riding in the follow-up car. The theory suggests that George Hickey accidentally fired an AR-15 assault rifle when the vehicle suddenly stopped.

9. In his book, "Behold a Pale Horse" (1991), William Cooper claims that President John F. Kennedy was actually shot by his limousine driver. William Cooper's theory appears to be almost entirely predicated on the fact that the driver, secret service agent William Greer, is shown turning to his right and looking backwards. There is no evidence that William Greer was the shooter, though he was criticized by many after the assassination for his actions that day in not immediately accelerating away from the scene of the shooting.

10. President John F. Kennedy angered the oil tycoons headquartered in Texas when he announced that he favored scrapping the tax loophole enriching them, namely the oil depletion allowance, according to a book, "Farewell America."

11. Catholics in the American Aristocracy justified his assassination on the basis he committed, even nominally as a Catholic, violations of Church Canon law and doctrines. Shortly after being inaugurated in 1961, President Kennedy proceeded with the plan, started by President Dwight Eisenhower, to invade Cuba at the "Bay of Pigs". In so doing, he nominally violated Catholic Church canon law and doctrine, by proceeding to make war against another Catholic country, namely Cuba, and its leader, Fidel Castro, a reported Jesuit. The invasion plan became a fiasco when he refused to have USA war planes aid the invaders on the beach.

12. Three weeks before the Dallas assassination, President John F. Kennedy ordered a coup against the devout Catholic South Viet Nam government in Saigon. Murdered on his authorization for geopolitical reasons, was the South Viet Nam premier, Ngo Dinh Diem, and his two brothers. The premier's widow, Madame Ngu, taking up residence in Paris, supervised the American CIA's assassination of President John F. Kennedy, using French assassins previously part of a failed plot by disgruntled French Generals against French Premier De Gaulle. The French military was sore at General De Gaulle for not defending French interests in Algeria. Madame Ngu was in charge of huge narcotics trade funds from the "Golden Triangle" of Southeast Asia.

13. More mainstream theories involve the suggestions that there was a second gunman or that the Cubans, CIA, Mafia or even the FBI were involved in some form or another in the shooting of President John F. Kennedy.

HYBRID NATURE OF THE FEDERAL RESERVE BANK SYSTEM

The disclosed function of the Federal Reserve System in the USA is to maintain price stability and full employment. The undisclosed primary function of the Federal Reserve System, as with every government licensed central bank, is to protect its private shareholders within the fractional reserve commercial banks from bank runs. It has been successful in its intended function; but the cost has been an exponentially expanding money supply with the ensuing depreciation of the dollar currency.

As ruled by the USA Court of Appeals, for the Ninth Circuit, headquartered in San Francisco, and not challenged or disputed: "The regional Federal Reserve banks are not government agencies....but are independent privately owned and locally controlled corporations." *Lewis vs. United States*, 680 F.2d 1239 (9th Circuit, 1982). To be referred to in a law library, the reference to be read as: Volume 680, Federal Reporter 2nd series, starting at page 1239.

Whenever the USA government needs money, it does not issue USA Notes, which it could; but does not. These notes would be dollars backed by the full faith and credit of the USA's government. The USA does not issue dollars straight out of the USA Treasury; instead, it issues Treasury Bonds. The USA Treasury then sells these bonds to the Federal Reserve. The Federal Reserve buys the bonds. In payment for the bonds, the Federal Reserve creates money "out of thin air" as a book-keeping entry with which it buys the bonds. The money that the Federal Reserve created then goes to the USA government. The Federal Reserve holds the USA bonds, and for its services is paid 6 percent interest on the bonds that it holds. This ingenious accounting mechanism allows a government to raise funds for its spending welfare and warfare programs without going through the inconvenience of raising taxes. In fact, it can even gain popularity by cutting taxes in the process.

The Federal Reserve, as a privately owned bank, but with its appointments subject to senate and presidential approval is effectively a hybrid private and governmental institution. It controls the USA money supply. Yet, contrary to public belief and to its "Federal" name, it is not

a branch of the USA “Federal” government. It is not mentioned in the Constitution of the USA. No constitutional amendment was created or voted on to create it. Its constitutionality has never been challenged before the USA Supreme Court.

BRETTON WOODS AGREEMENT, 1944, 1971

The Bretton Woods, New Hampshire, conference agreement was set up in reaction to the financial turmoil of the Great Depression in the 1930s which caused a great deal of antagonism and currencies instabilities. In 1944, 44 world governments met for 22 days to reach the agreement.

The cause of the Great Depression appears to have been the forcible removal of gold from the international monetary system, including the suspension of the gold standard by the UK in 1931, and the confiscation of the gold coins of the citizens of the USA in 1933, which made government bonds the main alternative for savings. With a falling rate of interest, the liquidation value of debt rose since it was capitalized at a lower rate, wiping out savings and capital. It is a well-known fact that lower interest rates are associated with a higher value of bonds. For instance the prepayment of a mortgage if the prevalent interest rate is lower than the original at the time of the creation of the mortgage is usually associated with a prepayment penalty which is a capital loss.

The agreement came into force after World War II and was created by the International Monetary Fund (IMF), the World Bank, and half a century later, the World Trade Organization (WTO). Its basic fulcrum was the stability of the dollar and its conversion into gold. It was assumed that exchange rates would be fixed and not varied too much. This remained the norm for about 20 years.

In the 1960s, the system came under increasing pressure when the USA had a small amount of inflation. At that time, this small inflation was considered rather large, particularly against the growth of other countries whose economies were becoming stronger.

When the 1944 gold standard or Bretton Woods Agreement was reached, the USA dollar became the world's preferred reserve currency. It was not only the only currency convertible into gold at \$35 an ounce, but, unlike gold, it could also earn interest. In the second half of the 1960s, President Lyndon B. Johnson increased government spending in a booming economy with full employment causing major imbalances. More dollars were printed and foreigners started to exchange their USA dollars for gold. By 1970, only 55 percent of the USA dollar was backed by gold. By 1971, that ratio had fallen to 22 percent. In support of the dollar, the German Bundesbank or Buba purchased \$4 billion in April 1971. On May 4, 1971, the Bundesbank purchased \$1 billion in 1 day, and on May 5, 1971, it purchased \$1 billion in the first hour of trading, after which intervention was given up and currencies were allowed to float freely. A severe devaluation of the dollar ensued.

While other countries obtained more dollars and exchanged some of them for gold, the USA began running balance of payment deficits to finance the Vietnam War. This placed pressure on the Bretton Woods system leading the USA to break from it in 1971. What ensued was a period of increased inflation in the 1970s in the USA.



Figure 61. Bretton Woods Resort Monetary Conference, New Hampshire, 1944.

Once the USA moved off gold it entered a world of so called fiat currencies or currencies issued by government decree. In that world, there is nothing behind money except the credibility of the government and of the central banks. They had the responsibility of maintaining the stability of the currency. Yet the USA and other countries did not always honor this responsibility because of the ever present tension between maintaining stability of the currency and maintaining full employment or economic growth.

It is becoming more recognized that maintaining full employment and economic growth is a false economy, even though it is required politically to avoid popular discontent and eventually street rioting, rebellion and revolution. Most central bankers and most economists understand that they should not set up full employment and economic growth in opposition to stable currency. Maintaining stable currency domestically is important to building a base for a sustainable prosperity over the long term.

THE GLASS-STEAGALL ACTS I AND II

In 1933, following the Great Depression of 1929, The Emergency Banking Relief Act of 1933 which prohibited citizens from owning gold as money and ordered them to turn it to the government, and the Glass-Steagall Act I and Act II laws were passed. Writer and right wing philosopher Ayn Rand called the confiscation of gold in 1933 by President Franklin Delano Roosevelt, an adult polio victim, whose family's original name was changed from its German origin name of Rosenfeldt to the more American Roosevelt: "Moral cannibalism."

The Banking Relief Act of 1933, also known as the Glass-Steagall Act, forced a separation of commercial and investment banks by preventing commercial banks from underwriting securities. Investment banks were prohibited from taking deposits. It was repealed in 1999. The Glass-Steagall Act worked brilliantly, helping to prevent a major financial crisis. It was replaced by the Graham-Leach-Bliley Act, which ended regulations that prevented the merger of banks, stock brokerage companies, and insurance companies. The American public's interests were thrown to the speculators on Wall Street.

"All the News That's Fit to Print."

The New York Times.

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ROOSEVELT ORDERS 4-DAY BANK HOLIDAY, PUTS EMBARGO ON GOLD, CALLS CONGRESS

HITLER BLOC WINS A REICH MAJORITY; RULES IN PRUSSIA

Stay-at-Homes Turn Out and Give Government 52% of 39,000,000 Record Vote.

NAZIS ROLL UP 17,300,000

Get 44% of Total Poll and Even Wrest the Control of Bavaria From Catholics.

ELECTION IS PEACEFUL

Berlin is Quietly Guarded—The

By FREDERICK T. BIRCHALL.
Special Correspondent to THE NEW YORK TIMES.
BERLIN, Monday, March 6.—With almost mathematical pre-

Hitler's Home In Wide Recoil, Tokyo Hears

Wishes to THE NEW YORK TIMES.
TOKYO, Monday, March 6.—Private information reaching Tokyo states that discontent due to famine conditions is so acute in Soviet Russia that a mob attacked Church Stalin's house in Moscow on Jan. 29 and was driven off by troops after 400 persons had been killed. Other reports from Siberia, partly corroborated by information reaching military circles here, indicate the famine area is widespread. Before disturbances occurred at Irkutsk, and 80,000 here are said to have joined the revolt, including Communists and Red soldiers.

The Japanese discount a good part of these rumors, but they come from too many sources to be entirely ignored. It is believed these disturbances are much more serious than the Soviet Government has admitted.

GERMAN NEAR END CAPES INTO COMA

Death Is Imminent From Shot Aimed by Germans at

JAPANESE PUSH ON IN FIERCE FIGHTING; CHINA CLOSING WALL

Jehol Forces Offer Stouter Resistance of Campaign as They Are Cornered.

BUT LOSE ANOTHER PASS

Chang's Troops at Kupei Bar Retreat Southward to the Peiping Area.

NANKING ADMITS DEFEAT

Assaults "Vital" City, Japanes

By The Associated Press.
TOKYO, March 5.—(Reut.) Japanes news agency dispatches from Changchun (Jehol City) today said the first phase of the Japanese

Relief Wages Will Be Paid Despite Holiday, Gibson Says

Harvey D. Gibson, chairman of the Emergency Unemployment Relief Committee, declared yesterday that the bank holiday would not interfere with the payment of wages to unemployed men and women holding emergency jobs through the committee's work and relief bureau.

"Emergency wages must be paid and some way must be found to pay them," Mr. Gibson said. "I have no doubt that we will find a way to do it. We are not worried about it at all. Arrangements are certainly being made to meet the emergency relief payroll."

The weekly payroll of the committee exceeds \$1,000,000.

BEWILDERED CITY STILL PAYS IN CASH

Continues to Patronize the Theatres and Stores.

HOPEFUL MOOD PREVAILS

BANKS HERE ACT AT ONCE

City Scrip to Be Ready Today or Tomorrow to Replace Currency.

EMERGENCY STEP PRAISED

Financiers Look for Little Interruption in Business Under Federal Program.

'TRUST DEPOSITS' TO AID

Cash Now Can Be Placed in New Accounts and Drawn From—Money—

Clearing House certificates will be issued in New York, if needed, just as soon as they are issued, possibly today and probably not later than tomorrow, as a result of President Roosevelt's proclamation of last night.

The President's Bank Proclamation

WASHINGTON, March 5.—The text of President Roosevelt's proclamation on the banking situation, issued at the White House at 11 o'clock tonight, was as follows:

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA.

A Proclamation

WHEREAS there have been heavy and unwarranted withdrawals of gold and currency from our banking institutions for the purpose of hoarding; and

WHEREAS continuous and increasingly extensive speculative activity abroad in foreign exchange has resulted in severe drains on the nation's stocks of gold; and

WHEREAS these conditions have created a national emergency; and

WHEREAS it is in the best interests of all bank depositors that a period of respite be provided with a view to preventing further hoarding of coin, bullion or currency or speculation in foreign exchange and permitting the application of appropriate measures to protect the interests of our people; and

WHEREAS it is provided in Section 5 (b) of the act of October 6, 1917 (40 stat. L. 411) as amended, "that the President may investigate, regulate or prohibit, under such rules and regulations as he may prescribe, by means of license or otherwise, whoever shall wilfully violate any of the provisions of this act or of any license, rule or regulation issued hereunder, and whoever shall wilfully violate, neglect or refuse to comply with any order of the President issued in compliance with the provisions of this act, shall, upon conviction, be fined not more than \$10,000 or, if a natural person, imprisoned for not more than ten years or both."

Now, therefore, I, Franklin D. Roosevelt, do hereby proclaim that the provisions of the act of October 6, 1917, as amended, shall be enforced in accordance with the provisions of the act of October 6, 1917, as amended, and I do hereby direct that the necessary orders be issued for the enforcement of the act of October 6, 1917, as amended.

USE OF SCRIP AUTHORIZED

President Takes Steps Under Sweeping Law of War Time.

PRISON FOR GOLD HOARDER

The Proclamation Provides for Withdrawals From Banks Against New Deposits.

CONGRESS SITS THURSDAY

Day of Conference With the Cabinet and Financial Men

WASHINGTON, March 6.—To prevent the export, hoarding or sale of gold or silver, coin or bullion or currency, President Roosevelt issued a proclamation at 11 o'clock tonight, in which he au-

Figure 62. Declaration of bank holiday during the Great Depression.

A few days after he was inaugurated as president in March, 1933, President Franklin Delano Roosevelt, a most clever and capable politician in American history, declared a bank holiday and ordered all the people under the jurisdiction of the USA to surrender their gold coins. Although President Roosevelt promised to return the gold after the banking crisis has subsided, this promise was never honored. He marked up the value of gold from \$20.67 to \$35 per ounce, leaving people with paper that is worth $(35 - 20.67) / 20.67 = 14.33 / 20.67 = 0.6932$ or 69 percent less, which effectively devalued the dollar currency by the same amount.

The Glass-Steagall Act I codified into law the fractional reserve banking system, invented by England, whereas banks can issue loans several times the magnitude of what they have on deposit and practically earn interest on money that they do not have on hand. It redefined money held on deposit to include government and commercial obligations or debt.

The Glass-Steagall Act II was enacted to prevent the occurrence of the speculative bubble that occurred in the 1920s as a result of the unsustainable exponential growth in the amount of credit made available by the joining of commercial and investment banking. It separated investment banks from commercial banks.

The unsustainable growth in credit eventually caused a downward spiral of price deflation culminating in the Great Depression. Some measures to mitigate it had in fact an opposite effect, such as the Smoot-Hawley Tariff Act of 1930. In June 1930, Senator Reed Smoot and Representative Willis C. Hawley jacked up tariffs to record levels on more than 20,000 imports into the USA and helped to bring about the Great Depression. The Smoot-Hawley Tariff Act raised import duties to record highs and was a large contributing factor in the length and depth of the Great Depression.

DODD-FRANK ACT OF 2010

After the Financial Crisis of 2008, the USA Congress could have simply reinstated the Glass-Steagall Act. The act was just 37 pages long, but it had worked well. Instead, after bank lobbying, Congress passed the Dodd-Frank Act which is 2,300 pages long. No one is sure what is in it or what it means; but it has added a tangle of regulations.

The act is so long and complicated that it is nicknamed the "Lawyers' and Consultants' Full Employment Act of 2010. The same banks and investment firms that lobbied for the repeal of the Glass-Steagall Act in 1999 that aggressively and successfully lobbied for the Dodd-Frank Act in 2010. While there are some useful features in the Act, the basic problems still remain: Industry insiders were able to assure that business as usual could continue with substantial profits and bonuses.

FINANCIAL CRISIS INQUIRY COMMISSION, 2009

In 2009 the USA Congress created the "Financial Crisis Inquiry Commission" to investigate the causes and consequences of the financial catastrophe that almost brought down the world financial system. They concluded:

"We conclude this crisis was avoidable. The crisis was the result of human action and inaction. The prime example is the Federal Reserve's pivotal failure to stem the flow of toxic mortgages, which it could have done by setting prudent

mortgage lending standards. The Federal Reserve was the one entity empowered to do so and it did not.... We conclude widespread failures in financial regulation and supervision proved devastating to the stability of the nation's financial markets."

According to the Financial Crisis Inquiry Commission, the Federal Reserve failed to use the tools at its disposal to regulate mortgages or bank holding companies or to prevent the abusive lending practices that contributed to the crisis. The central bank did not "recognize the cataclysmic danger posed by the housing bubble to the financial system and refused to take timely action to constrain its growth.". It also: "failed to meet its statutory obligation to establish and maintain prudent mortgage lending standards and to protect against predatory lending."

LIQUIDITY CRISES

Recessions are direct consequence of the reserve bank system. Every dollar comes into the system as debt. Debt incurs interest and more money has to be repaid than is in existence, creating a cycle of liquidity crises.

As a simple example: a reserve bank creates \$100. It lends it to a commercial bank. The interest rate is 10 percent per year. At the end of the year, the commercial bank has to repay \$10. After 10 years, the original \$100 is repaid back to the reserve bank. However, the commercial bank still owes the reserve bank the \$100 principal. The problem is that there now is no money in the system in order to do so since the reserve bank has only created \$100. The only way for the commercial bank to repay the reserve bank is for it or some other entity to borrow more money from the reserve bank. This money would also incur interest, and so on, repeating the vicious cycle.

The outcome of this type of pyramid scheme is always going to be a liquidity crisis. Since the commercial banks are the primary borrowers from the reserve bank, one of the symptoms is a banking crisis. The only way to get out of this situation now is for the reserve bank to inject liquidity and debts to be written down. This new liquidity also now incurs debt continuing the cycle and causing problems later on.

The root cause of the problem is that the incremental reserve banking system is inherently unstable. While it is adopted, the cycles of boom and bust are inevitable

EXORBITANT PRIVILEGE, EURODOLLARS

The dollar based monetary order arose globally in the 1930s and 1940s because the dollar remained a hard currency pegged to gold whilst all the currencies of Europe and Japan were devalued during the Depression and the two world wars.

However, following the Vietnam War, President Richard Nixon at the advice of Secretary of State Henry Kissinger declared that the USA dollar was no longer convertible into gold on August 15, 1971. The USA had been on the gold standard since 1789, and the dollar was convertible at the rate of 1/35th of an ounce of gold per dollar as it had remained for the previous 38 years.

Winston Churchill tried to use the French gold smuggled out of France into Canada, the UK and the USA before the German invasion for the purchase of war materiel. General Charles

de Gaulle vehemently objected to the idea on the basis that this gold would be needed for the reconstruction of France after the war.

From 1968 to 1971 Europe had been receiving dollars from the USA forces stationed in Europe and called them Eurodollars. The European nation were not happy to receive this currency and were busy converting as much as they could to gold. The French, under President Charles de Gaulle, advised by Jacques Rueff as an economic adviser, were converting in the 1960s their dollars into gold; effectively a run on the bank.

Jacques Rueff, had the clearest comprehension of the importance of sound money based on gold specie. In 1965, Charles de Gaulle called a thousand newspapermen together and spoke of the importance of gold as the central element of an international monetary system that would put large and small, rich and poor nations on the same plane.

Charles de Gaulle called the dollar an: “exorbitant (extraordinary) privilege.” Led by President de Gaulle of France, Switzerland, Germany, Italy and France were the main sellers of Eurodollars for gold.



Figure 63. French President Charles de Gaulle advocated a gold standard.

During the war, the USA had accumulated around 26,000 tonnes of gold selling war supplies to the embattled European nations and as war booty. Steadily, the Europeans and others exchanged their euro-dollars for gold. Over time, France ended up with more than 3,000 tonnes; Germany over 3,000 tonnes; Italy more than 3,000 tonnes and Switzerland more than 3,000 tonnes. The USA gold holding dropped to over 8,000 tonnes. The USA "lost" $(26,000 - 8000) / 26,000 = 1.0 - (8/26) = 1.0 - 0.31 = 0.69$ or 69 percent of its gold reserves back then in an effort to keep gold at the then prevalent exchange rate of \$35 per ounce. President Richard Nixon in 1971 decisively stopped the process, and effectively reneged on two centuries of good faith killing the Bretton Woods Agreement; that if imitated by other countries, would have depleted the USA's gold reserves.

Since then all currencies in the world became fiat currencies, or currencies issued by decree, as government issued coupons continued growing in supply at unsustainable exponential rates by the central banks of the world.



Figure 64. President Richard Nixon ended gold convertibility in 1971.

PETRODOLLARS

Prior to the closing of the gold window the oil price stood at \$8 a barrel. Afterwards it moved steadily up to \$35 a barrel and the gold price rose eventually to \$850 an ounce from \$42 an ounce. The shortfall in the total global petroleum supplies came from the countries surrounding the Arabian/Persian Gulf. Each of them needed to rely on a greater power to guarantee the existence of their respective ruling dynasties.

The USA provided this needed protection on condition that the oil suppliers priced their oil in USA dollar, hence the petrodollars were created. This was a “sine qua non” or: “without which, no!” condition. The oil suppliers outside of the USA, except for Russia, depended for their security on the USA as they do today. The USA made it clear that this area and its oil comprised a USA vital interest over which it was prepared to go to war.

Most nations’ petroleum imports comprise 25 percent or more of their imports. Without it, the world’s economies just would not function. Hence the USA held the key to world dominance, petroleum.

It was also clear to the Arabian Persian Gulf and other oil producing nations that if they changed from the USA dollar to any other currency in payment of their oil, they would then lose power. That was President Saddam Hussein’s of Iraq main mistake when he demanded payment for Iraqi oil in Euros. That was also Lybia’s leader Muammar Al Gadhafi when he contemplated the establishment of an African gold-backed currency. Iran demanded payment for its oil in gold and set itself as a target in the cross-hairs of the USA and the UK.

CRITICISM OF THE GOLD STANDARD, ANDREW MELLON’S “LIQUIDATIONIST THEORY”

“The Liquidationist Theory” of Andrew Mellon, the Treasury secretary who is notorious for advising USA President Herbert Hoover during the Great Depression involves many perils. According to President Herbert Hoover as a source, it advises to:

“Liquidate labor, liquidate stocks, liquidate the farmers, liquidate real estate. It will purge the rottenness out of the system. High costs of living and high living will come down. People will work harder, live a more moral life. Values

will be adjusted, and enterprising people will pick up the wrecks from less competent people.”

Federal Reserve Chairperson Ben Bernanke characterized this remark as “pretty heartless.” The Federal Reserve Bank is accused to have helped cause the Great Depression by keeping interest rates high to defend the gold standard, and by letting banks fail. Even though a gold standard would keep inflation lower over the long haul, this is achieved at the cost of severe fluctuations in economic output.

A commitment to a gold standard could not even be credible. The Bank of England stuck to a gold standard for decades because it had adopted a firm commitment to the gold standard. In a modern democracy like the USA, in contrast, the pressure to devalue the dollar to stimulate growth is irresistible. Speculators, realizing that, would undermine the gold standard by demanding gold as a payment medium instead of the depreciating fiat currency.

According to Ben Bernanke, Federal Reserve Bank chairperson, at a lecture at George Washington University, price stability and financial stability as key objectives of the Federal Reserve Bank. Focusing on the latter one first, the Federal Reserve Bank was established to reduce the risk of financial panics. He points out:

"A financial panic is possible in any situation where longer-term, illiquid assets are financed by short-term, liquid liabilities; and in which short-term lenders or depositors may lose confidence in the institution(s) they are financing or become worried that others may lose confidence."

Ben Bernanke goes on to blame the gold standard for these panics. Banks, by definition, have a maturity mismatch, making long-term loans and taking short-term deposits. As such, they are prone to financial panics. To mitigate the risk of financial panics, central banks act as a lender of last resort. This in turn creates incentives for financial institutions to increase leverage and to become too-big-to-fail. To address a panic, the Fed would double down and provide more liquidity, potentially exacerbating future banking panics. After each crisis, new rules are introduced to regulate the banks. The resulting financial system may not be safer, but it will increase barriers to entry, further bolstering the leadership position of existing, too-big-to-fail banks. With all the government guarantees and too-big-to-fail concerns, banks might then be regulated in an attempt to have them act more like utilities. Ultimately, that might make the financial system more stable, but will stifle economic growth. Financial institutions are vital to finance economic growth, as they facilitate risk taking and investment.

The problem of all financial panics is not the gold standard - otherwise, the panic of 2008 would not have happened. The problem of financial panics is that "longer-term, illiquid assets are financed by short-term, liquid liabilities." The key missing element in the argument is “leverage.” The "panic" and the "contagion" may occur when leverage is employed, as it creates a disproportionate number of creditors, including consumers with cash deposits. A way to achieve a more stable financial system is to reduce incentives for leverage through mark-to-market accounting and a requirement to post collateral for leveraged transactions. The financial industry objects to and lobbies against this, arguing that holding a position to maturity renders mark-to-market accounting redundant.

GLASS-STEAGALL ACT II, 1933

The Glass-Steagall Act II enacted in 1933 to limit credit growth and the involvement of banks in the securities markets was repealed in 1999 by President Bill Clinton at the behest of the investment banks. In 1999, Gordon Brown, Chancellor of the Exchequer in England sold 60 percent of the UK's gold reserves allegedly to avoid destabilization of the monetary system by a failing USA bank that made a wrong bet on gold.

A world boom in the 1990s started by the President Ronald Reagan ideology of Reaganomics with its tenet of: "cut taxes and borrow the money because deficits do not matter," that became popular in the 1980s. It collapsed in 2000, but was resuscitated by Federal Reserve Chairperson, from 1987 to 2006, Alan Greenspan's, followed by Ben Bernanke's, negative real interest rates causing a housing bubble and a collateralized debt market collapse in 2008.

The Glass-Steagall Act II prohibited investment banks from acting as commercial banks. Investment banks which make speculative bets could not own commercial banks which accept savings deposits from customers, and thereby risk the savings of the depositors. In 1998-1999, investment banks, insurance companies, and real estate companies contributed \$200 million to USA politicians in order to repeal the act specifically designed to prevent another Great Depression that was caused by excessive financial risk taking. On November 12, 1999, President Bill Clinton signed into law the Gramm-Leach-Bliley Act, which repealed the Glass-Steagall Act of 1933.

Accordingly, the investment bankers gained access to commercial banks deposits generating a huge amount of credit that financed the USA's participation in World War I and culminated in the 1920s stock market bubble. Since then, the dollar has lost 98 percent of its value.

RICARDO'S SUSTAINABLE FREE TRADE SYSTEM

A fiat currency system does not balance trade among nations. Under a pure gold standard, a trade deficit nation faces a money supply decline as gold leaves it to the trade surplus nation, resulting in deflation and lower prices. The trade surplus country faces a money supply increase as gold reaches its shores and inflation occurs and the prices there rise. The shifts in the price levels eventually force the establishment of a new equilibrium in trade, whereas not too much gold is leaving or arriving to either country.

Under such a free market system, as the economist Ricardo observed, both sides gain from trade that is sustainable. Producers are given a true reflection of demand to adjust to in order to adjust the production efficiencies in an optimal allocation of resources to meet the demand.

A fiat currency does not balance trade and gives false messages of unsustainable levels of demand to producers. The surplus country accumulates the other's currency, and the deficit country does not face a decline in its money supply. Trade remains unbalanced. Producers around the world could not distinguish between real-demand currencies and those created under a fiat creation system. Fiat currencies are responsible for the creation of massive debts and cyclical crises. Under a classic gold standard, real decisions are forced about spending by governments. Governments must either borrow from the private sector and displace other investments, or tax their citizens and foreigners to finance their spending programs. Printing money has allowed uncontrolled spending and debt accumulation that would not have been possible otherwise. It has also allowed the launching of otherwise unfinancable conflicts and wars.

Social unrest could also result. A political blogger and forensic psychologist from Tennessee warned about such a possibility by coining the phrase "Going Galt" in the fall of 2008. This is in reference to the 1957 novel "Atlas Shrugged" by right wing writer Ayn Rand, in which

her character John Galt, as a protagonist of the entrepreneurial class leads them into ceasing productive activities in order to starve the government of tax revenues. Sales of novels by Ayn Rand went up and demonstrations by an antigovernment group, the Tea Party, are punctuated by references to “Going Galt” and “Enough.” More significantly, arms and ammunition sales have increased all over the USA reflecting a feeling of lack of safety, as well as applications for concealed weapons permits in states that allow them such as Florida, with a 6 months backlog in their processing.

The Bureau of Labor Statistics, BLS estimates that the dollar currency has lost over 95 percent of its value since the 1913 Federal Reserve Act initiated the dollar fiat currency system. The devaluation has been a disguised tax and way for governments to avoid paying the real cost of their debts to both citizens and foreigners. It has disturbed a principal check and balance upon government spending and borrowing. It has also come at the expense of USA citizens falling into debt.

The USA dollar has been characterized as the worst currency in the world, except for all the others. The entire global currency system is in an unsustainable competition to inflate and dilute one against the others.

LEGALITY OF GOLD STANDARD

The American Constitution mandates a metallic monetary standard for the USA in a clear unambiguous language. Opponents of the gold standard have never been able to amend the USA Constitution so as to formalize the abolition of the gold standard.

In 1933 President Roosevelt confiscated the gold of the USA citizens in return for irredeemable paper money. Switzerland changed its constitution through a referendum.

A key principle supporting a gold standard is that jurisprudence cannot tolerate a double standard of justice. Governments and their departments and agencies must be subject to the same contract law as their citizens. There is no legal ground to allow the Treasury department and the Central Bank to issue obligations which they have neither the means nor the intention to honor, whilst any citizen doing it will be dealt with according to the Criminal Code.

To claim that the gold standard is not practicable is asserting that a government should be exempt from the provisions of its Criminal Code in its dealings with its citizens and with foreigners.

MONETARY METALS

It was suggesting that gold is just one of several marketable commodities, and that a basket of a wider selection could provide a better monetary reserve than gold.

This reasoning is false since the marginal utility of gold declines more slowly than that of any commodity or a basket of commodities.

There exist only two monetary metals: gold and silver. Other precious metals such as platinum and palladium are not monetary metals. Gold and silver are not scarce. In terms of their stocks to flow ratio. Gold and silver are the most abundant metals on Earth. What distinguishes gold and silver apart from other precious metals is their stocks to flow ratio. The stocks to flow ratio has a high value for the monetary metals, but has a small value for the other precious metals.

Holding monetary metals is not investing but is an insurance policy. Like a life, accident, or health insurance policy, one is better off if he never needs to collect.

In a balance sheet, the value of one's assets and liabilities would be thus assessed not at their dollar or euro price, but at their gold equivalent.

MANUFACTURING VERSUS SERVICES, GREATER FOOL THEORY

The Spanish and Portuguese galleons returned from the new world loaded with pillaged silver and gold leading to a period of prosperity. This prosperity was temporary, leading to inflation and higher prices and worse, to a neglect of farming and manufacture. History shows that this resulted in a period of decline that lasted for four centuries.

In the period 2004-2007, the process was repeated in the USA where imported gadgets replaced the flow of silver and gold. Manufacturing and its associated jobs was "outsourced" to distant lands and illusory "smarter" service jobs, particularly risky financial engineering replaced them. The stacked powder kegs eventually blew up in 2008. Luckily farming was not outsourced, since agricultural land, unlike factories, cannot be shipped abroad.

In a "Greater Fool Theory" the financial engineers created a risky tangle of securitization, particularly in the housing industry. Playing with fire, they knew it was all going to blow up at some time. They believed that they would effectively hedge themselves against risk with even more dubious securities. They even believed that they would be more clever and quicker than their competitors in escaping to the exit doors before things got really ugly. This greater fool theory mindset is characteristic of unsustainable bubbles when liquidity suddenly dries up and markets turn for the worse for all of them with no exit doors available.

The unsuspected result was a government that was spending \$1 billion per hour, with unemployment rising to a level of 10 percent in early 2010 in the midst of the largest economic downturn since the 1930s Great depression. Housing prices lost 20 percent of their values, with foreclosures leading to 14 million empty houses with their previous proud family owners dispersed as tenants to cramped apartments and motel rooms, going uncounted in the homeless statistics. According to the Federal Reserve, in 2009, household net worth was \$51.5 trillion, down \$11.2 trillion or 18 percent, from 2007 and marked the first decline since 2002. The government, trying to avoid a total economic meltdown, went on a spending binge committing \$11.7 trillion to bailouts and giveaways to favored financial firms. The bailouts were used by the banks to buy the so-called toxic debt at 20 cents on the dollar then turning back and selling it to the USA government at 60 cents on the dollar.

The blame is conveniently placed on imaginative buzzwords such as "subprime rates losses," "animal spirits" and "market forces" when it should have been known that hedges cannot function if most of the financial institutions are holding the same hedges. "The West was just recycling the East's savings glut," according to USA Federal Reserve Bank chairperson, Ben Bernanke. In the process it built too many shopping malls and too many houses to recycle it.

Total debt in the USA went from 150 percent of Gross Domestic Product (GDP) in the 1980s to 350 percent in 2007. The financial markets panicked when they realized that such debt could not be repaid and has been discounting debt burdened assets since then.

One gloomy solution to liquidate debt was given in 1929 by Treasury Secretary Andrew Mellon: "Liquidate labor, liquidate stocks, liquidate the farmers, and liquidate real estate. It will purge the rottenness of the system. Values will be adjusted, and enterprising people will pick up the wrecks from the less competent people." Andrew Mellon's recipe was not followed by then Presidents Edgar Hoover and Theodore Roosevelt prolonging the duration of the 1930s Great Depression.

PIXEL MONOPOLY GAME MONEY, FINANCIAL MELTDOWN, GLOBAL DEBT LIQUIDATION, CASINO CAPITALISM, 2007-2009

Benoit Mandelbrot, who introduced Chaos Theory and Fractal Geometry mathematics, in 1983 said: “Even though economics is a very old subject, it has not truly come to grips with the main difficulty, which is the inordinate practical importance of a few extreme events.”

Mandelbrot was proven right in a unique twist of events when the USA in 2008-2009 became indebted to its private central bank, the Federal Reserve Bank, to the tune of \$12.8 trillion dollars in order to bail out the national commercial and investment banks and the insurance companies which themselves are privately owned and controlled by the same people. The International Monetary Fund, IMF put losses to the global banking system at \$4 trillion, of which \$2.7 trillion was on USA originated assets, \$1.2 trillion from Europe and \$149 billion from Japan.

In the first years of President George W. Bush administration the banking authorities allowed five investment banks to increase their leverage from 12:1 to an unsustainable 30:1. They also were allowed to give high ratings of AAA to undocumented (no-doc) “garbage” loans that would not be repaid but nevertheless generate phony temporary book entry profits that justify large fees and huge bonuses to the bank employees initiators and brokers. A thirty to one leverage means that the whole capital can be wiped out with just a loss of 3.3 percent. These banks were: Bear Stearns, Lehman Brothers, Merrill Lynch, J.P. Morgan, and Goldman Sachs. The first three did not survive the ensuing crisis five years later, the last two; with the elimination of their three competitors, later prospered with large dollops of practically interest free zero percent Federal Funds rate taxpayers’ money. It was also later disclosed that they would take opposing positions to their own customers. It also helps if you can borrow money at almost no interest and lend it at much higher interest rates.

A collapse of the USA real estate property market in 2007 due to an oversupply of constructed homes that found no buyers resulted in a freeze of the credit markets. This halted growth, leading the world’s biggest financial institutions to report more than \$1.48 trillion of temporary write downs and credit losses. The losses are temporary since the banks foreclosed on their collateral which will eventually find its way back into the market.

The contraction prompted the central banks and governments to cut interest rates and adopt a near Zero Interest Rate Policy (ZIRP) and pledge more than \$12.8 trillion for stimulus programs and rescue measures of the banking and insurance systems. The USA economy lost 5.7 million jobs since the recession began in December 2007, and the jobless rate rose to 8.9-9.1 percent in April-May 2009, the highest since September 1983.

As of March 2007, Treasury secretary Henry Paulson told Americans that the global economy was: “As strong as I have seen it in my business career.” “Our financial institutions are strong,” he added in March 2008. “Our investment banks are strong. Our banks are strong. They are going to be strong for many, many years.” Federal Reserve chairperson Ben Bernanke said in May 2007: “We do not expect significant spillovers from the subprime market to the rest of the economy or to the financial system.” In August 2008, Paulson and Bernanke assured the country that other than perhaps just \$25 billion in bailout money for Fannie Mae and Freddie Mac, the fundamentals of the economy were sound.

The crisis was a reaction to a reported “electronic run on the banks” that resulted in the drawdown of \$550 billion of money market accounts in the USA in just “an hour or two,” starting

at 11 am on September 11, 2008. The Treasury opened up its window to help, pumped \$105 billion in the system and quickly realized they could not stem the panic tide.

The treasury and the Federal Reserve Bank decided to close the operation, close down the money accounts and announce a guarantee of \$250,000 per account so there would not be further panic. On September 15, 2008, Treasury Secretary Paulson and Chairman of the Federal Reserve Ben Bernanke testified before the USA Congress that on the previous Thursday, September 11, an 'electronic run on the USA banking system took place between the hours of 9 and 11 am. That had stop-gaps not been executed, by 2 pm on September 11, 2008, the hemorrhaging of \$5.5 trillion' would have taken place, resulting in the collapse of not only 'the entire economy' of the USA but as well of the world within just '24 hours,' leading to 'the end of our economic and political system as we know it.' The USA responded and gave the banking system \$700 billion in October 2008 to shore up investments that were gone sour.

The date on which the hemorrhaging is said to have taken place, September 11, 2008 is the same date the USA financial headquarters at the World Trade Center were attacked seven years earlier.

FAIR VALUE ACCOUNTING, MARK TO MODEL

The financial manipulation based on "mark to model" rather than "mark to market" casino capitalism that is estimated at more than \$10 trillion perpetrated by those running the world's major financial institutions, brought the financial system to brink of collapse during September / October 2008. The Financial Accounting Standards Board (FASB) revised in 2009 the rules to allow banks and companies to use their best "judgment" to a greater extent in determining the "fair value" of their assets. The FASB also made it easier for companies to avoid having to make impairment charges against earnings when they suffer losses on their investments.

The change in 2009 to using fair value by banks to value their loan portfolios occurred as a result of the Financial Accounting Standards Board (FASB), pressured by USA lawmakers and financial companies, voting to relax fair-value accounting rules. Changes to fair-value, or mark-to-market accounting, approved by the FASB allow companies to use 'significant' judgment in gauging prices of some investments on their books, including mortgage-backed securities. Analysts say the measure may reduce banks' write downs and boost net income."

Fair value is a subjective, judgmental value which is about whatever the banks want it to be in order to manipulate their balance sheets and income statements. If a banks is acquiring paper from another bank, it wants fair to be low; if it is reporting values for it balance sheets, it want fair to be high. In the sense of fair, it is clear that the banks are holding huge sums of bad paper on their balance sheets which are often valued at very inflated figures.

ACCRETABLE YIELD, VIRTUAL PROFITS

There is another accounting manipulation that the banks use to inflate their virtual profits on loans by booking them before they are actually realized. The FASB made it possible for the biggest USA banks to book profits on loans that have not been fully repaid." These profits are called accretable yield, whereby mega banks book income on loans that have reduced credit quality by recognizing the value of the bonds on their balance sheets and the cash flow those securities are expected to earn.

This is cash flow that those banks are expected to earn. The J. P. Morgan firm is reported to have taken on \$118.2 billion in toxic debt when it acquired Washington Mutual Inc. in 2008. As a receiver of that debt, it was allowed to mark that debt down to fair value, or \$88.65 billion. Those same debts may appreciate by some \$29.1 billion over the life of the loans. As these loans are paid back, the difference is booked as profit. This in turn results in inflated earnings, higher stock prices, and generous fees and bonuses for the individuals who engineered the virtual profits.

This occurs when a bank can acquire worthless or bad loans or bonds at a discount from their face value and then proceed to start collecting the loans on the premise that they will be fully paid off. As J. P. Morgan took over Washington Mutual, it took over the outstanding loans at pennies on the dollar on the premise that they were bad with the Washington Mutual stock holders losing the discount amounts of the loans). Once it acquired these loans, it started collecting them or their collateral on the basis of their full amount face value without regard to the discounted amounts that it paid for them.

This situation prevailed in the 1930s during the Great Depression when USA small town banks and their assets were absorbed by larger banking conglomerates.

THE GREAT DEFLATIONARY BANKING CRISIS 2008-2011

A deflationary global crisis started in 2008. At its core was that global production, fed by uncontrolled credit denominated in fiat money, greatly exceeded the consumption that can be financed by the income of the individuals who comprise the world's population. Governments responded by borrowing, printing and spending on an unprecedented scale to absorb the global excess capacity and to prevent asset prices from deflating. These measures cannot continue indefinitely as the structure of the global economy is unstable and unsustainable.

A one-time audit of the USA Federal Reserve revealed that \$16 trillion were secretly advanced to USA banks, corporations and foreign banks during the 2008 panic. Part of it is a case of these banks borrowing \$1 billion overnight, returning it, borrowing it again the next night and running up the total. Accounting for the double counting, the lending reached its peak on December 5, 2008 at \$1.2 trillion. This figure was about three times the size of the USA federal budget deficit that year and more than the total earnings of all federally insured banks in the USA for the decade through 2010.

And the banks that took out those loans are no more solvent now than they were during the panic three years ago. The difference now is they no longer have to apply "mark-to-market" accounting; they can value their "assets" however they damn well please.

The phenomenon of globalization has resulted in a downward pressure on wage rates in the industrialized countries at a time when the abandonment of sound money unleashed an explosion of credit that allowed industrial production around the world to soar. Tens of millions of new manufacturing jobs have been created in developing economies, but adverse demographic trends have prevented wages from rising. The prevailing wage rate in the manufacturing sector is \$5 per day across much of the developing world. Two billion out of the world's seven billion people live on less than \$2 per day. This results in an excess of production relative to purchasing power.

Between 1970 and 2008 the ratio of total credit to GDP rose from 170 percent to 370 percent in the USA as Americans consumers became caught up in the culture of credit. Rapid credit expansion fuelled asset price bubbles in stocks and property that allowed Americans to

continue spending more each year even though average wage rates had stagnated. The rest of the world responded by expanding industrial production to sell into the USA market.

In 2008, when the USA private sector became incapable of supporting its debt load, the driver of global growth, USA consumption, went into reverse, global trade crashed and the global economy spiraled toward disaster.

Governments stepped in and caught the collapsing global economy in a safety net woven with the equivalent of trillions of dollars in deficit spending and trillions more in newly created money. Global demand was maintained by government spending and transfer payments; bankrupt banks were made whole by access to free money from central banks; and asset prices were supported by ample liquidity.

First, the governments' intervention is unsustainable. Second, nothing is being done to address the causes of the crisis: the flaws in the global monetary and trade superstructure, and insufficient aggregate demand.

The USA is the world's largest economy, comprising more than 20 percent of global GDP. Unemployment there is nearly 10 percent. The USA economy is no longer viable because wage rates in the USA manufacturing sector are 40 times higher than wage rates in the developing world. There is no sign that either political party has a strategy that could reverse the country's rapid economic decline. A protectionist backlash against free trade appears increasingly inevitable.

However, USA trade tariffs would be bad for America, terrible for the world and catastrophic for China and all the other countries dependent on export-led growth.

Runaway credit growth, mismanaged trade, financial sector deregulation and numerous other policy mistakes have brought the world to the brink of disaster. If a breakdown of the global economy is to be averted, policymakers must confront the structural nature of this crisis and quickly implement an aggressive strategy to restructure and rebalance the global economy.

With storm clouds appearing in 2007, pressure on the banks to raise their capital ratios and clean up their balance sheets resulted in a credit contraction in 2008 with the banks cutting lending in concert at a rate of 1 percent per month. The banks needed to cleanse their balance sheets of bad loans designated as toxic assets. Accordingly USA bank loans fell at an annual rate of 14 percent from \$7,147 billion to \$6,886 billion within three months to August 2008. Over the four weeks up to August 24, 2008 bank credit shrank at a 9 percent annual rate. This did not happen since the 1930s and the broad M3 money supply fell at a 5 percent annual rate. The M2 money supply shrank at a 12.2 percent and the M1 money supply at a 6.5 percent annual rate. It is not clear why the USA Federal Reserve allowed the process to occur.

The banks acted collectively to cut credit lines and their levels, dried up loans and pressured people to pay off loans and acquiring the collateral from those who could not, all the while discontinuing making loans to businesses and the public. The USA taxpayers provided bailout funds, grants and loans to rescue the big banks from the bad loans they have made. Once the banks are restored to prosperity, they could then start lending again.

A total collapse was averted when the USA taxpayers were forced to underwrite the fraud and cover the losses of figment asset valuations that allowed bank officers collectively to allocate themselves billions of dollars in bonuses. To avert total collapse of the economic system, \$1.8 trillion in initial extra spending for failed financial institutions bailouts, such as Fannie Mae and Freddie Mac, was initiated with an eventual total of \$23.7 trillion to be spent to initiate a "recovery." This resulted in government "unfunded" liabilities in 2012 to soar past \$117 trillion with a USA personal family of 4 share of the national debt topping $117 \times 10^{12} / (315 \times 10^6 / 4) =$

\$1,485,714, and bailouts and “stimulus” spending that burned money at a rate of \$200 million per hour.

By 2015 the unfunded liability is expected to reach \$143.685 trillion. At that point each USA family of four would have a share of this liability of $143.685 \times 10^{12} / (315 \times 10^6 / 4) = \$1.824 \times 10^6$; an unsustainable feat, unless runaway money printing is resorted to.

Bankers operated under the umbrella of “moral hazard.” Moral hazard is how decision makers can become sloppy when they think the risk associated with dangerous behavior is reduced by illusory protection by insurance securities. This is like going bungee cord jumping in at a tourist destination just because one bought the extra travel insurance anyway.

The number of paper dollars in circulation was doubled within about a year from \$800 billion in August 2008 to \$1.7 trillion in October 2009.

To stimulate economic growth, China committed to spend 13 percent of GDP, the USA 5 percent, Germany 2 percent, Japan 2.5 percent, and the UK 1.4 percent. A problem with Europe is the size of the welfare states that do not give much room for fiscal stimulus, whereas as unemployment rises so does government spending and hence the budget deficits widen causing prolonged economic pain for many years.

If in real terms one can consider write-downs of 50 percent in USA equities, 35 percent in USA housing, and 35-40 percent in commercial real estate, we have a total loss of about \$20 trillion of perceived wealth from a peak total of about \$50 trillion. This relates to a GDP of about \$13 trillion, the annual value of all USA produced goods and services.

The International Monetary Fund, IMF estimated that the 2008 global banking crisis would produce about \$1 trillion of losses. President George Bush delivered America’s first \$3 trillion budget. In 2009, the IMF has doubled its estimate of banking sector losses to \$2 trillion, while private economists put the number between \$3 and \$4 trillion. According to the latest estimates, President Barak Obama’s first budget produces a deficit of \$1.8 trillion in 2010.

Table 23. Government spending and debt accumulation.

Year	Federal Government Spending [\$ trillion]	Federal Government Debt [\$ trillion]
2001	1.979	5.812
2002	2.112	6.192
2003	2.261	6.728
2004	2.393	7.345
2005	2.573	7.929
2006	2.728	8.494
2007	2.900	8.989
2008	3.116	9.914
2009	3.757	11.723
2010	3.703	13.390
2011	3.456	14.656

Academics call the situation: “insensitivity to scope.” People can understand something on a small scale but have a difficult time comprehending the same thing on a massive scale. To place the matter into perspective, one trillion seconds equals 31,546 years or 315 centuries, one

trillion dollar bills placed end to end would reach 96.9 million miles, far enough to reach the sun, and at an average new car costs \$28,400, \$1 trillion would buy more than 35 million cars.

Businesses will not make new investments, no matter how badly central bankers want to force-feed them at the trough of newly created money, as long as interest rates are driving down. They would not make an investment today if they were told that tomorrow they could finance it at a cheaper rate. Falling interest rates erode the value of capital, because the return from earlier investments proves insufficient to amortize debt contracted at higher rates. At the end of the capital erosion road comes the realization that production and finance stands bereft of any capital, which results is a credit collapse.

An effect of the repeal of the Glass-Steagall act was to allow commercial and investment banks to consolidate and contributed to the 2007-2008 credit and subprime mortgages financial bubble. It resulted in a de facto nationalization of the western global banks; the undisputed “masters of the universe.” Governments of the world pumped \$4 trillion of tax payers’ funds to get liquidity flowing among the banks that stopped lending to each other for lack of confidence for the repayment of the loans among each other.

The start of the 2007-2008 collapse can be traced back to June 2007 and the subprime mortgage crisis but the financial panic portion of the collapse can be traced to September 15, 2008 when the Lehman Brothers commercial banking was left to seek bankruptcy protection whereas the Bear Stearns Company was bought out by J. P. Morgan Chase in March 2008 with \$30 billion of Federal reserve backed funds. On that day the Dow Jones Industrials (DJI) average closed at 10,917. Four days later the DJI reached a high close of 11,388, then came the deluge and the financial panic of 2008 as the DJI fell 31 per cent in less than a month.

The USA federal government budget balance as a percent of the 2009 GDP reached a negative -13.7 percent. This can be interpreted as about 1/7 of the \$14 trillion of every good and service produced in the USA. With a total debt of \$60 trillion and an economy of \$14 trillion, the USA, with an imperial outreach with a defense allocation using fully 25 percent of its budget and an entitlement share of 50 percent, leaving just 25 percent as real budget , finds itself overextended and in an unsustainable situation.

Table 24. Balance sheet of financial crisis, 2008-2009.

Entity	Sum [\$10 ⁹]
Federal Reserve	
Term Auction Facility, TAF	900
Discount Window Lending	
Commercial Banks	99.2
Investment Banks	56.7
Loans to buy ABCP	76.5
American International Group, AIG	112.5
Bear Stearns	29.5
Term Securities Lending Facility, TSLF	225
Swap Lines	613
Money Market Investor Funding Facility, MMIF	540
Commercial Paper Funding Facility	257

Treasury (Troubled) Asset Relief Program, TARP	700
Other entities:	
Automakers, General Motors, Ford, Chrysler	25
Citigroup	326
Federal Housing Administration, FHA	300
Fannie Mae/Freddie Mac	350
Total	4,610.5

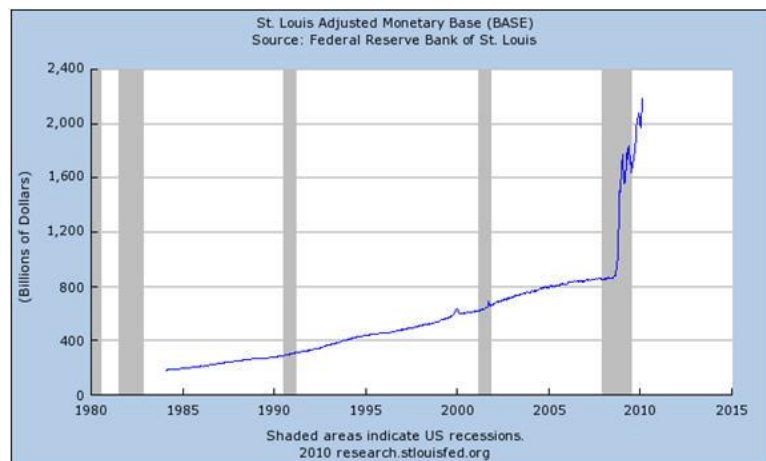
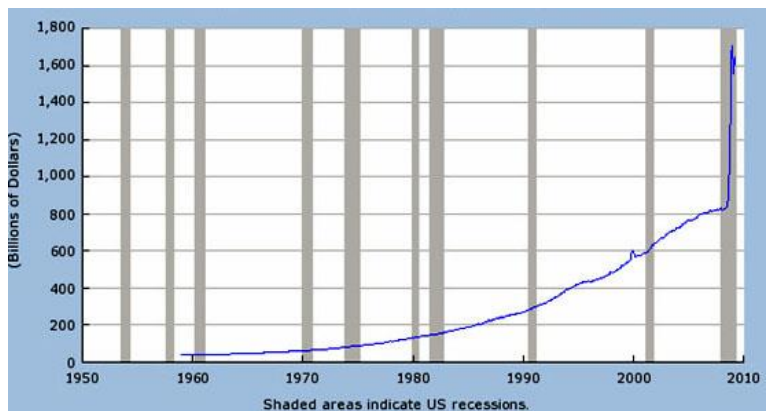
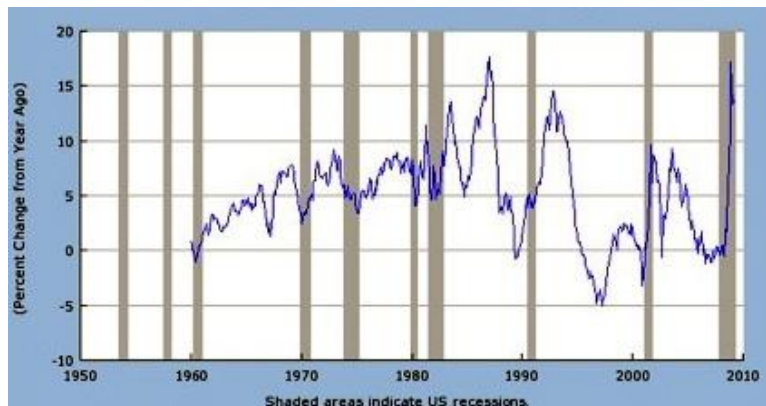


Figure 65. Board of Governors M1 money stock, M1NS, adjusted for changes in the reserve requirements. The Monetary Base (BASE) includes currency in circulation as banknotes and coins as well as commercial bank's reserves with the central bank. Source: Board of Governors of the Federal Reserve System, Federal Reserve Bank of Saint-Louis.

Interest rates have been falling for 28 years from 16 percent in 1980 to 4 percent in 2008. Capital destruction had taken a great toll on the manufacturing and production sector, causing most of the American industry to move overseas where wages were lower. The financial sector was also affected since banking capital, like industrial capital, was also been destroyed by the relentless fall of interest rates.

The press and media placed the blame on bankers and used the word "banksters" to designate them. A joke was made to the effect that calling any of those bankers who helped bring the financial sector to its knees "banksters" was probably doing a disservice to gangsters.

The saying goes: "America sneezes and the rest of the world catches a cold." Europe organized \$1.7 trillion in guarantees on bank loans. Institution and debt were guaranteed by the full faith and credit of the American government leading to the first \$1-2 trillion fiscal deficit in USA history. South Korea guaranteed \$100 billion in bank debt and provided banks \$30 billion in loans. The Dutch government "injected" \$19.6 billion into its ING insurer. As large as these government guarantees and capital injections are these amounts were small compared to the amount of value destroyed in the residential real estate market and in the share market where \$30 trillion has been wiped off the value of global shares. The real estate markets in the USA and the UK imploded.

President Barak Obama administration changed the prevalent accounting rules in order to reduce the reported deficit level. Under the mounting global criticism for its fiscal excesses, it took 'corrective' action by changing the accounting rules for the reporting of the federal deficit. According to a Treasury monthly statement:

"The administration has reclassified prior-month expenditures related to the Emergency Economic Stabilization Act (EESA -- also known as TARP). Consistent with statutory requirements of the Federal Credit Reform Act and EESA, TARP purchases are now being accounted for on a net present value basis, taking into account market risk. Accordingly, budget outlays have been reduced and direct loan financing activity correspondingly increased by \$175 billion."

While such gimmickry continues, it would be lucky to skirt along the boundaries of Generally Accepted Accounting Principles, GAAP based accounting; given the inability of the government to assess 'market risk' within the bounds of reality, this has not been the nature of the monthly deficit reporting.

The USA 2012 budget included a \$1.333 trillion deficit. From July 31, 2011 to January 31, 2012; or within six months, the USA national debt grew from \$14.5 trillion to \$15.4 trillion, an increase of \$1.1 trillion. In comparison, in the first 206 years of the USA's history through August 1982, the USA accumulated a national debt of just \$1.1 trillion.

According to President Ronald Reagan: "Government's view of the economy could be summed up in a few short phrases: If it moves, tax it. If it keeps moving, regulate it. And if it stops moving, subsidize it."

QUANTITATIVE EASING WITH DEBT LIQUIDATION

Central banks electronic money printing has the purpose of monetizing government debt and is one of the primary drivers of inflation. A higher level of monetization is a form of Quantitative Easing (QE), which involves a number of mechanisms to directly spend money printed electronically by the Central Bank without its going through the banking system.

This unique form of QE would involve the direct transfer of financial instruments such as bonds from the Central Bank to its government. The government would be capable of spending money printed electronically without its adding to the government's debt.

In this case, the interest earned on government debt bought by the Federal Reserve Bank printing money, is used to buy government debt from the banks. The government pays the Federal Reserve interest on this debt, most of which then gets recycled back to the government. So effectively the government has free money to spend that it would not have otherwise. The more bonds the Federal Reserve buys, the less net interest the government has to pay.

The interest paid to the government is what is left after \$1 billion in operating expenses, 6 percent interest paid to the member banks, paying interest on reserves, repo interest, and other expenses, without an audit.

In the theoretical case where all of the bonds were owned by the Central Bank, this would mean that the net interest paid by the government on all of its debt would be virtually zero, except for the transactions costs and the cost of maintaining the associated bureaucracy managing the process. Effectively the government would have no debt to service. The reason is that without any interest to pay on it, the debt effectively ceases to exist. This process allows the government to spend money without increasing its net debt burden.

Even more interesting, the government would be actually reducing its debt burden as the debt is actually being liquidated as the net debt interest burden falls towards zero. So as the government debt is disappearing through inflation of the currency, its debt is also being effectively liquidated as the interest the government pays on its debt is going back to itself. This is apparently occurring in many nations without public nor press awareness of the ingenious process.

A governments can thus spend the money on its favorite wars, social programs, and even give away tax cuts. In this case truly "deficits do not matter." In this financial alchemy, a government would be effectively liquidating debt since it does not pay interest on it. It is paying itself the interest on the purchased bonds. The paradox is that the debt continues to exist officially, yet it does not effectively exist.

SECULAR STAGNATION, JAPAN'S LOST DECADE

The economies of the USA and other countries such as Japan, Austria, Ukraine and Greece are expected to grow slower in the future than in the past and present as a result of both demographic factors with aging populations exiting the work force, and a slower pace of productivity gains from technological advances. According to USA Federal Reserve Central Bank Chairperson Janet Yellen: "At an extreme, such developments could even amount to a type of 'secular stagnation,' in which monetary policy would need to keep real interest rates persistently quite low relative to historical norms to promote full employment and price stability, absent a highly expansive fiscal policy [36]."

“Secular stagnation” refers to the theory that an economy may become stuck in a long-term period of slow growth and low interest rates, due to certain external factors. Originally developed in the late 1930s by economist Alvin Hansen, it was revived by former White House economic adviser Larry Summers, who in 2013 asked whether the USA may be mired in secular stagnation.

Alvin Hansen's theory was that a lack of technological innovations could be to blame for the stagnation. Larry Summers, however, was more focused on an exogenous shock. In April 2014, Brown University economists Gauti Eggertsson and Neil Mehrotra published a comprehensive model of secular stagnation, showing how income inequality and a drop in population growth could lead the economy's ideal interest rate to fall. Gaiti Eggertsson and Neil Mehrotra's point is that a surplus of individuals looking to save their money, combined with a paucity of individuals looking to borrow money, can lead the market-clearing interest rate to fall to unusually low levels. If the actual interest rate is too high because it is at historically normal levels, then money will not flow from the would-be providers of income to the potential users of income. That would cause an economy to become mired in slow growth for longer than the economic cycle would predict; consequently making the stagnation secular rather than merely cyclical [36].

While the concept sounds obscure, the prospect is a scary one fraught with pitfalls. The most prominent modern example of a country suffering from secular stagnation is Japan, where a so-called “lost decade” quickly morphed into fully 20 years of fallow growth. Japan's debt to GDP ratio in 2015 reached over 200 percent; the world leader in this category. Japan's grand plan is to devalue the yen, undercut its manufacturing competition, namely China and Germany, increase exports and on the side, eventually pay its debt back with a worthless depreciated currency. With all these measures, Japan has been continuing to run trade deficits, having not put a dent in its trade problems.

Secular stagnation is politically polarizing. In 2014, some members of Congress proposed legislation that the Fed should endeavor to follow the “Taylor Rule,” or John Taylor's equation, which mandates that the Federal Reserve Bank base monetary policy on specific economic measures and suggests an equilibrium interest rate of 2 percent. If we live in a world marked by secular stagnation, the equilibrium rate could even be lower. In such a world, if the Federal Reserve Bank begins to act as if the equilibrium interest rate is higher than it actually is, it could result in “appreciable economic costs.” That may create or elongate a secularly stagnant environment [36].

If secular stagnation predominates, then bond returns remain very low, stock returns fall, and the chance for a financial crisis increases. The risk of pension insolvencies increases, retirement standards of living fall, and the financial viability of the Social Security and Medicare systems is undermined. Secular stagnation refers to a long term, generally interpreted as 10 years or more, period of very little to no economic growth.

“Secular Stagnation: Facts, Causes and Cures”, is an e-book edited by Coen Teulings and Richard Baldwin, and published by the Centre for Economic Policy Research (CEPR). The Contributors to the book include Lawrence Summers and Paul Krugman, as well as numerous economists from such institutions as Harvard, MIT, Oxford, Cambridge, the International Monetary Fund and the Principal Economist for the Executive Board of the European Central Bank.

What matters is the way that the nations of the world fight secular stagnation, which is not so much by adopting low interest rates, but rather creating real negative interest rates in inflation-

adjusted terms. What many leading economists agree upon is that if we are facing a long-term environment of stagnation, then investor behavior has to be changed. The recommended tool of choice for changing investor behavior is effectively to punish those who follow traditional investment strategies. Interest rates are thus forced below the rate of inflation, creating a negative return in inflation-adjusted terms as a matter of policy. This is why banks over the 2008-2015 period were offering almost no interest in checking, savings or money market accounts, even while food and utilities and medical care continued to increase in price.

Traditional investors feel the pain of negative real interest rates as a direct result of a deliberate government policy. Such pain makes people change their behavior. The desired change in behavior is to encourage the adoption of high risk investments to stay ahead of inflation, and alleviate the pain. These risks are ones that people, especially in retirement, would not ordinarily take. However, the theory is that the more people who are driven to seek out risk, then the greater the supply of low cost funds to corporations and innovators, and the greater the resulting business development, and the more jobs that are created, until the stagnation is eventually broken.

A 2015 program of Quantitative Easing (QE) by the European Central Bank deliberately drove interest yields into negative territory and sent investors scrambling for alternatives. It was intended to drive them into taking higher risks that will help create economic development and jobs. For conventional investors, the implications are counter to what is generally assumed in financial planning and pension and retirement planning strategies. The entire basis of those plans, as people are taught, is that they will receive market-based positive returns, and that this interest will compound over time and thereby create wealth for them and fund their retirements.

If people accept the possibility of secular stagnation, then they have to accept the possibility that for years to come as a matter of governmental policy they will lose money if they follow the usual investment advice, as the process of what is supposed to be wealth creation is reversed into an unsustainable process of wealth destruction.

One could foresee the implications if changes in investor behavior occur accordingly on a massive scale. The implications would go well beyond just interest rates, for secular stagnation also means very little economic growth in real terms. Stock returns are driven by economic growth on a fundamental basis. If the economic growth is low or nonexistent, then one should expect much lower stock market returns in the future than in the past.

When enough people are forced to take higher risks with their savings and investments than they would otherwise like to, which is the essence of the measures for fighting secular stagnation, then all of the cheap and easy available money leads to a possibility that a series of financial bubbles will be created. The popping of those financial bubbles can lead to severe financial crises and social dislocations.

The projected funding of the Social Security and Medicare Programs in the USA is based upon the assumption of historic rates of economic growth continuing into the long term future. If this projected growth does not materialize, including the slower growth rates of heavily indebted nations, or the slower growth rates of nations with rapidly aging populations, or future potential economic and/or financial crises, or a shift in economic growth from the Western to the Eastern nations, then a void is created in the future; an emptiness where the phantom wealth which was assumed to be created and counted upon fails to materialize as the assumed growth fails to occur. Secular stagnation is not a doomsday event, but a chronic disease in the future. Hypothetical hoped-for wealth that simply fails to occur.

WHY NOT RETIRE THE DEBT?

A question arises as to why would governments not just retire their debt? The answer is that retiring the debt would shatter the illusion that fiat currencies have real intrinsic values. The financial markets propagate the assumption that government debt will be repaid, even though it will never be repaid. Retiring the debt would send a message of impending money printing to retire the debt, with the consequence that no one would want to buy or hold the thus depreciating currency.

Government bonds and their associated government budget deficits and increased debt is meant to allow people today to live beyond their means, to pay less taxes to finance military adventures or the services they receive. The USA's economy is saturated with an unsustainable debt burden of \$54 trillion or 3.5 times the GDP as of 2012. The USA government has a debt of \$16 trillion, growing at the rate of one trillion / year, larger than the USA economy of \$15 trillion in GDP. The consequence is future inflation as the currency depreciates, and today's debt is unfairly passed on to the future generations in the form of a lowered standard of living.

EMPLOYMENT STATISTICS

Government statistics show different employment figures: The official unemployment or headline unemployment figure, the true full unemployment figure, and the private sector jobs loss. The last category is covered by government deficit spending on temporary nonproductive jobs.

The headline figure of unemployment is the one featured in newspaper articles and business news. This is not the full rate of unemployment. This official rate is known as the U3 rate. It is politically advantageous since the USA Bureau of Labor Statistics calculates unemployment in six different ways: U1 to U6. Only in the U6 statistic are all the categories of unemployment added together.

Table 25. Unemployment percentage statistics, November 2010.

	Unemployment November 2010 [percent]
Headline unemployment, U3	9.8
Full unemployment, U6	7.2
Artificial unemployment	9.0
Total	26.0

The difference between the U3 and U6 statistics are in the treatment of the long term unemployed (those who have not filed an employment application recently) and involuntary part time workers.

Additionally, there has been a major shift in the composition of the USA's economy since World War II. The government's share of the economy increased from 35 percent to 43 percent. Government jobs are replacing private sector jobs. These government jobs are short term unproductive jobs that are financed by massive deficit spending. As of 2011, about 9 percent of the USA's economy is financed by deficit spending; one can simply argue that should that spending disappear, the unemployment rate would jump up correspondingly.

Table 26. Government versus private percentage of the USA's Economy.

	2007	2009
Private sector	65	57
Government sector	35	43

The peak unemployment reached 25 percent in 1933 during the worst part of the Great Depression. Considering the U6 figure and the deficit figure results in a value of 26 percent by November 2010; a value comparable to that of the Great Depression. There may even a hidden multiplier effect raising that value even higher to the 30 percent level.

INFLATION SOURCES

Debt creation is one of the biggest ways the banking system generates inflation. The money multiplier, or fractional reserve ratio, determines how much banks actually need to keep in their coffers to meet withdrawal requests by depositors. The bank have the privilege, granted to them by governments, the rest can be out in the system in the form of loans, speculative investments, and the like.

For a reserve ratio of $p = 0.10 = 10$ percent and a deposit at the bank of \$1,000, the banking system has been granted the privilege by government not to just lent \$900 and keep \$100 as a reserve, but to create roughly $\$1,000 / p = \$1,000 / 0.10 = \$10,000$ in loans off that initial \$1,000. In a sense, the banking system has created inflation by inventing money from the deposit. One of the biggest misconceptions in this dawning age of awareness of the Federal Reserve and what it does is that the Federal Reserve is solely responsible for inflation. While it does set the multiplier value, the central bank itself does not create much of the inflation we experience. That is done in the banking system by creation of 10 times the value of the deposits into loans, and earning interest on the created money.

Each time a debt is taken by a borrower from a bank, he helps the banking system to create inflation, which erodes the purchasing power of the money he just borrowed plus all his other funds. If people stop borrowing enough, inflation would not occur. A fiat monetary system needs inflation to be sustainable.

The government and banking elite would have the populace believe that it is bad loans and falling home prices that cause deflation. Much of the contraction of debt accumulation is forced on people by job losses and/or reduction in earnings because of overcapacity or overproduction that cannot be countered by the available consumption level.

The irony of it is that foregoing unnecessary consumption and additional borrowing and making smart financial decisions is the secret those in charge of the banking system and the upper levels of government do not want known. They encourage borrowing and consumption because inflation is a basis of the existing financial system.

The existing financial system and the money system must be preserved because that is where actual political power is derived in the current paradigm. This is a reason why governments promote entitlement societies. They assist in preserving the fiat paradigm and at the same time maintaining control over the perpetually indebted citizenry living beyond their means with millstones around their necks. The sad fact is that it is totally unnecessary. People in the USA

live by the adage: “It is not what you make, it is what you spend.” It is in this case what they borrow to spend, getting them into trouble as individuals and as a nation.

INFLATION AND GOVERNMENTS WAR FINANCING

Excessive government spending on wars is historically followed by inflation. In the American Civil War in 1861, the Union printed more money, borrowed everything it could, and spent it all to fight back the Confederates rebels. Inflation between 1861 and 1865 ended up at 117 percent for the period at a 16.7 percent annual basis.

In the First World War in 1917, President Woodrow Wilson aggressively emptied the government coffers. Prices increased 126 percent between 1917 and 1918 at a 50.3 percent annual rate.

For the Second World War, in the 1940's the USA went a surge in government spending with prices rising 108 percent between 1941 and 1945 at a 15.7 percent annual rate of inflation.

During the Vietnam War in the 1960's, and during the quest for the “Great Society” the USA government spent in a big way with the result of the “lost decade” of the 1970's and the ensuing stagflation.

The official budget deficit for the fiscal year 2009 was \$1.4 trillion. According to Congressional Budget Office statistics, the deficit is the highest in dollar amounts ever, more than triple 2008 record high. It is 9.9 percent of the annual GDP, the highest since 1945. Outlays increased 18 percent from 2008, while government revenues crashed 17 percent.

Over 60 percent of the annual spending growth came from four sources: President George W. Bush administration's TARP, President Obama's stimulus bill, Fannie Mae and Freddie Mac.

Government's ordinary spending was up across the board in 2009:

- a) War spending (Defense expenses): \$636 billion, up 7.0 percent.
- b) Social Security: \$659 billion, up 8.6 percent.
- c) Medicare: \$428 billion, up 9.8 percent.
- d) Medicaid: \$251 billion, up 24 percent.

The only area with significant declines was the interest payments on public debt, down 23 percent from 2008, only because short term interest rates were brought down to near zero.

In 2009, about one fourth of the USA's total income is earned by 1 percent of its population. That level has only been attained once in its history in 1928, around the start of the last economic depression.

FINANCIAL ENGINEERING, SHADOW BANKING SYSTEM

Financial engineering became a driver of the velocity of money beginning in 1991 initiating the first securitizations of bank loans and mortgage debt at the Merrill Lynch brokerage company. A shadow banking system was created that funded a large part of the credit markets outside the watching eyes of the normal regulatory authorities.

By 2007 the shadow banking system self-destructed upon discovering that the commercial bankers mismatched their liabilities and their assets. They were in fact borrowing on a short term basis and lending on a long term basis and doing it in a highly leveraged fashion, which is an unsustainable process. They were buying up long term assets paying about 5 percent, then they

were selling commercial paper that they convinced and paid the rating agencies to conveniently rate them at an AAA level at about 2 percent interest, resulting in a 3 percent profit spread.

To make things more exciting than a paltry 3 percent profit, leverage at a level of 8 was adopted resulting in a 24 percent return. Now real money was being made in origination fees, commissions and monster bonuses.

The house of cards collapsed and imploded when people became smarter and discovered that the assets on the balance sheets of the various securitizations were not worth what they had been made to appear to be, starting with the so-called subprime mortgages. The commercial paper market simply imploded and initiated the 2007-2009 banking crisis.

HOUSING BOOM, CREDIT DEFAULT SWAPS, COLLATERIZED BASED SECURITIES, MORTGAGE ELECTRONIC REGISTRATION SYSTEM, MERS

The Mortgage Electronic Registration Systems, MERS, is a private company that registers up to 60 million USA mortgages electronically and tracks changes in their ownership. A problem arises because the last many years have seen banks and lenders turn to the use of derivatives to package and sell mortgages to other investors and pension funds around the world. Sometimes, a mortgage on a particular property can pass through several hands before it reaches a final point and time.

If and when the property owner defaults on his note, the question of foreclosure surfaces. Apparently, many/most/all of the MERS recording procedures were made to grant MERS legal rights as nominee instead of recording them with the local clerk of court as assignments. Thus, the agency overseeing these mortgages and following up on foreclosures is MERS in many cases and not the actual owners of the notes.

Historically, banks were able to buy and sell mortgage loans, and when they did, a legal document called an Assignment of Mortgage was always filed in the local clerk's office to prove the loan had changed hands. Filing an Assignment was cheap, costing less than \$10, and it created a paper trail. When the loan changed hands several times, a new Assignment was recorded each time to show who the new owner was. The Assignment process was little more than a boring paper trail formality until the housing boom but it has taken on huge ramifications. The way to link ownership and the right to sue to foreclose with the mortgage was through an Assignment, but there is not always an Assignment.

The reason is that the ownership of the loans which were held by MERS 'as nominee' cannot be proven, and without knowing who owns the loan, the mortgage lien is unenforceable. One of the boiler-plate mortgages during the housing boom often named MERS 'as Nominee.' If a mortgage names MERS 'as nominee' one may very well have a good defense to stop a foreclosure.

The system may seem archaic, but it worked for centuries. Trouble is that some on Wall Street felt it was too slow and costly. In an era of electronic banking, Wall Street wanted a system allowing the instantaneous electronic transfer of entire mortgages, or just pieces of them.

As part of the housing boom Wall Street created a huge electronic swap meet to allow banks to buy and sell their loans electronically. Bundles of mortgages were called Collateralized Backed Securities. They were insured by Credit Default Swaps: CDSs. The entity which acted as the electronic clearing house and filing system keeping track of the loans which were sold is MERS. It was meant to be a modern day substitute for the clerk's office by eliminating filing

fees, and speeding up the trading of mortgage loans. Banks saved over a billion dollars in fees by not paying to have Assignments of Mortgage recorded.

It is unclear how many of 60 million delinquent mortgages by 2009 were handled with MERS designated as Nominee without recording instead of providing for Assignments with recordings. Any and all foreclosures now in the pipeline with MERS listed as nominee may offer a perfect defense. This means the home owner can continue living in the home without paying on his mortgage; and the mortgage holder cannot do anything about it. Many people did just that, living in their homes without making payments on the mortgages.

Many of these mortgages have passed through many hands over many years. Many of the original loan records are now lost or cannot be found. Without the original signed documents, courts are not in any mood to grant foreclosures.

With potentially 60 million mortgages involved, many of them may not be enforceable. In those cases, the property owners can seemingly continue to live on the property without making any loan payments which will only go to promote more damage, vandalism and destruction to the properties.

UNEMPLOYMENT LEVEL

The official USA jobless rate reached 9.5 percent in 2009, the highest rate since 1983, excluding millions of people who have given up on finding work and those forced into working fewer hours than they would like. By July 2009, 57 commercial banks and institutions failed, and more than 15 percent of Americans lived below the poverty line.

Over 1.53 million homeowners were in the foreclosure process in the first half of 2009. Around 1.9 million individual properties were in some form of foreclosure, or one in every 84 USA properties; a major destruction of wealth.

The real national unemployment rate is far worse than the USA Department of Labor's usually shows. That is because the official rate does not include about 3.7 million people who are reluctantly working only part time because of the poor labor market. And it does not include the workers who have given up scouring want ads for seemingly nonexistent jobs.

When these are accounted for, the unemployment rate rises to 15.6 percent. In June of 2009, that number was 9.4 percent, the largest since 1983. The Bureau of Labor Statistics began tracking this alternative measure in 1995.

About 6 million USA citizens lost their jobs over the period December 2007 to June 2009. Those out of work for six months or more, designated as long term unemployed, are not counted in this official statistic and reached another 4 million. Another 9.1 million people were working on a part time basis because they could not land a full time job, and are not also included in the statistic.

IMPERIAL OVERSTRETCH

The USA depends more and more on foreign investors to finance its debt. This was initially favorably during the reigns of Louis IV in France and Philip II in Spain, but eventually ended as disasters. The same situation occurred in the shift of world economic dominance from the then British Empire to the USA around 1941-1945.

According to the metaphor of "Imperial Overstretch" by Yale historian Paul Kennedy who chronicled "The Rise and Fall of the Great Powers":

“As I suggested at that time, a strong person, balanced and muscular, can carry an impressively heavy backpack uphill for a long while. But if that person is losing strength (economic problems), and the weight of the burden remains heavy or even increases (the Bush doctrine), and the terrain becomes more difficult (rise of new Great Powers, international terrorism, failed states), then the once-strong hiker begins to slow and stumble. That is precisely when nimbler, less heavily burdened walkers get closer, draw abreast, and perhaps move ahead.”

Allowing the banking system to go to 30:1 over-leverage based on “value at risk” models and other financial wizardry that clearly neither the banks nor the regulators understood, was unsustainable policy. The 30:1 leverage is not just three times more risky than a 10:1 leverage; it is 25 times more risky.

On October 3, 2008, President George W. Bush signed the Emergency Economic Stabilization Act of 2008. In an unprecedented bailout of the USA banking and insurance businesses, the act initially called by its authors as “Troubled Asset Relief Program,” or TARP, gave Treasury Secretary Henry (Hank) M. Paulson in September 17, 2008 the power to buy worthless “assets” that the banking, insurance and mortgage lending firms wanted to dump, using a massive “bailout package,” that started at \$700 billion and eventually grew to \$12.8 trillion dollar of extra spending; nearly a year’s USA output, also designated as “toxic assets relief program,” “cash for trash” but later designated as the more palatable “rescue plan,” or “emergency economic stabilization plan,” in addition to a “Supplementary Financing Program,” placing him above the law with provisions such as: “The Secretary is authorized to take such actions as the Secretary deems necessary to carry out the authorities in this act without regard to any other provision of law regarding public contracts”, and: “Decisions by the Secretary pursuant to the authority of this Act are non-reviewable and committed to agency discretion, and may not be reviewed by any court of law or any administrative agency.” When Hank Paulson ran Goldman Sachs, he became famous for developing a special unit in the company dedicated to short selling the very mortgage backed securities that another unit in the company was busily selling off to every pension fund they could reach on the planet.

The business model was simple. The banks bought up subprime loans from the knaves who made them. Then they cut them up, slicing and dicing them into tranches of different risk levels. They got the rating agencies to bless them and then they sold them off to naïve investors. The idea was to earn huge fees upfront, while laying the risk onto the greater fools who bought the stuff. When the going was good with housing prices increasing, it looked as though no business could be better. They were providing a valuable public service, helping people buy houses by redistributing the risk from the people who incurred it to people who had no idea it was there. In the process, they earned large fees and bonuses to build large mansions and purchase yachts.

Incidentally, the bailout sum exceeded the cost of the Iraq and Afghanistan wars combined. Over 1.18 million jobs were lost in 2008. The unemployment rate reached 6.5 percent in October 2008, a 14 years high with 10 million unemployed Americans, headed towards 8 percent, with 61 percent of grown adults with jobs; the lowest level in 15 years and employed adult men with jobs at its lowest level since the Bureau of Labor Statistics (BLS) started keeping statistics in 1948. The Commerce Department reported that disposable income fell 8.7 percent in the third quarter of 2008. USA wealth declined: in 2008, USA corporations holdings declined in

value from \$20 trillion to \$12 trillion, a $(20 - 12) / 20 = 8 / 20 = 40 / 100$ or a 40 percent decrease in value, homeowners saw their equity in their homes decrease by \$8 trillion, and the American workers saw a drastic decrease in the value of their savings, pensions and retirement funds..

The \$700 billion bank rescue turned into expenditures of \$850 billion. The Senate packed the measure with \$150 billion worth of “pork” projects favored by key senators as rewards to those who contribute to their reelection campaigns funds. The so-called “sweeteners” included \$397 million for a “domestic production activities deduction” for the motion picture industry, \$33 million for an economic development program in American Samoa, \$100 million in tax breaks for “certain motor sports racing track facilities,” and a \$2 million excise tax exemption for “certain wooden arrows designed for use by children.”

The total bailout cost was initially estimated to be in the range of \$3.2 trillion, and was the largest ever since the Great Depression with an addition to a total federal debt outstanding around \$10.3 trillion and unfunded liabilities of about \$50 trillion. With a follow up TALF program, the total expenditures have reached an astounding estimated \$10-12 trillion.

It is estimated that there is a 10 times multiplier for every dollar the government puts into the banking system, which translates into the result that this new \$3.2 trillion expenditure does not equal just \$3.2 trillion but $3.2 \times 10 = \$32$ trillion infusion into the money supply. That is because every dollar that goes into the banking system will then get lent out to someone, who will then use that dollar to buy goods from someone, who will then use that dollar to hire people. In comparison, the actual reported reserves in the banks in the USA have been just a paltry \$42 billion over the previous decade.

At the Mortgage Bankers Association annual convention in October 2008 members of the political protest group Code Pink showed up at the convention and the groups and walked on stage during a panel discussion on Fannie Mae and Freddie Mac and demanded a moratorium on foreclosures. Meanwhile, outside the Moscone West Convention Center in San Francisco, another group of people picketed as the convention attendees entered in. Their main issue was the \$700 billion bailout, and the battle cry was: “Jail them, don't bail them.” The main point, and the main issue for everyone, is there should be a stop to foreclosures and evictions and the government should be assisting the victims of the crisis and not the people who created it. When the housing bubble became a more general economic crisis, the ways to deal with it were coming from Wall Street and the bankers, and not coming from the point of view of who were the victims of this, people who had been pushed into loans they should never have gotten.”

The banks traded in complex derivatives products between themselves, in what is termed as the over the counter market. The exposure to the Securitized debt packages was further exaggerated by the use of leverage of in many cases more than 30 times the banks’ assets against valuations based on complex models that inflated the packages values during the boom times which allowed huge profits and bonuses to be assigned to the bank managers. The critical point is in the final link in a long chain of sliced and diced debt packages was the USA housing market.

As USA house prices fell, the gap between the real value and the banks inflated model values to boost profits grew, until the crunch point in August 2008, when it dawned on market participants that in actual fact they did not have a clue as to the real value of these mortgage backed securities and hence the credit markets froze as no one wanted to buy something they could not value and nor lend to financial institutions that may default on their obligations. The impact hit all banks, whether or not they had exposure to the USA housing market, as those whose business model relied heavily on short-term money markets to finance long-term mortgages were

in deep trouble. Many banks were left with assets that are worth less than 50 percent of their booked value.

This does not mean a 50 percent loss for the banks on investments. The banks had deployed leverage of as much as 30 times of assets. Capital of say \$100 million is controlling risk of as much as \$3,000 million or \$3 billion. Thus a 50 percent loss results in a loss of value of \$1,500 million. That is fully 15 times the initial capital of \$100 million.

Hence the banks have been reluctant to price their debt packages at the market price as that would mean the bank is effectively bankrupt with losses far greater than the banks' capital base. So the market remained frozen until all of the illiquid mortgage backed debt has been transferred to the tax payers in exchange for liquid cash, hence prompting the USA bailout of 2008.

The banks were able to dump their risky assets on to the Federal Reserve and once they received the newly created cash in exchange for these securities, they loaned this money to the USA government by purchasing USA Treasuries. The Federal Reserve created new money and instead of lending it directly to the USA government, it used the banking system as its conduit. The Federal Reserve created more than a trillion dollars. It also dropped its discount rate to almost zero; thereby allowing banks to borrow money cheaply. The banks were able to obtain inexpensive funding from the Federal Reserve, and went on reinvesting this capital in USA Treasuries. The banks offloaded their toxic assets on to the Federal Reserve and made profit by investing in USA Treasuries and the American government got access to a cheap source of funding its deficit spending and financing its foreign wars.

The \$700 billion bailout appeared to be an exercise in futility. The rescue effort administers one wrong medicine after another: Shunting rotten assets to the balance sheet of the central bank, consolidating banks through forced mergers, and cutting interest rates. These measures compounded the problem.

The crisis was not a subprime crisis or a real estate crisis per se and was not caused by loose lending standards, or by the banks recklessly and aggressively increasing their assets.

The crisis was caused by shriveling capital ratios due to the destruction of manufacturers and bank capital through 28 years of falling interest rates. Falling interest rates destroy capital by increasing the liquidation value of debt. This is an insidious process that leads to capital dissipation.

HOUSE OF CARDS, UNSUSTAINABLE CREDIT "TSUNAMI"

An employee of the Standard and Poor rating agency, according to Bloomberg news was quoted to have said: "Let us hope we are all wealthy and retired by the time this house of cards falters." According to Bloomberg: "And in an investigation over at Moody's...the employees at Moody's Investors Service told executives that issuing dubious credit worthy ratings to mortgage-backed securities made it appear they were incompetent or 'sold our soul to the devil for revenue'".

In a testimony to the USA House Committee of Government Oversight and Reform by former Federal Reserve chairperson Alan Greenspan in October 2008, he described his view of the causes of the 2007-2008 credit bubble as:

"We are in the midst of a once-in-a century credit tsunami. Central banks and governments are being required to take unprecedented measures. You, importantly, represent those on whose behalf economic policy is made, those who are feeling the brunt of the crisis in their workplaces and homes."

“What went wrong with global economic policies that had worked so effectively for nearly four decades? The breakdown has been most apparent in the securitization of home mortgages. The evidence strongly suggests that without the excess demand from securitizers, subprime mortgage originations (undeniably the original source of crisis) would have been far smaller and defaults accordingly far fewer. But subprime mortgages pooled and sold as securities became subject to explosive demand from investors around the world. These mortgage-backed securities being "subprime" were originally offered at what appeared to be exceptionally high risk-adjusted market interest rates. But with USA home prices still rising, delinquency and foreclosure rates were deceptively modest. Losses were minimal. To the most sophisticated investors in the world, they were wrongly viewed as a ‘steal.’”

“The consequent surge in global demand for USA subprime securities by banks, hedge, and pension funds supported by unrealistically positive rating designations by credit agencies was, in my judgment, the core of the problem. Demand became so aggressive that too many securitizers and lenders believed they were able to create and sell mortgage backed securities so quickly that they never put their shareholders' capital at risk and hence did not have the incentive to evaluate the credit quality of what they were selling. Pressures on lenders to supply more "paper" collapsed subprime underwriting standards from 2005 forward. Uncritical acceptance of credit ratings by purchasers of these toxic assets has led to huge losses.”

“It was the failure to properly price such risky assets that precipitated the crisis. In recent decades, a vast risk management and pricing system has evolved, combining the best insights of mathematicians and finance experts supported by major advances in computer and communications technology. A Nobel Prize was awarded for the discovery of the pricing model that underpins much of the advance in derivatives markets. This modern risk management paradigm held sway for decades. The whole intellectual edifice, however, collapsed in the summer of last year because the data inputted into the risk management models generally covered only the past two decades, a period of euphoria. Had instead the models been fitted more appropriately to historic periods of stress, capital requirements would have been much higher and the financial world would be in far better shape today, in my judgment.”

“When in August 2007 markets eventually trashed the credit agencies' rosy ratings, a blanket of uncertainty descended on the investment community. Doubt was indiscriminately cast on the pricing of securities that had any taint of subprime backing. As much as I would prefer it otherwise, in this financial environment I see no choice but to require that all securitizers retain a meaningful part of the securities they issue. This will offset in part market deficiencies stemming from the failures of counterparty surveillance.”

Alan Greenspan was very vocal in his aversion to increasing financial supervision as Fed chairman from August 1987 to January 2006. He said in a May 2005 speech that: “Private regulation generally has proved far better at constraining excessive risk-taking than has government regulation.” It should be noted that during his term at the Fed's helm, Greenspan

repeatedly warned lawmakers against inhibiting markets, such as by tightening oversight of certain types of derivatives.

Economist Milton Friedman was quoted as: “If you put the Federal Government in charge of the Sahara Desert, there would be a shortage of sand within five years.”

Financier Warren Buffett expressed the unsustainability of the situation with a famous farmer story: “Our country has been behaving like an extraordinarily rich family that possesses an immense farm. In order to consume 4 percent more than they produce; that is the trade deficit; we have, day by day, been both selling pieces of the farm and increasing the mortgage on what we still own.” It is a fact that financial policy in the USA is biased toward favoring the banking system, not main-street.

THE CONSUMER AND SERVICES ECONOMY MIRAGE

Simone Wapler describes a consumer economy:

“Of course, a consumer economy requires consumption, but that is not all it requires. Imagine an island where a fisherman, a hairdresser, a doctor and a central banker live. The fisherman sells his fish. The hairdresser cuts hair. And the doctor does whatever doctors do. They all live on their services, using shells for money. The population is stable; everybody does what he is supposed to do. Everyone is fed. They all have nice haircuts. And they all get medical treatment. The number of shells is stable too. That is all there is to the story.”

The explanation to be appended here is that the only way people can get their hair cut two times a day, eat twice as many fish, or get sick more often and expect to get the same treatment they got before is by increasing productivity. This in turn inevitably requires savings and investment. Otherwise, increasing consumption is just not possible. Adding more shells does not affect the productive capacity which remains constant.

A suggestion by the economist Milton Friedman was:

“Money is too important to be left to central bankers. You essentially have a group of unelected people who have enormous power to affect the economy. I have always been in favor of replacing the Fed with a laptop computer, to calculate the monetary base and expand it annually, through war, peace, feast and famine by a predictable 2 percent.”

A sustainable banking system is impossible in conjunction with a fiat currency system and fractional reserve and central banking. A banking system built on a sound foundation would involve adequate oversight so that the bank’s capital is not squandered as top executives bonuses and salaries, a currency that is defined by a specified basket or amount of tangible commodities or “specie,” banks must maintain reserves equal to 100 percent of their demand deposits, the Federal Reserve, USA Mint and the Federal Deposit Insurance Corporation (FDIC) should be liquidated, so that no government guarantee can stand behind bank currency inflation, and assuring that banks remain sound and noninflationary. This situation is unlikely to occur in the foreseeable future, rather, a succession of muddle through cycles of booms and busts can be foreseen. As of December, 2008, the write downs in the global financial system had reached

\$993.9 billion, against \$919 billion in capital, an indication of an insolvent global financial system, except for central banks bailouts issuing fiat currencies.

AUSTRIAN BUSINESS CYCLE THEORY, ABCT

Economists over the past two and a half centuries refined the ABCT theory since Richard Cantillon first discussed it in the 1720's. At some point it was known as the Manchester, England theory and later as the monetary theory of business cycles. It acquired the name "Austrian" because the chief proponents in the late 19th and early 20th centuries were from Vienna. A famous advocate was Friedrich Hayek who won the Nobel Prize in 1974 and wrote the classic book: "Road to Serfdom."

FRIEDRICH HAYEK BOOM AND BUST THEORY

Austrian economist Friedrich A. Hayek won the Nobel Prize for his work showing how the central bank's intervention into the economy gives rise to the boom-bust cycle. Hayek's theory is known as the Austrian theory of the business cycle, and is an alternate to those theories who blame the market for problems caused by the manipulation of money and credit.

According to economist Henry Hazlitt: "The artificial booms a central bank provokes must end "in a crisis and a slump, and...worse than the slump itself may be the public delusion that the slump has been caused, not by the previous inflation, but by the inherent defects of 'capitalism.'"

Central banks can artificially lower interest rates by increasing the supply of money and thus the funds banks have available to lend through the banking system. This is construed to stimulate the economy. What it actually does is to mislead investors into embarking on an investment boom that the artificially low rates seem to validate, but that in fact cannot be sustained under the existing economic conditions.

Investments that would have been allocated as unprofitable are falsely appraised as profitable, and over time the result is the squandering of the available resources in investment that should never have been made.

If lower interest rates are the result of increased savings by the populace, this increase in saved resources provides the material wherewithal to see the additional investment through to completion. The situation is very different when the lower interest rates result from the central banks' creation of new money as credit and book entries. In that case, the lower rates do not reflect an increase in the pool of savings from which investors can draw. The additional investment that the lower rates encourage leads the economy down a path that is unsustainable in the long run. Investment decisions are made that quantitatively and qualitatively diverge from what the economy can support. The boom cannot last, no matter how much new money the central bank creates in a vain attempt to stave off the inevitable bust.

A recession or a depression is the correction phase of the process to restore the economy to a new growth path when the bad investments and supporting created debt are eventually liquidated. The real damage is not created in the corrective phase, but rather in the unsustainable boom phase where capital is misallocated and squandered.

GLOBAL BANKING

Three primary global banking operations exist: the World Bank, the Bank for International Settlements (BIS) and the International Monetary Fund (IMF). The USA Congress has not authorized USA participation in the BIS, yet its central bank; the Federal Reserve does. The BIS clears checks and keeps track of the financial status and accounts of the various nations, relative to each other.

The BIS estimates that there are about \$620 trillion of derivatives floating around the world, and some estimates from others have gone as high as the incomprehensible \$200 quadrillion. The global GDP as the sum total of all the goods and services produced by the world in an entire year is only around \$60 trillion.

The BIS's estimate of \$620 trillion in derivatives means that there are over \$10 in derivatives for every \$1 of global economic activity. This is analogous to a gambler at the roulette wheel betting \$1 while 5 other persons around him each betting each other \$2 on whether the first person wins or loses. The USA Treasury Department says it has 260 million ounces of gold in reserve. At the price of \$1,230 an ounce, it is worth just \$319 billion.

The World Bank makes loans, and the IMF manipulates currencies and financial markets around the world on behalf of the leading international bankers. Other global banking entities are the European Union (EU) central bank and the Bank of Japan. The North American free Trade Agreement (NAFTA) was conceived for North America. Unsubstantiated rumors occasionally pop up about a new currency being under consideration for both North and South America referred to as the Amero.

The world saw a simultaneous global credit bubble and witnessed the mother of all government debt bubbles. This was not just a collection of national bubbles but a kind of Global New Deal. It coalesced into a system where the world's top thirty banks are operating under the supervision of some government panel; a new sanitized form of socialism. The world witnesses the birth of "super banks" and greater control of the levers of global banking and a concerted effort to flood the world with new fiat money which, with a time delay, would eventually translate into a still unsustainable global inflation.

RELATIONSHIP TO ENERGY PRICES

A result that is tied up to the global energy market was that in September 1971, one month after President Nixon pulled the rug from under the world, the Organization of Petroleum Exporting Nations (OPEC) met to decide what to do about the dollar's declining real value. In Resolution XXV.140, they decided that: "Member Countries shall take necessary action ... to offset any adverse effects on the per barrel real income of Member Countries resulting from the international monetary developments of 15 August 1971." Eventually, this took the form of higher prices, as it took more and more depreciating dollars to buy a barrel of oil. They took dollars in payment for their oil, and these dollars mostly ended up buying Treasury bonds. Their own domestic currencies were linked to the diluting dollar, exporting to them USA domestic inflation.

In an analogy introduced by Lew Rockwell: "The monetary issue can be understood by analogy to orange juice. The more water you add, the less substance it has. If you keep adding, eventually you come to the point when you can no longer tell that it was ever orange. This is the same with money."

Overall, the sequential unsustainable exponential growth bubbles keep occurring and collapsing. An even larger speculative bubble than the 1929 one, the so-called dot.com bubble,

occurred in the USA in 2000. Another bubble occurred earlier in Japan in 1990. A 2002-2008 subprime credit and real estate property, subprime credit cards, subprime auto loans, and subprime student loans bubble occurred in the USA.

STUDENT LOANS BUBBLE, INDENTURED SERVITUDE

According to the USA Department of Education, 2/3 of students who earn a bachelor degree use some type of loan to finance their education with an average loan of roughly \$23,000. The New York Times reported that as much as 94 percent of students borrow to get a college degree. The USA taxpayers underwrites roughly \$105 billion / year in Title IV student loans, with \$24 billion going to for profit schools owned by Wall Street asset managers. Student loans guaranteed by the taxpayer are a major source of revenue for the USA higher educational system and if default rates accelerate, it could bring about a serious debt problem to the nation's colleges.

Excessive borrowing for an education will be a dark cloud hanging over this generation for decades. Default rates on student loans for traditional undergraduate and graduate rates are as high as 15.8 percent, and as high as 48 percent for for-profit colleges. The New York Fed reports that nearly one in four student loan holders are falling behind on their student loan payments. Student Loans With Over \$1 Trillion are Likely One of the next popping financial bubbles. Federal student loans interest rates are expected to rise to 6.8 percent on July 1st 2012 from their 3.4 percent base if Congress does not act. Banking lobbies oppose any reduction in interest rates. If Congress does nothing, the average student's \$23 thousand subsidized loan costs will increase an additional \$5,000 over a ten year period.

Barry James Dyke, author of *The Pirates of Manhattan II: Highway to Serfdom*, predicts that student loans, in excess of \$1 trillion, will likely be one of the country's next financial infernos. He states:

“Student loans are a form of indentured servitude as student loans cannot be discharged in bankruptcy (much like due taxes). Student loans do not die with death. Collection agencies can call day and night to collect student loan debts. Garnishment to pay student loan debt is common. Students are not getting enough well-paying jobs to pay back these enormous loans, yet The Department of Education through the Department of Treasury can attach tax refunds to pay off student loans. What is more, our Congress drove the getaway car for academia and the banks in 2005 with the Bankruptcy Abuse and Consumer Protection Act of 2005 — which turned student loans into non-dischargeable debt.”

REGRESSION TO THE MEAN, SELF CORRECTION

Exponential growth is unsustainable. Eventually what grows up exponentially must decay, usually exponentially again. Statisticians call the process: “Regression to the mean.” The “mean value,” “mathematical expectation” or just plain “mean,” identifies the region of normality around which measurements can vary. Whenever a variable ventures into abnormally high or low territory, it will eventually return to the mean.

Variables that eventually regress to the mean are met in everyday life such as atmospheric temperature, frequency of rainfall, wind speed, water current, and for that matter even investment

returns, population growth as well as resource usage; be it water, crop land or fuel supplies. This is what makes exponential growth bubbles self-correcting.

EXCESS LIQUIDITY, MARSHALL K

Excess liquidity is money created in an economy that is beyond what the real economy can absorb. It is measured by a term named after the English economist Alfred Marshall: “Marshall K” as the difference between growth in the money supply and nominal GDP. The measure is the surplus of money that is not absorbed by the real economy. When the money supply grows faster than nominal GDP, then the excess liquidity tends to flow to the financial assets. On the other hand, if the money supply is growing slower than the nominal GDP, then the real economy absorbs more available liquidity. This is a reason why stocks excessively go up, even when the economy is weak, but the money supply is rising.

REINTRODUCTION OF A HARD CURRENCY, TRIFFIN’S DILEMMA

Triffin’s dilemma describes the constant need for the global reserve currency issuer to supply the world with enough of a supply of the reserve currency by way of a long term trade deficit. Eventually, according to Yale economist Robert Triffin, this would lead to a loss of confidence in that reserve currency.

The French financial journal La Tribune reported in April 2009 that much of the world wants to dethrone “King Dollar,” as the world’s reserve currency. The USA dollar dominated the world markets for more than half a century. The UK ceased being the world’s largest economy in the last decade of the 19th century. It was surpassed by the USA, then by Germany, Japan, China and France. The state of California in the USA has a larger economy than UK. The UK and its sterling pound currency were victims of World Wars I and II, with the USA and the dollar taking the lead position.

In September 2009, Heiner Flassback, director of the United Nations Conference on Trade and Development, calling for a new global reserve currency that is composed of many world currencies with an array of adjustable pegs and variable exchange rates suggested that: “An initiative equivalent to Bretton Woods or the European Monetary System is needed.” The advanced justification was: “An economy whose currency is used as a reserve currency is not under the same obligation as others to make the necessary macroeconomic or exchange-rate adjustments for avoiding continuing current account deficits. Thus, the dominance of the dollar as the main means of international payments also played an important role in the build-up of the global imbalances in the run-up to the financial crisis.”

An under the radar movement exists worldwide to return gold as a monetary reserve asset as it was in the 1960s. The justification is that the dollar as a reserve currency has been mismanaged. China, over the period 2003-2009 increased its gold holdings 600 tonnes by 75 percent. It transferred its gold holdings from the State Administration of Foreign Exchange (SAFE) to the People’s Bank of China (PBOC) effectively adding it to its monetary reserves, and not considering it just as a commodity such as copper or petroleum.

On the other hand, the International Monetary Fund, IMF, approved the sale of 403 tonnes of gold from its stocks of 3,217 tonnes, or 103.4 million ounces as part of a plan “to put its finances on a sounder footing and create an endowment with the proceeds.”

There are 49 countries in the world that forbid ownership of gold by their citizens in forms other than jewelry or numismatic coins. The sale and purchase of jewelry is even taxed.

Ahead of a Group of Twenty (G20) summit meeting in London on April 2, 2009, on March 26 2009, the Russian first deputy foreign minister Andrei Denisov called for an international conference to discuss: “The idea of a new global accounting unit or a new global currency,” stoking a debate sparked when Chinese central bank governor Zhou Xiaochuan proposed a “super sovereign reserve currency,” a few days earlier as a replacement to the dollar.

The Russians focused on a basket of currencies or regional currencies which would enable the ruble to gain a par status with the dollar and other key currencies such as the euro.

Venezuelan president Hugo Chavez sought support of the petroleum producing countries for a proposed oil-backed currency.

China worked out bilateral agreements with many of its neighbors and other trading partners such as Argentina, to swap goods rather than use the dollar as a unit of exchange. It also focused on the notional Special Drawing Rights (SDRs) created and held by the International Monetary Fund (IMF) and tracking a basket of major currency values has lost two-thirds of its value against gold in the last 10 years. They are considered as an international reserve asset, created by the IMF in 1969 to supplement the existing official reserves of member countries and support the Bretton Woods fixed exchange rate system. They are allocated to member countries in proportion to their IMF quotas. It was envisioned then that they would become the paper international currency used in international trade and especially in the settlement of accounts. But since the process involved a give-away of these SDRs to key central banks, which are owned by the private international banks, the plan never was acceptable around the world.

The SDRs initially came into being in 1969 as a process to use in international financial settlements. The concept was that they would be a type of currency to replace gold and silver. Instead of nations holding gold, silver and hard currencies as national reserves, the goal was for the world’s nations to hold and use SDRs. They were primarily distributed to the USA, UK, Japan and the European countries with the Asian, African and Latin American third world countries getting a smaller proportion.

By the 1970s, dissatisfaction over the SDRs set in to limit their use and acceptance globally. These SDRs are now based on four currencies-the US dollar, the Japanese yen, the euro and the British pound. They are used largely as a unit of account by the IMF and other international organizations. China wanted to expand the basket of currencies forming the basis of the SDR valuation to include all major currencies including the Chinese yuan and the Russian ruble. It also wanted a settlement system between the SDRs and other currencies so that they can be freely used in international trade and financial transactions. The SDRs would be managed by the IMF and would gradually replace existing reserve currencies.

COST OF LIVING ADJUSTMENT, COLA

Alternatively, responding to the demand of a few economically savvy foreign investors who are in a race to convert their depreciating paper debt assets into tangible assets such as oil and gold, the USA Treasury Department has boosted the sale of Treasury Inflation Protected Securities (TIPS) to concerned investors and holders of USA debt. These are supposed to hold their value as the inflation statistics from the Bureau of Labor Statistics (BLS) rise. These inflation statistics are ingeniously adjusted to an acceptable 2-3 percent level from the actual 10-15 percent level to hold down the Cost of Living Allowance (COLA) paid to the Social Security

recipients of the federal retirement programs and much of the private insurance annuity and retirement programs and even welfare payments in the USA.

Official statistics generated by statisticians on the employ of the federal government accordingly are self-serving and are doctored to suit the governmental goals and differ substantially from the more realistic ones generated by private employ statisticians, and must be weighted accordingly.

Table 27. Inflation statistics from different sources.

Statistic	Government estimate [percent]	Private estimate* [percent]
Annual USA Consumer Price Inflation (August 15, 2012)	1.41	9.02**
Annual USA Consumer Price Inflation (November 17, 2010)	1.17	8.51
USA Unemployment (August 3, 2012)	8.3	22.9
USA Unemployment (November 5, 2010)	9.6	22.5
Gross Domestic Product (GDP) annual growth/decline (July 27, 2012)	+2.21	-2.15
Gross Domestic Product (GDP) annual growth/decline (November 23, 2010)	+3.24	-1.44
USA M3 money supply (August 4, 2012), month of July, year on year (yoy) growth rate	-	2.86

*Shadowstats.com.

**Hyperinflationary threshold is considered as 9 percent.

The USA government in the 1990s changed the way that the CPI-U was reported. The goal then was to reduce the reported rate of inflation along with a resulting reduction in the cost of living adjustments for programs such as Social Security. This enabled the government to reduce the deficit without anyone in Congress having to do the impossible: voting to cut Social Security benefits. What the government tried to do was change the CPI from a fixed-weight index where it effectively measured the cost of inflation, reflecting the ability to maintain a constant standard of living, to a cost of living measure based on the idea that people would substitute hamburger for steak, for example, if steak got too expensive.

This is a declining standard of living measurement. Using the C-CPI would allow the government to knock another 0.6–1 percent off official inflation, further reducing the cost of living adjustments to Social Security, impacting people's retirements.

Since the 1914 founding of the USA Federal Reserve central bank, the USA dollar has lost 95.7 percent of its purchasing power, based on the government's headline CPI number. Based on the ShadowStats inflation estimate, reflecting 1980 methodologies, the dollar has lost 98.9 percent of its purchasing power. In that same 99-year period, the dollar also has lost 98.9 percent of its purchasing power against gold. Gold has fully offset the pummeling effects of domestic inflation on the purchasing power of the USA dollar, as measured over decades.

CURRENCY NATURE OF GOLD

The research firm Ibbotson and Associates used data going back to 1978 capturing an inflationary period. It determined that the price of gold and inflation hold a low correlation factor of 0.08. Thus gold cannot be considered as a commodity that would hold a near unity correlation factor with inflation.

Going back to 1973, the correlation factor between the month-end price of gold and the value of the dollar as reported by the Federal Reserve is a negative -0.45 , a much stronger correlation than with inflation.

If we shorten the time period from the gold's 1980 peak value to 2011, over the 30 years period the correlation factor is a more significant negative -0.65 . When the value of dollar currency is in favor the price of gold retreats, and vice versa. This identifies gold as a currency more than it is a commodity.

As a currency, the gold's price is a gauge of the currency market's concern about the possible diminishment of the purchasing value of the dollar. Since its separation from gold, the dollar has undergone a long downtrend punctuated by periodic of strength. The Federal Reserve's Major Currencies Dollar Index went down by 23 percent since 1973, and down by 45 percent since the dollar's peak value around 1985.

GOLD AND SILVER STANDARD

The Greek philosopher Aristotle defined the basic attributes of "good money" about 2,300 years ago. It has to be durable, divisible, convenient, consistent, and have value by itself. Governments have assigned state monopolies through their public treasuries in association with privately owned central banks the responsibility of creating fiat currencies out of thin air with the added freedom to inflate it infinitely as a form of stealth taxation on their own citizens as well as foreigners and a repayment of debt and obligations to both.

The UK came off the gold standard in 1931. Gold had been the world's monetary system from 4000 BC to 1933 AD. A movement for reintroducing a gold standard is ongoing. A viable alternative to a gold standard could be proposed as the adoption of a basket of useful commodities such as wheat, rice, petroleum, copper, uranium, silver, and gold. According to the sarcastic version of the Golden Rule: "He who holds the gold rules."

Financier George Soros around 2003 shorted out and attempted to crash the Malaysian currency. He had accumulated a fortune earlier shorting the British Pound. Malaysia survived the attack under the leadership of its Prime Minister Mahathir Mohammed.

In 2003, he proposed a pan-Islamic gold dinar and the silver dirham as hard currencies. They are defined in Holy Quran as specific weights of gold and silver. His plans went nowhere at the time because of mistrust between the governments of the Islamic countries. The idea was quashed by the International Monetary Fund (IMF) as illegal, but keeps popping out at every credit cycle and currency depreciation crisis.

China has been encouraging its citizens to accumulate gold for an eventually planned gold-backed yuan currency; which would place them on the map as an international money leader and turn the yuan into a reserve currency. Russia has been consistently buying large amounts of gold reserve on the road to a possibly gold-backed ruble.

The gold dinar coin was reintroduced in 2006 by the Malaysian state of Kelantan. Its introduction was in response to the fact that the Islamic faith, in fact much like Christianity in Medieval times, neither allows the charging nor the acceptance of interest, considering it as usury,

in Latin: “Quidquid sorti accedit, usura est” or: “Whatever exceeds the principal is usury.” At-risk investment and trade with equity that is exposed to gain or loss is encouraged instead.



Figure 66. One Gold dinar 4.25 grams coin introduced by Indonesia.

In the 1780s, Noah Webster and Jeremy Bentham in the USA, succeeded in repealing the then prevalent anti-usury laws. These laws had prohibited lending at interest, except for the king, who usually made himself exempt from them. Banks would pay savers and retirees interest which for most of the 19th century and into the early 20th century was around 5 percent. The banks would lend the savings at a higher interest to businesses and industries which flourished leading to prosperity.

In the early 20th century, the economist John Maynard Keynes convinced President Franklin D. Roosevelt to take the USA off the gold standard which he thought was a “barbarous relic.” Since then bankers and governments colluded into printing so much money that the interest payment on savings has been wiped out and even made negative through currencies devaluation and inflation of the money supply, practically penalizing saving. Governments, through inflation, borrow money when it buys a loaf of bread, and repay the debt when the same money is worth just a slice of the loaf bread, if ever. The result is that retirement of the working classes cannot be achieved based on their savings alone. A social contract was set whereas wealth is taken from the younger workers to support the retired older ones; an unsustainable option for the long term. A “money illusion” was created whereas savers think that they are doing fine financially, but in reality they are going downhill because of the decline in the purchasing power of their savings.

An attempt was made during the period 1944-1971 to revive the gold standard, but President Richard Nixon killed it on August 15, 1971 in favor of an ever inflating money supply

and depreciating fiat currency. Since then a cyclic system of painful inflation episodes that is extinguished by even more painful deflation periods is characteristic of the modern economical system.

A proposal has been floating around for the United Arab Emirates (UAE) to peg its dirham currency to gold. The region has had a bad experience with a fiat currency before. The king of Persia issued a failed fiat paper currency in the year 1294, the first paper currency outside of China.

Even if the UAE owned no gold at all, which is not the case, it would be able to properly adjust the supply of the dirham to meet demand and the UAE would have, in effect, a currency linked to gold. The dirham coin used to be worth 3.207 grams of gold, and circulated alongside another popular Islamic currency, the dinar. The 14th century Islamic scholar Ibn Khaldoun, wrote that the dinar had the weight in gold of 50.4 grains of barley, or 4.25 grams. The Malaysian gold dinar coin contains 4.25 grams of gold. The first standardized gold dinar coins date back from 698 AD also contained 4.25 grams of gold.

In January 2009, the Gulf Cooperation Council (GCC) at its 29th annual summit meeting at Muscat, Oman came out with an approval for the creation of a single currency for the six-nations economic block: Kuwait, Qatar, Oman, Bahrain, Saudi Arabia, and the United Arab Emirates. The implementation awaits the choice of a location for the Central Bank, which would decide with a Monetary Council on the gold reserves for the Central Bank.

Success depends on the collaboration of Saudi Arabia which possesses substantial physical as well as mineral gold reserves. The Saudi Arabian royal family must overcome western objections, particularly from its USA and UK allies, as well as rise above lingering historical sensitivities, seeking a common benefit. The ruling Faisal family of Saudi Arabia is reported to descend from Edomite tribes that historically dwelled in the ancient Hashemite kingdom; today's Jordan. The current Hashemite king Abdallah of Jordan and his father King Hussein are renowned to descend from the Sharif Hussein bin Ali who was the Emir of Mecca. The British at the time of Lawrence of Arabia during World War I allied themselves with the Emir Faisal I to defeat the Ottoman Turks and helped him establish the Kingdom of Saudi Arabia.

The Arabic word “Khaliji” or “Of the gulf” has been adopted for the new currency as a ‘G’ symbol with a central vertical bar appearing like in the dollar and euro currencies. The argument for its adoption is that having a gold and silver backed currency is considered as a way of removing usury, or riba from the financial system according to Islamic economic jurisprudence.

Usury or riba is explicitly forbidden in the Holy Quran:

“2: 175 God has permitted trade and has forbidden usury”

“3:130 O you who have believed, do not consume usury, doubled and multiplied, and fear God that you may be successful”

Usury is considered as one of the “seven heinous sins” or “Al Sabaa Al Mübiqat,” in Islam. These are: the association in worship of other entities other than God (Al Shirk), the practice of witchcraft (Al Sihr), suicide or to take unjustly a life that God has forbidden, consuming usury (Al Riba), the unlawfully taking of orphans’ wealth, fleeing from a battlefield, and to falsely accusing chaste believing women. The Prophet Mohammed in his farewell address or last sermon on 10 Zul Hajj, 10 HC (Hegraic Calendar), chastised his followers from using

usury: “God has judged that there shall be no usury.” Islam considers usury as an unjust way of accumulating wealth, which it encourages to be fairly distributed for social justice through the acts of the mandatory Alms or Zakat as a yearly 2 ½ percent of the value of real possessions and capital, the voluntary Charity or Sadaka to the needy, and the laws of inheritance.



Figure 67. Symbol of the gold backed gulf khaliji and the Burg Khalifa, Dubai, the world's tallest freestanding structure (2014): \$1.5 billion, 828 m, 2,717 ft, 160 stories high. An observation deck exists two thirds of the way up at the 124th floor.





Figure 68. Gold coin dating back to the time of Alexander the Great. Roman gold aureus and silver denarius.

The Middle East petroleum traded on the Dubai Mercantile Exchange could then be priced in a gold linked dirham, dinar or khaliiji. The world would have a hard currency again, as the dollar was before 1971. The khaliiji would immediately become an international currency and the UAE would get into the lucrative global currency business. They could issue bonds denominated in the gold khaliiji, whose interest rates would fall to low levels. In fact these debt securities do not need to pay any interest at all according the Islamic Law which strictly prohibits usury, since their value would be pegged to gold. They can be sold discounted at a fixed discount rate that provides a fair fixed storage, management and administration cost in addition to a factor accounting for the appreciation or depreciation in the price level of gold or the commodities basket; within, say, 6 percent. Incidentally, the privately owned USA Federal Reserve central bank makes a profit at a maximum 6 percent level of about \$48 billion/year on its roughly \$800 billion of USA Treasury bonds holdings.

On the other hand, one can quote: “Gold won’t always get you good soldiers, but good soldiers will always get you gold.”

Table 28. Gold Appreciation against 13 currencies, 1999-2009. Gold appreciation implies currency depreciation. Source: International Monetary Fund, IMF.

Currency	Decade 1999-2009 Gain [percent]
USA dollar	292
Euro	181
Japanese yen	249
Chinese yuan	249
UK pound	298
Brazilian real	273
South African rand	365
Canadian dollar	179
Indian rupee	313
Mexican peso	434
Russian ruble	310
Australian dollar	182
South Korean won	299

As discussed by Nathan Lewis: “When the British pound was pegged to gold from 1823 to 1914, a ninety one year stretch, the average interest rate on Consols - government bonds of

infinite maturity - was 3.14 percent. It never rose above 4.0 percent. In the past century, no central bank has ever managed such a record of success. After four decades of experimentation with floating currencies, nothing has ever come close to the performance of a gold standard in action.”

It is much a matter of luck that the disunited, squabbling and utterly uninformed Arab, Islamic, and Asian countries have so far missed on the opportunity to start a new currency that is based on gold or a basket of tangible commodities. According to supporters of the concept, such a feat would have had great historical significance, in that it would have saved the world from the threat of a new Dark Age resulting from an unsustainable and dysfunctional global system of fiat currencies plagued with periodic crises and bubbles. It would have passed the lighthouse of human civilization from the West to the East, positioning the Orient to lead the world into a mutual sustainable and stable prosperity based on fairness and freedom from serfdom. As an ultimate bonus, raising funds and issuing government bonds to finance wars would not be possible to be created anymore “out of thin air,” resulting in a more stable and more peaceful world.

STABLE GOLD-PEGGED CURRENCY

Stable Money is superior to Unstable Money. “Stable Money” is money that is stable in value. Capitalist economies work best with conditions of stable money. “Discretionary” monetary policy does not solve any problems, and actually causes new ones.

Gold is stable in value. Unlike other commodities, gold does not go up and down in value. It is the premier monetary commodity, and has been for literally thousands of years. Although it is a bit of a stretch to assume that gold is perfectly unchanging in value, after centuries of experience, it is established that it is sufficiently stable in value to serve its purpose as a monetary benchmark. Gold is a better measure of stable value than any other available reference or statistical concoction.

If a currency’s value is pegged to gold, that currency will be as stable as gold. A gold-value peg is the best means to accomplish our goal of stable currency value. For the last 500 years, every government that has wished to implement a stable-currency policy has used some variant of a gold standard. There is no need to invent another, inferior solution.

A token currency, whether coins or notes, can be pegged to gold via the adjustment of the money supply. “Supply” is technically known as “base money,” which consists of notes, coins, and bank reserves. If the currency’s value sags below its gold peg, then supply is reduced. If the currency’s value is higher than its gold peg, supply is increased. No gold bullion is needed to maintain this peg: only a mechanism to increase and decrease the supply of base money. Central banks accomplish this today by buying and selling government bonds in “unsterilized” transactions. This is effectively the same as currency board systems in use today.

A “lender of last resort” can be provided within the context of a gold standard. The original “lender of last resort,” or what is today called a central bank, was the Bank of England during the 19th century. The Bank of England was also the world’s premier champion of the gold standard. The Federal Reserve in the USA was originally constituted in 1913 to serve as a “lender of last resort” within the context of a gold standard system, and did so for 58 years until 1971. Central banks’ original purpose was perverted during the 20th century due to the rise of manipulated fiat currencies.

DEBIT CARD BASED GOLD/SILVER-BASED CURRENCY

A proposed creative way for a silver/gold-based currency is for a financial entity, such as a bank, a brokerage, or a credit card company simile, to acquire gold and/or silver and store it in its vaults. It could issue silver and gold debit cards backed by the silver and the gold. Consumers send in money to buy a chunk of silver or gold, then use the silver debit cards at participating retail establishments. The price paid for the silver or the gold would account for the fluctuations in the market value of the currency that is used to purchase it.

Eventually, the retailers sell back the silver/gold to the financial entity which sells it again to the consumers. The financial entity charges a couple percent points as profit from the retailers and the consumers for its management, in the tradition of credit cards companies, at each stage of these transactions. The physical silver or gold never leaves the financial entity's vault.

To preserve its customers' confidence, the financial entity would strictly refrain from adopting the tradition of fractional reserve banking of selling more silver or gold than it actually has in the vault, hence avoids debt creation. The more nervous people are about negative interest rates on their money in the banks, of banks bail-ins, and the more uncertain people are about fiat currency; the more this proposed strategy would be sustainable and successful.

REGIONAL OIL-BASED CURRENCY: THE SUCRE

An alliance of Latin American and Caribbean governments discussed the creation of a regional electronic currency that was expected to circulate by 2010. Venezuelan president Hugo Chavez has urged his allies to stop storing currency reserves in dollars and proposed creating an international currency backed by oil reserves.

The new currency is to be called the "sucre" and is to be built around the Bolivarian Alternative for the Americas, ALBA trade bloc of nations. The word sucre is an acronym of: the Sistema Único de Compensación Regional, which can be translated into English to mean the "Unique System for Regional Compensation". Sucre, as the name of the currency, honors Antonio Jose de Sucre, a South American independence hero.

The idea of a regional monetary zone with the sucre as its currency unit was first proposed at the Third Extraordinary Summit of ALBA in Caracas, Venezuela on November 26, 2008 in order to reduce the dependence on the USA dollar as a reserve currency in the world economy.

The ALBA group of nations is a trade group based on the Bolivian Alternative for the Americas. ALBA includes the Latin American countries of Bolivia, Cuba, Dominica, Honduras, Nicaragua, and Venezuela. It is a regional organization founded in 2004 under the initiative of Venezuela and Cuba to counter the USA-led Free Trade Area of the Americas, FTAA which collapsed at its fourth summit at Mar del Plata, Argentina in 2005. Besides the six ALBA nations, Ecuador, Paraguay, St. Vincent-Grenadines and Grenada and possibly Haiti will also participate in the new sucre money system.

The ALBA countries and their allies plan to begin using the virtual sucre, with future plans to convert it into a hard currency. The sucre system would have four branches: The Regional Monetary Council, The Sucre currency itself, the Central Clearing House, and a regional reserve and emergency fund.

INTERNATIONAL SPECIAL DRAWING RIGHTS, SDRs

Talks abound on the possible adoption of a basket of currencies which underpin the International Monetary Fund's Special Drawing Rights: SDRs.

This includes encouraging a greater role for the SDR itself as a reserve currency, in an effort to move away from dollar hegemony. France and China are keen for the IMF to broaden the currencies that make up its SDR international reserve assets from the current basket of dollars, euros, yens and pounds sterling.

China wants to promote the use of SDRs for pricing commodities and in global trade and adding its renminbi currency to the basket. Russia has championed the SDRs, advocates adding the ruble to the basket of currencies, and recruited fellow emerging heavyweights China, Brazil and India to promote it as a reserve currency.

As the Federal Reserve central bank in the USA keeps up quantitative easing and printing money as a hidden tax on its citizens and the rest of the world by debasing its currency, the USA adopts tax cuts and deficit spending, continually issues bonds to finance its unending foreign wars, and its Congress fails to curb spending on its favored social programs; the faith in the dollar as a global reserve currency is unsustainable and it is likely to continue diminishing. Eventually it will be replaced by another form of a global reserve currency.

GROSS DOMESTIC PRODUCT, GDP, KEYNESIAN ECONOMICS

The Gross Domestic Product, GDP, for a given nation is defined as:

$$GDP = C + I + G + (X - M)$$

where : C = Consumption, personal and business,

I = Investments,

G = Government spending,

$(X - M)$ = Exports - Imports.

The Keynesian school of economics argues that when there is a drop in the Consumption C due to a recession that the Government deficit spending G must be raised to offset the drop. Another alternative is to increase the trade surplus $(X-M)$; which is a difficult task. This is the basis of the argument advocating stimulus deficit spending in many world economies. The stimulus spending would help keep a recession from turning into a depression.

The hope is that as a recovery takes hold, this will allow the Consumption C to rise so that there is no more need for government deficits spending. Lord John Maynard Keynes argued that governments should run surpluses in good times and accept deficits in bad periods. This is conveniently forgotten by most governments, incurring deficits in both good and bad times.

If the Government spending G is reduced, this has a negative effect on the GDP in the short run. In recoveries, the growth of the private sector usually overcomes the negative effect.

With continuous deficit spending, bond investors start to ask for higher rates for government debt and then the interest rates would increase dramatically. On the other hand, reducing the deficit too fast could return the country back into a recession.

The deficit reduction will reduce the GDP. As less taxes are collected, this makes the deficits worse implying more cuts than planned, which means further lower tax receipts in a vicious feedback cycle.

For a country which cannot print its own currency such as Greece, Spain or Ireland (being members of the European Union), the only way it can return to competitiveness is to decrease the

cost of production. This is primarily achieved by a deflation of the economy through a reduction in labor cost resulting in less tax receipts, recession as well as social unrest.

For a country that issues its own currency, inflation is the recourse to eliminate the debt incurred from the issuance of bonds for deficit spending.

THE CASE FOR AND AGAINST GOLD, THE BARBAROUS RELIC

Economists Arthur Rolnick and Warren Weber from the Federal Reserve Bank of Minneapolis, concluded that gold and silver standards consistently outperform fiat standards by analyzing data over many decades for a large sample of countries. They found that “every country in our sample experienced a higher rate of inflation in the period during which it was operating under a fiat standard than in the period during which it was operating under a commodity standard.” Thus economists who promote the government approach of Keynesian economics fail to comprehend the damaging consequences of spurring economic activity through a money illusion.

A move toward a new international monetary system based on gold will more likely take place in the USA through grass-roots efforts. “The Indiana Honest Money Act” would allow citizens the option of paying in or receiving back gold, silver or the equivalent electronic receipt as an alternative to Federal Reserve notes for all transactions conducted with the state of Indiana.”

On the other hand, financier Warren E. Buffett, in a 1998 speech at Harvard University, gave no quarter to the yellow metal. Gold, he stated, “gets dug out of the ground in Africa, or someplace. Then we melt it down, dig another hole, bury it again and pay people to stand around guarding it. It has no utility. Anyone watching from Mars would be scratching their head.” More recently, in his 2011 annual Berkshire Hathaway letter, Buffett took another sharp wire brush to gold. He called gold an “unproductive” asset that will “never produce anything.” Gold, declared Buffett in that same 2011 letter, reflects a “buyer’s hope that someone else... will pay more for [it] in the future.” According to Warren E. Buffet, gold as an asset “will remain lifeless forever,” and Gold prices are held aloft “by the belief that others will desire it even more avidly in the future.”

Niall Ferguson, Harvard economist and Oxford scholar wrote: “Gold is demonstrably not the ultimate inflation hedge. Nor is it anything much compared to stocks, bonds or real estate. Gold has a future of course, but mainly as jewelry.” This is the opinion adopted by the majority of economists, historians and financial writers. In their view gold is a historical relic that deserves to be scorned, along with human sacrifice as primitive, brutish and uncivilized.

John Maynard Keynes in 1945 expressed this general opinion: “Was it not I, who wrote that ‘Gold is a barbarous relic’?”

Many contend that gold has primarily been an investment of last resort, attractive more for its popularity during a crisis of confidence in the financial system than for its inherent value. Central banks of the world buy gold at its highest price point to protect themselves against a theoretical run on their currencies, hedge funds buy gold to hedge against their more lucrative higher risk investments, and institutions buy gold following the rest of the crowd like lemmings falling off a cliff to their ultimate fate.

What supports this view is that gold does not pay interest and provides no enticing income yield stream like other investments. Its value comes primarily from the fact that it holds its value over the long term. The economist Stephen Harmston wrote: “It is said that an ounce of gold

bought 350 loaves of bread in the time of Nebuchadnezzar, king of Babylon, who died in 562 BC. The same ounce of gold still buys approximately 350 loaves of bread today. Across 2,500 years, gold has in other words retained its purchasing power, relative to bread at least.”

The fact is that in the 20th century, a flood of fresh competitors for investment wealth outshone gold as a source of wealth acquisition. Gold retains its luster only in times of financial crises when bonds are oversupplied and threatening to default, stock earnings tumble eroding their face values, and fiat paper currencies are diluted and inflated into oblivion: “He who owns the gold, makes the rules.”

THE BASIS, CONTANGO AND BACKWARDATION

Great wealth can be accumulated if Malaysia and the UAE followed the smart example of China by selling their gold short on the world market while retaining physical control of it. What they would be doing is “trading the basis;” a practice widely used in the grain trade.

The “basis” is the difference between the future price and the cash price of a commodity. It is the price of the active nearby futures contract minus the cash price of the physical commodity. In the commodity futures markets the technical term for a positive basis is “contango.” That for a negative basis is “backwardation.”

A contango situation implies the existence of an ample supply of the commodity in the warehouses available for immediate delivery. Backwardation implies shortages of the commodity. The basis is limited on the upside by the carrying charges. However, there is no limit on the downside as the basis can fall to any negative value, meaning that the cash price can exceed the futures price by any amount, in the case of a shortage.

The basis is the signal telling a warehouse operator about the state of demand for his warehouse space. A positive basis is the market price of available space in the warehouses. It tends to be low when warehouses have a lot of vacant space to fill, and high when they are close to full. The basis helps to allocate scarce warehouse space between competing uses; and it guides the warehouse operator in telling how fast he should fill his vacant warehouse space, or how fast he should make space available for alternative and more urgent uses. He must decide which commodity to buy and which to sell. The warehouse operator should buy the commodity with the higher basis and sell the one with the lower basis.

Backwardation indicates an abnormal condition of a shortage, whether it is due to insufficient production, increased consumption, or lack of foresight in providing sufficient supplies to cover future needs.

Economist John Maynard Keynes “normal backwardation” theory does not appear to match reality. In his “Treatise on Money” in 1930 he developed a theory of the futures markets and introduced the concept of “normal backwardation.” Backwardation is considered as the normal condition of the futures market so that, by implication, the contango situation is “abnormal.” According to Keynes, backwardation, or discount on the futures price as compared to the spot price, is a necessary incentive that is supposed to persuade speculators to buy forward contracts. In his view the discount is just the “insurance premium” that speculators collect for shouldering the risk that the price of the commodity may fall during the time-span to delivery.

The fact is that the normal condition of the futures markets is that of contango; not backwardation, whereby the futures price is at a premium compared to the spot price. The premium accrues to the warehouse operator who carries the physical commodity while hedging it by selling an equal amount of futures.

John Maynard Keynes' renowned misstep in introducing the misnomer "normal backwardation" is considered by many economists as second only to that of Karl Marx who introduced the "theory of value" according to which labor is the exclusive source of value, so that the value of merchandise is directly proportional to its labor content. Accordingly, a government can create value by burying bottle caps in the ground and then letting people prospect for them and dig them out at great cost in labor, as has been suggested by John Maynard Keynes.

Another misstep of Keynesian economics is the obsession with the idea of overproduction and with the need to fight it by all available means. It dismisses the real world situation where scarcity is the basic human need an increasingly large humanity has to worry about, not overproduction.

TRADING THE BASIS IN GRAIN AND SILVER

Astute official Chinese traders have discovered a fact, kept under tight wraps, that has escaped the Western nations: that they can derive for China a silver income from its silver reserves by covered short selling; effectively trading the basis or carrying charge, even while retaining the actual physical control of the silver hoard; which has been diligently done according to many observers around 2007-2009.

The grain trade rivals the oil trade worldwide. Grain companies have long learned how to use futures contracts effectively to manage risk, and to maximize income from their grain storage elevators. A major development was the introduction of basis trading as a form of dynamic hedging, to replace price trading. In the grain market, the basis is the difference between the futures price and the local cash price of the grain at the grain elevator or terminal. The basis varies from one location to another and seasonally from one delivery month to another in a somehow quite predictable fashion.

Trading the basis means buying or selling hedged grain. It is systematically done irrespective of the price in the following way:

- a) The grain merchant goes long the basis by purchasing hedged grain when the basis is wide or possibly positive, and then selling the basis when it is narrow or becomes possibly negative.
- b) He goes short the basis by selling hedged grain first when the basis is narrow or possibly negative, and selling it later when the basis is wide.

Since most grain production is sold to the ultimate consumer within the year of production, the grain basis possesses a characteristic yearly cycle with a trough just before harvest and a peak just after harvest. The abundance of grain supplies kept the market stable. Under that condition, the opportunity for trading is confined to buying and holding grain. This is designated as the "carry trade" involving buying when the basis is at its highest and selling when it is at its lowest. The basis has been following a consistent pattern and as it declines from harvest to the end of the crop year, the grain trade is provided with a reliable source of income.

In contrast, the silver basis is not cyclic. Silver is typically accumulated year after year by investors and bullion banks. Thus, instead of an annual cycle following the crop year, the silver basis has a long term declining trend that is a strong hint of a slowly developing shortage.

Home mortgages denominated in gold have been available in Vietnam for some time. Some shopkeepers were adjusting their retail prices according to the gold exchange rate. They were in effect operating on an underground gold standard.

One normally has to release control of saved money in order to earn interest income and consequently assume the risk that the borrower may default. However, if physical control is not given up, then one can have a durable risk free profit opportunity in holding monetary metals in

the balance sheet using the avenue of covered short selling. That is possible since the price of monetary metals fluctuates.

The price fluctuation of a monetary metal, like the flow and ebb of the oceans, represents energy that can be harnessed only by those who understand monetary economics.

The reinstatement of a de facto gold standard is a reflection of the resentment of the developing world, which has barely started to figure out how it has been expropriated of its resources, wealth and labor by the fiat monetary systems in which bankers in collusion with governments accumulate real goods in exchange for colored printed paper, entries in spread sheets, balance books, electrons flowing in computers wiring and pixels glittering on computer screens.

Financier J.P. Morgan said: "Gold is money and everything else is not". A variation is that: "Gold is money and everything else is credit". Credit is as dependable as the solvency of the debtor, which in turn infers the existence of an unsustainable debt system that is prone to sudden disintegration.

GOLD REPATRIATION

Repatriation of gold got underway in 2011 when the government of Venezuela led by President Hugo Chavez repatriated Venezuela's gold reserves. That also coincided with the top in gold prices.

Some believe that the suppression of gold prices has been led by the Bullion banks: Barclays Bank, Scotia Moccata, Deutsche Bank, JP Morgan Chase, HSBC Bank, and, UBS. They need to buy gold to replace the gold they and others sold into the market during the late 1990's and early 2000's. The gold was originally leased from many of the world's central banks. The central bank gold shortage has been estimated by some to be upwards of 12 to 14 thousand tonnes although some believe it is only around 5 or 6 thousand tonnes.

The Netherlands repatriated 120 tonnes of their gold from various foreign vaults in 2014. The Bundesbank of Germany took upwards of five years to repatriate their gold. Other Euro zone countries are considering repatriation.

VIRTUAL MONEY CREATION PROCESS

It must be noted that banks do not just make money on the interest differential from lending out other people's deposits. Through the fractional reserve banking system, they make money by lending out more than they take in by "creating" virtual deposits; keeping only a small fraction as a "reserve" with the Federal Reserve or Central bank.

We consider a situation where the USA government, or any other government for that matter, needs money to finance some activity without resorting to the unpopular action of imposing taxes on its citizens. It could simply just issue from its treasury Treasury Notes as for instance dollars backed by the full faith and credit of the USA government.

To reach a larger magnitude of issuance, it instead issues Treasury Bonds to the Federal Reserve Bank. The Federal Reserve as the central bank pays for the bonds by literally "creating money out of thin air," a handy phrase introduced by Lord John Maynard Keynes, as a book entry form, or correspondingly from electrons as entry in a spreadsheet on a computer. The money that the Federal Reserve created then goes to the USA government to spend on its favored targeted programs. The Federal Bank now holds the USA Bonds. It is most interesting to notice that the

USA government then pays interest to the Federal Reserve on the very bonds that it itself issued, with a profit to the privately owned Federal Reserve Banks, which now hold the bonds, not to exceed 6 percent.

The fractional reserve system requires about 10 percent of new deposits to be kept with the Federal Reserve or Central Bank. If a new deposit of \$1.0 million of fresh money is added to the banking system, the bank receiving the deposit must place $1,000,000 \times 0.10 = \$100,000$ with the central bank and can loan the balance of \$900,000. When that loan arrives as a deposit with another bank, \$90,000 must be placed with the central bank and \$810,000 can be loaned out. That in turn will arrive as a deposit elsewhere and \$81,000 must be placed with the central bank and \$729,000 can be loaned out, and so on. Finally when all these iterations are complete, the central bank ends up with \$1.0 million as deposits from the banks that have made loans of about \$9.0 million and earning interest on it from just an initial \$1 million deposit, a multiplication factor of 9. The essence of the monopoly that is granted to the private banks by the government is such that an injection of new money into the economy allows the banking system to generate loans of approximately 9 times the amount of the new money.

It should be noted that the Federal Reserve as a private bank is in no way “Federal”, and is definitely not a branch of the USA government. In fact it is not mentioned at all in the Constitution of the USA or any amendments to it. Its constitutionality has never been considered by the USA Supreme Court. Yet it effectively controls the USA money supply and the level of interest rates.

In the 19th century, the “paper money” was called “bank notes” because they actually were notes from a bank representing a specified amount of real money on deposit. People carried the bank notes because they were more convenient for large amounts of money than gold or silver coins. The USA dollars today specify in print on their back that they merely are “Federal Reserve Note,” because they are not redeemable for anything besides more Federal Reserve notes. That is why today’s paper money substitutes are called fiat currencies; having been issued by government decree and possessing zero intrinsic value. They are not redeemable for anything, but are accepted because governments have just decreed it.

It has been suggested by insiders that it is in fact the financial powers and the financial aristocracy of Old Europe and the UK that effectively control the USA Federal Reserve as private voting shareholders more than is publicly known. They have been deliberately and quietly restoring economic and financial power back to Europe by depreciating the USA currency, and consequently sapping the USA’s economical wealth, versus the European Euro, Swiss Franc and Sterling Pound; since they have resented what they considered as “arrogant and reckless” fellow USA bankers for two generations.

UNSUSTAINABLE DEBT ACCUMULATION, DEFLATION AND INFLATION CYCLES

The formal dictionary definition of inflation is: “A persistent, substantial rise in the general level of prices related to an increase in the volume of money and resulting in the loss of value of currency.” Notice the causal relationship here in that the increase in the money supply is the fire that generates the rising price increase smoke.

A euphemism used for inflation by the central bank is: “accommodation.” Another one is: “Quantitative Easing,” QE.

The general culture notices the smoke, not the fire, and associates inflation with rising prices of goods and services. A description of inflation is Stott's law which states that: "The more of anything there is, the less they will be worth."

An increase in the price level can be caused by either inflation or supply and demand. Assuming a refinery accident, the supply of refined products such as gasoline or fuel oil would be curtailed, driving their prices up. On the other hand, an increase by the central bank of the money supply would also drive prices up through the different cause of too much money chasing a constant supply of goods with a constant demand. So the same outcome of increase in prices can be caused by different causes, one of them being inflation. Actually, price levels are driven by both a supply and demand component as well as a money supply one. Since separating the price effects is difficult, it makes sense to look at the cause of inflation in the money supply increasing at a faster rate than the increase in productivity of an economical system at a given time.

The history of the modern capitalist economy is a cyclic repetition of crises. The crises differ in progression but are variations on the same theme. Easy money created by central banking and geared up by leverage floods the financial system through innovative but dubious financial engineering products. This pumps up asset prices to unsustainable levels hiding their speculative nature. Euphoria predominates creating bubbles until one day an unexpected random initiating event triggers a loss of confidence in the continued rise of prices, and the whole leveraged house of cards crumbles down.

While giving the illusion of a free market economy, western economies have a large component of central planning conducted by their central banks and their political institutions. These are the elephant in the living room that is not supposed to be noticed nor acknowledged whilst it is destroying the room's contents. The blame is then conveniently placed on "unfettered free markets."

At the point where the exponential growth of credit and debt creation becomes unsustainable, the excesses must be corrected, and debt cannot be repaid out of savings and must be eliminated through planned and orchestrated cycles by the banking system of monetary contraction and expansion in the following ways:

1. Through deflation and bankruptcies, which cause the over-extended borrowers to forfeit their collateral to the lenders who initially appear to bear the losses of the debt failures. In fact, the collateral pledged against the loans is foreclosed upon and the lending institutions take possession of it to dispose of it at a later stage in the cycle. Money panics and stock markets crashes are orchestrated to transfer the wealth from those who over extended themselves into debt to those who acquire their assets at a fraction of their values. Eventually the broader community also suffers as a result of the economic recession or depression and the collapses that follow. The collapses follow a chaotic sequence: financial, commercial, political and ideological, social, and possibly cultural collapse and full meltdown.

Yale University economist Irving Fisher used the term "Debt Deflation" in an article written in 1933 at the nadir of the Great Depression. The Debt Deflation Theory of Great Depressions, was revolutionary, where it identified two stages on the road to depression. In the first stage, too-high levels of aggregate debt depress economic activity because of all the money spent servicing that debt by paying the due interest. Irving Fisher termed the process "Debt Deflation." He argued that debt deflation only leads to general depression when there is a fall in the general price level.

Observations from the Japanese economy during the 1990s, suggests that monetary policy would not be able to restart a depressed economy suffering from asset deflation and a widespread financial crisis. The reason is that lower interest rates cannot motivate fixed investment when the market is glutted with existing assets worth much less than their cost of replacement, hence discouraging new productive projects.

2. Inflation through a rapid debasement of the currency which allows debt to be serviced in currency with a vastly reduced purchasing power. Lenders are repaid but suffer a reduction in the value of their capital. The broader community suffers from massive price inflation and the economic dislocations that follow, eliminating the savings and the accumulated wealth of the populace as well as foreign creditors.

3. Using an orchestrated combination of deflation and inflation or deflation-inflation as a combination of the above two ways where there are initial bankruptcies over a short period of politically unbearable deflation; followed later by a more politically acceptable inflation of the currency and its debasement to eliminate the accumulated debt to both citizens and foreigners.

INTEREST RATES AND DISCOUNT RATES

Interest rates and discounts rates are different concepts, leading to confusion in their use. One of the differences pertains to the way they are collected. The discount rate is collected in advance immediately upfront, whereas interest rates are collected at some future times or at the end of the loan period. An aphorism says that: "There is no easier profession than that of a banker, as long as he can tell apart a bill of exchange and a mortgage."

Adam Smith suggests that: "There are two different ways in which capital may be employed so as to yield a revenue to its employer: circulating capital and fixed capital." One source of credit is related to the fixed capital and its scarcity is measured by the rate of interest. The other is related to the circulating capital and its scarcity is measured by the discount rate. Both rates are a market phenomenon: the interest rate is regulated by the bond market, and the discount rate by the bill market.

The rate of interest is inversely proportional to the propensity to save, and the discount rate is inversely proportional to the propensity to consume. A common belief is that the two propensities are antithetical: when people save more, they must consume less, and vice versa. This view does not account for the propensity to hoard commodities such as gold, silver, works of art, or antiques, which is the opposite of saving, originating as a protest against low interest rates, increased currency depreciation, or the banks appropriating the depositors' savings by paying them interest on their deposit that is lower than the inflation rate, or no interest at all; even charging them fees for holding their deposits.

An example of hoarding is the Strategic Petroleum Stockpile in salt mines in the USA. Another example is the supertankers filled with crude petroleum prying the world oceans looking for a port offering a profitable delivery price. A third example is the hoarding of residential real estate in the USA by subprime holders in expectation for higher prices at some future time when they would be dishoarding it. It is possible for both the propensity to save and the propensity to consume to fall at the same time, being explained by a simultaneous rise in the propensity to hoard real goods.

INTEREST RATES

Interest rates can be modeled to grow exponentially. If humans or banks survived long enough, a sum of 1,000 dollars borrowed or invested at an exponential growth rate of $P = 5$ percent per year would grow to a debt or profit in 100 years, according to Eqn. 11, of:

$$\begin{aligned}
 R(t) &= R_0 \cdot e^{+kt} \\
 &= R_0 \cdot e^{+\frac{P}{100}t} \\
 &= 1000 \cdot e^{+\frac{5}{100}100} \\
 &= 1000e^5 \\
 &= \$148,413
 \end{aligned}$$

Notice that the continuous exponential model used here is not exactly the same as the discrete linear power model preferred by economists, which calculates the accrual of an initial sum R_0 resulting from an annual compounded interest or discount rate i , over a period of N years as:

$$\begin{aligned}
 \text{Initial sum} & \quad R_0 \\
 \text{After 1 year:} & \quad R_0 + R_0 i = R_0(1+i)^1 \\
 \text{After 2 years:} & \quad R_0(1+i)^1 + R_0(1+i)^1 i = R_0(1+i)^1(1+i) = R_0(1+i)^2 \\
 \text{After 3 years:} & \quad R_0(1+i)^2 + R_0(1+i)^2 i = R_0(1+i)^2(1+i) = R_0(1+i)^3 \\
 & \dots \\
 & \dots \\
 \text{After } N \text{ years:} & \quad R_0(1+i)^{N-1} + R_0(1+i)^{N-1} i = R_0(1+i)^{N-1}(1+i) = R_0(1+i)^N
 \end{aligned} \tag{19}$$

Thus:

$$\begin{aligned}
 R(N) &= R_0 \cdot (1+i)^N \\
 &= 1,000 \times (1+0.05)^{100} \\
 &= 1,000 \times 1.05^{100} \\
 &= \$131,501
 \end{aligned}$$

This gives the same order of magnitude value, but is not quite the same. The two models become equivalent if the continuous time t is replaced by the discrete number of years N , and the fractional growth per year (k) in the exponential model is replaced by:

$$k = \ln(1+i). \tag{20}$$

We suggest that the economics textbooks and literature may be rewritten using the simpler exponential model, favored by engineers and scientists, instead of the more complex linear interest accrual model favored by economists, if it were so desired.

In this case, Eqn. 11 can be rewritten as:

$$R(N) = R_0 \cdot e^{+N \cdot \ln(1+i)} \quad (11)'''$$

Using the exponential model again with $N = 100$ years, and $i = 0.05$, in Eqn. 11''', yields exactly the same exact result as the linear model:

$$\begin{aligned} R(N) &= R_0 \cdot e^{+N \cdot \ln(1+i)} \\ &= 1000 \cdot e^{100 \cdot \ln(1+0.05)} \\ &= \$131,501 \end{aligned}$$

It is interesting to see how much the sum of 1,000 dollars would become after 500 years instead of 100 years:

$$\begin{aligned} R(N) &= R_0 \cdot e^{+N \cdot \ln(1+i)} \\ &= 1000 \cdot e^{500 \cdot \ln(1+0.05)} \\ &= \$39,323,261,827,200. \end{aligned}$$

This is an outstanding sum of $\$39 \times 10^{12}$ or 39 trillion dollars.

FATE OF THE FEDERAL RESERVE CENTRAL BANK

USA Congressman Dr. Ron Paul from Texas, a 2008 election presidential candidate, introduced on February 4, 2009 "The Federal Reserve Board Abolition Act, H. R. 833." According to Ron Paul:

"Madame Speaker (Nancy Pelosi), I rise to introduce legislation to restore financial stability to America's economy by abolishing the Federal Reserve. Since the creation of the Federal Reserve, middle and working-class Americans have been victimized by a boom-and-bust monetary policy. In addition, most Americans have suffered a steadily eroding purchasing power because of the Federal Reserve's inflationary policies. This represents a real, if hidden, tax imposed on the American people.

From the Great Depression, to the stagflation of the seventies, to the current economic crisis caused by the housing bubble, every economic downturn suffered by this country over the past century can be traced to Federal Reserve policy. The Fed has followed a consistent policy of flooding the economy with easy money, leading to a misallocation of resources and an artificial "boom" followed by a recession or depression when the Fed-created bubble bursts.

With a stable currency, American exporters will no longer be held hostage to an erratic monetary policy. Stabilizing the currency will also give Americans

new incentives to save as they will no longer have to fear inflation eroding their savings. Those members concerned about increasing America's exports or the low rate of savings should be enthusiastic supporters of this legislation.

Though the Federal Reserve policy harms the average American, it benefits those in a position to take advantage of the cycles in monetary policy. The main beneficiaries are those who receive access to artificially inflated money and/or credit before the inflationary effects of the policy impact the entire economy. Federal Reserve policies also benefit big spending politicians who use the inflated currency created by the Fed to hide the true costs of the welfare-warfare state. It is time for Congress to put the interests of the American people ahead of special interests and their own appetite for big government.

Abolishing the Federal Reserve will allow Congress to reassert its constitutional authority over monetary policy. The United States Constitution grants to Congress the authority to coin money and regulate the value of the currency. The Constitution does not give Congress the authority to delegate control over monetary policy to a central bank. Furthermore, the Constitution certainly does not empower the federal government to erode the American standard of living via an inflationary monetary policy.

In fact, Congress' constitutional mandate regarding monetary policy should only permit currency backed by stable commodities such as silver and gold to be used as legal tender. Therefore, abolishing the Federal Reserve and returning to a constitutional system will enable America to return to the type of monetary system envisioned by our nation's founders: one where the value of money is consistent because it is tied to a commodity such as gold. Such a monetary system is the basis of a true free-market economy.

In conclusion, Mr. Speaker, I urge my colleagues to stand up for working Americans by putting an end to the manipulation of the money supply which erodes Americans' standard of living, enlarges big government, and enriches well-connected elites, by cosponsoring my legislation to abolish the Federal Reserve.”

7.29 SUSTAINABILITY OF RESERVE BANKING SYSTEM

INTRODUCTION

The central reserve banker's game of nations is inextricably tied to oil and energy consumption, since the USA economy bases its prosperity on the importation of about 60 percent of its oil, and must pay for it and protect access to it with 865 military bases throughout the globe. The central banking system creates free money to obtain almost free energy. However, the laws of thermodynamics are such that free energy is unsustainable and in fact does not occur in nature. In addition, for an unsustainable system, the basic law of economics that will continue to apply is: “There Are Not No Such Thing As A Free Lunch.”

As of 2007 in the USA, bank credit was \$8.923 trillion and loans and leases amounted to a record \$6.574 trillion amounting to about $8.923 + 6.574 = \$15.497$ trillion in bank assets and liabilities. It is being backed up by a minuscule \$40.2 billion in bank reserves that has remained roughly the same since the year 2000. That is an insignificant $40.2 \times 10^9 / 15.497 \times 10^{12} = 2.61 \times 10^{-3}$ or 0.002594. This amounts to a quarter of 1 percent. It in turn implies an

unsustainable transient system that must eventually revert to an equilibrium condition at some future time.

The nations of Brazil, Russia, India, and China (BRIC) are growing from broad based industrial, resources and manufacturing expansion in contrast to the growing dependence by the USA economy upon financial engineering as creative and sophisticated credit services and financial instruments such as swaps and securitized debt, generating the largest credit expansion in history. The financial industry innovative and aggressive creation of derivative contracts alone generated 450 trillion dollars which is about 15 times the world's Gross Domestic Product (GDP).

Consumer's credit and debt is reaching unsustainable levels. Between 2000 and the third quarter of 2006, the mortgage debt of USA private households almost doubled within 6 years from \$4,801.7 billion to \$9,497.4 billion. During the five years period of 1995-2000, non-financial debt growth by 32.4 percent went together with 22.2 percent real GDP growth. In the following five years period of 2000-2005, non-financial debt grew by 47.3 percent and real GDP by 13.4 percent. This signals deterioration in the relationship between debt growth and economic growth. Since 1985, the cumulative USA deficit has grown to about \$4 trillion, or about: $\$4 \times 10^{12} / 300 \times 10^6 = \$13,333$ per each man, woman, and child, or $\$13,333 \times 4 = \$53,332$ per each family of four.

As of 2007, foreign investors owned about \$8 trillion of USA financial assets, including 13 percent of all USA stocks, 24 percent of corporate bonds, 43 percent of treasury bonds, and 14 percent of government agency debt. In the 1980s, the USA was the world's largest creditor nation, but by 2003, foreign investors owned \$9.4 trillion of USA assets, while the USA claims on the rest of the world were \$7.2 trillion suggesting that the USA had become the world's largest debtor nation.

In March 2006, the USA Federal Reserve, the quasi-governmental central planning organization owned and controlled by the privately owned central banks, stopped publishing the M3 measure of money supply that measures the money available in the banking system. When it stopped reporting the M3 aggregate used pretty much everywhere else in the world, the Fed cited that the data: "did not convey any additional information about economic activity that is not already embodied in M2 and has not played a role in monetary policy process for many years." The European Central Bank (ECB) finds the M3 aggregate useful, publishing monthly updates for the 15 nation Eurozone of 350 million people. The Bank of England, home to the world's 5th largest economy, published a broader M4 measure of the money supply.

This happened when M3 had grown 13 fold since 1980, going from 800 billion to over 10 trillion amounting to 10 percent growth per year. The rise in the latest five years had an annual growth of 15 percent. A large USA trade deficit allowed various exporting countries to accumulate dollar based securities. By the end of 2005, the top five countries with the largest holdings of foreign reserves were: Japan, China, Taiwan, South Korea and Russia, a large exporter of oil.

As of 2008, the M2 measure is down a comfortable 6 percent, but the no longer published M3 measure was at 16.4 percent; a figure last seen around June 1971, two months before President Nixon closed the gold window and imposed wage and price controls.

That the Fed no longer publishes M3 figures is a transparent attempt to avoid showing how rapid monetary growth was. M1 is basically money readily convertible, meaning cash and checking accounts, while M2 adds primarily what is in savings accounts, including certificates of deposits and money market accounts. On the other hand, M3 includes the large deposits of banks, institutional money including mutual funds, Eurodollar deposits and repurchases agreements or

what is held by the large financial institutions. It was felt by many economists that it was the best measurement of how the Fed is creating money and credit in the financial system.

A wealth transfer progressed to nations relying upon conventional manufacturing and commercial growth. The USA runs a trade deficit that exceeds \$100 billion annually with China, \$100 billion with Japan, and \$50 billion with the European Union. The trade deficit averaged a manageable \$80 billion annually during the 1980s. It has increased into the \$300 billion range in the 1990s. By 2003, this figure had reached \$500 billion or about 5 percent of Gross Domestic Product (GDP). Since 1953 the USA's manufacturing base has been allowed to decline from 30 percent of GDP, when it had a trade surplus, to about 15 percent by 2007.

Former USA Treasury Secretary John Connally addressed other foreign central bankers: "The deficits are our responsibility, but they are your problem." Skewed statistics benefiting from conveniently designated categories in basic tallies are adopted to stretch the duration of what many economists consider as an unsustainable energy and monetary system, as long as feasible.

FAKE ASSETS

Some analysts have been writing that the sky is falling and that banks are going to have to write-down massive amounts of capital destroying their capital structure. The Financial Accounting Standards Board (FASB) is the referee for accounting practices. A new rule was implemented on November 15, 2007. Statement 157 requires a financial firm to divide its assets into three categories called Level 1, Level 2 and Level 3.

Level 1 means assets that can be marked-to-market, where an asset's worth is based on a real price, like a stock quote.

Level 2 is mark-to-model, an estimate based on observable inputs which is used when no quoted prices are available. One gets several bids and averages them, or base the assumption on what similar assets sold for.

Level 3 values are based on "unobservable" inputs reflecting companies' "own assumptions" about the way assets would be priced. That would be market talk for best guess, or in some cases SWAG (Simple Wild Asset Guess.)

At one point, the credit crunch could cause \$250 billion to \$500 billion of losses at banks and brokers around the world.

MONETARY TRENDS

The purchasing power of consumers is assessed by how the price of goods and services is varying. It is possible to have two situations occur simultaneously. For instance both inflation and deflation can lead to the destruction of the values of obligations: Inflation through depreciation and deflation through default.

Nine possible situations can be identified:

1. Inflation:

The word "inflation" covers two different concepts, and it is important to distinguish between them. One concept is the monetary inflation, which occurs when the supply of money increases faster than the supply of goods and services. The other concept is the price inflation, which is an increase in the overall level of prices for goods and services. The relationship between

the two is a cause and effect. Monetary inflation causes price inflation. Whereas everyone sees price inflation when it happens, few people notice the monetary inflation that is causing it. And so they tend to blame the producers of goods and services for higher prices rather than the money creating central banks in collusion with governments.

Inflation can be considered as a process of money dilution. The simplest but accurate way of thinking about inflation is that it is the result of too much money chasing too few goods. Most experts disagree on an exact definition of inflation since it takes different forms as monetary inflation, credit inflation, price inflation, debt inflation, asset inflation, exported inflation, wage inflation, energy inflation and cost inflation. An accepted definition is that it refers to an increasing monetary and credit supply leading to rising prices and, therefore, diluted purchasing power, because it takes more money to acquire the same amount of a good or service.

Inflation is a monetary phenomenon occurring when a central bank adds to its holdings of assets. It does so by creating new money and purchasing the assets with the newly created money. This money is spent into circulation in order to buy the assets, and then spent by the recipients of this money. The new money multiplies through a multiplier effect throughout the fractional reserve commercial banking system. With monetary inflation, debt can be reduced in value. Inflationary money and credit expansion is the tried and true favored medicine for governments to recover from recessions, in addition to tax cuts, interest rate reductions encouraging Mortgage Equity Withdrawal (MEW), deficit spending, military buildup and the financing of military operations.

In standard monetary theory, emphasis is given to the initial phases of inflation, in which an increasing money supply funds economic expansion and tends to cause booms, bubbles, and speculation. Less attention is usually given to the second stage of inflation, in which prices rise; interest rates are increased; and economic growth rates; after an acceleration, begin to slow down. There is an illusion that inflation is good for growth; that is true of the first stage, but only of the first stage. Stagflation, in which rising prices are accompanied by reduced growth, invariably occurs as a second stage.

Those burdened with high debt welcome high rates of inflation. By reducing the value of money, inflation benefits borrowers at the expense of lenders. By repaying with money of lesser value, the borrowers partially default, even when paying in full. The main borrowers are indebted governments and the overly leveraged financial sector. Consequently they are the leading advocates of inflation. Inflation helps these interests manage their debt burdens and in the case of the financial sector, profit from the increased lending that low interest rates and quantitative easing encourage. On the other side of the coin are the holders of the debt or lenders: the savers, pensioners and retirees. These groups want lower prices and higher rates of interest on their accumulated lifetime labor savings as capital. Higher living standards for those who have worked and saved for many years and want to enjoy the fruits of their efforts, favor lower prices.

Higher inflation is perceived to give businesses more flexibility to retain workers in periods of weak growth. If sales revenue falls, companies will not be able to lower wages, and will instead resort to layoffs to maintain their profitability. This is only true in cases involving labor union contracts or minimum wage workers. In all other cases, business could reduce wages instead of layoffs. If prices for consumer goods are also falling, real wages may not even decline as a result of the cuts. In situations where wages cannot be legally reduced, as is the case for unionized or minimum wage workers, layoffs are often the employer's only option for keeping costs in line with revenue. Inflation allows employers to do an end run around these obstacles. In an inflationary environment, rising prices compensate for falling sales. The added revenue allows

employers to hold nominal wage costs steady, even when the raw amount of goods or services they sell declines. When inflation rages, higher skilled workers will often demand, and receive, pay raises. But low-skilled workers, who lack such leverage, are usually left holding the bag.

This implies that politicians can impose a high minimum wage to pander to voters, but then count on inflation to lower real labor costs, thereby limiting the unemployment that would otherwise result. What the government openly gives with one hand, it secretly takes away with the other. Workers vote for politicians who promise higher wages, but those same politicians also create the inflation that negates the real value of the increase. While governments take credit for the former, they never assume responsibility for the latter.

The same analysis applies to labor unions. Based upon political protection offered by friendly officials, unions can secure unrealistic pay hikes for their members. But the same governments then work to reduce the real value of those increases to keep their employers in business.

Governments need inflation to bail themselves out of the policy mistakes they make to secure votes. The sustainable policy would be to run balanced budgets rather than incur debts that can only be repaid with the help of inflation. The alternative would be to abolish the minimum wage and the special legal protections offered to labor unions, rather than papering over the adverse consequences of bad policies with inflation.

2. Hyperinflation:

This is a circumstance envisioned not in terms of single, or double digit inflation; but more along the lines of seven to ten digit inflation seen during the last century. Hyperinflation invariably occurs for a main reason: too much government deficit spending that leads to too much government borrowing; and these debts are then turned into currency by the government's captive central bank. Under these circumstances the currency becomes worthless as in the case of the Continental currency in the USA in 1781, the French "Mandats Territoiriaux" in 1796, the mark in Germany's Weimar Republic, in 1923, in Hungary after World War II, and in the dismembered Yugoslavia of the early 1990's. History teaches that hyperinflation is an unsustainable policy.



Figure 69. The Continental currency financed the American Revolutionary War and was backed by silver and gold.

3. Deflation:

Deflation rarely occurs and is the opposite of inflation. It refers to a decreasing money and credit supply leading to widespread falling prices and a greater purchasing power. Deflation occurs when the ratio of Money Supply to Actual Assets (MS / AA) goes down when the Money

Supply goes down, which it can do for a variety of reasons, one of which is when any creditor has to take a loss, because fiat money is created by a bank at the instant that someone borrows money from a bank. Too much deflation hinders economic expansion because it can curtail spending as consumers wait for lower prices. Not only can this reduced consumer spending hurt corporate profits, deflation can force businesses to sell goods at prices lower than planned, sometimes at below the cost of production, eventually bankrupting them. To allow prices to deflate would be to follow the policies associated with the Great Depression.

Despite reams of evidence that show how an economy can thrive when prices fall, there is now a nearly universal belief that deflation is an economic poison that works its mischief by convincing consumers to delay purchases. For example, in a scenario of 5 percent deflation, a consumer who wants to purchase a \$1,000 refrigerator will postpone the purchase if he expects it will cost only \$950 within a year. If deflation persists indefinitely, the advanced unrealistic argument is that the consumer would put off the purchase indefinitely. Economists thus suggest that deflation will destroy aggregate demand and force the economy into recession.

However, deflation can exist in parts of the economy as temporary assets bubbles as bursts of irrationality and can coexist with monetary inflation. For instance, a 5 percent decline in the price of housing would equate to \$1 trillion in lost home equity; a debt and asset deflation. Deflation means that the pro-rata money available for each asset goes down, which makes some prices go down, which hands losses to the owners of the assets, which they do not like, which are netted against gains when paying taxes, which means less tax revenue to the governments, which the governments do not like. Since governments dislike deflation, they actively fight it, resulting in shorter periods of deflation than inflation.

4. Reflation:

Occurs when mild inflation returns following a period of stagnant or falling prices. It occurs when the velocity of money stops decreasing for at least two quarters and the economy starts emerging from recession.

5. Disinflation:

Happens when prices are rising, but the rate of inflation is slowing.

6. Stagflation:

Usually is the second stage of an inflationary process. When the rising cost of money through increased interest rates slows the economy, but the amount of liquidity that remains continues to fuel inflation, a situation arises where stagnation and inflation can coexist. The situation is designated as stagflation; a word first coined by the British Chancellor of the Exchequer, Iain Macleod. Stagflation refers to the vicious combination of rising prices and falling output.

7. Stagdeflation:

This corresponds to falling labor and goods markets and no growth in association with a sharp fall in the commodities prices. Such a situation shortly arose in 2008 on a global basis.

8. Lowflation:

Is defined as a situation where prices are rising, but not fast enough to offer the economic benefits that are apparently delivered by higher inflation. While in the past, central banking policy usually focused on "inflation fighting," now central banks talk about "inflation ceilings" and more recently "inflation targets". Despite the observation that people actually tend to buy more when prices fall, few have argued that it has the same demand killing dynamics as deflation, but many say that it should be avoided simply because it is too close to deflation. Considering the feeling that even a brief bout of minor deflation could lead to a catastrophic negative spiral, they argue for a prudent buffer of 2 percent inflation or more, trying to convince the uninformed that what hurts them financially is good for them.

9. Liquidity trap:

This is a situation in monetary economics in which a country's nominal interest rate has been lowered nearly or equal to zero to avoid a recession, but the liquidity in the market created by these low interest rates does not stimulate the economy. In that situation, borrowers prefer to keep assets in short term cash bank accounts rather than making long term investments. This makes a recession even more severe, and can contribute to deflation.

KEYNESIAN ECONOMICS

The English economist John Maynard Keynes was probably inspired by the story of the prophet Joseph narrated in both the Old Testament and in the Quran. Joseph interpreted a dream by the Egyptian Pharaoh in which he witnessed seven lean cows that were feeding on seven fat cows, as seven years of drought to follow seven years of abundant agricultural production, following the yearly flooding of the River Nile as well as rainfall in the Middle Eastern region. Appointed as a commerce and finance minister by the Pharaoh, Joseph stockpiled and saved Egypt's surplus grain production during the predicted seven fat years to use them during the following seven lean years. Even Egypt's neighbors benefited when Joseph's tribe escaped the generalized drought and moved to Egypt as a matter of survival.

Keynes inspiration suggested that governments should generate surpluses during their economy's expansion part of the economic cycle, and deficit spend during the contraction part of the cycle to encourage a quick recovery. Government intervention was needed since the populace was not smart enough to save for itself.

In fact, governments universally adopted Keynes's deficit idea with a twist: they have proven adept at running deficits even during the fat years. For instance, the USA under the tenure of President George W. Bush as "a war president," even with lean years on the horizon, was running a historically record budget deficit of the order of \$2 trillion for 2009.

IRVING FISHER EQUATION, $MV = PT$

Irving Fisher was the most influential economist during the period of the Great Depression. He interacted with the economist Joseph Schumpeter and had an influence on the English economist John Maynard Keynes. He had access to President Roosevelt and died on

April 30, 1947. Irving Fisher objective was to achieve stable money, and he was of the opinion that a commodity based standard would be the most stable substitute for the gold standard.

He introduced the famous Fisher equation of exchange which states that:

$$MV = PT$$

where: M is the Money or the supply of money,

V is the Velocity, how fast the money circulates in the system,

P is the Price per item sold, or price of money,

T is the number of Transactions or the quantity of items sold.

An alternate form of the equation can be considered as:

$$MV = Q$$

where: Q = PT is the Gross Domestic Product, GDP.

The equation says that the total money spent MV must be equal to the total sales PT.

As the velocity V of the money increases, or as the money supply M increases on the left hand side, the right hand side must also increase through the number of transactions or the quantity of items sold T or the price P per item increasing. If V and T were kept constant, there follows that the price P is inexorably proportional to the money supply M:

$$P = \frac{V}{T} M = \frac{V}{Q} M .$$

If the supply of money M is increased and the velocity V stays the same, and if the GDP, Q does not grow, inflation ensues through the increase in the price P.

If, on the other hand, the velocity V is reduced through a recession, and if the supply of money M is not increased, deflation results through a decrease in the price level P. The solution to deflation becomes an increase in the supply of money M.

Considering the velocity V, it can be calculated knowing the GDP and money supply as:

$$V = \frac{Q}{M} = \frac{PT}{M}$$

When the denominator M or money supply, grows up faster than the numerator Q or GDP, the value of the velocity goes down, and vice-versa. The money supply M could rise rapidly making the velocity V go down. If the prices P are rising, the velocity V goes up. If the quantity sold is going down, that would make the velocity go down.

The velocity V is a function of three variables, and it could be rising (a supposedly good sign) although prices P were exploding upward (a bad economic sign) and the money supply M was rising (another bad economic sign) if quantity the sold T was actually falling (an undesirable economic sign). This is the situation when stagnation is coupled to inflation, aptly called “stagflation.”

PREPONDERANCE OF INFLATION OVER DEFLATION

Governments, central banks, commercial and investment banks favor the inflation of the money supply. The reasons are that inflation:

1. Is a form of hidden stealth taxation,
2. Supports the expansion of government power and control of society,
- 3) Supports the militaristic budgets and objectives of national governments,
- 4) Benefits leveraged speculators and the asset rich at the expense of conservative savers and the asset poor. This leads to greater wealth disparities than would not otherwise exist and to resentment amongst those who are on fixed incomes or at the bottom of the economic ladder,
5. It distorts price signals, leading to the reallocation of valuable resources into financial services rather than production and manufacturing.

Whereas inflation does the greatest long term economic damage, it is recession that is the most feared on the short term. History teaches us that it was the raising of interest rates that turned the 1930 recession into the Great Depression of 1933, which lasted until World War II, which was the way to snap out of it. During the Great Depression, President Franklin D. Roosevelt first New Deal program and government spending occurred in 1932 at an unemployment rate of 37 percent. The Supreme Court declared much of it unconstitutional in 1935. The New Deal part II was started in 1937. It never drove unemployment below 20 percent. The onset of World War II in 1939, not government spending, prompted the USA recovery from the Great Depression. The USA created a war economy in 1940 and entered the war in 1941.

At the time, in May 1939, Treasury Secretary Henry Morgenthau Jr., before the USA House Ways and Means Committee, 6 years after the New Deal Inception, was quoted as: “We have tried spending money. We are spending more than we have ever spent before and it does not work. I say after eight years of this administration, we have just as much unemployment (20 percent) as when we started.”

As World War II ended in 1945, the unemployment rate had been reduced to the 2 percent level and it since averaged 5.5 percent over the period 1970-2008. Great wealth was destroyed in other parts of the world as a result of the war, but the USA was the only country that was left with its productive capacity intact, which was the leading cause to its prosperity in the 1950s when it represented 50 percent of the global Gross Domestic Product (GDP). Since then, USA presidents used the war metaphor to rally the masses behind them for ineffective yet very expensive wars: the War on Poverty, the War on Drugs, the Cold War, and the War on Terror.

The rule of thumb is that a recession is two consecutive quarters where GDP declines. A depression is a severe recession with five quarters of GDP decline. Another definition is a recession with GDP declining by more than 10 percent or one that lasts more than 3 years. The USA Great Depression saw the GDP falling 30 percent over the period 1929-1933 and also by 13 percent between 1937 and 1938 for a period of 43 months. The depression of 1873-1879 lasted 65 months.

The periods conventionally designated as depressions and recessions can be regarded as severe and mild credit and money contractions, respectively. In a credit and money contraction, prices decline and wealth flows from the paper aristocracy to the majority of savers. In a credit

and money expansion, prices increase and wealth flows from the majority of savers to the paper aristocracy.

According to the National Bureau of Economic Research (NBER) a recession is defined as: “A recession is a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in production, employment, real income and other indicators. A recession begins when the economy reaches a peak of activity and ends when the economy reaches its trough.”

Depression, in a highly leveraged world that is accustomed to prosperity, would result in serious civil strife. Politically, it must be avoided no matter what the economic or financial costs. Despite the illusion to the effect that the Federal Reserve is pursuing a dual mandate to both fight inflation and promote growth, in reality it can only promote growth; a fact that few economists dare to discuss.

Banks are in the business of lending money and from that perspective, inflation benefits them. The higher the rate of inflation of the money supply and credit, the bigger their profits from collecting interest on the issued loans. Inflation also keeps a segment of the public happy: those who have the ability to invest, as their assets continue to rise in value, thereby giving the illusion of prosperity. The hidden agenda of the central banks and politicians is to create and encourage inflation, whilst telling the public that they are in fact fighting it. During highly inflationary times, it is always the majority of the public that suffers, as their savings, incomes and pensions slowly erode in value.

According to Ben Bernanke, then Governor, and later Chairman of the Open Market Committee (OMC) of the Federal Reserve (FED), in a speech on November 21, 2002 entitled “Deflation: Making sure ‘It Doesn’t Happen Here’” :

“The sources of deflation are not a mystery. Deflation is in almost all cases a side effect of a collapse of aggregate demand; a drop in spending so severe that producers must cut prices on an ongoing basis in order to find buyers. Likewise, the economic effects of a deflationary episode, for the most part, are recession, rising unemployment, and financial stress.”

He goes on to suggest that the best way to cure deflation is to avoid it altogether by preempting it. In his speech, he tells a story: Imagine that an alchemist has learned to make unlimited quantities of gold at no cost. What would then happen to the price of gold, and when would it happen? The price of gold he suggests would plummet immediately; before the alchemist produced a single ounce; because markets discount future events *immediately*. Economists throughout the world agreed with him. The punch line of the story follows:

“What has this got to do with monetary policy? Like gold, USA dollars have value only to the extent that they are strictly limited in supply. But the USA government has a technology, called a printing press (or, today, its electronic equivalent), that allows it to produce as many USA dollars as it wishes at essentially no cost. By increasing the number of USA dollars in circulation, or even by credibly threatening to do so, the USA government can also reduce the value of a dollar in terms of goods and services, which is equivalent to raising the prices in dollars of those goods and services. We conclude that, under a paper-

money system, a determined government can always generate higher spending and hence positive inflation.”

Bond dealers desks have referred to Ben Bernanke with the nickname: “Helicopter Ben,” in reference to the speech on November 21, 2002, in which he borrowed an idea introduced by economist Milton Friedman and suggested a metaphorical money drop from a helicopter as a way to stave off deflation:

“Even if households decided not to increase consumption but instead re-balanced their portfolios by using their extra cash to acquire real and financial assets, the resulting increase in asset values would lower the cost of capital and improve the balance sheet positions of potential borrowers. A money-financed tax cut is essentially equivalent to Milton Friedman's famous ‘helicopter drop’ of money.”

THE SAVINGS PENALTY, WEALTH DESTRUCTION

If governments were serious about encouraging savings, they would have provided tax breaks for interest on savings, instead of providing tax breaks on interest on debt. The logical conclusion is that governments encourage debt rather than savings.

A central bank with inflation targets creates a disincentive to saving. If there is a cumulative deficit, then governments invariably inflate part of it away and pay back the remaining fraction. Inflation of the currency will penalize the savers and reduce the value of their accumulated wealth. Governments consider that savers are not fully entitled to their money if they keep it stagnant within the active economical system, and that they should be thankful if they can keep a fraction of the real value of their money.

It is a myth of modern times that saver's purchasing power increases over time. Governments consider savings as a social privilege rather than a social right and that it is an implicit social contract with the rest of the population. Over an interim period, the rest of the population does not prevent savers from saving, but in the long term, through negative real interest rates or inflation, society represented by government tells the savers what that social contract is going to be worth. Stated in a different way, savers are expected to give up trying to plan for their own future and let societies or governments do it for them.

DEBT REPUDIATION

Under the rules of the fractional reserve fiat currency system, debt rather than savings is encouraged. It can only be expanded and transferred, and never extinguished. Only the transfer of the actual commodity in a commodity based system can fully extinguish debt.

Regardless of how low the inflation rate is, the exponential monetary expansion proceeds faster than debt is being extinguished, or new goods are being produced, and causes the system to eventually collapse with the replacement of the inflated currency by a new one.

There exists a second and rarer kind of hyperinflation that occurs when people stop having confidence in the currency and the ability of a government to force the acceptance of its fiat currency, from events such as bankruptcy or internal weakness caused by civil strife or external wars.

This occurred in Russia and Argentina. In these cases the cause of hyperinflation was a consequence of the onerous burden of debt and depression. Once debt could not be serviced without near poverty, which is a form of economic slavery, both governments made a conscious policy decision to default on their external debts to other nations and not their internal debts to their own people. It is in this case not inflation in the currency but rather an outright repudiation.

When the foreign debt was repudiated the other nations halted both credit and imports making their rubles and pesos worthless. The rapid decline in value of the currency can be called hyperinflation, even without wages rising. Prices rose as people tried to rid themselves of their worthless currency in favor of either real goods or an alternate medium of exchange.

EXPONENTIAL LAW OF DEFLATION, DEFLATIONARY SPIRAL

It can be observed that as bond yields go higher and higher, their bond value go lower and lower. The bond yields go higher if a large supply of them is available to the market, that the yield has to be set higher to attract buyers of the debt. They also go higher in the presence of inflation to compensate for the decrease in the value of the principal.

An empirical observation is that halving interest rates brings about the same proportional increases in bond prices, regardless at what level the halving takes place. It makes no difference whether the decrease is from 14 to 7 percent or from 2 to 1 percent, the value of the long term bonds will increase by about the same factor. A much smaller drop in interest rates could bring about the same proportional increase in bond prices, provided that the rates are low enough.

We attempt a mathematical formulation of this empirical observation by restating the deflationary behavior of long term bonds as:

“The change $dB(I)$ in the value of a long term bond is proportional to the change in the interest rate dI and the current value of the bond $B(I)$.”

Mathematically this can be expressed as:

$$dB(I) \propto -B(I).dI$$

where the choice of the negative sign implies a negative rate of change.

The proportionality sign can be replaced by an equality sign if we use a proportionality constant λ , and write a rate equation:

$$\frac{dB(I)}{dI} = -\lambda B(I)$$

We can separate the variables then integrate to determine the functional relationship of the bond value as a function of the interest rate I as:

$$\int_{B_0}^{B(I)} \frac{dB(I)}{dI} = -\lambda \int_0^I dI$$

Integrating using limit integration yields:

$$\ln \frac{B(I)}{B_0} = -\lambda I$$

This appears to be a logarithmic decay behavior. We proceed further by taking the exponential of both sides of the equation to yield:

$$\begin{aligned} \ln \frac{B(I)}{B_0} &= -\lambda I \\ e^{\ln \frac{B(I)}{B_0}} &= \frac{B(I)}{B_0} = e^{-\lambda I} \end{aligned}$$

From which we obtain the negative exponential dependence of the bond value $B(I)$ as a function of the interest rate I as:

$$B(I) = B_0 e^{-\lambda I}$$

The interest rate at which the bond value is decreased to half its value can be designated as the bond “half value interest rate” $I_{1/2}$:

$$\frac{B_0}{2} = B_0 e^{-\lambda I_{1/2}}$$

Cancelling B_0 from both sides of the equation and taking the natural logarithm of both sides of the equation yields:

$$\ln \frac{1}{2} = \ln 1 - \ln 2 = 0 - \ln 2 = \ln e^{-\lambda I_{1/2}} = -\lambda I_{1/2}, \quad \forall B_0 \neq 0$$

From which the bond value decay constant can be expressed as:

$$\begin{aligned} \lambda &= \frac{\ln 2}{I_{1/2}}, \\ I_{1/2} &= \frac{\ln 2}{\lambda} \end{aligned}$$

The negative exponential dependence of the bond value can thus be also written as:

$$B(I) = B_0 e^{-\frac{\ln 2}{I_{1/2}} I}$$

For n times the half value interest rate, the bond value becomes:

$$B(n) = B_0 e^{-\frac{\ln 2}{I_{1/2}} n I_{1/2}} = B_0 e^{-n \ln 2}, \forall I_{1/2} \neq 0$$

$$B(n) = B_0 e^{-n \ln 2} = B_0 e^{-\ln 2^n} = B_0 \frac{1}{e^{+\ln 2^n}}$$

$$B(n) = B_0 \left(\frac{1}{2} \right)^n$$

This implies that n times the half value interest rate would lead to n times half of the value of the long term bond, suggesting an exponential decay of its value, with a subsequent liquidation of debt and of financial or production capital.

EXAMPLE

One doubling of the half value interest rate whether it is from 7 to 14 percent or from 1 to 2 percent implies that $n = 1$ and:

$$B(1) = B_0 \left(\frac{1}{2} \right)^1 = \frac{B_0}{2},$$

which halves the initial value of the bond.

LIQUIDATION OF DEBT

The cutting of the prevailing interest rate leads to an increase of the burden of any that was contracted in the past. This fact is hard to accept since contradicts the common intuition that it should decrease the burden of debt to be contracted in the future. The lack of understanding stems from the reluctance of the mind to admit that cutting interest rates increases the burden of debt contracted in the past, because it contradicts the intuitive expectation that it should decrease the burden of debt to be contracted in the future.

We consider the perpetual debentures earlier designated as Consols. These would pay a perpetual yearly interest rate to their holders. The UK issued Consols in the 19th century but they were terminated in 1914.

They were supposed to be saleable at any time by their holders in the secondary market. In fact, there was a catch: they would only be able to sell them at a discount to their face value if the prevailing interest rate has been reduced compared to the one that they were issued at.

To study how this could happen, we estimate the present value of a perpetual debenture of face value F paying an interest at the rate of i percent per year. To calculate its present value, we consider the prevailing interest rate as j percent per year. We can write:

$$\text{Annual interest payment} = Fi$$

We consider the discount factor:

$$\text{Discount factor: } r = 1 - j, 0 \leq r \leq 1$$

The present value or discounted value of the n-th yearly interest payment can be written as:

$$\text{Discounted yearly payment: } Fir^n = Fi(1 - j)^n$$

The total discounted value of the yearly payments would be:

$$\begin{aligned} D &= Fir^0 + Fir^1 + Fir^2 + Fir^3 + \dots + Fir^n + \dots \\ &= Fi(1 + r^1 + r^2 + r^3 + \dots + r^n + \dots) \\ &= Fi \frac{1}{1 - r} \\ &= Fi \frac{1}{1 - (1 - j)} \\ &= F \frac{i}{j} \end{aligned}$$

since:

$$\frac{1}{1 - x} = 1 + x + x^2 + x^3 + \dots, \forall 0 < x < 1$$

There ensues that the Liquidation value of debt D is inversely proportional to the prevailing interest rate j.

This also leads to the simple relationship:

$$Dj = Fi$$

EXAMPLE

A perpetual debenture with:

Face value: $F = \$1,000$

Interest rate: $i = 5 \text{ percent}$

Yearly payment: $Fi = 1,000 \times \frac{5}{100} = \$50$

Its present or discounted value if the interest rate remains at 5 percent is:

$$D = F \frac{i}{j} = \$1,000 \frac{5}{5} = \$1,000$$

If the interest rate is halved to 2.5 percent, the discounted value becomes:

$$D = F \frac{i}{j} = \$1,000 \frac{5}{2.5} = \$2,000$$

Its discounted value has doubled since two instead of just one debenture would have to be purchased to generate the same level of yearly income.

Thus as the prevailing interest rate is halved, say by the central bank, the liquidation value of debt is doubled. Thus for m halving of the interest rate, the liquidation value of the debt is increased as:

$$D = F \frac{i}{\frac{i}{2^m}} = F \cdot 2^m, \forall i \neq 0$$

EXAMPLE

For $m=3$ halvings of the interest rate, the debt is increased by a factor of:

$$D = F \cdot 2^3 = 8F$$

For $m=7$ halvings of the interest rate, the debt is increased by a factor of:

$$D = F \cdot 2^7 = 128F$$

For $m=10$ halvings of the interest rate, the debt is increased by a factor of:

$$D = F \cdot 2^{10} = 1024F$$

The unsustainable situation that culminated in the 2008 financial collapse is described by Antal E. Fekete as:

“The term ‘liquidation value of debt’ is self-explanatory, meaning the lump sum that will liquidate it before maturity, should it be necessary in case of a takeover, merger, shot-gun marriage, bankruptcy, or outright nationalization of the banking system. The point is that when the rate of interest *falls*, the liquidation value of debt *rises*. Why? Because the stream of interest payments is now discounted at a lower rate of interest. Therefore at maturity it will fall short of liquidating the debt.

Here is a familiar example. When the rate of interest falls, the market immediately bids up the price of bonds. This is the same to say that the liquidation value of the debt underlying the bond is raised. Debtors wanting to liquidate their bonded debt before maturity are not let off the hook on the same terms. The market

demands more than the pound of flesh originally agreed upon for releasing the debtor from his bond. This example clearly shows that a fall in the rate of interest, far from alleviating the burden of debt, aggravates it.

Bank capital is debt, and it has been eaten away by persistently falling interest rates. Impairment of capital has been ignored and, after 28 years of negligence, the global banking system now stands denuded of capital. Those shareholders who can read balance sheets see through the fancy values banks are putting on their assets, and they dump the stock before bank capital goes all the way to zero.”

According to the financier Warren Buffet: “When the tide goes out, you see who has been swimming naked.” By 2008, the investment banking industry had disappeared and \$15 trillion of accumulated global wealth had been liquidated. At the end of September 2008, for the first time in its history, the USA had a collective net worth of \$56.5 trillion, cancelled out by \$56.4 trillion in debts, liabilities and unfunded promises for Medicare and Social Security.

Bonds are debt and the bond issuer finds his capital or savings reduced to half their initial value; losing half the value of his capital.

A more detailed analysis would account for the real interest rate as the difference between the nominal interest rate and the inflation rate that the bondholder receives for holding the bond.

The present analysis identifies the exponential decay nature of a deflationary spiral and its effect on capital. This could be the root cause of depressions. Falling interest rates create capital gains for the bond holders.

But these gains come right out of the capital losses of the producers and savers and causes wholesale bankruptcies in the production and saving sector. Production would stop as a result of the financial sector siphoning off capital from the production sector. Industrial jobs would be exported since there would be no capital left to support them anymore at home. Writer and right wing philosopher Ayn Rand described the situation as: “Keynesianism is the gigolo of science.

PRICE INDICES

Three main price indexes are used to calculate the previous situations. Each uses a different calculation.

1. The Consumer Price Index (CPI) compares a household's cost for a specific basket of finished goods and services with the cost of the same basket during an earlier benchmark period. As a reference base, the average index level for 1982-84 is used. The weight given to each basket item is fixed. The old and a new present price change equations are:

$$\begin{aligned} CPI_{old} &= \frac{p_1}{p_0} = \frac{(1+m)(1+q)}{(1+prod)(1+pop)} \\ CPI_{new} &= \frac{p_1}{p_0} = \frac{(1+m)(1+sub)}{(1+prod)(1+pop)} \end{aligned} \tag{21}$$

where:

p_0 is the price level at time $t=0$
 p_1 is the price level at time $t=t_1$
 m is the percent price change by money supply expansion
 q is percent price change caused by quality changes
 $prod$ is the percent price change caused by productivity improvements
 pop is the percent price change caused by population growth
 sub is the percent price change caused by substitution effects

Over time this price change has become synonymous with inflation. However it must be noted that inflation is recognized as a monetary effect. The change in price level contains components other than the monetary effect, and is better considered as a cost of living rather than an inflation measure. In general, the absolute size of the individual effects other than $(1+m)$ is small.

The old consumer price index calculation was based on a basket of goods and did not contain the substitution effect, which is negative in value. In 1998 the Bureau of Labor Statistics (BLS) adopted recommendations by the Boskin Commission and made two primary changes to the calculation of the CPI. It began estimating the price impact of quality changes and it adopted the substitution adjustment that allowed the replacement by comparable goods when price changes improved the value of one good versus the value of the other good, thus the substitution term $(1+sub)$ replaced the quality term $(1+q)$ leading to about a 1.1 percent reduction in the CPI.

Some typical values of the components are reported as:

Productivity:	-2.0 to -2.5 (percent/year)
Population growth:	-1.0 to +1.0 (percent/year)
Substitution:	-0.5 (percent/year)
Quality improvements	+0.6 (percent/year)

Some authors suggest that the monetary induced price change could exceed the CPI, or the cost of living by about 3 percent prior to 1998 and 4 percent after 1998, suggesting that real inflation could be larger than as expressed by the CPI.

2. The Producer Price Index (PPI) uses a similar benchmark approach, but instead measures price changes reported by establishments at the wholesale level, not the retail level.

3. The Personal Consumption Expenditures (PCE) price index takes a chain weighted approach and links weighted averages from one year to the next. This better reflects the changing composition of spending compared to the CPI's fixed basket approach. For instance, it captures the substitution effect characterized by consumers avoiding a spike in higher priced beef by purchasing lower priced chicken. The PCE is considered more comprehensive and consistent over time than the CPI and PPI. It is the favorite measure of inflation for the Fed. A statistical device called "trimming" is proposed for a more realistic estimate of the PCE accounting for food and energy. From the field of statistics, trim analysis uses the idea of ignoring a few "outliers." A *trimmed mean* is calculated by discarding a certain number of lowest and highest values and then computing the mean of those that remain.

The Federal Reserve Board (Fed) in the USA through its Federal Open Market Committee (FOMC) uses these price indexes to help set monetary policy. The Fed sets interest rates and/or the banks' reserve requirements, and when it modifies them, it targets the economy's sweet spot which that point that produces maximum employment, purchasing power and growth without generating enough upward pressure on prices to produce inflationary expectations of inflation.

Open market operations were introduced *ex post facto* in the 1930s as a way of injecting new money into the economy even though they were not authorized in 1913 Federal Reserve Act of 1913. The Federal Reserve enters the open market to buy government bonds from a set of dealers and paying for them with freshly created money. This has become the main engine of inflation through the monetization of government debt on a large scale. Bond speculators, aware of the Federal Reserve need to the open market to buy bonds, buy the bonds first and then unload them on the Federal Reserve at a substantial profit with no incurred risk. This creates an instability of ever increasing bond values, leading the decreasing interest rates with a subsequent destruction of capital.

Other countries, such as China, avoid the use of interest rates as a tool and instead control the fraction of reserves that the banks are demanded to maintain, to control the money supply.

MONEY AGGREGATES

The term money is defined across a continuum from *narrow money* that includes highly liquid forms of money or money as a means of exchange, to *broad money* that covers less liquid forms of money or money as a store of value.

M0: The narrowest measure of the money supply. It represents outstanding currency such as coins and banknotes in circulation excluding bank vault cash.

M1: includes physical currency such as minted coins and printed paper, traveler's checks, demand deposits which are checking accounts that pay no interest and other checkable deposits that pay interest, including Negotiable Order of Withdrawal (NOW) accounts. Thus it is currency plus overnight or demand deposits plus vault cash. It is referred to as the monetary base. It is critical since it is used in daily transactions and is the base from which the fractional reserve banking system multiplies the money supply.

M2: includes M1 plus most savings accounts with an agreed maturity of up to two years or deposits redeemable at notice for up to three months. This includes Money Market Deposit Accounts (MMDA) which are high yielding bank deposits that offer limited check writing privileges. They are similar to money market fund shares but are issued either by banks or by the Federal Deposit Insurance Corporation (FDIC). Included are small denomination of less than \$100,000 Repurchase Agreements (RPs) and Certificate of Deposit accounts (CDs). It includes retail or non-institutional Money Market Mutual Fund (MMMF) shares owned by individuals.

M3: was discontinued as of March 23, 2006. It included M2, plus large denomination larger than \$100,000 certificate of deposit accounts and repurchase agreements, money market fund shares, and debt securities of up to two years. It included deposits of euro dollars.

MZM (Money with Zero Maturity or immediately available money): has recently become the preferred measure of money supply used by the Federal Reserve on the basis that it better represents money readily available within the economy for spending and consumption. It is a measure of all liquid money supply within an economy. An MZM asset is one that can be immediately redeemed without suffering a penalty or a capital loss. It represents all money in M2 less the time deposits, plus all money market funds.

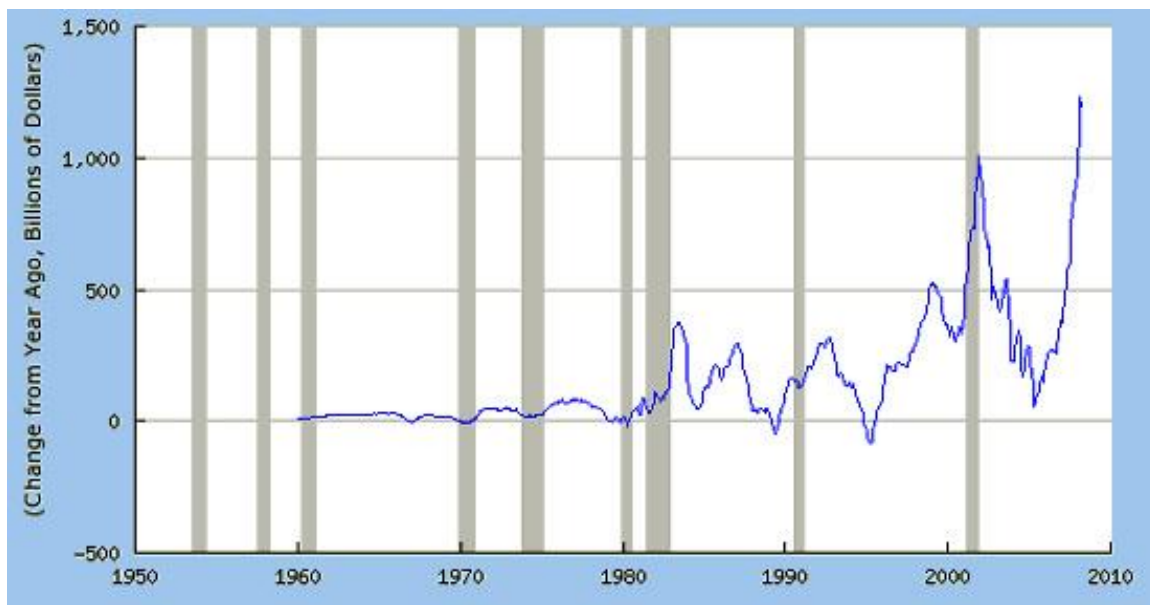


Figure 70. Money with Zero Maturity, or immediately available money, MZM. Shaded areas correspond to recession periods. Source: Federal Reserve Bank of Saint-Louis.

Most attention in the USA has been fixated on the M1 aggregate which is an obsolete measurement of the money supply because money is swept from the M1 accounts every night into interest bearing money markets which are not counted as M1. As a result, the so called M1 “monetary base” is useless as an indication of the nation’s money supply. Because of this confusion, people end up worrying about “deflation” when M1 moves sideways, whereas MZM has been increasing pointing out to “inflation.” Deflation rarely occurs within a fiat currency framework.

CONTROL OF THE MONEY SUPPLY

The USA Federal Reserve, whose advertised dual mandate is achieving price stability by fighting inflation and maximum sustainable full employment by fighting deflation; which is a thankless combination of two contradictory and incompatible tasks, manages the money supply to achieve these goals through three mechanisms:

- 1. Setting of the Federal Funds Rate:** By decreasing interest rates and effectively making money less expensive to borrow, the Federal Reserve increases the demand for money. It is less clear if the same process works in reverse.
- 2. Purchasing USA Government Treasuries:** When the Federal Reserve purchases USA treasuries, it loans money to the USA government. In addition to the money created by the Fed to purchase these treasuries, the assets of the Federal Reserve increase allowing them to lend more to their clients under the fractional reserve banking system.
- 3. Adjustment of the Reserve Ratios:** Banks have a license operate under a fractional reserve banking system whereby they must legally hold a set amount of cash reserves against the amount they lend out to their customers. By adjusting the reserve ratio limits, the Federal Reserve can

affect the amount of money commercial banks are able to lend. Increasing these ratios deflates the money supply because banks can no longer lend out as much as before. Decreasing them has the opposite effect. As of December 21, 2006 the reserve ratios for USA banks were as shown in Table 29.

Table 29. Reserve Ratios of USA Banks. December 2006.

Liability amount [10 ⁶ \$]	Required reserve [percent]
0-8.5	0
8.5-45.8	3
>45.8	10

Interestingly, the European Central Bank (ECB) has a single mandate which is to maintain price stability by defending the value of the euro currency, which translates into just fighting inflation.

Global commercial banks are only required to set aside 56 cents (\$0.56) for every \$100 worth of AAA rated securities they hold. That's roughly an 178:1 leverage. For BBB rated securities, the set-aside requirements jump from \$0.56 to \$4.80; a margin increase of about 750 percent. For lower BB-minus securities, the requirement skyrockets to \$52 per \$100 worth of securities held which is a margin increase of more than 9,000 percent.

The single measure of money supply that the Fed actually has control of is M1. M1 is just one measure of the money supply, and includes all coins, currency held by the public, traveler's checks, checking account balances, NOW accounts, automatic transfer service accounts, and balances in credit unions. As of M2, which includes money markets and other time deposits, the Fed does not have direct control of it, although they can influence it.

As an anecdote, about 2/3 of USA cash currency exists overseas, with 2/3 of the hundred dollar bills being held in Russia.

The adjustment of the interest rates up, leads to businesses finding it more expensive to expand capacity and production, causing them to cut back on investment spending. Households' balance sheets deteriorate from the higher interest rates that they are forced to pay on their mortgages, credit balances and home equity loans, causing them to cut back on consumption spending.

Adjustment of the interest rates down results in businesses finding it cheaper to expand capacity and production, and so they ramp up investment spending. Households find their balance sheets looking better and feel flush, expanding consumption spending.

There is a major complication that the economist Milton Friedman called the "Long and variable lags" in the system. Actions by the Federal Reserve affect production, demand and inflation, and the economy in general, with a time lag of about 15 months into the future.

If the price indexes are rising at an undesirable rate, the Fed may hike the prevailing interest rates. If the price indexes are falling at an undesirable rate, the Fed may cut the interest rates. The Fed monitors all price indexes, but the core PCE, which excludes food and energy prices, is its primary price indicator.

The PPI is sometimes used to gauge the CPI and PCE. However, the PPI tends to be more volatile, and can correlate more with the direction but not the magnitude of price changes.

The CPI has many uses. For instance, according to the Bureau of Labor Statistics (BLS), it is used to adjust income payments to Social Security beneficiaries, military and federal civil service retirees and survivors, and food stamp recipients. It is also used to adjust the federal income tax structure to prevent inflation induced increases in taxes.

Despite being backward looking indicators, the price indices have a big influence on the interest rates, the economy, and stock and bond prices. Stocks and bonds typically fall in reaction to higher than expected price indices readings implying inflation, particularly when the economy is growing near or above its full potential. Undesirable rates of inflation can hurt the valuation of stocks and bonds, raise expectations for Fed rate hikes, and eventually lead to a slowing economy.

Governments and main stream economists do reason that some level of inflation in their economies is necessary in order for consumers and businesses to make spending decisions without feeling it would be smarter to wait for later lower prices or deflation. An annual range of 1-2 percent is generally considered acceptable by the economists without unduly hurting bond prices.

Lower than expected price indices or deflation readings can lift the prices of stocks and bonds, but there is a limit with stocks. At first, rising bond prices and falling bond yields enhance the relative attractiveness of stocks. However, stocks can suffer if the price indices readings keep declining, especially if the economy is growing near or below its full potential. It implies slower corporate profit growth as consumers postpone purchases. As demand slows, this downward spiral can feed on itself, and prices and profits fall further leading eventually to a recession, and in severe cases lasting for several consecutive quarters to a depression.

FRACTIONAL RESERVE BANKING

The mechanics of money creation by the Federal Reserve and fractional reserve banks are fascinating and are worth being explored. Some people consider the central bank and the Federal Reserve System as unconstitutional entities in that they possess a tremendous power and a monopoly control over money and credit, which is an ominous power. The Federal Reserve is blamed for the dollar's value being eroded systematically since its inception in 1913 through a systematic process of increasing the money supply. Since 1913 up to 2008, the dollar currency has lost about 96 percent of its value. Any chairperson of the Federal Reserve is more powerful than even the president of the USA because he has so much control over the USA and global economies.

Governments and their central banks are partners in the simple but effective money creation process, which follows three circular steps:

- 1: The Federal Reserve or central bank issues a new paper money or equivalent balance sheet entries.
- 2: The Federal Reserve Bank loans it to the large favored private banks at low interest rates.
- 3: The large private banks use the borrowed money to buy government bonds or treasuries.

In that process the created money travels in a full circle, from thin air, to the Federal Reserve or central bank, to the banks, and then back to the government, with the big banks taking a small but significant fractional cut of the cash in the process.

As the USA Treasury, which is a government agency, sells a 100 dollar bond to the Federal Reserve, which despite its name is not federal at all and is a privately owned entity, the Federal Reserve gives in return the USA Treasury a 100 dollar note that costs the Federal Reserve absolutely nothing. The Federal Reserve, for its service, then charges the USA Treasury interest

on the note. In fairness, the overall profit to the Federal Reserve Banks is limited to a ceiling of 6 percent.

The USA Treasury sends the 100 dollar bill into circulation spending it for instance as salaries of federal employees, social programs, the military, or security agencies. This 100 bill ends up at a private commercial bank where it starts a new life of its own. The private bank can send the 100 dollar bill to the Federal Reserve Bank and place it on deposit there. Once on deposit there, it can then borrow 90 dollars from the Federal Reserve that it, again, creates out of thin air, to loan out in commercial or private loans. The 10 dollars difference are here kept in reserve, hence the name, “reserve banking.” Thus with a 10 dollars bank reserve for a 100 dollars bill, the USA Treasury borrows and spends into circulation 90 dollars.

If the 10 percent reserve requirement is lowered it gets even more interesting. If one asks where the interest comes from to pay on the money that was created out of thin air and what is the true rate of return on a note that did not cost the Federal Reserve Bank anything in the first place, the answer is: infinity. Very few people question why do governments print bonds and sell them to the privately owned Federal Reserve bank in exchange for currency (notes) and pay interest on those bonds to a private bank when it could just issue the notes (currency) themselves without +having to pay any interest at all.

Thomas Edison suggested that a country that can issue bonds can also issue notes or currency. Both are promises to pay but one enriches the banks and the other runs the government. President Andrew Jackson (referred to as the American Napoleon) caused the closing of the previous federally chartered Second National Bank by refusing to renew its charter in 1836. He claimed it was the greatest accomplishment of his life, and two years later in 1838, he had paid off all the national debt. In 1924, before his death, President Woodrow Wilson said in regards to the creation of the Federal Reserve in 1913: “I have unwittingly ruined my country.”

FEDERAL RESERVE BANK BALANCE SHEET

The Federal Reserve Bank balance sheet counts the deposits that commercial banks keep at the Federal Reserve Bank. When the Federal Reserve Bank creates currency, it typically does so by buying USA government Treasuries through “Open Market Operations.” If the Federal Reserve Bank buys \$1 billion worth of USA government Treasuries, the counterparty to the Federal Reserve is a commercial or investment bank. There exist a select group of “dealer” banks that act as counterparties to the Federal Reserve Bank.

The bank sells a government Treasury to the Federal Reserve Bank, and the Federal Reserve Bank pays the bank for the Treasury it bought. But the currency that the Federal Reserve Bank pays does not actually go into the bank’s general bank account, where it can spend it. Instead, it goes into that bank’s account at the Federal Reserve Bank. That money that the bank has now on deposit with the Federal Reserve Bank is unavailable to the bank. The bank cannot draw on that money. At that stage, it cannot spend that money.

The only thing the bank can do is use that money as a reserve asset when it does its reserve asset calculations. It cannot withdraw it ever. The only way that money gets out of the Federal Reserve account is if the Federal Reserve Bank sells any Treasury or debt instrument back to the bank. The bank can now use that money in its deposit account at the Federal Reserve to pay for that Treasury; that is how the money comes out of the money supply.

Thus the process of creation and destruction of money, or the mechanism by which the Federal Reserve Bank is creating and destroying this money, is intimately tied to the commercial bank accounts at the Federal Reserve, called "Reserve Accounts." But because that money cannot be spent by the bank or by anybody, that money is not functionally part of the money supply yet.

If an investment company has \$1 billion worth of government Treasuries, and it wants to sell these Treasuries, the Federal Reserve Bank buys \$1 billion worth of Treasuries from the bank, and that money gets into the reserve account; the bank buys a Treasury from the investment company and pays the investment company. That money that was created by the Fed was not created and went straight to into the economy; it got stuck there in the reserve accounts. One cannot look at the increase in the reserve account balances and make an extrapolation or make a deduction as to what that means to the overall money supply. One has to actually count the money supply to see what impact it has on the economy. What the Fed is doing is actually changing the structure of Federal Reserve Bank balance sheets, and it only creates the ability for the banks to create money in the economy.

The banks cannot create the money if the demand for the money is not there in the economic system or if the match between credit demand and creditworthiness is not there. The entities that actually creates the money supply is not the Federal Reserve Bank. It is the normal commercial banks. It is when individuals or businesses take loans from the banks that the creation of the loan is the creation of money. This results in an increase in the money supply and hence inflation.

When the opposite occurs as individuals or businesses pay back their loans, they extinguish the debt and decrease the money supply in the economy, hence deflation occurs. That is how the money supply increases and decreases. So all the Federal Reserve Bank did was enable the banks to create the money through issuing interest-bearing debt.

It must be noticed that the rate at which the banks actually created the money depended on the economic demand for that money.

UNSUSTAINABILITY OF MONETARY INFLATION, CYBER CURRENCY

Inflation is commonly described as the increased cost of purchasing goods and services. In fact it is inflation in the quantity of the money supply or credit that later translates into price inflation. The main inflation statistic in the USA is the Consumer Price Index (CPI), which is the change in the overall price of a shopping basket of consumer goods charted over time. In fact it is considered by some economists, with its adjustments to the money supply term, more of a cost of living measure than an inflation measure. When inflation rises, the cost of the goods goes up and a given amount of money finds its purchasing power decreased accordingly.

Governments have discovered a clever way of taxing their citizens, without calling it a tax, and to gradually eliminate the debt they owe foreigners as well as their own citizens as pensions and entitlements, without calling it debt renouncement; through the ingenious process of monetary and credit inflation and depreciation of their currencies. In an unsustainable process the entitlements are growing at a yearly rate of 8 percent and are supposed to be supported by the USA economy that is growing at a yearly rate of 3 percent.

ONE IN A MILLION

What the majority of common people does not understand and fails to comprehend is that banks possess a monopoly to loan money which does not exist, and then receive compound interest and repayment of previously nonexistent funds in return.

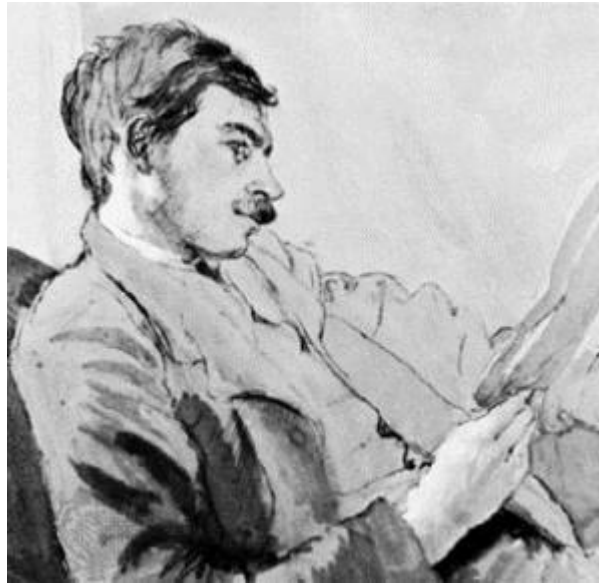


Figure 71. John Maynard Keynes.

The economist John Maynard Keynes in 1920, stated:

"By a continuing process of inflation governments can confiscate, secretly and unobserved, an important part of the wealth of their citizens. By this method they not only confiscate, but they confiscate arbitrarily; and, while the process impoverishes many, it actually enriches some. The sight of this arbitrary rearrangement of riches strikes not only at security, but at confidence in the equity of the existing distribution of wealth.

Those to whom the system brings windfalls, beyond their deserts and even beyond their expectations or desires, become 'profiteers,' who are the object of the hatred of the bourgeoisie, whom the inflationism has impoverished, not less than of the proletariat. As the inflation proceeds and the real value of the currency fluctuates wildly from month to month, all permanent relations between debtors and creditors, which form the ultimate foundation of capitalism, become so utterly disordered as to be almost meaningless; and the process of wealth-getting degenerates into a gamble and a lottery.

Lenin was certainly right. There is no subtler, no surer means of overturning the existing basis of society than to debauch the currency. The process engages all the hidden forces of economic law on the side of destruction, and does it in a manner which not one man in a million is able to diagnose."

One of those "one man in a million" was the author Ernest Hemingway when he said in 1932 in "Notes on the Next War: A serious Topical Letter":

“The first panacea for a mismanaged nation is inflation of the currency; the second is war. Both bring a temporary prosperity; both bring a permanent ruin. But both are the refuge of political and economic opportunists.”

A famous quote of Keynes in 1923 was:

“But this long run is a misleading guide to current affairs. In the long run we are all dead. Economists set themselves too easy, too useless a task if in tempestuous seasons they can only tell us that when the storm is long past the ocean is flat again.”

Common people are usually deceived by their ruling elites and channel them into one of several “acceptable” choices. A perennial trick used by a parent or a caregiver to a child is: “Would you like to eat your vegetables with the blue spoon or the red fork? Good choice!” Along this line, Robert Greene, in his work: “The 48 Laws of Power,” identified this process as Law 31: Control the Options – Get Others to Play with the Cards You Deal:

“The best deceptions are the ones that seem to give the other person a choice; your victims feel they are in control, but are actually your puppets. Give people options that come out in your favor whichever one they choose. Force them to make choices between the lesser of two evils, both of which serve your purpose. Put them on the horns of a dilemma: They are gored wherever they turn.”

This reflects the methods suggested by Edward Bernays, the nephew of Sigmund Freud and the father of modern propaganda. Edward Bernays was hired by the United Fruit Company to convince the American public that Guatemala’s democratic and legally elected President Arbenz Guzman was a dangerous individual and thus justified a CIA led coup to remove him from office; a chapter in history where the term “Banana Republic” was initiated. In his book “Propaganda (1925)”:

“The conscious and intelligent manipulation of the organized habits and opinions of the masses is an important element in democratic society. Those who manipulate this unseen mechanism of society constitute an invisible government which is the true ruling power of our country.

We are governed, our minds are molded, our tastes formed, our ideas suggested, largely by men we have never heard of. This is a logical result of the way in which our democratic society is organized. Vast numbers of human beings must cooperate in this manner if they are to live together as a smoothly functioning society.

In almost every act of our daily lives, whether in the sphere of politics or business, in our social conduct or our ethical thinking, we are dominated by the relatively small number of persons who understand the mental processes and social patterns of the masses. It is they who pull the wires which control the public mind.”

According to Noam Chomsky:

“Mass education was designed to turn independent farmers into docile, passive tools of production. That was its primary purpose. And don’t think people didn’t know it. They knew it and they fought against it. There was a lot of resistance to mass education for exactly that reason. It was also understood by the elites. Emerson once said something about how we’re educating them to keep them from our throats. If you don’t educate them, what we call “education,” they’re going to take control — “they” being what Alexander Hamilton called the “great beast,” namely the people. The anti-democratic thrust of opinion in what are called democratic societies is really ferocious. And for good reason. Because the freer the society gets, the more dangerous the great beast becomes and the more you have to be careful to cage it somehow...”

REPARTITION BASIS WORLD PENSION SYSTEMS

All the world's pension systems originated from the one set up in Prussia by Otto von Bismarck. It was introduced to the USA around 1935.

Bismarck offered people a pension on what is called a “repartition basis.” All the money goes into a pot, and those who join the system get from the pot whatever the politicians decide they can get. Some vocal groups and the elite ruling classes such as government and state employees, politicians, teachers, police, the military and fire-fighters are allowed to retire earlier, supposedly because their skills are time limited.

Bismarck assigned to people who retired at the ripe age 65 a substantial pension since he knew that the average life expectancy in Prussia at the middle of the 19th century was just 45 years. He fully knew that he did not have to pay out many pension claims since the laws of probability would ensure that most pensioners would not live long enough to get back what they contributed. On the other hand, the average person did not know how long he would live, so he could imagine himself living to a ripe old age and taking advantage of the public pension system as a recipient of government handouts.

Bismarck, as a shrewd politician aimed at making the population “docile” so they would “serve the state” more easily.

Today, the life expectancy is much longer to about 75 years at the same time that the politicians promised larger benefits with a lowered age to get them. Thus the pension systems are going broke all over the world with fewer younger people available to support an increasing old population in the industrialized nations, unless the magic of inflation is deliberately used to reduce the value of the promised entitlement payments.

UNSUSTAINABILITY OF SOCIAL SECURITY

The trustees of the Social Security program in the USA announced in October 2007 that by 2017 the program would begin paying more in benefits to the baby boomers, which began retiring in 2007, than it receives in social security taxes. By 2041, the trust fund is projected to be exhausted, unless a reduction in the level of benefits is somehow instigated.

According to the Urban Institute, a person who turned 65 in 1980 paid \$96,000 into the Social Security system and received back \$203,000. Meanwhile, someone turning 65 in 2030 will pay \$398,000 into the system and get back only \$336,000.

The situation is becoming more unsustainable for the baby boomers with an increase in the unemployment rate, which predicts a major reduction in their standard of living. The non-retired or unable to retire, senior population in the USA workforce stands at 16.4 percent. This is so since private debt in the USA stands at 280 percent of Gross Domestic Product (GDP) while the public debt stands at 72 percent of GDP.

In the Western world, well-educated high earners are staying in the workforce longer than they used to. In the USA, nearly two-thirds of men with a professional degree ages 62–74 are still working, if not necessarily full-time. Among high-school graduates, it is only one-third. According to the Economist in April 2014: “Employment rates are falling among younger unskilled people, whereas older skilled folk are working longer. The divide is most extreme in America, where well-educated baby boomers are putting off retirement while many less skilled younger people have dropped out of the workforce.”

Gallup pollsters conducted polls in the early 1990s and found that the average retirement age was 57 in both 1991 and 1993. From 2002–2012, the average hovered around 60. Over 2012–2013, the average age at which Americans report retiring has increased to 62.

According to the economist: “Pay has risen sharply for the highly educated, and those people continue to reap rich rewards into old age because these days the educated elderly are more productive than their predecessors. At the other end of the social scale, however, things look grim. Manual work gets harder as people get older, and public pensions look more attractive to those on low wages and the unemployed.”

The talk about increased life expectancy does not apply to the least-educated Americans: In 1990, a white woman who lacked a high school diploma could expect to live to 78. By 2008, only 73. S. Jay Olshansky at the University of Illinois-Chicago suggests that the numbers are unsustainable no matter the gender or ethnicity. Among Americans who did not graduate from high school:

“White men have a life expectancy no better than they did in 1972.

White women have a life expectancy no better than they did in 1964.

Black women’s life expectancy is no better than in 1962.

And for black men, it is no better now than it was in 1954.”

Pressed by The Washington Post for explanations behind the trend, he could only speculate:

“I am not sure the least educated members of the population are missing out on the advances in medical technology as much as they are adopting harmful behavioral habits that shorten their life. I have argued for quite some time that the only control we have over the duration of our lives is to shorten it, and we exercise that control often and with increased frequency (smoking, obesity, etc.).”

Nor is education the only factor that correlates with longevity. Men who make more than the median income and reach the age of 65 are living six years longer than they did in the late 1970s. It should be remembered that higher earners are the ones more likely to keep paying into Social Security.

UNSUSTAINABILITY OF MEDICARE AND MEDICAID

Social Security might make it through a few decades unscathed. But Medicare and Medicaid are another matter. Men who make less than the median income level are living only about 16 months longer. The problem is solved this way:

“Well-educated high-earning Americans will work till they drop and pay into Social Security the whole time. Meanwhile, the least-educated Americans will die off before they can collect much in the way of benefits.”

As it stands now, white men with no high school diploma typically live to only 67, which happens to be full retirement age for anyone born after 1959. Health care took up 6.2 percent of federal spending in 1970. By 1990, the share had doubled to 12.4 percent. And by 2011, it had doubled again, to 24.3 percent. This is a doubling time of 20 years. A person aged 55 presently needs to think about health care will double again within 20 years to take up 50 percent of the federal budget by the time he reaches $55 + 20 = 75$; or whether something in the unsustainable system will collapse before then.

BOOM AND BUST PROCESS, PONZI SCHEME

Ponzi was a schemer, a “confidence man,” or in short “con-man,” from the early 20th century who figured out that he could promise to pay people a high rate of return to entice them to turn their money to him for investment. He would pay the first investors the promised high yields with the capital investments from the last ones into the scheme.

The scheme worked perfectly for the people who got into it early. However Ponzi schemes always blow up. The late comers end up losing all their contributions for lack of others joining after them. The problem is essentially the same in all extraordinary financial episodes; from the Tulip Mania, the South Sea Bubble, the Dotcom Bubble and the Subprime Mortgages Housing Bubble.

A Ponzi Scheme is defined as follows:

“A Ponzi Scheme is a fraudulent investment operation that pays returns to its investors from their own money or the money paid by subsequent investors, rather than from profit earned by the individual or organization running the operation.”

According to economist Murray Rothbard, from the University of Las Vegas in his book “America’s Great Depression,” a properly functioning economy is balanced with some industries enjoying expansion and other industries suffering contraction. A cluster of errors caused by monetary intervention in the markets such as bank credit expansion to businesses or individuals may result in a major boom that is inevitably followed by a bust: “The boom is the time when errors are made. The ‘depression’ is actually the process by which the economy adjusts to the wastes and errors of the boom. Far from being an evil scourge, the depression is the necessary and beneficial return of the economy to normal. Evidently, the longer the boom goes on the more wasteful the errors committed, and the longer and more severe will be the necessary depression readjustment.”

Financier George Soros in his theory of “reflexivity” describes the process as: “Boom-bust processes usually revolve around credit and always involve a bias or misconception. This is usually a failure to recognize a reflexive, circular connection between the willingness to lend and

the value of the collateral. Ease of credit generates demand that pushes up the value of property, which in turn increases the amount of credit available.”

The bust process is a pressure relief valve that corrects the excesses. Stock market crashes destroy wealth and the savings of the population. Such examples of crashes are shown in Table 30.

Table 30. Duration of different crashes.

Start	End	Decline [percent]
March 1937	March 1938	49.1
September 1929	September 1930	46.2
October 1919	December 1920	44.2
September 1973	September 1974	40.8
October 2007	October 2008?	40.3
November 1916	December 1917	40.1
January 1907	January 1908	39.2

A result of the bust process is trade protectionism that plagued the world in the 1930s. The Smoot-Hawley Act and protectionism turned a possibly mild depression into the Great depression.

In the 1930s either social welfare in the USA or a blame game in Europe that led to a march toward World War II, was adopted to spring out from the bust phase, mask the difficulties, restore full employment, divert the attention of the populace and avoid discontent, social strife and street riots like in the 1930s. The war for the control of oil is already under way and should dominate the first part of this century, in addition to the control of water and food supplies.

Another victim is civil liberties and rights with the tendency toward a dictatorial capitalist society with the USA becoming an increasingly surveillance society and in the growth of the apparatuses of a police state.

UNSUSTAINABILITY OF PRACTICED BANKING

Capitalism is not the cause of booms and busts per se. It is rather banking as practiced that leads to them.

For a loan principal P and interest charged i , in a fixed money supply system, the money needed to pay the interest is not created. Thus one can estimate a probability p of lenders and borrowers that must go bankrupt, both in a fiat currency or a gold-based system as:

$$p = \frac{i}{i + P}$$

In practiced banking the bankruptcy is just temporarily postponed in an unsustainable way by expanding the money supply by the reserve banking system to create more debt cover the original interest due. Eventually so much money is borrowed to pay for the accumulated due interest that the borrowers do not have sufficient income to make the required payments and the whole system collapses in a cascading avalanche of a deflationary debt destruction.

Economist Milton Friedman wrote: “The Great Depression in the United States is a testament to how much harm can be done by mistakes on the part of a few men when they wield vast power over the monetary system of a country.”

ENGINEERED CONFLICTS

Booms and depressions are cyclic processes that are characteristic of the current world economic system. It can be observed that the cycles coincide with a period of a human generation from 70-100 years.

The turning points from one excess of an inflationary bursting bubble to the excess of a deflationary depression is punctuated by social dislocations, civil wars or global conflicts. Wars are engineered to gain control of coveted resources, or to divert the attention of the populace from their economic troubles and unite them against some foreign enemies and provide full employment in these war efforts.

The Stamp Acts catalyzed the American Revolutionary War and the independence of the USA from England circa 1782. The election of President Abraham Lincoln catalyzed the American Civil War around 1863. First World War occurred around 1914. The stock market Crash of 1929 catalyzed the USA Great Depression followed by the World War II era about 1943.

Other minor American wars, equivalent to sporting events and circuses for the entertainment of the masses; were the War of 1812, the Mexican War, the Spanish War, the Korean War, the Vietnam War, the first Gulf War, the second Gulf War, the Somalia War, the Bosnia War, the Kosovo War, and the dual wars in Afghanistan and Iraq. Contemplated future distractions are a witch’s brew of wars on the drawing boards in Darfur, Iran and Pakistan.

People will collectively do their best to avoid a repeat of these events, at least while there are some of them still alive that witnessed or lived through the last crisis. However within a lifetime, these cataclysmic events are forgotten, resurgent nationalism has to feed, and the mistakes are inevitably repeated by the newer generations drawn by their elites into fighting yet another war to end all wars.

PRIVATE OWNERSHIP OF THE FEDERAL RESERVE, PRIVATE VS. PUBLIC CONTROL OF THE CURRENCY

The British Parliament granted a monopoly in 1694 to the privately owned Bank of England, establishing a tradition still existing worldwide. Central banking exists primarily to protect large fractional reserve commercial banks from bank runs, and therefore to preserve the fractional reserve banking system nationally

Analogously, in the USA, the Federal Reserve Board, in short Fed, was established in 1913 by the 63rd Congress, pursuant to the 16th Amendment to the Constitution to oversee the nation's money supply. It took almost four decades before it could truly perform this function. In its early years, the Fed acted almost as an adjunct to the Treasury Department when it was called upon to keep bond yields low by buying Treasury bonds, thereby artificially increasing the money supply.

According to the Federal Reserve’s own definition:

“As of March 2004, of the nation's approximately 7,700 commercial banks approximately 2,900 were members of the Federal Reserve System - approximately 2,000 national banks and 900 state banks. Member banks must

subscribe to stock in their regional Federal Reserve Bank in an amount equal to 6 percent of their capital and surplus, half of which must be paid in while the other half is subject to call by the Board of Governors. The holding of this stock, however, does not carry with it the control and financial interest conveyed to holders of common stock in for-profit organizations. It is merely a legal obligation of Federal Reserve membership, and the stock may not be sold or pledged as collateral for loans. Member banks receive a 6 percent dividend annually on their stock, as specified by law, and vote for the Class A and Class B directors of the Reserve Bank. Stock in Federal Reserve Banks is not available for purchase by individuals or entities other than member banks.”

The Federal Reserve is considered by different sources as an independent agency, a bank of banks or a bank cartel, that no other government agency can overrule the actions it takes, and its monetary policy is exempt from audit by the Government Accountability Office (GAO). Stock can only be purchased by member banks and by no USA citizen, government, corporation or any non-bank entity.

As of March 2007, the assets of the main banks and holding companies, and hence their ownership of the Federal Reserve, were as shown in Table 31.

Table 31. Banks ownership of the USA Federal Reserve Bank. March 2007.

Bank / Holding Company	Consolidated Assets [10 ⁶ \$]	Domestic Assets [10 ⁶ \$]	Percent of domestic assets
Bank of America	1,663,208	1,570,954	18.43
JP Morgan Chase	1,783,859	1,189,664	13.96
Wells Fargo / Wachovia	1,180,327	1,157,851	13.59
Citibank	1,228,139	689,116	8.09
PNC Bank	289,248	287,318	3.37
Bank of New York Mellon	349,132	275,087	3.23
US Bank	263,561	262,671	3.08
Suntrust Bank	174,237	174,237	2.04
HSBC Bank	179,991	169,057	1.98
Goldman Sachs	161,455	161,455	1.89
Other	2,678,987	2,584,673	30.33
Total	9,958,144	8,521,881	100.00

The Bureau of Printing and Engraving in Washington, DC prints the Federal Reserve notes on contract from the Federal Reserve System for the nominal sum of .00260 each in units of 1,000, at the same price regardless of the denomination. These notes, printed for a private bank, then become liabilities and obligations of the USA government and are added to its present \$10 trillion debt. The Federal Reserve Notes are actually promissory notes or promises to pay, rather than what is traditionally considered as money. They are interest bearing notes issued against interest bearing government bonds, which is paper issued with backing as paper, also known as fiat money, having only the fiat of the issuer to guarantee the notes. The Federal Reserve Act authorizes the issuance of these notes: “for the purposes of making advances to federal reserve

banks. The said notes shall be obligations of the United States. They shall be redeemed in gold on demand at the Treasury Department of the United States in the District of Columbia.” The Federal Reserve Act stipulates that the stock of the Federal Reserve Banks cannot be bought or sold on any stock exchange. It is passed on by inheritance. About one half of the owners of the Federal Reserve Bank stock are not Americans.

The president of the USA appoints the Governors of the Federal Reserve Board, who are then confirmed by the Senate.

As described by Addison Wiggin:

“In 1913, President Woodrow Wilson was successful in publishing the Federal Reserve Act through Congress. The act allowed the government to establish the third central bank in the nation’s history.

Think of the Fed as the bank of banks, and the government’s bank — the gatekeeper of the USA economy. The board, which is run by seven governors and presided over by a chairman and vice chairman, is charged with managing the supply of money and credit to the economy. By manipulating interest rates and creating money, the Fed can either stimulate or stifle the economy. The Federal Reserve is the primary force in determining our nation’s money supply. The Fed’s two main goals are (1) to help stimulate economic growth and (2) to try to keep inflation low. These goals often conflict.

The central bank Federal Reserve System has a tremendous amount of power and a monopoly control over money and credit. The chairman of the Federal Reserve is more powerful than even the president because he has so much control over the economy. The Fed is the key to how much money and credit is in the USA economy in any given time. This is due to the fact that the United States currency is a *fiat money* in other words, it is not backed by anything tangible, and therefore it can be created out of thin air.”

The Banking and Currency Bill or the Carter Glass Bill which was the House of Representatives version of the final Federal Reserve Act, passed the House on September 18, 1913 by 287 to 85 votes. On December 19, 1913, the Senate passed their version by a vote of 54 to 34. More than 40 important differences in the House and Senate versions remained to be settled, and the opponents of the bill in both houses of Congress were led to believe that many weeks would yet elapse before the Conference bill would be ready for consideration. The Congressmen prepared to leave Washington for the annual Christmas recess, assured that the Conference bill would not be brought up until the following year. Now the supporters of the bill prepared and executed the most brilliant stroke of their plan. In a single day, they ironed out all 40 of the disputed passages in the bill and quickly brought it to a vote. On Monday, December 22, 1913, the bill was passed by the House 282-60 and the Senate 43-23. On December 21, 1913, The New York Times commented editorially on the act: “New York will be on a firmer basis of financial growth, and we shall soon see her the money centre of the world.”

The unprecedented speed with which the Federal Reserve Act had been passed by Congress during what became known as "the Christmas massacre" had one unforeseen aspect. President Woodrow Wilson was taken unaware, as he had been assured the bill would not come up for a vote until after Christmas. He refused to sign it, because he objected to the provisions for the selection of the Class B Directors. Bernard Baruch, a principal contributor to President Wilson’s campaign fund, was stunned when he was informed that President Wilson refused to

sign the bill. He hurried to the White House and assured Wilson that this was a minor matter, which could be fixed up later through "administrative processes". With this reassurance, Wilson signed the Federal Reserve Act on December 23, 1913. History proved that on that day, unprecedented power was passed into the hands of an elite group of international bankers.

In an afterthought, President Woodrow Wilson later wrote in 1916: "Our system of credit is concentrated. The growth of the nation, therefore, and all our activities, are in the hands of a few men," as related in: "National Economy and the Banking System," Senate Document No. 3, N. 223, 76th Congress, first session, 1939. He is quoted as regretting his actions:

"I am a most unhappy man. I have unwittingly ruined my country. A great industrial nation is controlled by its system of credit. Our system of credit is concentrated. The growth of the nation, therefore, and all our activities are in the hands of a few men. We have come to be one of the worst ruled, one of the most completely controlled and dominated governments in the civilized world. No longer a government by free opinion, no longer a government by conviction and the vote of the majority, but a government by the opinion and duress of a small group of dominant men."

By the late 1940s, the Fed balked at being a de facto arm of the Treasury Department, and in 1951, managed to reach the "Accord with the Treasury." This allowed it to use its own discretion in buying Treasury securities, and otherwise become a financial policy maker independently of the executive branch; effectively creating a fourth branch of government.

The name of the USA Federal Reserve Banks implies that they are owned by the USA Federal Government. It is an institution that in fact has no "reserves" and is no more "federal" than the "Federal Express" company. The illusion is conveniently nurtured with the added icing that they are independent in their policy making process of creating the money supply and determining the interest rates. These two processes determine the well-being of the nation's citizens, and can cause social upheaval and even wars worldwide. The truth about this matter is unexpected to most people: The USA Federal Reserve is neither a Federal nor a USA entity. It is an amalgam of private individuals appointed by the central banks, some of which are not even USA owned nor based.

The Federal Reserve Open Market Committee (FOMC) or Fed, like other central bankers of the world, carries out a process of central economic planning by meeting eight times each year. As a group of twelve people they meet to make secret decisions that have a profound impact on the USA and global economies. None of them are elected. Eight of the representatives: the Chairman and the Board of Governors, are political appointees of the President. All twelve men are bankers. Their meetings are closed to the public. Members of the USA Congress and the Senate Banking and Finance Committees are barred from attending, or even knowing what is discussed. No detailed account of arguments or discussions is ever made public.

While most people regard the Fed as the primary inflation fighter, in reality it is the sole inflation creator. The FOMC seeks to foster an economic environment characterized by low and steady inflation.

Under the current system, the small group of bank appointed individuals who sit on the Federal Reserve Board holds an incredible amount of power. These men, with their decisions on interest rate policy determine what the ordinary citizens home mortgage payment will be, their car payment, and whether they shall have a job or not. It is a privately owned non-governmental

central planning system solely serving the interests of the privately owned central banks who appointed them.

As an example, if we were interested in knowing who owns the majority of the stock of the New York Federal Reserve Bank, we must first present out the fact that the stock in the original 12 regional Federal Reserve Banks in the USA was purchased by national banks in these twelve regions.

A reason for considering the Federal Reserve Bank of New York is because it has been privileged with the tasks of setting the interest rates levels and directing the open market operations of the Federal Reserve Banks system, thus controlling the daily supply and price of money throughout the USA. It is the stockholders of that bank who are the real directors of the entire Federal Reserve Banks system.

On May 19, 1914, the Federal Reserve Bank of New York issued 203,053 shares, and, as filed with the Comptroller of the Currency, the large New York City Banks was assigned more than half of the outstanding shares.

The Rockefeller Kuhn, Loeb-controlled National City Bank was assigned the largest number of shares of any bank in the amount of 30,000 shares. J. P. Morgan's First National Bank was allocated 15,000 shares. When these two banks merged in 1955, they owned in one block almost 1/4 of the shares in the Federal Reserve Bank of New York, which controlled the entire system, and thus they could nominate their own choice, with a façade of an endorsement from the President of the USA and a later hearing followed by approval by the USA's Congress, Paul Volcker, Alan Greenspan, Ben Bernanke or anyone else of their choice to become Chairperson of the Federal Reserve Board of Governors.

Chase National Bank was allocated 6,000 shares. The Marine Nation Bank of Buffalo, later known as Marine Midland, was assigned 6,000 shares. This bank was owned by the Schoellkopf family, which controlled Niagara Power Company and other large interests. National Bank of Commerce of New York City obtained 21,000 shares.

The shareholders of these banks, which own the stock of the Federal Reserve Bank of New York, are the dynastic bankers who have influenced the political and economic destinies of Europe and the USA since 1914. These are the Rothschilds of Europe, Lazard Brothers of London, Lazard Frères of Paris or Eugène Meyer of France, Baring Brothers and Samuel Montague of England, J. and W. Seligman, Ladenburg Thalmann, Speyer Brothers, Kuhn Loeb Company, M. M. Warburg Company of Hamburg, Germany, Lehman Brothers, Goldman Sachs, the Rockefeller family, Goldman Sachs, Jacob Schiff, Otto Kahn, and the J. P. Morgan interests.

These financial interests have merged and consolidated in recent years, so that the control is much more concentrated. National Bank of Commerce is now Morgan Guaranty Trust Company. Lehman Brothers has merged with Kuhn, Loeb Company; First National Bank has merged with the National City Bank.

In the other eleven Federal Reserve Districts in the USA, these same shareholders indirectly own or control shares in those banks, with the other shares owned by the leading families in those areas who own or control the principal industries in these regions.

The Federal Reserve Banks began operations on November 16, 1914 with total assets were listed at \$143,000,000, from the sale of shares in the Federal Reserve Banks to stockholders of the national banks which subscribed to it. The actual part of this \$143,000,000 which was paid in for these shares remains shrouded in mystery. Some historians believe that the shareholders only paid about half of the amount in cash; others believe that they paid in no cash at all, but sent in checks which they drew on the national banks which they owned. This seems most likely, that

from the very outset, the Federal Reserve operations were “paper issued against paper,” that bookkeeping entries comprised the only values which changed hands.

For the shareholding banks it is quite difficult to lose any money when it is created out of electrons and in the words of John Maynard Keynes, “out of thin air” as book entries, at no cost to them and to then lend it out by the fractional reserve banking policy, which multiplies the effect of the increased money supply on prices, via increased liquidity; and then to collect interest for lending that which they do not truly possess.

ENGINEERED MARKET COLLAPSES

Banks purchase Treasuries because they are used to bolster their deposit base. This is because they need to pay back all the cash that they borrowed to loan out to their customers.

Treasuries are used to pay back cash because they are essentially cash in a deferred state. When they mature, the USA Government credits cash to the banking institution.

Banks borrow Treasuries from the Federal Reserve central bank and they do not buy them, then they sell the Treasuries to individuals so they hold them on the book as an asset and make a loan against that asset.

When banks make a loan against the Treasury security asset, they do not really possess it. The Treasury is still held in electronic form but they loaned out the cash that would be received from the Treasury; so these loans were supposed to be returned in cash form so they can pay back the Federal Reserve, who purchased them from the USA Treasury. Thus the bank borrows from the Fed instead of purchasing the security outright.

An interesting fact is that a bank possesses a reciprocity mode structure. An asset for the bank is a liability for anybody else and vice versa.

A deposit by a customer to a bank of \$10,000 becomes a \$10,000 liability for the bank. Operation on the reserve system means that for a 10 percent reserve, the bank needs to keep just \$1,000 as a reserve. But the bank does not really have it on deposit and what the bank does is to purchase a \$1,000 bill or note or bond and loan out the remaining \$9,000 to an individual or a corporation and earn interest on it, in good times, that is.

In bad times, if it so happens that the borrower cannot pay off the loan and goes bankrupt, the bank has a \$1,000 USA security, but it does not have the other \$9,000 fractional amount needed to cover what was loaned out. Thus the bank borrows this \$9,000 from the Federal Reserve, but they borrow this in the form of Treasuries and while it pays interest on these Treasuries, eventually it needs to pay the cash back when the Treasury matures.

When the banks have loaned out all their cash holdings and they need cash delivered to them they simply buy it. But what they buy is not cash today: this is too expensive and could collapse the market values of equities. Thus they buy cash futures that are due a few months to a year from today.

The banks borrow on a massive scale. Outsiders to the banking industry assume that the banks held the initial \$1,000 deposit when in fact they loaned out nine times that initial \$1,000. If the borrower cannot repay the loan, the bank is not going to get that \$1,000 back and cannot pay the depositor back. Not only that, but it cannot repay the \$9,000 that it loaned out, needing even more cash deposits as Treasury bills.

What happens if the banks do not have enough cash deposits when they are going to be due is that they are compelled to engineer a collapse of the stock market through the actions of the central bank whose stock they own in the first place, and take the cash that the panicked stock

sellers have put into it right back out. Meanwhile their Treasury Bills will become worth more as well, increasing their deposit base and repeating the growth and collapse cycle.

OPENING AND CLOSING THE FED WINDOW, ECONOMIC CYCLES

Whenever the Federal Reserve decides that the economy needs a stimulus, it lowers the interest rates. Borrowing by businesses and individuals becomes easier, and more money flows into the economy. This is referred to as “opening the Fed window.” The result is an increase in the money supply.

If the money supply is increasing, consumers feel wealthier and more money is changing hands as they exchange goods and services. This puts a chain of events into motion. Businesses see increased sales and therefore order more materials and increase production. This increases the demand for labor and goods. The prices of stocks rise and firms issue equity and debt. The money supply continues to expand. The prices for these goods and services begin to rise, particularly when the output growth reaches its capacity limits. A bubble is formed followed by a mania. The public expects inflation. Lenders insist on higher interest rates to offset an expected decline in purchasing power over the life of their loans. When inflation is rising, the currency loses its value, and the Fed raises interest rates. Borrowing becomes more expensive and money eventually flows out of the economy.

When the supply of money fails to expand, or when its rate of growth declines, economic activity declines. In this case, either reduced inflation as disinflation arises or when the Fed determines that the economy needs a stimulus, interest rates are lowered, borrowing becomes easier, and more money flows into the economy. This is known as *opening the Fed window*, and the result is an increase in the money supply. If the money supply is increasing, consumers are feeling wealthier and more money is changing hands as they buy goods and services.

This puts a chain of events into motion. Businesses see increased sales and therefore order more materials and increase production. This, in turn, increases the demand for labor and goods. What happens after that, in a buoyant economy, is that prices of stocks rise and firms issue equity and debt. If the money supply continues to expand, the prices for these goods and services begin to rise, especially if output growth reaches capacity limits — in other words, a bubble is formed. As the public begins to expect inflation, lenders insist on higher interest rates to offset an expected decline in purchasing power over the life of their loans. When inflation is rising, the dollar is quickly losing value, and the Fed raises interest rates, which means borrowing becomes more expensive and money eventually flows out of the economy.

In another scenario, the economy could become stagnant and inflation can rise simultaneously; a situation referred to as stagflation. The Fed becomes faced with a difficult choice, because it cannot raise interest rates and lower them at the same time. It must choose either to stimulate the economy or to fight inflation. This last happened in the USA in the late 1970s, and led to difficult economic times..

MONOPOLY BOARD GAME ANALOGY

As a state sponsored monopoly, the Federal Reserve acts much like a dominant player in the Monopoly board game by Parker Brothers.

Such a player buys some spare games boxes. When he starts loosing he uses the extra money from the spare games. He would also double or triple the prices of homes, hotels, railroads

and utilities on the board and say that I'm the only one who can do this because owns the board game.

The other players would accuse him of cheating, but he would respond that he is making the game more realistic by acting like the Federal Reserve.

He gets to increase all the existing play money just for himself. Meanwhile all the prices of the properties are increased for the other players, who only get to keep the money they had from the previous play. He can justify the move as his Federal Reserve Discount Window move and he is the only player who is allowed to use it.

CONFLICT BETWEEN NATIONAL GOVERNMENTS AND RESERVE BANKING

International bankers possess the important trait that they are truly supra-national in their conduct, transcending borders, and not holding allegiance to any particular nation. Speaking to the USA Senate on February 17, 1950, James Paul Warburg, whose family cofounded the USA Federal Reserve, said: "We shall have World Government, whether or not we like it. The only question is whether World Government will be achieved by conquest or consent."

President Abraham Lincoln during the American Civil War (1861-1865) sought financing of the war from the international bankers, much like previous European monarchs. The war being a risky business, the London bankers offered him \$5 million and asked him for an exorbitant usury level of 12 percent interest. President Lincoln convinced Congress to pass a law authorizing the printing of full legal tender Treasury notes to pay for the war effort, which were backed by gold, writing about it: "We gave the people of this Republic the greatest blessing they have ever had - their own paper money to pay their own debts." These Treasury notes were printed with a green ink on their back, hence the name: "Greenbacks."

The USA bypassed the international bankers and printed exactly \$449,338,902 worth of Greenbacks as a debt free and interest free money to finance the war. It served as legal tender for all debts, public and private.





Figure 72. Lincoln greenbacks, 1861.

As a reaction, in England, “The London Times,” fearing for its monarchy and its empire printed:

“If that mischievous financial policy, which had its origin in the North American Republic, should become indurated down to a fixture, then that Government will furnish its own money without cost. It will pay off debts and be without a debt. It will have all the money necessary to carry on its commerce. It will become prosperous beyond precedent in the history of the civilized governments of the world. The brains and the wealth of all countries will go to North America. That government must be destroyed, or it will destroy every monarchy on the globe.”

Consequently, the British Government, which was controlled by the London and other European Bankers, moved to support the Confederate South against the North, hoping to defeat President Abraham Lincoln and the Union.

However, Lincoln fully understood the British people, and he knew that they would not support slavery. This was a factor in issuing the Emancipation Proclamation, which declared that slavery in the USA was abolished. This disarmed the London bankers who could thus not openly support the Confederacy.

In addition, the Czar of Russia sent a contingent of the Russian Navy to the USA with orders to operate under the command of Abraham Lincoln, if needed, to prevent the British Navy from breaking the blockade that the North had imposed on the South

The North was victorious in the Civil War and the Union was preserved, but Lincoln was assassinated. Afterwards, the USA Congress revoked the Greenback Law and enacted, in its place, the National Banking Act. The national banks accordingly were to be privately owned and the national bank notes they issued were to be interest bearing. The National Banking Act also provided that the Greenbacks should be retired from circulation as they reached the Treasury Department in payment of taxes.

The USA Treasury Department in 1972 calculated the amount of interest that would have been paid if the 400 million dollars would have been borrowed at interest instead of being issued by Abraham Lincoln at 4 billion dollars; ten times or 1,000 percent of the original amount.

PROCESS OF MONEY AND CREDIT CREATION

The twelve regional Federal Reserve Banks are private institutions operating collectively in a quasi-governmental capacity. When a government spends more than it receives in tax revenue and cannot raise any more taxes, it experiences a budget deficit. To make up this shortfall, it reverts to the issuance of new debt inflating the money supply as a stealth form of taxation of both its citizens and foreigners who hold its currency or debt instruments. This takes the form of treasuries that are sold on the open market. When there is not sufficient interest in the open market to buy up the required number of treasuries, the government will turn to the Federal Reserve, otherwise known as the lender of the last resort.

When the government borrows funds from the Federal Reserve, both the treasuries and the money are literally created out of thin air and electrons; practically cyber money as book entries. These newly acquired government securities increase the assets of the Federal Reserve Bank and enable it to lend out many times that amount through the fractional reserve banking system.

This process which is known as “monetizing the debt” is considered as inflationary. As an example, let us assume that the legislated reserve ratio is 0.1 and the government requires \$10 billion from the Federal Reserve to cover a shortfall. The government creates \$10 billion in government bonds to give to the Federal Reserve who issues \$10 billion in newly created money to the government. Interest payments on these bonds are paid for by tax revenue and/or additional deficit spending. The Federal Reserve may now legally lend out as a first round: $10 / 0.1 = \$100$ billion. This deposited money can be lent over and over again by the banks in which it is deposited subject to the reserve ratio.

This credit expansion as a direct result of the government borrowing from the Federal Reserve dilutes the value of all outstanding currency. When the value of the dollar goes down, prices go up. In effect, it is a stealthy tax collected from everyone who holds USA currency, whether a citizen or a foreigner because they can now buy less with it today than they could have before.

The Federal Reserve creates credit through its open market operations with financial instruments such as the like repos and coupon passes. If it desires to inject liquidity or credit into the financial system, the Federal Reserve calls up some favored large broker dealers and buy some of their bonds with credit they create out of thin air, and this process expands their balance sheet. With its balance sheet expanded, the dealer then passes this credit on to the market by making loans to mortgage companies or traders' margin accounts. Because each layer of lender institutions is only required to keep a marginal reserve amount of capital on hand, a \$1 billion repo done by the Federal Reserve banks eventually creates as much as \$100 billion in new credit to the USA consumers.

Inflation does not necessarily mean a literal printing of paper money, even though it could partially occur this way. Inflation primarily happens as accounting entries by increasing or inflating the money supply by the process in which central banks are allowed to virtually borrow from their own governments sums of money in their own currencies. These sums of money are deposited in their accounts, and they can thus lend it to borrowers. These borrowers then deposit what they borrowed in their own banks. This shows again as entries on the banks' balance sheets, so they can lend this money once more, and so on and on, many more times through a multiplier effect.

We derive the expression for the multiplier M through a process of summing a sequence. The adjustment of the reserve percent fractional requirement p in the commercial banks that own the stock of the Federal Reserve Bank can lead for an initial deposit N_0 to the banks being collectively allowed to lend a sum of $N_0(1-p)$, of which the banks can now lend another sum $N_0(1-p)(1-p) = N_0(1-p)^2$, and so on with a total sum N as:

$$N = N_0 + N_0(1-p) + N_0(1-p)^2 + N_0(1-p)^3 + \dots, \forall 1 > p > 0 \quad (22)$$

The multiplier M can be derived as:

$$\begin{aligned} M &= \frac{N}{N_0} = 1 + (1-p) + (1-p)^2 + (1-p)^3 + \dots \\ &= \frac{1}{1-(1-p)} = \frac{1}{p}, \quad \forall \quad 0 < p < 1. \end{aligned} \quad (23)$$

If only n banks are considered in the cycle rather than an infinite number, Eqn. 22 becomes:

$$\begin{aligned} M &= \frac{N}{N_0} = 1 + (1-p) + (1-p)^2 + \dots + (1-p)^{n-1} \\ &= \frac{1-(1-p)^n}{1-(1-p)} \\ &= \frac{1-(1-p)^n}{p}, \quad \forall \quad 0 < p < 1. \end{aligned} \quad (23)'$$

EXAMPLE

Consider a $p = 0.10$ or a 10 percent reserve requirement.

Bank 1 has a \$1,000 monetary base in the form of reserve balances. Let us assume, for simplification, that it has no loans and has just one deposit account with a value of \$1,000 by a depositor who deposited Federal Reserve Notes.

The bank delivers the cash to its regional Federal Reserve branch to be held at its vault and Bank 1 has \$1,000 in reserve balance.

Bank 1 can now make a loan considering the 10 percent reserve requirement of \$1,000 - \$100 = \$900.

The recipient of the loan deposits the \$900 amount in Bank 2. Bank 2 must keep a 10 percent reserve of: $\$900 \times 0.1 = \$90$, and can lend $\$900 - \$90 = \$810$, and so on as shown below.

Table 32. Multiplier effect in reserve banking for a 10 percent reserve.

Bank	Deposits [\$]	Loans [\$]	Reserve Balances	Multiplier M

			p = 10 % [\$]	
1	1,000	900	100	1
2	900	810	90	1.9
3	810	729	81	2.71
4	729	656.1	72.9	3.439
5	656.1	590.49	65.61	4.095
6	590.49	531.49	59.049	4.68559
7	531.441	478.2969	53.1441	5.217031
8	478.2969	430.46721	47.82969	5.6953279
9	430.46721	387.420489	43.046721	6.12579511
10	387.420489	348.6784401	38.7420489	6.513215599
Accumulation over 10 banks	6513.215599	5861.8940391	651.3215599	6.513215599
...	...	...	...	
Overall banking reserve system	10,000	9,000	1,000	10

For the overall banking system the multiplier M from Eqn. 23 is:

$$M = \frac{1}{p} = \frac{1}{0.1} = 10,$$

The amount of deposits in the overall banking reserve system becomes:

$$N = M.N_0 = 10 \times \$1,000 = \$10,000,$$

for an initial deposit of \$1,000.

Central banking and fractional reserve banking is the major money creation process in the world as electronic and accounting entries and not necessarily in the form of paper money. The reserve requirement in the USA is reported to be an astoundingly small 0.85 percent. This suggests that for an infinite number of deposits, from one bank to another, the multiplier is:

$$M = \frac{1}{p} = \frac{1}{\frac{0.85}{100}} = \frac{100}{0.85} = 117.65$$

In this case, an initial deposit of 1,000 dollars would allow the banks collectively to lend to different customers a sum of $117,650 - 1000 = 116,650$ dollars. The banks would pay the depositor interest on the initial 1,000 dollars deposit, but otherwise they would earn interest on the extra 116,650 dollars that show on their books, but were created and added to the money supply as electronic entries practically out of electrons in the wires.

Table 33. Reserve requirements of different account types.

Account type	Reserve requirement, 2004 Percent
Non-personal time deposits: time deposits held by a depositor other than an individual such a Certificate of Deposit, CD	No reserve requirement
Net transaction accounts: checking accounts, demand deposit accounts, Negotiable Order of Withdrawal NOW accounts, credit union share draft accoubts	
\$0-\$6.6x10 ⁶	No reserve requirement
\$6.6x10 ⁶ -\$45.5x10 ⁶	3 %
>\$45.5x10 ⁶	\$1,164 + 10 % of amount > \$45.5x10 ⁶
Non-transactional accounts: personal savings accounts, money market accounts and certificates of deposit, CD	No reserve requirement

Banks traditionally profit on the interest rate difference, or "spread", between the money they borrow from depositors and the money they lend to corporations. They may leverage up ten to one, supporting \$100 billion of assets on \$10 billion of equity. Thus, if their spread is 2 percent, and they are levered 10:1, their return on equity is a remarkably profitable 20 percent and even more like 24 percent because of the return on the underlying capital.

Technically, bonds are issued by the Treasury Department and notes are issued by the Federal Reserve banks. Money and credit creation is achieved by a process whereby the Federal Reserve banks buy the bonds with freshly printed notes, while the Treasury uses these notes to pay the bond holders. Bonds are supposed to have value because they are 'redeemable' in the notes which, in turn, are supposed to have value because they are 'backed' by bonds. In fact both instruments are paper or electronic entries and accounting items that are irredeemable and neither has backing in the form of any verifiable segregated wealth in existence. At the heart of the money creating process, however explained, analyzed, or defended, is the fact that both the Treasury and the Federal Reserve banks possess the privilege of issuing obligations that they have neither the intention nor the means to honor.

If the rate of inflation of the money supply exceeds the supply of goods and services that the money supply can purchase, more money must be spent to buy a specified amount of goods or services. To the normal citizen spending the money, it is perceived as an increase in the prices of the goods he purchases. Price inflation eventually follows monetary inflation. In reality, it is a decrease in the value of the currency; an interesting case of relative perception.

CURRENT STATUS

There are about 8,500 banks in the USA and the developed world. Capital is concentrated in the top 50 banks which hold about 80 percent of the assets.

As of 2008, the Federal Deposit Insurance Corporation (FDIC) insured commercial banks have about 7.89 percent of capital as their outstanding assets, so they are roughly levered up by about $1.0 / 7.89 = 12.5$ times. Loans are generally about 60 percent of their assets.

Some investment banks are leveraged up to 30 times. The Fannie Mae and Freddie Mac mortgage banks holding about 75 percent of the USA home mortgages were leveraged to 50 times their capital before they imploded and were nationalized in September 2008 at a cost of \$5.4 trillion to be added to the existed liabilities of the USA Federal government. Lord William Rees-Mogg comments on this event: “In 1934, President Roosevelt talked of public expenditure rising by \$4 billion, in 2008 President Bush has increased USA exposure by \$5 trillion, a thousand times as much.” The transfer and guaranteeing of such a large liability to the USA public sector is an unprecedented experiment that the world economist will continue to observe and dissect in awe. It is not a problem for the government, but a problem for the people who are affected by it by the dilution of their savings and wealth. The immediate effect would be to lead to an unstable currency, with a bias toward inflation and the adoption of alternative way of preserving their wealth.

To be considered as well capitalized a bank ought to have at least 5 percent of capital in Tier One assets, and 10 percent of what is considered risk based assets. Some regulators would like to see a capitalization ratio of 12 percent.

At a leverage ratio of 12.5, for every \$1 million in capital that an example bank has, it can lend out \$12.5 million. The profit it makes is the difference between the interest cost of its own capital and the money it borrows to lend, and the interest rate it charges its borrowers.

If the bank is paying 4 percent for its capital and is charging 7 percent to its borrowers, it would make: $(0.07 - 0.04) \times 12.5 \times 10^6 = 3.75 \times 10^5 = \$375,000$ in gross profits.

That is a return of $375,000 / 1,000,000 = 0.375$ or a respectable 37.50 percent on the invested capital.

That is why so many banks are being started all over the country every year, and the USA cities' landscapes are dotted with small bank branches: it is a quite profitable business; for anybody who can get into it.

That is perfectly true, unless the borrowers would start reneging on their obligations, maybe because, either they became incapable of making the monthly payments on their mortgages anymore, or that the values of their mortgages has exceeded the value of the equity in their homes, so they intentionally walk out on their mortgages dumping their loss in equity on the banks.

Leverage is a two way street and can travel in two opposite directions of profit or loss. Suppose that our example bank has a loan delinquency of \$500,000, this would have cancelled its profit to a negative $375,000 - 500,000 = -125,000$ loss.

Not only would all the profit disappear, but it would also incur a reduction in its capital from \$1 million to $1,000,000 - 125,000 = \$875,000$. This reduces its interest income since it can now only now loan: $12.5 \times 0.875 = \$10.9375$ million; instead of the previously calculated \$12.5 million value. To maintain its loan portfolio, more capital has to be raised from new investors, at a possibly higher interest rate, in addition to writing off the bad loan.

Banks currently borrow money from most of their checking accounts depositors at zero cost. They pay a nominal value for savings accounts. In fact, if inflation is taken into account, it is the depositors who pay the banks to keep their checking and savings accounts deposits at a real negative interest rate. They only pay a positive real rate of interest when they borrow from other banks or sophisticated investors, and lately from private equity firms, individual financiers and the international state owned Sovereign Wealth Funds from Singapore, China, South Korea,

Kuwait and the United Arab Emirates that have lately joined the fray. These entities are facing the old adage: “Fool me once, shame on you. Fool me twice, shame on me,” and are accumulating equity interests in the banks in the form of common preferred stock, diluting the shareholders equity, and charging in the process prohibitive interests rates for their capital infusions.

GLOBAL INFLATION OR DILUTION OF CURRENCY AND CREDIT ASSETS

Central banks all over the world have the freedom, the ability and the motive to create an endless stream of money. Banks of other countries of the world are participating in the global game of nations and drinking as much as they can from the trough of British and USA inflation. Credit creates the liquidity for additional consumption in the USA, but today we have a global economy where American consumers pay dollars to buy products from other nations.

For simplicity let us assume that the USA buys its goods from a single country X. When a company in X receives dollars in trade, this normally would drive up USA interest rates: the company goes to the central bank of X to exchange its dollars for its local currency. The central bank of X would normally sell those dollars into the currency market for its country’s currency thus driving up USA interest rates. Instead, what is really happening is that it is more profitable for this bank to sterilize these dollars: the central bank of X prints its own currency to give to the company and takes the dollars and buys USA securities.

It is not the excess savings of country X investors that are buying USA securities as stipulated to the uninformed, instead its central banks are creating credit themselves to buy those securities. The tick data that measure foreign inflows of money does not distinguish between private investors and central banks going through brokers to buy USA securities. It is believed that as much as 90 percent of foreign money buying USA securities as Treasury Bonds, corporate bonds, mortgages, and stocks is not private investment, but central banks issued money and credit.

Public debt in Asian countries expanded as a result, and created worries about excessive speculation: Thailand in 2006 raised the margin requirements to reduce speculation that was occurring as a result of monetary expansion. It was quickly slapped down by its trading partners who did not want to rock the boat at this time and it had to cancel its action.

The situation is very unstable in the long run. A massive correction in debt and derivatives, whose magnitude is exponentially growing with time, is bound to occur at some time. These complex derivatives are financial securities whose value depends on something else; such as stocks, bonds, futures, options, loans, and even just promises to pay. The USA Federal Reserve balance sheet in 2006 alone has empirically expanded by \$30 billion in this way and created \$3.5 trillion of new credit in the USA through a multiplier effect of:

$$M = \frac{3.5 \times 10^{12}}{30 \times 10^9} = 116,666,$$

which is 0.84 percent less than the derived theoretical value of 117,650.

Table 34. Percentage annual increase of money in circulation globally, 2007.

Location	Annual increase [percent]

Eurozone	10.0
UK, M4	13.0
India, M3	20.3
China, M2	17.2
Australia, M3	13.0
South Korea, M3	11.3
New Zealand, M3	18.0
Japan, M3	6.0
Russia, M3	49.0
USA, M3	12.0

The USA figure for M3 is an estimate since, to avoid vexation and an unhappy populace, it was no longer published by the Federal Reserve as of March 2006.

Table 35. Annual money and credit growth rates in world currencies, 2008.

Currency	Annual money and credit growth rate, 2008 [percent]
Argentine peso	22.21
Australian dollar	22.73
British sterling	12.30
Brazilian real	21.43
Canadian dollar	12.28
Chinese yuan	18.30
European euro	11.74
Hong Kong dollar	18.07
Indian rupee	23.77
Japanese yen	1.80
Mexican peso	10.24
Norwegian krone	15.60
Russian ruble	23.38
Saudi Arabian rial	21.65
South African rand	23.68
South Korea won	17.63
Swiss franc	2.09
USA dollar	15.70

Public debt around the world grew exponentially and total debt in 2006 in the USA stood at 3.6 times the Gross Domestic Product (GDP). In 1929 it was 2.8 times the GDP.

So far, using skewed and reassuring statistics and inflation figures, central bankers all over the world have managed to keep the public's inflationary concerns under check. They have developed what so far has been a sure fire winning system whose secret involves borrowing money to place derivative bets, then selling parts of these bets to other people who then borrow

the money to buy them, all of whom borrow more money to place offsetting bets, then everybody uses the loans as collateral to create new loans and borrow more money to make other derivative bets. The amount of the financial derivatives they created is reported by the Bank of International Settlements (BIS) to have reached \$415.2 trillion in 2007 which is 798 percent of the global Gross Domestic Product (GDP). However, once the world masses wake up to the inflation scheme, there may be a stampede out of paper assets into real assets and the existing unsustainable monetary system would collapse.

MINSKY'S FINANCIAL INSTABILITY HYPOTHESIS

New Keynesianism is the most influential macro-economic theory at present. At the core of the doctrine stands the “Dynamic Stochastic General Equilibrium Model” that is used as the main analytical tool of the central banks in the world. According to this model, money and credit as well as the financial market play no important role. The model’s technical features suggest that the financial markets have no economic consequences in the long term. It possesses several policy implications. One such implication is that the central banks could safely ignore asset prices and concentrate their attention only on dealing with the consequences of an asset price bust. Another such implication is that they could also safely ignore headline inflation.

The economist Hyman Minsky advanced the “Financial Instability Hypothesis.” It postulates that long term economic stability breeds its own instability through a “vicious circle” of rampant financial speculation and Ponzi financing. Examples are the financing of the Social Security and Medicare systems in the USA.

Hyman Minsky described the three sequential steps of debt in capital markets in his Financial Instability Hypothesis as:

“Three distinct income debt relations for economic units, which are labeled as hedge, speculative, and Ponzi finance, can be identified. Hedge financing units are those which can fulfill all of their contractual payment obligations by their cash flows: the greater the weight of equity financing in the liability structure, the greater the likelihood that the unit is a hedge financing unit. Speculative finance units are units that can meet their payment commitments on ‘income account’ on their liabilities, even as they cannot repay the principal out of income cash flows. Such units need to ‘roll over’ their liabilities – issue new debt to meet commitments on maturing debt. For Ponzi units, the cash flows from operations are not sufficient to fill either the repayment of principal or the interest on outstanding debts by their cash flows from operations. Such units can sell assets or borrow. Borrowing to pay interest or selling assets to pay interest (and even dividends) on common stocks lowers the equity of a unit, even as it increases liabilities and the prior commitment of future incomes.

It can be shown that if hedge financing dominates, then the economy may well be an equilibrium seeking and containing system. In contrast, the greater the weight of speculative and Ponzi finance, the greater the likelihood that the economy is a deviation amplifying system. The first theorem of the financial instability hypothesis is that the economy has financing regimes under which it is stable, and financing regimes in which it is unstable. The second theorem of the financial instability hypothesis is that over periods of prolonged prosperity, the

economy transits from financial relations that make for a stable system to financial relations that make for an unstable system.

In particular, over a protracted period of good times, capitalist economies tend to move to a financial structure in which there is a large weight to units engaged in speculative and Ponzi finance. Furthermore, if an economy is in an inflationary state, and the authorities attempt to exorcise inflation by monetary constraint, then speculative units will become Ponzi units and the net worth of previously Ponzi units will quickly evaporate. Consequently, units with cash flow shortfalls will be forced to try to make positions by selling out positions. This is likely to lead to a collapse of asset values.”

The process is unsustainable. It grows and grows until, at its so called “Minsky Moment,” the frauds are revealed, and it all collapses in a heap of instability and chaos. Recessions would not be the worst possible outcome in which the Minsky’s Moment, according to Wolfgang Munchau would become a Minsky’s Eternity. At this eternity, as Mark Anthony described Julius Caesar who was stabbed to death: “He that did ride so high, doth lie so low.”

THOMAS JEFFERSON’S AND ANDREW JACKSON’S OBJECTIONS TO CENTRAL BANKING

By 1791 a remark by USA founding father Thomas Jefferson was:

“The central bank is an institution of the most deadly hostility against the Principles and form of our Constitution. I believe that banking institutions are more dangerous to our liberties than standing armies. Already they have raised up a money aristocracy that has set the government at defiance. This issuing power should be taken from the banks and restored to the people to whom it properly belongs. If the American people ever allow the banks to control the issuance of their currency, first by inflation, and then by deflation, the banks and corporations that will grow up around them will deprive the people of all property, until their children wake up homeless on the continent their fathers conquered. The issuing power of money should be taken from banks and restored to Congress and the people to whom it belongs. I hope we shall crush in its birth the aristocracy of the moneyed corporations which already dare to challenge our Government to a trial of strength and bid defiance to the laws of our country.”

President Garfield shortly before his assassination declared that whoever controls the supply of currency would control the business and activities of the people. President Abraham Lincoln had issued the Greenback non-interest bearing notes to finance the USA Civil War before being assassinated.

In 1836, President Andrew Jackson was infuriated by the tactics of the bankers asking him to renew the charter of the Second Bank of the United States, referred to the bankers as:

“You are a den of vipers. I intend to rout you out and by the Eternal God I will rout you out. If the people only understood the rank injustice of our money and banking system, there would be a revolution before morning.”



Figure 73. Second Bank of the United States note.

President Jackson withdrew the \$10 million in government funds, as the charter of the Second Bank of the United States expired in 1836, and deposited them in state banks. The flow of cash caused an expansion of the national economy and great prosperity. The government paid off all the national debt and was left with a surplus of \$50 million in its Treasury. In retaliation, the Bank of England “threw out” all the paper connected with the USA in one day, refusing to accept or discount any securities, bonds or other financial paper, causing a contraction of credit and the money panic of 1837.

In a book edited by H. E. Bergh, “The Writings of Thomas Jefferson,” Vol. III, p. 145, Thomas Jefferson reportedly discusses the constitutionality of the bill to establish a national bank on February 15, 1791:

“The bill for establishing a national bank, in 1791, undertakes, among other things,

1. To form the subscribers into a corporation.
2. To enable them, in their corporate capacities, to receive grants of lands; and, so far, is against the laws of mortmain.
3. To make alien subscribers capable of holding lands; and so far is against the laws of alienage.
4. To transmit these lands, on the death of a proprietor, to a certain line of successors; and so far, changes the course of descents.
5. To put the lands out of the reach of forfeiture, or escheat; and so far, is against the laws of forfeiture and escheat.
6. To transmit personal chattels to successors, in a certain line; and so far, is against the laws of distribution.

7. To give them the sole and exclusive right of banking, under the national authority; and, so far, is against the laws of monopoly.

8. To communicate to them a power to make laws, paramount to the laws of the states; for so they must be construed, to protect the institution from the control of the state legislatures; and so probably they will be construed.

I consider the foundation of the Constitution as laid on this ground--that all powers not delegated to the United States, by the Constitution, nor prohibited by it to the states, are reserved to the states, or to the people (12th amend.). To take a single step beyond the boundaries thus specially drawn around the powers of Congress, is to take possession of a boundless field of power, no longer susceptible of any definition.

The incorporation of a bank, and the powers assumed by this bill, have not, in my opinion, been delegated to the United States by the Constitution."

At an earlier date, Jesus Christ did not have a bright opinion about the precursors of the modern day bankers; the money changers who had set shop at the Temple in Jerusalem, referring to them in Matthew 23:34 as:

"You snakes! You brood of vipers! How will you escape being condemned to hell? Therefore I am sending you prophets and wise men and teachers. Some of them you will kill and crucify; others you will flog in your synagogues and pursue from town to town."

The modern-day world bankers are definitely a group of individuals bright and smart enough to understand these objections and correct the situation, however the author Upton Sinclair once remarked: "It is difficult to get a man to understand something when his salary depends on him not understanding it."

DARK POOLS OF LIQUIDITY, UNLIMITED SUPPLY OF DERIVATIVES, HOUSE OF CARDS, FINANCIAL WEAPONS OF MASS DESTRUCTION

The total value of the global issuance of derivatives is reported to have reached 6-7 times the global Gross Domestic Product (GDP). The financial system has been wired up to \$370 trillion dollars of privately negotiated investment contracts. They are supposedly written to shift risk from one bank, pension fund, insurance company or brokerage firm to another. Many are linked together in long chains, with each contract providing collateral for the next. Paul Wilmott from Oxford University has written several books on derivatives. He estimates the derivatives market at \$1.2 quadrillion, or about 20 times the size of the world economy. The world's annual gross domestic product is around 55 trillion dollars.

There are five "too big to fail" banks in the USA that each have more than 40 trillion dollars in exposure to derivatives. In 2014, the USA national debt is sitting at a grand total of about 17.7 trillion dollars, so 40 trillion dollars is a large sum of money. According to the New York Times, USA banks "have nearly \$280 trillion of derivatives on their books."

When the housing bubble burst back in 2007, the total notional value of derivatives contracts around the world had risen to about 500 trillion dollars. According to the Bank for

International Settlements, by 2014 the total notional value of derivatives contracts around the world has ballooned to a staggering 710 trillion dollars.

If one adds up total global public debt we get a number of \$54 trillion. If one includes all global debt it is about \$230 trillion. Looking at global stock market capitalization we get a number a little over \$60 trillion. So, adding the values of all debt and all stocks on the planet together we come up short of \$300 trillion. Global GDP for 2012 was just shy of \$72 trillion and the value of all gold ever mined one gets a number of a modest \$6 trillion.

Table 36. Large banks assets and exposure to derivatives. The top 5 USA banks control \$ 279 trillion worth of derivatives notional value, which is about equal to all debt and all stock values combined for the entire planet, 2014.

Bank	Total assets \$ trillion	Exposure to derivatives \$ trillion
JP Morgan Chase	2.5	67
Citibank	1.9	60
Goldman Sachs	0.9	54
Bank of America	2.1	54
Morgan Stanley	0.8	44
Deutsche Bank		75

A hypothetical example could shed light on how these pools of derivatives can be created. Institution A convinces Institution B to purchase 100 units of a bond issue at a face value of 1 million dollars each, paying a coupon yield of 10 percent of par value. Institution A thus comes into possession of an IOU valued at \$100 million, whilst Institution B becomes in possession of another \$100 million of legally binding bonds. Institution A buys back for \$50 million the rights to all the coupon payments of the bonds from Institution B with another IOU and leaves it with only the \$100 million of stripped bonds. At this point Institution B has bonds worth \$100 million and an IOU for another \$50 million. Institution A has an IOU for \$100 million and a book entry of \$50 million in the ownership of the coupon interest payments from the bonds. Institutions A and B have by now generated a total of $100 + 100 + 50 + 50 = \$300$ million of assets on their books, that they can securitize and sell or trade to other institutions, to unwary or uninformed teachers or institutional employees retirement funds and the private equity and hedge fund or Leverage Buy Out (LBO) firms managers who are seeking a piece of the pie until the ultimate collapse of the house of cards à la Enron and the Amaranth natural gas speculation fashion. The returns to the managers can be conveniently used to purchase real income producing properties, commodities, stocks and government secured treasury bills and bonds. The banks, investors, regulators and depositors do not know this since the hedge funds consider their techniques as proprietary and cover them with a cloak of secrecy, and that is all that is needed to create an unlimited supply of derivatives and a dark pool of liquidity. Private equity firms can borrow to buy profitable companies, extract a lot of fat banking and consulting fees from the company's wealth, pay the fund managers and consultants salaries, slash jobs, cut services and squeeze even more booty out of the company, then turn around and sell the whole now gutted and unprofitable entity in an Initial Public Offering (IPO) to the unwary general public and pension fund managers.

Hedge funds are considered as a deception created to legally separate rich fools from their money, where investors are asked to pay 2 percent of their capital in fees and 20 percent of any profit. The Forbes magazine reported recently: “Hedge funds are a hot bed of questionable behavior, whether at blue chip Wall Street firms or at fly by nights. Two youngsters and a 53 year old assistant literature professor at a small college in New York formed a hedge fund, JB Stanley, and lost most of the \$400,000 they raised from 15 investors. They siphoned off the rest for car payments, ATM cash withdrawals and other personal uses, according to SEC claims that led to a summary judgment against the three managers.” An old Wall Street adage is: “Even turkeys can fly in a hurricane.”

Sophisticated names are used by the financial engineers in the investment banks with algorithms based upon faulty assumptions to lure the uninformed institutions, pension funds, insurance companies, and the hedge funds away from their money. In the subprime mortgages area where these mortgages are issued to borrowers with low credit ratings, it is something called Residential Mortgage Backed Securities (RMBS). These are subdivided by the financial alchemists with the help of the rating agencies into tranches of low investment grade Collateralized Debt Obligations (CDO). Other financially engineered instruments are the Credit Default Swaps (CDS) as risk insurance. These are exactly like insurance policies against a bond default. When bond defaults become more likely, the value of these CDS insurance policies increases.

A CDO is an investment-grade security backed by a pool of bonds, loans and other assets. CDOs do not specialize in one type of debt but are often nonmortgage loans or bonds. Similar in structure to a Collateralized Mortgage Obligation (CMO) or Collateralized Bond Obligation (CBO), CDOs are unique in that they represent different types of debt and credit risk. In the case of CDOs, these different types of debt are often referred to as 'tranches' or 'slices'. Each slice has a different maturity and risk associated with it. The higher the risk, the more the CDO pays.

FINANCIAL ENGINEERING, WIZARDY AND ALCHEMY

As described by economist John Mauldin, this is how “toxic waste” was unsustainably turned into gold, before the house of cards collapsed over the period 2007-2008. This was how subprime mortgages were sold and then securitized:

“Huge Investment Bank (HIB) would encourage mortgage banks all over the country to make home loans, often providing the capital, and then HIB would purchase these loans and package them into large securities called Residential Mortgage Backed Securities or RMBS.

They would take loans from different mortgage banks and different regions. They generally grouped the loans together as to their initial quality as in prime mortgages, ALT-A and the now infamous subprime mortgages. They also grouped together second lien loans, which were the loans generally made to get 100% financing or cash-out financing as home owners borrowed against the equity in their homes.

Typically, a RMBS would be sliced into anywhere from 5 to 15 different pieces called tranches. They would go to the ratings agencies, who would give them a series of ratings on the various tranches, and who actually had a hand in saying what the size of each tranche could be. The top or senior level tranche had the rights to get paid back first in the event there was a problem with some of the

underlying loans. That tranche was typically rated AAA. Then the next tranche would be rated AA and so on down to junk level. The lowest level was called the equity level, and this lowest level would take the first losses. For that risk, they also got any residual funds if everyone paid. The lower levels paid very high yields for the risk they took.

Then, since it was hard to sell some of the lower levels of these securities, HIB would take a lot of the lower level tranches and put them into another security called a Collateralized Debt Obligation or CDO. And yes, they sliced them up into tranches and went to the rating agencies and got them rated. The highest tranche was typically again AAA. Through the alchemy of finance, HIB took subprime mortgages and turned 96% (give or take a few points depending on the CDO) of them into AAA bonds. At the time, I compared it with taking nuclear waste and turning it into gold. Clever trick when you can do it, and everyone, from mortgage broker to investment bankers was paid handsomely to dance at the party.

Will we ever forget Charlie Prince's line, the CEO of Citigroup, saying that 'As long as they are playing music, you have to get up and dance?' just a few weeks before the market imploded? Apart from having his rhythm being proven totally horrendous and overseeing an implosion which cost Citigroup tens of billions, it was a great statement of the zeitgeist of the financial world at the time."

CARRY TRADE

A twist involved the so called "carry trade." It has been a popular trading strategy among the global investment managers as well as individual currency traders. It refers to the carry or the interest rate one earns by selling a low yielding currency and purchasing assets in a high yielding currency with the returns.

Carry traders could borrow the Japanese yen at a low interest rate then place the money in USA bonds, emerging markets currencies, subprime CDOs for a much higher yield. They could thus enjoy a "positive carry."

As of 2007, it has been estimated that as much as \$1 trillion had been staked on the carry trade. However, when the yen value rises, and the CDOs go bad, their carry goes negative. Eventually the hedge funds reported staggering losses, and some went out of business.

The unsustainability of the process can be exemplified by the blowup of two funds generated by the Bear Stearns investment bank in 2007: High Grade Structured Credit Strategies Fund and High Grade Structured Credit Enhanced Leverage Fund. The potential repercussions on the global markets were staggering when these trades unwound in a non-orderly manner. Over the weekend of March 16, 2008, Bear Stearns was sold to J. P. Morgan Chase and Co. for just \$2 per share, well below the \$84 book value of the company and the \$170 it traded at one year earlier. The total sale price was only one quarter of the value of the securities firm's headquarters building in midtown Manhattan. Before the sale was announced, the Fed stepped in and provided emergency funding to Bear Stearns through John Pierpont Morgan Chase and Co. in order to avoid a collapse. Minutes after the fire sale of Bear Stearns was announced, the Fed cut the discount rate by a quarter of a percentage point to 3.25 percent.

THE GOLD CARRY TRADE

During the 1980s and 1990s, central banks engaged in protecting their issued fiat currencies by forcing the price of gold lower by loaning gold to investment banks at a low, say 1 percent interest. The banks then sold the gold into the market pushing down the market price and invested the proceeds in notes paying about 5 – 6 percent, pocketing the difference and later repaying the loans with gold later purchased at a lower price.

This gold-carry trade forced the price of gold down for almost 20 years as the amounts of central banks gold sold, estimated at 10,000 – 15,000 metric tonnes, were more than enough to oversupply the market demand for gold.

By 1999 the banks' leveraged bets on gold's falling price were so large that if the price of gold rose, the massive losses would force at least one investment bank into bankruptcy. To prevent such an occurrence, on May 8, 1999, Chancellor Gordon Brown of the UK suddenly announced that the UK would be selling 415 metric tonnes of its gold, fully 58 percent of its total gold reserves, leaving the UK with only 300 metric tonnes, the lowest amount of any major country in the world. Eleven days earlier, on April 27, 1999, Chancellor Gordon Brown had requested the International Monetary Fund (IMF) sell \$10 billion or 1,000 metric tonnes of its gold on the open market. The purpose of the gold sales by the Central Bank of England was to drive the price of gold lower in order to avert a financial meltdown.

The rumor in London at the time was that New York investment bank Goldman Sachs had a 1,000 metric tonnes short gold position in the market and if the price of gold were to rise they would suffer catastrophic losses... The rumors also included speculation that Goldman Sachs had shorted the gold on behalf of the USA government; that the USA government was actively colluding with Goldman Sachs to manipulate the price of gold, and the market had turned against them. Two months later, the August 1999 futures contract settled at \$257.80 per ounce, a 20-year low, allowing Wall Street banks to profitably exit their short trades.

THE WASHINGTON AGREEMENT

On September 26, 1999 fifteen European central banks unexpectedly announced a five-year moratorium on new gold sales and limits on the amount of gold they would lend. Known as the "Washington Agreement," the banks' moratorium stunned gold markets. News that most central bank gold would no longer be leased and/or sold meant previously suppressed gold prices would rise. The announcement triggered a crisis at COMEX, The New York commodities exchange, where exposed shorts betting on a lower price of gold frantically attempted to limit their losses resulting in an overwhelming avalanche of orders.

A Commodity Futures Trading Commission (CFTC) investigation reported that: "... [on September 27th, 1999] gold options volume, which had averaged approximately 6,434 contracts during the first seven business days of September 1999, quintupled to 34, 893 contracts, and gold options price volatility began to increase." On September 28, 1999 COMEX had 2,636 unmatched gold options trades, as compared with a normal average of less than three, which amounted to approximately 17.52 percent of all gold options trades for the day. The floor brokers and Future Commission Agents (FCMs) stated that the number of orders sent to the floor on September 28, 1999 exceeded anything in their memory; the number of gold options trades increased more than twelve-fold over normal levels, and trading volume increased more than eight-fold over normal levels.

On September 21, 1999, five days before the Washington Agreement limiting central bank gold sales was announced, the price of gold began to rise, indicating insider trading. From a 20-

year low of \$257, gold reached an intraday high of \$339 in London on September 29, 1999, a spectacular 32 percent rise in only nine days.

Just as the London bullion market was peaking, the bankers attacked on COMEX in New York. Lacking the bullion they had previously used to suppress the price of gold, the bankers instead used ‘paper gold’, i.e. gold derivatives, to do in New York what they could no longer do in London. Gold derivatives such as futures and options contracts are paper assets or securities whose value is derived from an underlying asset such as gold. Prior to 1971, paper money itself was a derivative as its value was a function of its convertibility to gold. No longer convertible, paper currencies, today, are just trading stamps issued by sovereign states with expiration dates written in invisible ink.

The investment bank that led the attack on gold was JP Morgan. The large Wall Street bank took massive short positions, i.e. bets that gold will fall, in order to force the price of gold lower. JP Morgan’s September 1999 attack on gold was successful. Gold’s price on December 31, 1999 was virtually unchanged from what it had been on January 1st one year earlier as the bankers desired it to be.

ICELAND’S FINANCIAL CRISIS, DOG AND CAT GAME

In October 2008, the country of Iceland became bankrupt and its currency, the krona, was abandoned when it lost 2/3 of its purchasing power.

Iceland, over its 1,100 years of history depended on the fishing industry for its income. However, using financial engineering methodologies, Iceland’s three biggest banks, with assets of a few billion dollars, grew them to \$140 billion within three and a half years. It was the most rapid expansion of a banking system in the history of mankind. As the USA stock market doubled, the Icelandic stock market went up by 900 percent. The skilled fishermen stopped catching fish and became involved in speculating in stocks and real estate. By 2006, the real estate prices in its capital Reykjavik doubled, and the average Icelandic family was three times as wealthy as it was in 2003.

Since the interest paid on holdings in their krona currency was artificially set at 15.5 percent, Icelanders used the carry trade to buy euros or yens at a 3 percent interest rate and made huge loans in euros and yens. International financial entities “invested” heavily in Iceland’s banks financial instruments with its 15.5 percent rate of interest on the krona. As the unsustainable house of cards eventually collapsed, the krona lost its value whilst they still owed the euros and yens they had bought. The Germans banks invested; and lost, \$21 billion, the Netherlands \$305 million. Sweden \$400 million, the UK \$300 billion with Oxford University alone \$30 million.

At some point, the Icelanders discovered that trading paper assets is a productive enterprise. Those who fancied themselves as financial experts, took out large sums of short term loans from abroad. They were then re-lending this money to themselves and their friends to supposedly purchase assets on a long term basis. An outside fund manager said that it was like: “You have a dog and I have a cat. We agree that they are each worth a billion dollars. You sell me the dog for a billion, and I sell you the cat for a billion. Now, we are no longer pet owners, but Icelandic banks with a billion dollars in new assets. They created fake capital by trading assets amongst themselves at inflated values.”

Incidentally, the only Icelandic bank that remained solvent is managed by women, suggesting that cool-headed decision making and risk aversion are key features of sustainable finance.

SMOKE AND MIRRORS

On “Tax day” April 15, 2009, the uninformed well-meaning participants revived the idea of a Tea Party to protest the existing level of taxation. The original Tea Party invoked by the commemoration was in fact about the lifting of a tax. The originally celebrated tea party was perpetrated by smugglers who lost their pricing advantage with the repeal of the British Tea Tax. What was dumped in the Boston harbor bay by the smugglers disguised as Indians was nothing but “the legal tea” so that the smugglers could sell theirs.

The first Sons of Liberty faced a giant trade monopoly called the British East India Company which hit the American shores with a cheap addictive product called “tea” served with slaves-grown sugar that undersold all competitors. Three ships: the Dartmouth, the Eleanor, and the Beaver hit Boston harbor on December 8, 1773. On December 16, 1773, 60 Sons of Liberty ducked into the local blacksmith, smeared their faces in coal dust, pretended to be Mohawk Indians and split into three groups and mounted the boats waiting to unload their cargo. They were surrounded by British armed ships, but carried on splitting up crates with axes and tomahawks for three straight hours braving up 324 crates containing 10,000 pounds of tea. Upon passing the house of the British Admiral, he yelled out at them: “Well boys, you have had a fine, pleasant evening for your Indian caper, haven’t you? But mind, you have got to pay the fiddler yet!”

John Stumpf, the Chief Executive Officer of Wells Fargo, dissected the unsustainable behavior of many lenders: “It is interesting that the industry has invented new ways to lose money when the old ways seemed to work just fine.”

In the 2007 annual report of the Berkshire Hathaway, its Chairman of the Board Warren E. Buffet comments: “You may recall a 2003 Silicon Valley bumper sticker that implored, ‘Please, God, Just One More Bubble.’ Unfortunately, this wish was promptly granted, as just about all Americans came to believe that house prices would forever rise. That conviction made a borrower’s income and cash equity seem unimportant to lenders, who shoveled out money, confident that HPA – House Price Appreciation – would cure all problems. Today, our country is experiencing widespread pain because of that erroneous belief. As house prices fall, a huge amount of financial folly is being exposed. You only learn who has been swimming naked when the tide goes out – and what we are witnessing at some of our largest financial institutions is an ugly sight.”

In addition: “Many helpers are apparently direct descendants of the queen in Alice in Wonderland, who said: ‘Why, sometimes I’ve believed as many as six impossible things before breakfast.’ Beware the glib helper who fills your head with fantasies while he fills his pockets with fees.”

EXPONENTIAL NATURE OF MONETARY INFLATION, DILUTION

Inflation follows the most interesting type of computational mathematics; exponential arithmetic. We first try to explain the process of price increases. Using our derived Eqn. 5’, with the inflation rate now replacing the interest rate i , let us calculate the price our descendants will pay for a \$ 1 loaf of bread after a human lifetime of $N = 70$ years if the inflation rate is a moderate $i = 0.06$ or 6 percent:

$$\begin{aligned}
R(N) &= R_0 \cdot e^{+N \cdot \ln(1+i)} \\
&= 1 \cdot e^{70 \cdot \ln(1+0.06)} \\
&= \$59
\end{aligned}$$

Thus through an inflation rate of 6 percent prices should increase for our descendants, or for a toddler at his retirement, by a factor of 59 times within a lifetime, unless the supply of wheat to make bread also increases by the same rate as inflation.

Speaking of retirement, the young 25 years old professional receiving a promise for a \$5,000 monthly payment on a retirement annuity based on his lifetime salary contributions to his employer's retirement fund at a retirement age of 65 years, would in fact only have the following "present value" or buying power at retirement after 40 years of productive employment and regular contributions:

$$\begin{aligned}
R_0 &= R(N) \cdot e^{-N \cdot \ln(1+i)} \\
&= 5000 \cdot e^{-40 \cdot \ln(1+0.06)} \\
&= \$486.1
\end{aligned}$$

Our young professional will only have at retirement no more than about one tenth the buying power that he has at the present time. To attain parity, his monthly payment on his retirement annuity should increase by the rate of inflation to a value of:

$$\begin{aligned}
R(N) &= R_0 \cdot e^{+N \cdot \ln(1+0.06)} \\
&= 5,000 \cdot e^{40 \cdot \ln(1+0.06)} \\
&= \$51,428.59
\end{aligned}$$

This means that to maintain his buying power he should be receiving a monthly annuity (\$51,428.59) equal to perhaps his whole present annual salary. In fact the present value of this amount is:

$$\begin{aligned}
R_0 &= R(N) \cdot e^{-N \cdot \ln(1+i)} \\
&= 51,428.5896856e^{-40 \cdot \ln(1+0.06)} \\
&= \$5,000
\end{aligned}$$

We consider now the case of energy supplies, and how they can be smartly acquired on a few cents on the dollar. Suppose that country A buys oil from country B. For securing its energy supplies and protecting country B's friendly rulers' hold on power, country A maintains at a significant cost a military presence in land bases, in the air, or on the high seas around the supplier country. To return the favor, country B rulers and bankers deposit the proceeds from the oil sale in country A's banks and also in its currency. In open fairness they would be earning for their country some interest rate of say, 2 percent in the process, that they could spend on generating public works and programs in education and health care that they can highly publicize to get re-

elected into their highly compensated offices, and to secure the loyalty of their citizens. They no doubt highly deserve it, considering that they are protecting the wealth of their fellow citizens.

Not only would country A benefit by lending the deposits in its banks to other potential borrowers at a higher interest rates and profit from the difference, but it can also eliminate a significant amount of its debt in the process. Suppose that the inflation rate is 6 percent. Accounting for the earned interest of 2 percent, the effective inflation rate becomes: $i_{\text{eff}} = 6 - 2 = 4$ percent. Over a human lifetime or a 70 years period the oil money bank deposit will be repaid by a fraction of its present value of:

$$\begin{aligned}\frac{R_0}{R(N)} &= e^{-N \cdot \ln(1+i_{\text{eff}})} \\ &= e^{-70 \cdot \ln(1+0.04)} \\ &= \$0.064219\end{aligned}$$

Thus only 6.4 cents will be repaid per 100 cents or 1 dollar of debt. This makes the energy business in partnership with the banking system as the major sources of wealth acquisition in the world. Economic consultant Harald Malmgren best described the situation: “The Arabs have learned that they pump oil out of the sand, hold the dollars, and the dollars turn back to sand.”

THE EMPEROR’S NEW CLOTHES

When it comes to financial engineering wizardry, the Federal Reserve in the USA has on its payroll some of the sharpest minds on Earth. They have succeeded in seducing the rest of the planet into trading in USA dollars. This has conferred enormous disproportionate power upon the USA, and made it possible to run trade balances of astronomic proportions as goods imported are paid for with an endlessly expanding supply of electronically created money. The trading partners of the USA have been duped, and have been left holding a very big bag. There is an old saying: “Never give a sucker an even break,” and the Fed certainly do not intend to.

Interest rates are the price of money. They reflect both supply and demand. If demand for money is strong, the Fed can engineer an increase in the price of money by raising the interest rates, but still create lots of money at the same time. This surplus of liquidity is what can allow inflation to accelerate even as higher interest rates are slowing the economy down.

In 1995 the banks fractional reserve ratio in the USA was not just lowered, but it was effectively eliminated entirely. The net result is that banks in the USA are not required to back assets which largely correspond to the M3 money supply measure or “broad money,” with any cash reserves. As a consequence, banks in the USA can effectively create money without limit. This change in the banks’ ability to create loans coincided with new and exotic forms of money being invented via the securitization of debt and extended to entirely new asset classes. The justification formally given by the Fed is:

“Although reserve requirement ratios have not been changed since the early 1990s, the level of reserve requirements and required reserve balances has fallen considerably since then because of the widespread implementation of retail sweep programs by depository institutions. Under such a program, a depository institution sweeps amounts above a predetermined level from a depositor's

checking account into a special-purpose money market deposit account created for the depositor. In this way, the depository institution shifts funds from an account that is subject to reserve requirements to one that is not and therefore reduces its reserve requirement. With no change in its vault cash holdings, the depository institution can lower its required reserve balance, on which it earns no interest, and invest the funds formerly held at the Federal Reserve in interest-earning assets.”

As an example, rather than shrinking, as the interest rate hikes by the Fed in 2006 would have suggested, the money supply growth rate had actually accelerated during the previous two years. The M2 money supply measure was 5 percent larger than it was 12 months earlier. Two years earlier, when monetary policy was supposed to be at its loosest, the M2 was up a little more than 3 percent. The dollar lost 80 percent of its value from 1971 to 2006.

The USA suffers from a combined trade, budget and a current account deficits. The trade deficit is the value of a nation’s imports in excess of the value of its exports. As more goods are imported than exported, its currency is leaving the country. If those abroad choose to keep the currency rather than selling it, one says the trade deficit is being “financed.” A current account deficit is the trade deficit plus the net balance in services, net income on overseas investments and net transfers. Foreigners need to acquire more than \$2 billion worth of dollar denominated assets such as treasury bills and bonds per day, just to keep the value of the dollar stable and to “finance” the trade deficit.

The statistics are most interesting. The USA sent \$218 billion more abroad in the second quarter of 2006 than it brought in from other nations. The current account deficit was just a little less than the record deficit of \$223 billion in the fourth quarter of 2005. As Americans continue to import more than they export, and as foreigners remain willing to hold the dollars they earn this way, foreign holdings of USA treasury securities on September 30, 2006 totaled more than \$2 trillion. Foreign investors are financing not just the USA trade deficit but the USA budget deficit as well. The budget deficit in fiscal 2006 was \$248 billion. The trade deficit might shrink but the budget deficit will climb because of recent tax cuts, war spending and shrinking government revenue from a slower growing economy.

The year 2005 USA deficit spending including accruals was \$3.5 trillion and increasing in magnitude. According to the USA Today Newspaper: “... administration opposes including Social Security and Medicare in the audited deficit. Its reason: Congress can cancel or cut the retirement programs at any time, so they should not be considered a government liability for accounting purposes.” This is suspiciously a case of impending if not already ongoing stagflation. Stagflation is unbearable for too long politically, so to counter it, a recession would have to be engineered.

In the game of wealth of nations complications could arise. For instance, depositors of oil revenue in a given currency could get savvier, greedier, or become subjected to higher pressure to spend on public sector projects, and demand payment of higher interest rates exceeding the inflation rate. Thus the borrowing country is forced to couple fiscal policy adjusting its interest rates on different debt durations, short or long term, to its monetary policy. Should the effective interest rates remain low, the value of its currency would decrease since the depositors can withdraw their monetary deposits and invest them in other currencies that pay higher effective interest rates.

In the worst case, foreigners would lose confidence in the dollar currency and start replacing it with other assets. A quick, steep drop in the USA currency would be inflationary by

increasing the cost of imports. Foreigners do not need to sell the dollar for it to come under pressure, their acquiring less of it in favor of other currencies such as the Euro, the Sterling Pound or gold would decrease its value.

A decrease in the value of a currency, even though increasing its exports, leads to a chain of undesirable events. This decrease in the wealth of the nation can lead to higher inflation, followed by higher interest rates, followed by increased unemployment and economic stagnation, followed by public discontent, finally throwing the existing rulers out of office through the ballot box in a democratic society; and leading to discontent, rioting, chaos, turmoil, and red, orange, green or other colored named revolutions in an authoritarian one. If the moved deposits were large enough, it would be construed by country A as economic warfare, and should negotiations or threats fail, it would be compelled to resort to military might, if feasible, to force country B to deposit its revenue in country's A currency, where it would be helplessly subjected to its monetary inflation and currency depreciation.

Witness the regime change, invasion and occupation, sectarian strife and civil war brought upon an oil producing country that had the misfortune of its leaders not following the rules of the game and depositing its oil revenue in euros rather than in dollars. Besides bringing a golden age of democracy to it, this was also supposed to result in \$15/barrel oil. However, oil as of 2007 averaged \$55/barrel, and briefly reached \$100 per barrel at the start of 2008, placing upward pressure on other prices in general. In addition, import prices, are vulnerable to a dollar that has been weakened by a budget deficit and massive borrowing from China with its trade surplus. Assuming that the dollar declines suddenly by 30 percent, and should importers raise their dollar prices in proportion, then the 1/6 of USA spending on imports will see prices rise by: $\frac{1}{6} \times \frac{30}{100} = 5$ percent, possibly initiating a recession.

To avoid conflict and stabilize what is inherently an unstable situation, regular meetings and negotiations occur among the banking representatives of the industrialized wealthy nations such as the General Agreement for Trade and Tariffs (GATT), International Monetary Fund (IMF), World Bank, World Trade Organization (WTO), Group of Seven or Group of Ten, crafting, negotiating, and coordinating the world's trade and fiscal and monetary policies.

For instance, countries exporting real goods to the USA such as China, Japan and the Organization for Petroleum Exporting countries (OPEC) found themselves being paid with paper obligations that were depreciating at the rate of 12 percent per year over the period 2001 to 2004. The monetary expansion in the dollar currency was caused over that period by the need to keep the economy afloat by encouraging borrowing by the consumers at low interest rates, and by uncontrolled spending on popular domestic and foreign programs, undertaken to win presidential and senatorial elections leading to the double whammy of both a budget deficit as well as a trade deficit.

Regarding the budget deficit, a projected \$5.6 trillion 10 years budget surplus inherited at the end of President Bill Clinton administration was flipped by the subsequent President George W. Bush administration into a \$2.47 trillion 10 year budget deficit. In the 2006 budget, cutting out on the farm program, food stamps, and Medicare to the tune of \$35 billion is used to pay off wealthy campaign contributors with \$70 billion in tax breaks by reducing the capital gains and dividends taxes. About \$37.1 billion or 53 percent of the \$70 billion tax cut would flow to 0.2 percent of people who earned \$1 million per year or more. A larger 78 percent of the tax cut would go to the 3.3 percent of payers who earn at least \$200,000 per year.

The current account deficit, the balance sheet of the USA trade in goods, services and investments was a record \$800 billion in 2005, 20.5 percent higher than in 2004. The trade deficit

in just goods and services, excluding investments, was \$725.8 billion, up 17.5 percent from 2004, the largest in American history. Sixty percent of the trade deficit accrued to five countries: China, \$210 billion, Japan, \$82.7 billion, Canada, 76.5 billion, Mexico, 50.1 billion, and Venezuela, an oil exporting country, \$27.6 billion. The current account deficit was expected to reach \$1 trillion in 2006 and the trade deficit \$800 million.

There exists only \$798 billion of actual cash in existence as of 2006, however that relatively modest sum of money fuels an \$11 trillion USA economy, a national debt of \$9 trillion, consumer indebtedness that is over \$30 trillion, \$80 trillion in accrued federal government liabilities, \$450 trillion in derivatives, a \$600 billion annual federal budget deficit, and an \$800 billion trade/current account deficit.

To eventually pay 6.4 cents on the dollar for oil is a neat winning game if it can be carried out forever. However, in the game of wealth of nations, astute exporters turned into buying real goods and assets with the depreciating dollar currency. This included bids for buying trophy acquisitions, including of all available things, oil assets. For instance the Chinese National Offshore Oil Company (CNOOC) (70 percent government owned), adding to its numerous deals with former Soviet Republics, Nigeria, Saudi Arabia, and Iran, made a \$18.5 billion bid for Union Oil of California (Unocal) in 2005, and for the consumer products maker Maytag, causing the prices of commodities, assets and real estate to shoot up in the USA.

Again in 2008 the Chinese firm Huawei Technologies was forced to pull out of its plans to buy the 3Com Company because it became obvious a federal panel would not approve the deal. The reason: 3Com makes anti-hacker software for the military and the USA cannot have that falling into Chinese hands, according to the Committee on Foreign Investment in the United States (CFIUS). Making matters worse is Huawei Technologies' alleged ties to the Chinese military which also could be said of a lot of Chinese companies. On the security front, new rules allow agencies like the Office of Director of National Intelligence a stronger voice inside CFIUS.

Dubai, one of the 7 United Arab Emirates (UAE), had a state owned company: Dubai Ports World purchase a British firm that managed 6 port facilities in the USA in 2006. Some members of Congress reacted with alarm, even though Dubai had been a staunch ally of the USA, and its ports host more USA Navy ships than any port outside the USA. "Why them Ay-rabs will nuke Long Beach in a heartbeat." The lone exception appears to be the finance sector, in which foreign rescues to Citicorp or Merrill Lynch were welcomed with open arms. In the end Dubai decided to pass on the deal. In the words of Sultan bin Sulayem, the head of Dubai Ports World: "The Americans didn't want us on that deal. Fine. We move on. There's lots of business to be done."

Another case of xenophobia of "furriners" using up their depreciating dollars for buying up "Merkin" assets is the purchase by a United Arab Emirates financial group of the Chrysler Building in New York, never minding that it was already owned by the German subsidiary of an Atlanta based fund making its American provenance dubious at best. The Flatiron Building; a 106 year old New York City landmark, was once one of the city's tallest skyscrapers. The majority stake of the building was sold to an Italian investment fund, the Sorgente Group: "The Flatiron is expensive, but with the dollar, it made sense," according to Valter Mainetti, the group's head.

Some of these deals were promptly sunk by protectionists that some pundits characterized as xenophobes and intolerant bigots who dislike foreigners. The USA's Chevron oil company was invited to purchase Unocal instead, and it promptly obliged. Whirlpool was encouraged to acquire Maytag. As a consolation prize, China's Lenovo was allowed to acquire IBM

Corporation's personal computer business for \$1.25 billion in 2005. Some Dubai and United Arab Emirates Sovereign Wealth Funds were allowed to save some financial institutions like Citigroup and Merrill Lynch from insolvency by acquiring small equity positions into them in 2007.

In the new global trade war, Russia's currency and gold reserves of \$266 billion are fed from a stream of energy exports, whereas China's reserves of \$920 billion are fed by a river of cheap labor factory exports.

Central banks worldwide have inexorably grown the money supply. In 2006, the growth ranged from 8.5 percent in the European Union, 7.5 percent in Australia, 9 percent in the USA, 18.4 percent in China, 19.1 percent in India, 23.2 percent in South Africa, and 45 percent in Russia mostly as capitalization of energy deposits.

The savvy acquisition of American firms reached a record \$322.7 billion in 2000. The buying spree continued in the USA financial services, banking and the manufacturing sectors to the tune of \$72.546 billion in 2004. Canada, an exporter of natural gas and wood products to the USA was the savviest and single biggest buyer of USA assets, particularly technology in 2004 with 40 percent in the purchases, surpassing the UK, which has been historically the most active investor in the USA. For instance, India's Mittal Steel spent \$4.5 billion to buy International Steel Group in Cleveland in 2004, South African Breweries Co. bought Miller Brewing Co. in 2002, Israel's Teva Pharmaceutical Industries bought VAX for \$6.899 billion, and Adidas-Salomon from Germany paid 3.521 billion for Reebok International.

About 5.3 million Americans held jobs with foreign firms in the USA in 2005.

Incidentally, the Committee on Foreign Investment in the United States (CFIUS) was formed in 1975 to monitor and bar at its discretion foreign purchases of USA companies, in response to investments by the oil exporting nations in the Middle East. It is composed of representatives from 12 government agencies and is chaired by a representative of the Treasury Department.

In 1837 Danish author Hans Christian Andersen wrote the fairy tale entitled: "The Emperor's New Clothes." Its punch line is that an innocent child loudly exclaims in the parade where the other spectators were raving to each other about how rich the fabric of the Emperor's new clothes was and how well tailored they were: "Look! The emperor has no clothes on!"

7.30 INFLATION STATISTICS, TAXATION BY INFLATION, THE ART OF MONETARY DILUTION

INTRODUCTION

Most government reports, under political influence, are continually undergoing alterations in the econometric models calculation methodologies on inflation, the payroll series, the unemployment series, and Gross Domestic product (GDP), with the express purpose of presenting a more positive economic outlook than reality.

The books are smartly altered with creative accounting techniques to make it appear that the consumer prices inflation is maintained in the range of 2-3 percent/year.

In fact over the period 2001 to 2004 the percent average annual dollar price changes were reported in the Commodity Research Bureau (CRB) index as shown in Table 37.

Table 37. Average Annual dollar price Changes, Commodity Research Bureau, CRB), 2001-2004.

Component	Percent
USA dollar currency	-12
Oil	+24
Gold	+18
Copper	+26
Real Estate	+12
CRB Index	+14

Table 38. Composition of the Commodity Research Bureau, CRB index.

Commodity	Composition [percent]
Energy (Crude and heating oil, natural gas)	17.6
Grains (Wheat, corn, soybeans)	17.6
Industrials (Copper, cotton)	11.8
Meats (Cattle, lean hogs)	11.8
Softs (Coffee, cocoa, sugar, orange juice)	23.5
Precious metals (Gold, silver, platinum)	17.6
Total	99.9

Table 39. Price Changes for main commodities.

Commodity	2008 [percent]	2009 [percent]
Aluminum (lb)	+36.70	+44.81
Cattle, live (lb)	+8.12	+0.15
Cocoa (lb)		+23.41
Coffee (lb)	+12.70	+21.00
Copper (lb)	+34.50	+138.38
Corn (bu)	+64.40	
Cotton (lb)		+54.22
CRB Index	+32.00	
Ethanol (gal)	+20.80	
Gasoline, unleaded (gal)	+43.30	-
Gasoline, Reformulated Gasoline Blendstock for Oxygen Blending, RBOB (gal)	-	+102.00
Gold (try oz)	+13.20	+22.90
Lumber (1,000 bd ft)	+3.10	
Natural gas (btu)	+78.90	-0.89
Nickel (lb)		+58.33

Oil, heating (gal)	+4.00	+50.73
Oil, light sweet crude (barrel)	+49.80	+77.94
Orange Juice (gal)		+88.25
Platinum (troy oz)	+35.70	
Pork bellies, lean hogs (lb)	-19.70	+7.84
Silver (troy oz)	+23.90	+48.50
Soybeans (bu)	+37.30	+6.97
Sugar		+128.19
Wheat (bu)	-2.20	-11.46

Table 40. Year over year change in the prices of different staples.

Item	Year-over-year change (October 2010) [percent]
Wheat	74.0
Oats	68.0
Cotton	66.0
Meat, pork	60.0
Sugar	44.0
Copper	37.0
Canola	36.0
Silver	36.0
Gold	31.0
Heating oil	29.0
Coffee	27.0
Gasoline	25.0
Meat, beef	18.0
Natural gas	15.0
Corn	14.0
Consumer Price Index, CPI-I, (August 2010)	1.1

The changes that were made had the impact of building upside biases into economic data, showing stronger economic growth going forward and building downside biases into unemployment. Over time, the reporting has moved away from common experience. The inflation rate instead of a reported 3.9 percent year to year as of April 2008, would be 7.3 percent if the 1990 methodologies were used, and 11.5 percent if the 1980 methodologies were used.

SILENT INFLATION, CONSUMER PRICE INDEX, CPI MANIPULATION

Following World War II, the Consumer Price Index (CPI) became a cost of living adjustment for auto workers union contracts with the car manufacturers. The idea was to use it as a measure of a basket of goods such a loaf of bread, a steak a gallon of gasoline and a quart of milk. The basket of goods is priced once every year and one calculates the percent change to

figure by how much salaries must be adjusted to maintain a constant standard of living. Notice here that the basic premise is here: “a constant standard of living.”

At the end of the 1980s the then chairperson of the Federal Reserve Alan Greenspan and Michael Boskin and the then head of the Council of Economic Indicators suggested a substitution alteration in its calculation. In the substitution concept, if steak goes up on price, people substitute the cheaper hamburger for it, lessening their cost of living. This is contrary to the original concept of the CPI, since it then becomes a measure of a declining standard of living rather than a constant one. This had no practical purpose other than reduce the cost of living adjustment to the Social Security recipients. It was a smart tool gifted to the USA Congress to contain the Social security payments without having to vote for increasing its funding level. The idea did not fly at the time.

The concept was adopted in an alternative way during the President Bill Clinton administration when the Bureau of Labor Statistics (BLS) introduced geometric weighting of the CPI for the purpose of mimicking a substitution based CPI estimate. With geometric weighting, if an item goes up in price it gets a lower rating and if an item decreases in price, it gets a higher weighting. The net effect is giving a lower inflation estimate than when linear weighting were used, leading to an effective 3 percent decrease in the estimate as a cumulative effect.

As an example, the average value, mathematical expectation or mean of the sequence 1, 2, 3 is:

$$\mu_{linear} = \frac{1+2+3}{3} = \frac{6}{3} = 2$$

whereas the geometric mean of the same sequence is:

$$\mu_{geometric} = (1 \times 2 \times 3)^{1/3} = 6^{1/3} = 1.817$$

which is less than the linear estimate.

This is also called logarithmic weighting since:

$$\ln \mu_{geometric} = \frac{1}{3} (\ln 1 + \ln 2 + \ln 3) = \frac{0 + 0.6931 + 1.0986}{3} = \frac{1.7917}{3} = 0.59723$$

Taking the exponential of both sides yields:

$$e^{\ln \mu_{geometric}} = \mu_{geometric} = e^{0.59723} = 1.817$$

which yields the same result as the geometric mean.

The Social Security payments to the uninformed beneficiaries would be about double what they are today, without this creative financing alteration.

There are two ways the manipulation is carried out: the first involves the methodological shift over time, and the second involves manipulation for political purposes.

The manipulation is carried out by widely reporting the so-called “core inflation rate” of the headline Consumer Price Index (CPI) as a measure of inflation. The core rate of inflation in 2005 rose by just 2.3 percent, its mean value over the previous 10 years. In these ten years the core inflation rate fluctuated between a maximum of 3 percent and a minimum of 1 percent

implying an inflation rate that is “well contained.” It is undoubtedly under good control since the adopted definition excludes from the core inflation rate estimate the contribution from food and energy costs which are included, interestingly enough, in the overall or headline CPI. The argument that is advanced for excluding them is that they tend to be volatile. In the theory adopted by policy makers, their volatility or their statistical variance is construed to make them unreliable as inflation long term trend indicators.

The increasing items are excluded and adjusted on the basis that consumers would substitute cheaper alternatives to the expensive ones. While it true that consumers can substitute a cheaper brand of toothpaste to another expensive one. It is doubtful that this will substitute human food, for instance steak for hamburger or cereal.

The core rate of inflation that seldom varies is advanced as a more reliable gauge of inflation, and that is what is conveniently reported. The reason the core rate of inflation has a low variance is simply because it does not include the more volatile components involved in daily living. The USA Treasury Department reflects the Federal Reserve line that consumer prices, as measured by the consumer price index (CPI), are under control. However, many mainstream economists admit that the CPI grossly understates true inflation. Major changes, which began in 1982 with the removal of house prices from the CPI calculation, have greatly distorted its message. In March of 2006, the reporting of the M3 money supply measure was stopped, as it showed an inconvenient and embarrassing large rate of increase.

The fact is that the CPI was manipulated to exclude housing prices, instead tracking rents despite the reality that most middle class Americans own homes, paying up monthly mortgages rather than rents. The cost of ownership of a home has increased dramatically: in many regions housing prices have more than doubled in just five years before the price adjustment in 2008-2009.

In addition, the estimate is further reduced by the price deflator accounting for increases in productivity. The basket of goods includes the price of guns and funerals; items that are assumed as being used in daily living, but not food and energy. Thus price inflation certainly is alive and well when it comes to the largest purchase most Americans make.

In general, the creative-financing statistical tools used for the CPI manipulation take the following forms:

1. **Product substitutions:** Items within the basket of goods are replaced by other items, should they increase faster in price. For instance, beef meat is replaced by chicken should the former increase faster in price. When beef steak gets too expensive it is substituted-for by hamburger. Rapidly increasing housing prices are substituted by slower increasing rental prices. This assumes maintaining a declining standard of living where the cost of living is replaced by the cost of survival.
2. **Seasonal adjustments:** Price increases are removed during peak consumption times of the year. For instance, gasoline fuel is removed during the summer peak driving season and heating oil is removed during the winter peak heating season.
3. **Hedonic or quality price adjustments:** There exists some legitimate academic use for this adjustment. The issue is common experience versus academic considerations. A car must have a catalytic converter adding \$500 to the price of the car paid by the consumer who has no choice but paying the extra amount. From the government statisticians’

perspective, this is a quality improvement to the car, and as a result it would not be included in the estimate of the CPI. If a text-book increases in price because it has color photographs, the increase is not counted in the inflation estimate even though the student bears the extra cost anyway. In theory, prices could be adjusted downward, but this rarely occurs. The quality of air flight in terms of narrower seat spacing, lower food quality, flight delays, long airport check-in lines and passengers search and confiscation harassment have hedonically deteriorated, but the lower level of service is not accounted for. The Bureau of Labor Statistics (BLS) suggests: "The hedonic quality adjustment method removes any price differential attributed to a change in quality by adding or subtracting the estimated value of that change from the price of the old item." As your computer gets more powerful every year, the BLS says you are getting more for your dollar; therefore the price fell even if you paid as much or more for the computer. Prices of improved computers are adjusted downwards since consumers are getting a better value and are achieving higher productivity in more advanced models. Opponents of the concept say hedonics can be used to conveniently hide "true" inflation.

4. **Geometric weighting:** To smooth out fluctuation logarithmic addition is used instead of arithmetical addition. This gives a lower weighting to items that are increasing in price, and a higher weighting to those items that are decreasing in price. The net effect is to reduce the reported CPI on an annual, or year-over-year (yoy) basis, by 2.7 percent from what it would have been based on the traditional weighting methodology. The results have been dramatic. The compounding effect since the early 1990s has reduced the annual cost of living adjustments in social security payments by more than one third.
5. **Core rate emphasis.** This excludes the volatile food and energy prices.
6. **Consumption function.** Another obvious manipulation includes the "consumption function," that is at the core of the whole adjustment theory, according to which that when a person gets an extra amount of income, they spend some and save some. There ensues an adjustment for the "wealth effect" which is the phenomenon whereas those who make or possess a lot of money, spend a little more and save a little less.
7. **Imputed income.** Another ingenious statistical manipulation includes the concept of "imputed income" including the "value" that is received in living in one's own home, or the "value" of one's free checking account. In 2007, 15 percent of the USA Gross Domestic Product (GDP) is attributable to imputed income.
8. **Birth/Death model.** Yet another manipulation of the employment figure concerns the "Birth/Death Model" which literally assumes that new businesses are being formed and employees are being hired which are too new to show up in the data. Six separate calculations of the unemployment rate are used, some more inclusive than the others.

The CPI manipulation is universally adopted by most world governments. For instance 34 items were added to Japan's CPI whose prices on balance were falling, and 48 items of goods and services that were becoming more expensive were removed resulting in a 2/3 decline in Japan's core consumer CPI from 0.6 percent in June 2006, to just 0.2 percent in July 2006.

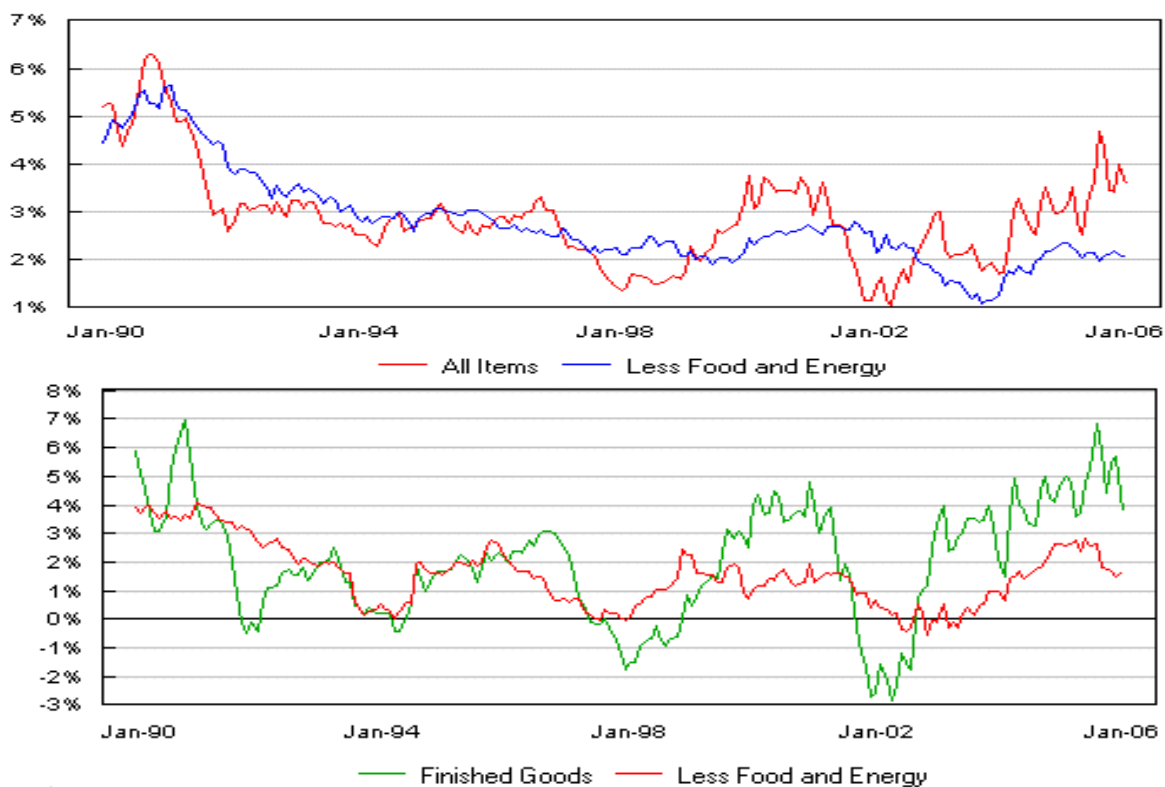


Figure 74. Consumer Price Index (CPI) as of March 16, 2006 (top) and Producer Price Index (PPI) as of March 21, 2006 (bottom), year on year (yoy) rate of change. Headline CPI is showing all items, and core CPI is excluding food and energy.

In the early 1980s a great alteration was implemented in the cost of housing, which used to include a component allowing for the cost of buying a house. This was altered with the Owners Equivalent Rent (OER) used at about 40 percent of the core CPI. The government statisticians will estimate what the individual owning a house would pay if he were to rent the house from himself, and then calculate how much he would increase his rent on himself each month as a figure to be used in calculating the CPI. Yet only 26 percent of Americans rent; the rest own their homes. Subtracting rent controlled and subsidized housing probably means about 20 percent of USA citizens are impacted by apartment rents. On the other hand, virtually all consumers are impacted by food and energy inflation.

The use of the core inflation figure instead of the headline inflation one was developed in the 1970s by Arthur Burns under President Nixon and is considered by many economists as meaningless, absolute nonsense and a gimmick. Its only validity is that we are dealing with volatile price commodities such as oil and food, and the premise is to take out a big spike in the price in a single given month and look at what inflation is over this short period. It becomes invalid when we look at an annual basis, whereas the month to month distortions are not considered anymore.

One incentive for the shrewd manipulation, other than making the populace feel good and reducing the value of the deposits by foreign creditors, is that the Cost Of Living Adjustments (COLAs), especially for Social Security and unemployment payments by the federal government

in the USA would dramatically increase if the real inflation rate, as measured for instance by the Commodity Research Bureau (CRB) index of 14 percent/year, or by the rate in the depreciation of the currency of 12 percent/year, were used instead of the reported core rate of inflation of 2-3 percent/year.

Deflation is feared by governments since it makes it harder to finance and repay their debts to both its citizens and foreigners. Deflation is a fall in the money supply, but it is always associated with falling asset prices. This happens when a lesser total amount of money has to be spread among the same amount of actual assets, which means that the pro-rata money available for each asset goes down, which makes some prices go down, which hands losses to the owners of the assets. However their losses are netted back against gains when paying taxes, which means less tax revenue to the government.

Technically speaking, in deflation, the ratio of Money Supply to Actual Assets (MS/AA) goes down when the Money Supply goes down, which it can do for a variety of reasons, one of which is when any creditor has to take a loss, because fiat money is created by a bank at the instant that someone borrows money from a bank. Therefore money also literally disappears when the debt, underlying the fiat money, disappears when being defaulted upon because the entity or person who owes the money to the bank decided to default on a mortgaged asset that has lost its underlying value.

Inflation, on the other hand is a cash cow for governments. They conveniently use it, when they cannot raise taxes any more to “monetize the Federal debt.” For instance, USA citizens benefiting from the Social Security retirement program are told that their benefits are pegged to inflation. If the payments are pegged to inflation at 2 percent, but inflation is actually 6 percent, the happy but uninformed beneficiaries only get 1/3 of the raise they should be getting. The government gets away with giving them a smaller raise every year, and the cumulative effect from 1980 is that they should be getting at least double what they are getting in 2010. It can be considered as a hidden 50 percent tax paid on top of the tax they are already subject to. Whether an individual is on social security, medicare, welfare, unemployment, veteran or some other entitlement program, the same applies in that he gets a smaller raise each year and a government keeps the difference to spend on its own growth and favored programs.

It is worth mentioning that these manipulations are not universally adopted by all economists. For instance, according to the European Central Bank’s president Jean Claude Trichet on July 17, 2008: “We do not consider core inflation as a good predictor of future inflation.”

Other countries allow their citizens to account for inflation when paying their capital gain taxes.

PERSONAL CONSUMPTION EXPENDITURES, PCE. CHAINED DOLLARS.

The USA Federal Reserve central bank prefers the Personal Consumption Expenditures (PCE) as a measure of inflation instead of the Consumer Price Index (CPI). The PCE uses chained dollars rather than a fixed basket like the CPI does. Since 2000, the Federal Reserve has used PCE in its reports to Congress about expectations for inflation.

In explaining its preference for the PCE, the Fed stated in the “Monetary Policy Report to the Congress,” Federal Reserve Board of Governors, February. 17, 2000:

“The chain-type price PCE index draws extensively on data from the consumer price index but, while not entirely free of measurement problems, has several advantages relative to the CPI. The PCE chain-type index is constructed from a formula that reflects the changing composition of spending and thereby avoids some of the upward bias associated with the fixed-weight nature of the CPI. In addition, the weights are based on a more comprehensive measure of expenditures. Finally, historical data used in the PCE price index can be revised to account for newly available information and for improvements in measurement techniques, including those that affect source data from the CPI; the result is a more consistent series over time.”

The reason is that the PCE and other chained inflation numbers generally yield lower inflation figures. Many in Congress and the American Association of Retired Persons (AARP) think that the concept of “chained dollars” is a conspiracy to defraud seniors on Social Security payments. The CPI is used to calculate adjustments for income taxes. If it is too low, then incomes rise faster in real terms than cost adjustments do, and that acts as a tax increase even as your pension is adjusted lower. But if inflation is calculated too high, then taxes are lower than they would otherwise be and the costs of Social Security and pensions are higher.

The USA central bank is well aware of the imperfections in the data and analyses, even as it defends them. It depends on government employment and inflation statistics because it does not have anything better. The USA ends up with a toxic brew of an essentially opaque central bank, using blunt instruments, to manipulate a statistic relevant to practically no one, towards ends it cannot define with any specificity.

ALTERED UNEMPLOYMENT STATISTICS

During President John F. Kennedy administration the concept of the “discouraged worker” was introduced. The government’s measure of an unemployed person is that the person must be actively seeking employment to be counted. This is legitimate only in areas of economic activity where people have a prospect of seeking jobs. In areas of low economic activity where jobs are unavailable, and people have given up looking for jobs, they were classified as discouraged workers.

During President Bill Clinton administration, discouraged workers were redefined. A discouraged worker for more than a year became no longer a candidate in any category and is no longer counted as unemployed. That reduced the unemployed count from 5 million persons to just 300,000; or a reduction by a factor of: $(5,000,000 - 300,000) / 5,000,000 = 4,700 / 5,000 = 0.94$, or fully 94 percent.

ALTERED GROSS DOMESTIC PRODUCT, GDP

The way the Gross Domestic Product (GDP) is reported is net of inflation. If an artificially low estimate of the inflation rate is used for deflating the GDP, one ends with an artificially high GDP rate net of inflation. The gimmicks of geometric weighting and hedonics in the estimate of inflation lead to about a 3 percent overestimate of real growth. As of 2008, the official GDP was +2.5 percent of positive annual growth. Adjusted for inflation it would lead to -2.5 percent of negative annual growth, implying a recession.

COUPLED INFLATION AND INFLATION INDEX MANIPULATION

We consider the effect of 14 percent inflation on the buying power of a retiree receiving Cost-Of-Living-Adjusted Social security at 3 percent within 20 years. The real discount rate would be: $14 - 3 = 11$ percent. According to our derived present value equation, the following “present value” or buying power at retirement after 20 years of productive employment and regular contributions of each dollar would be worth:

$$\begin{aligned} R_0 &= R(N).e^{-N.\ln(1+i)} \\ &= 1.0 e^{-20.\ln(1+0.11)} \\ &= \$0.124 \end{aligned}$$

This means that the social security recipient will be repaid only 12.4 cents on the dollar that he saved. The beneficiary loss to index management is: $(100 - 12.4) / 100 = 87.6$ percent.

The previous example shows that with a combination of monetary inflation and inflation index manipulation, there is no basis about the social security system ever becoming insolvent, since its supposedly inflation protected promises and obligations will be repaid with future inflated and diluted currency at the rate of 12.4 cents on the dollar.

It turns out that some inflation targeting central banks, such as the Bank of England and the European Central Bank, target overall inflation and not just the core. Stephen Cecchetti, professor of economics and finance at Brandeis University's International Business School in Waltham, Massachusetts, and a former research director at the New York Fed, agrees that the core is an unreliable guide:

“Since the goal of policy makers is stable prices overall, including those of food and energy, they should turn their attention to forecasts of headline inflation and stop focusing on core measures.”

Other creative accounting occurs in the reporting of the unemployment figures. The reported official unemployment figures do not include those people who have given up looking for a job perhaps due to the unavailability of jobs, joined a university as students temporarily parked for a better job opportunity or taken a part time job since they cannot find full time employment. When these are added up, the real rate of unemployment is closer to 10 percent rather than the reported 4 percent.

In fact, two sets of books are kept in the USA. The first set is the “President’s Budget,” issued by the Office of Management and Budget and used to develop the annual budget, is based on cash accounting. The other set of accounts, the “Financial Report of the United States,” issued by the Department of the Treasury, uses a more realistic accrual basis accounting. The USA Federal law requires all businesses with revenues in excess of \$5 million to use accrual accounting. Yet the budget figures released to the public do not follow this rule. Statistics more often than not, are misleading and distort the truth: The USA budget reported in the media suggests that the deficit was reduced to \$319 billion in 2005. However, the Financial Report issued by the Department of Treasury reports that it was \$760 billion; which is about twice as

large. The fact is that the USA budget process meant for general reporting uses accounting procedures that ignore long term, future obligations such as Social Security and Medicare.

The government statisticians at the Bureau of Labor Statistics (BLS) are diligently modifying the inflation calculations of the PPI by removing those pesky items that go up in price, but including more of those prices that do not, so that everybody in both government and the population will feel better. For instance, the accounting acrobatics are described in actual government language in a BLS publication as:

“The Bureau of Labor Statistics will soon update the value weights used to calculate Producer Price Indexes to more accurately reflect recent production and marketing patterns. The new weights, which will be introduced in February 2007 with the release of January 2007 index data, will be based on shipment values from the year 2002. All indexes will be affected by this weight update, including all the industry net output indexes, as well as those calculated for traditional commodity groupings.”

The better informed and honest government accountants at the Government Accountability Office (GAO), formerly the General Accounting Office, would not even certify the above statement, due to “Material weaknesses in financial reporting.”

A symptom of the debasement of the currency is that the USA Mint, concerned that rising metal prices could lead to widespread recycling of pennies (1 cent coin) and nickels (5 cents coins), has banned melting or exporting them in 2007. The penalty for non-compliance is up to a \$10,000 fine, and imprisonment of up to five years, or both. Travelers were allowed to carry only \$5 worth of coins out of the country but are allowed to take out up to \$10,000 of the paper currency.

Incidentally, USA courts have a 99 percent conviction rate. The USA has the highest percentage of people in prison in the world. Ten percent of the working age population are in jail, plus half the people work for or depend on an unproductive government.

The metal value of pennies, which are made of copper-coated zinc, is 1.4 cent. The metal value of the 5 cent coins, made from a copper nickel blend, is up to 7 cents. The penny was pure copper when it was first introduced in 1793, and its composition was last changed in 1982 in response to rising metal prices, which is a solid evidence of inflation. Copper was priced at 75 cents per lb in 1982, and was 3 dollars per pound in 2006. Adding in the costs of manufacturing, the USA Mint spends 1.73 cents for every penny and 8.74 cents for every nickel it strikes for circulation.

The USA government debt topped 9 trillion dollars, before accounting for its unfunded obligations for Social Security and Medicare. By adding in Social Security, Medicare and the USA government's other obligations such as military pensions, the current debt adds up to \$60 trillion. In his first address to Congress, President Ronald Reagan, pointed out that a stack of \$1,000 bills four inches high makes a person a millionaire, and that a trillion dollars would be a stack 67 miles high into the sky. To service its debt and keep the process going, the USA government must sell on the order of \$2.5 billion/day in new Treasury bills, much of it to foreigners already sitting on \$6 trillion of USA paper obligations. Absent the foreign buyers of USA Treasury securities, the only cure would be the repudiation of this colossal debt through a process of orderly monetary inflation and depreciation of the currency. If the process is noticed too early the whole house of cards would be unsustainable and begin to collapse with wealthy

Americans, foreigners and foreign governments rushing to switch out of the depreciating currency into real assets or other currencies.

7.31 UNSUSTAINABILITY OF MONETARY INFLATION, DILUTION

INTRODUCTION

The exponential growth in monetary bubbles is unsustainable. They eventually are overinflated until they pop out. They normally do not repeat themselves but cyclically reappear according to the prevailing fad.

Bubbles are governed by “the greater fool theory” which portends that the bubbles over optimistic participants are the fools who acquire over priced assets expecting to resell them to some other greater fool participants. The bubble continues to expand as long as the greater fools are available. When their supply dwindles, the bubble deflates into oblivion.

History is abundant with bubbles: The Mississippi Company in 1720, the Victorian land boom of the 1880s, Florida building bubble in 1926, sports cards and comic books in the 1980s and 1990s, Beanie Babies in 1996, Japanese stock market in the 1980s, the Asian Crisis in 1997, the Chinese stock market of 2006, the Indian stock bubble of 2008 and the Subprime lending housing bubble in 2006-2008 in the USA as well as the commodities bubble worldwide in 2006-2008.

DENARIUS AND AUREUS DEBASING (277 BC-268 AD)

The denarius silver coin was born as Rome’s currency in 277 BC. As the Roman Empire rose to prominence over the next 228 years it kept its value relatively well. Its original 66 grains of silver decreased only by 10 percent to 60 grains by 49 BC at the time of Julius Caesar.

In 64 AD the Roman Emperor Nero decreed that the number of aureus coins minted from a pound of gold should be increased from 41 to 45. This decreased the value of each gold coin by $(45 - 41) / 41 = 4 / 41 = 0.0976$ or 9.76 percent. He also took out 14.3 percent of the silver from the denarius coin replacing it with base metals.

As Rome continued to decline, by 193 AD the denarius had only 26 grains of silver, a $(66 - 26) / 66 = 0.606$ or a 60.6 percent devaluation from its original value. By 268 AD the denarius value was debased by 99.98 percent to practically zero as it became just base metal coated with a thin silver layer.

The debasement of the currency correlated with the economic, moral and political decline of the Roman Empire, and it stopped being accepted for trade by the rest of the world.

FINANCIAL BUBBLES AND MANIAS

In the 18th century speculators in France were involved in the government chartered Louisiana Company, in the 19th century in England the East India Company and in the 20th century in the dot.com companies then into the securitized subprime mortgage housing market in the USA. Examples of financial bubbles are:

PANIC OF 33 AD, ROME

From Will Durant's "History of Roman Civilization and of Christianity from their beginnings to AD 325":

"The famous "panic" of A.D. 33 illustrates the development and complex interdependence of banks and commerce in the Empire. Augustus had coined and spent money lavishly, on the theory that its increased circulation, low interest rates, and rising prices would stimulate business. They did; but as the process could not go on forever, a reaction set in as early as 10 B.C., when this flush minting ceased. Tiberius rebounded to the opposite theory that the most economical economy is the best. He severely limited the governmental expenditures, sharply restricted new issues of currency, and hoarded 2,700,000,000 sesterces in the Treasury.

The resulting dearth of circulating medium was made worse by the drain of money eastward in exchange for luxuries. Prices fell, interest rates rose, creditors foreclosed on debtors, debtors sued usurers, and money-lending almost ceased. The Senate tried to check the export of capital by requiring a high percentage of every senator's fortune to be invested in Italian land; senators thereupon called in loans and foreclosed mortgages to raise cash, and the crisis rose. When the senator Publius Spinther notified the bank of Balbus and Ollius that he must withdraw 30,000,000 sesterces to comply with the new law, the firm announced its bankruptcy.

At the same time the failure of an Alexandrian firm, Seuthes and Son due to their loss of three ships laden with costly spices and the collapse of the great dyeing concern of Malchus at Tyre, led to rumors that the Roman banking house of Maximus and Vibo would be broken by their extensive loans to these firms. When its depositors began a "run" on this bank it shut its doors, and later on that day a larger bank, of the Brothers Pettius, also suspended payment. Almost simultaneously came news that great banking establishments had failed in Lyons, Carthage, Corinth, and Byzantium. One after another the banks of Rome closed. Money could be borrowed only at rates far above the legal limit. Tiberius finally met the crisis by suspending the land-investment act and distributing 100,000,000 sesterces to the banks, to be lent without interest for three years on the security of realty. Private lenders were thereby constrained to lower their interest rates, money came out of hiding, and confidence slowly re-turned.

TULIP MANIA BUBBLE, 1630-1638

In the 1630s in Holland tulip bulbs, originating from Asia Minor, became all the rage and traded on the stock exchanges in Dutch cities. In a single month, the price of a single tulip bulb increased twenty fold. The Dutch burgomasters or local mayors traded and sold their prized possessions to participate in the tulip market. Families mortgaged their life savings for the bulbs that some of which would cost as much as a house.

In the autumn of 1636, demand for tulips sagged as German princes ravaged by the Swedes in the Battle of Wittstock, began digging up their bulbs and selling them for cash. The sudden glut caused prices to fall, and Dutch burgomasters began losing money. Rather than accepting their losses, the politically well-connected investors changed the market rules on trading tulips. They succeeded in ironing out a deal whereby the obligation to purchase bulbs at a fixed price would be suddenly converted into an opportunity to do so. What they in fact did

was to turn a tulip bulb futures contract into an option contract. The action was duly ratified by the Dutch legislature. On February 24, 1637, the Dutch florists announced that: "All futures contracts written since November 30, 1636 and up until the opening of the spring season, were to be interpreted as option contracts." In the worst case scenario, investors would lose 3 percent of the price of the contract. In the best case, prices would rise above the strike price, and they could make an instant profit while assuming the minimal 3 percent risk. As a direct result of these sudden rule changes people assumed there was little to no risk in buying tulip options, and the market exploded.



Figure 75. Tulip Mania. "For one rare bulb, a king's ransom."

The leverage associated with options brought in people of moderate means to join the speculative process. The options leverage allowed a \$1,000 investment to balloon to \$100,000. At this point it was believed that tulips values were immune to a decline and that they will always go up.

By February 1637, the price of tulips had risen 20 times.

The demand for rare tulips increased so much that regular marts for their sale were established on the Stock Exchange of Amsterdam, in Rotterdam, Harlaem, Leyden, Alkmar, Hoorn, and other towns. Symptoms of gambling became obviously apparent. The stock jobbers, ever on the alert for a new speculation, dealt largely in tulips, making use of all the means they so well knew how to employ to cause fluctuations in prices. At first, as in all these gambling mania, confidence was high and everybody won. The tulip-jobbers speculated in the rise and fall of the tulip stocks, and made large profits by buying when prices fell, and selling out when they rose. Many individuals grew suddenly rich.

At last, however, the more prudent began to see that this exponential growth folly was unsustainable. Rich people no longer bought the flowers to keep them in their gardens, but to sell them again at cent per cent profit. It was seen that somebody must lose fearfully in the end. As this conviction spread, prices fell, and never rose again. Confidence was destroyed, and a universal panic seized upon the dealers. The fact is that leverage is a double edged sword. When

prices started to slip, they resulted in a downward avalanche with the options calls buyers being wiped out to the advantage of the more savvy option calls sellers.

Reputable merchants were reduced almost to beggars, and many a representative of a noble family saw the fortunes of his house ruined beyond redemption. After the crash was rolling, people demanded, much like in recent times, that “the government do something.” Initially, the government offered to buy the options at 10 percent of face value. But as prices plunged even lower, the government could not afford to keep doing it.

At the peak of the mania a single tulip bulb increased exponentially to the equivalent of \$76,000 in February of 1637. At this juncture, the manic behavior turned into a panic with the public trying to save their investments to some inexistent buyers. Six weeks later, the price of a tulip bulb came down to its intrinsic \$1 value.

RESTORATION ENGLAND STOCKS, 1668

King Charles II of England played his divine right card 20 years after the Parliament cut off his father's head and issued new government bonds which were then called “stocks.” The purpose was to raise funds for yet another losing war against the Dutch.

He side-stepped the Parliamentary approval for the new debt, and started selling stocks against the promise of future tax receipts. By 1671 all the new money raised went straight to paying interest on the outstanding loans. The solution was for King Charles II to default on the debt bankrupting 11 of London's 14 largest goldsmiths which were the early bankers who would lend the British Crown money for its wars. In the process he also destroyed his credit with England's subjects.

King Charles II was forced to strike a secret deal with France, promising to stay out of its war against the Dutch in return for some regular cash payments. The deal was uncovered by a rash of anti-Catholics panics in London undermining all support for the Stuart royal family.

Within 15 years with the English crown bankrupt once more, his brother James II is overthrown in a popular and bloodless coup. He was replaced by William of Orange, the head of the Dutch Republic that King Charles II raised money to wage war against.

SOUTH SEA COMPANY BUBBLE, 1720

In the UK the shares of the South Sea Corporation jumped from 128 pounds in January 1720 to 1,050 pounds in July 1720 as they became a subject of hype. By December 1720 they collapsed down to 100 pounds. This has been dubbed the “Enron of England.” The South Sea Company was founded to fund British government debt in return for a monopoly on trade from the South Sea or Central and South America.

The British Parliament had passed the South Sea Act in 1720, which gave the South Sea Company a monopoly on trade, including slavery, with South America in return for financing part of the national debt run up in the War of the Spanish Succession.

The bubble collapse costs clergymen, country gentlemen and even scientist Sir Isaac Newton their life savings. Chancellor of the Exchequer John Aislabie was expelled from Parliament after an inquiry found he had accepted bribes, the Postmaster General took poison, and even King George I's two mistresses were implicated.

The Walpole government faced with the populace anger, seized the property of the company's directors and used it to partially pay off the victims. A resolution was proposed in the

British Parliament whereas the bankers involved in the scam would be tied up in bags filled with snakes then tipped into the Thames River.

Called as a sure bet by British Bankers the shares of the South Sea Company were hawked as a play on New World trade. The goal of the Company was: “A Company for carrying out an undertaking of great advantage, but nobody to know what it is ...” The hoped-for illusory profits never materialized, the investors bailed out, and the South Sea Company officials were sent to jail.

A poem by British poet Alexander Pope about the South Seas Bubble of the early 1700s which he witnessed:

“At length corruption, like a general flood,
Did deluge all, and avarice creeping on,
Spread, like a low-born mist, and hid the sun.”

After mentioning a few of the statesmen and patriots, peeresses and butlers, judges and bishops, and even “mighty dukes” who were corrupted during the mania, the poem ends with the line:

“Britain was sunk in lucre's sordid charms.”

REVOLUTIONARY USA CONTINENTALS, 1775-1781

Without a mandate to tax its people while fighting the revolutionary war, the USA's second Continental Congress authorized the supposedly limited issue of paper money as notes called Continentals. Like other government paper issues they were backed by neither gold nor silver but on expected future tax receipts.

They were effectively tradable bonds that were exchangeable for goods and services amongst the Patriots, rather than a hard currency. The Continentals were meant to be redeemed when the Colonies would win their independence from Great Britain. Before independence they converge towards zero in value as their printed supply increased exponentially.

During the first 6 months of their issue, the supply of Continentals rose from the equivalent of 2 million to 6 million dollars. By 1779 their total supply reached 242 million dollars which was 20 times the volume of the pre-war currency consisting of gold and silver coins.

George Washington complained: “A wagon load of currency will hardly purchase a wagon load of provisions. In March 1780, Congress announced a plan to redeem the Continentals at just 1/40 of their face value, effectively taxing the American citizens more than King George III of England would have ever dreamt of.

The Continentals currency issued to pay soldiers and to buy supplies, was eventually redeemed at 1 percent of face value in the 1790's, benefitting the speculators that bought these bills for even less from the holders who believed that they were worthless. The Constitutional limitations restricting government to coining gold and silver were born out of this experience.

FRENCH ASSIGNATS, 1789, MANDATS TERRITORIAUX, 1796

Examples of unsustainability can be glimpsed from the defunct monetary systems of times past such as the French Assignats and the American Continentals. Andrew Dickson White (1832 – 1918), a diplomat, author and educator who co-founded Cornell University, in the mid-1800s

collected and analyzed newspaper articles and documents that had appeared during the French Revolution. He emphasized those pertaining to the Revolutionary issues of paper money and he published his work in 1912 as an essay: “Fiat Money Inflation in France.”

At the eve of the French Revolution in 1789, the French government found itself burdened with heavy debt loads and chronic deficits caused by a lack of confidence in the business world that led to the decline of investment and a stagnating economy.

According to Andrew Dickson White: “Statesmanlike measures, careful watching and wise management would, doubtless, have ere long led to a return of confidence, a reappearance of money and a resumption of business; but these involved patience and self-denial, and, thus far in human history, these are the rarest products of political wisdom. Few nations have ever been able to exercise these virtues; and France was not then one of these few.”



Figure 76. French Republic Assignat currency of four hundred pounds or “quatre-cents livres.”

SCOTTISH ECONOMIST JOHN LAW LEGACY

What happened was that France’s National Assembly looked for a shortcut to prosperity and soon called for the introduction of paper money. Some well-informed individuals, such as the Minister of Finance Jacques Necker, urgently warned against it and reminded the French that 70 years earlier, the country had learned a tough lesson when exiled Scottish economist John Law had presided in France over a system of fiat money with ruinous consequences.

Early in the 18th century, John Law sought refuge in France after having killed Beau Wilson in a duel in England. France was broke at the time following the unbridled spending by Louis the 14th. John Law proposed to solve the financial problems with a novel monetary system based on a new national bank: the Banque Générale, and a new currency backed by the future profits from the territory of Louisiana in America, named after King Louis. John Law's project, the Mississippi Company, became initially a great success, until investors discovered they were

sold worthless swamp land. By 1720 he was the richest man in the world and France gave him the title of Duc d'Arkansas. It did not take too long before the bank went bankrupt. John Law fled away from the angry mobs to Venice, where he died and was buried there nine years later.

John Law was a Keynesian economist. A gambler and womanizer, John Law had befriended France's Duke of Orléans and by the late 1710s found himself running both France's central bank and treasury running an early form of modern day "quantitative easing" in creating money from nothing to buy government debt. It ended in tears with prices soaring, the small middle class wiped out. John Law ended up bankrupt and began traveling across Europe, bumming off friends and gambling just to stay afloat.

In his 1705 book: "Money and Trade Considered," he sought to revoke state bankruptcy by replacing gold money with arable land, paper notes, stock shares, future tax revenues and Mississippi Delta land holdings. According to John Law: "It is in the interest of the king and his people to guarantee bank money and to abolish gold species. ... The lands of France are worth more than all the gold in the mines of Peru." His *Compagnie de l'Occident* ended up owning a large area of disease ridden swamp populated by previous beggars and thieves in Louisiana.

Necker and his supporters were shouted down. The plan sounded sensible: the government would confiscate the lands of the French Church, which owned between 1/4 - 1/3 of all French real estate, and issue a total of no more than 400 million livres in large notes of 1,000, 300 and 200 livres, designated as "assignats," that would be backed by a piece of land. In addition, every note would bear 3 percent interest, to encourage holders to hoard them.

Church lands, which accounted for 1/3 of all land, were expropriated throughout France and a paper currency designated as assignats, not based on gold or silver, but on the security of Church lands, was issued. Both domestic and international creditors accepted the new currency as a legitimate payment. The new currency was initially used to successfully retire a significant portion of the public debt. Afterwards, the country succumbed to moral hazard. For, though Church lands in France were appraised at \$1 trillion, the government serially issued \$9.5 trillion in assignats leading to hyperinflation and depreciation.

The influx of fresh money would have given the French treasury: "Something to pay out immediately, relieve the national necessities, stimulate business, and give to all capitalists, large or small, the means for buying from the nation the ecclesiastical real estate." From the proceeds, the nation paid its debts and obtained new funds for new necessities.

The results of issuing the assignats appeared to be a dream comes true. According to White: "The treasury was at once greatly relieved; a portion of the public debt was paid; creditors were encouraged; credit revived; ordinary expenses were met, trade increased and all difficulties seemed to vanish." Regretfully, though, "Within five months after the issue of the four hundred million in assignats, the government had spent them and was again in distress."

People throughout the country started to cry for another issue of notes. Paper critics cautioned that there would be no stopping once the nation had stepped onto the slippery slope of inflation, but others dismissed the warning, saying: "The people were now in control and that they could and would check these issues whenever they desired."

By 1790 Le Comte de Mirabeau, one of the greatest paper advocates and demagogues gave a powerful "Stay the Course" speech, concluding that: "We must accomplish that which we have begun."

Pierre Paul Royer-Collard told the National Assembly, "If it is necessary to create five thousand millions, and more, of the paper, decree such a creation gladly."

France slid into inflation with calls for small denomination notes growing louder and according to White: "The cheaper currency had largely driven out the dearer, paper had caused small silver and copper money mainly to disappear; all sorts of notes of hand, circulating under the name of 'confidence bills,' flooded France, 63 kinds in Paris alone."

Everything was tried to supply small denomination silver and copper coins and hold them in circulation. Laws were passed that forced citizens to send their silverware and jewels to the mint. Churches and convents had to give up most of their silver and gold vessels, and church bells were melted down to supply the mint with copper. Regardless, silver and copper grew scarcer, and eventually the government gave in and printed smaller notes, starting out with five francs and finally going down to one single sou.

White says: "When inflationary pressure grew there cropped up a doctrine old and ominous, that all currency, whether gold, paper, leather or any other material, derives its efficiency from the official stamp it bears, and that, this being the case, a government may relieve itself of its debts and make itself rich and prosperous simply by means of a printing press: fundamentally the theory which underlay the later American doctrine of fiat money." "Frenchmen now became desperate optimists, declaring that inflation is prosperity. The nation was becoming inebriated with paper money. The good feeling was that of a drunkard just after his draught; and as draughts of paper money came faster, the successive periods of good feeling grew shorter."

Even though the amount of paper money had increased, prosperity had faded. Business became stagnant, and manufacturers starting to lay off workers. In one town, 5,000 workers were discharged from the cloth factories, but people still did not recognize the real cause. Exports were too cheap, they claimed, and heavy tariffs were placed on foreign goods.

A collapse in manufacturing and commerce was inevitable just as it came earlier at various periods in France, Austria, Russia, America, and in all countries where men have tried to build up prosperity on irredeemable paper.

With inflation, and faced with the prospect of a continuing devaluation of paper money, the public began to see saving and caution as foolish, and the naturally thrifty French turned into a nation of gluttons and gamblers. People threw their money haphazardly at the stock market and in the country at large there grew a dislike of steady labor and contempt for moderate gains and simple living.

Le Comte de Mirabeau's previous claims that patriotism and enlightened self-interest of the people would maintain the value of the paper money could not have been more wrong. A vast debtor class, consisting mainly of those who had purchased the church lands from the government, proved to have a vested interest in the depreciation of the currency. Since only small down payments had been required, with the balance to be paid in deferred installments, land buyers were hoping for a devalued currency to diminish their debt.

"Before long, the debtor class became a powerful body extending through all ranks of society, all pressed vigorously for new issues of paper, apparently able to demonstrate to the people that in new issues of paper lay the only chance for national prosperity. While every issue of paper money made matters worse, a superstition gained ground among the people at large that, if only enough paper money were issued and were more cunningly handled, the poor would be made rich. Henceforth, all opposition was futile."

In December of 1791, a new issue was ordered that diluted the value of the 100 livres note, whose value had already fallen to 80 livres, to 68 livres. As values fell, official rhetoric became even more adamantly optimistic and upbeat. Newspapers, political speeches and

pamphlets proclaimed that: "A depreciated currency is a blessing; that gold and silver form an unsatisfactory standard for measuring values, that commerce with other nations may be a curse, and hindrance thereto may be a blessing, that the laws of political economy, however applicable in other times, are not now so in France; that the ordinary rules of political economy are perhaps suited to the minions of despotism but not to the free and enlightened inhabitants of France at the close of the eighteenth century."

By March of 1792, after the fifth, 300 million-livre issue of paper money, the government decided that payment to all public creditors for any amount over 10,000 francs would be suspended. This was hailed as a boon for the poorer classes, but the result was just the opposite. Capitalists began to quietly withdraw their money from labor and locked it up: "In all the ways financial ingenuity could devise. All that saved thousands of laborers from starvation was that they were drafted off into the army and sent to be killed on foreign battlefields."

Andrew Dickson White in his essay on "Fiat Money Inflation in France describes the price performance of the roughly one-fifth ounce Louis d'Or gold coin weighing 0.1867 net fine ounces:

"The Louis d'Or stood in the market as a monitor, noting each day, with unerring fidelity, the decline in value of the Assignat; a monitor not to be bribed, not to be scared. As well might the National Convention try to bribe or scare away the polarity of the mariner's compass. On August 1, 1795, this gold Louis of 25 francs was worth in paper, 920 francs; on September 1st, 1,200 francs; on November 1st, 2,600 francs; on December 1st, 3,050 francs. In February, 1796, it was worth 7,200 francs or one franc in gold was worth 288 francs in paper. Prices of all commodities went up nearly in proportion.

Examples from other sources are such as the following: a measure of flour advanced from two francs in 1790, to 225 francs in 1795; a pair of shoes, from five francs to 200; a hat, from 14 francs to 500; butter, to, 560 francs a pound; a turkey, to 900 francs. Everything was enormously inflated in price except the wages of labor. As manufacturers had closed, wages had fallen, until all that kept them up seemed to be the fact that so many laborers were drafted off into the army. From this state of things came grievous wrong and gross fraud. Men who had foreseen these results and had gone into debt were of course jubilant. He who in 1790 had borrowed 10,000 francs could pay his debts in 1796 for about 35 francs."

Wages for the laboring classes stagnated. A Paper issue followed another paper issue, until the money in circulation reached 3 billion francs in 1793, and there was still no end in sight. Unrest in the general population grew, and more and more working class people called for capital punishment for price gouging and a 400 million-franc tax on bread for the rich.

On February 28, 1793, a mob of men and women in disguise began looting 200 stores in Paris, seizing everything they could get their hands on. Order could only be restored by buying off the mob with a 7 million francs grant.

The French government implemented new measures to raise money such as the Forced Loan, a tax on anyone with an income over 1,000 francs. For lower-income earners, the tax was fixed at 10 percent, for everyone over 9,000 francs of income at 50 percent.

Another measure was the Law of Maximum, consisting of four rules which supposedly served to help the working class: "First, the price of each article of necessity was to be fixed at

one and one-third its price in 1790. Secondly, all transportation was to be added at a fixed rate per league. Thirdly, five per cent was to be added for the profit of the wholesaler. Fourthly, ten per cent was added for the profit of the retailer.”

The first result of the Maximum law was that sellers did everything to evade the fixed price. Farmers would sell as little as possible, and so supplies became scarce, so urban citizens were put on an allowance and could only buy limited quantities of goods. Foreign goods, whose prices were much higher than the fixed upper limit, could not be legally sold by merchants, many of whom went out of business. Others ended up on the guillotine for violations of the Maximum law.

As reported by Andrew Dickson White: “To detect goods concealed by farmers and shopkeepers, a spy system was established with a reward to the informer of 1/3 of the value of the goods discovered. To spread terror, the Criminal Tribunal at Strassbourg was ordered to destroy the dwelling of anyone found guilty of selling goods above the price set by law. [If a farmer] tried to hold back his crops or cattle, alleging that he could not afford to sell them at the prices fixed by law, they were frequently taken from him by force and he was fortunate if paid even in the depreciated fiat money, fortunate indeed, if he finally escaped with his life.”

Discriminating between paper and specie in any transaction became a felony punishable with death, as did selling gold or silver coins. In 1794, the Convention decreed that: “The death penalty should be inflicted on any person convicted of ‘having asked, before a bargain was concluded, in what money payment was to be made.’” All commerce in the precious metals was suppressed, until the Maximum law was abolished one year later.

The currency inflation ended on February 18, 1796, when under a new government the machinery, plates and paper for printing assignats were ceremonially broken and burned on the Place Vendôme in Paris. Final calculations determined that the overall amount of paper money in existence was 40 billion francs. In comparison, a golden Louis d’or had climbed from a value of 920 paper francs in August 1795 to 15,000 francs less than one year later. One franc in gold was worth 600 francs in paper.

The Assignats hurt the rich and devastated the working class. According to historian Heinrich von Sybel: “Financiers and men of large means were shrewd enough to put as much of their property as possible into objects of permanent value. The working classes had no such foresight or skill or means. After the first collapse, came the cries of the starving. Roads and bridges were neglected; many manufactures were given up in utter helplessness.

Andrew Dickson White concludes: “The men who had charge of French finance during the Reign of Terror and who made these experiments, which seem to us so monstrous, were universally recognized as among the most skillful and honest financiers in Europe, which shows how powerless are the most skillful masters of finance to stem the tide of fiat money calamity when once it is fairly under headway; and how useless are all enactments which they can devise against the underlying laws of nature.”

RAILROADS BUBBLE, 1873

Railroad construction bloomed after the American civil war in the USA. Railroad stocks made up about 40 percent of the whole New York Stock Exchange, NYSE market capitalization.

A financial panic in 1873 led to dozens of railroad lines going bankrupt, only to be acquired by the better capitalized ones.

BICYCLES BUBBLE, 1890s

At some time more than 300 bicycle companies competed with each other in the bicycle market in the 1890s, when bicycles were favored as a cheap transportation means.

By the advent of the automobile, only 12 USA bicycle manufacturers remained in the market.

RADIO BUBBLE, 1920s

The introduction of radio technology as a novelty in the roaring 1920s fostered a competitive boom. Radio Corporation of America, RCA's shares increased from a \$1 price in 1921 to \$573 in 1929, only to collapse later by more than 95 percent.

FIRST USA GOLD RUSH BUBBLE, 1848-1854

After gold was discovered in the streams of northern California around 1848, a national frenzy and a mass migration of gold prospectors and wealth seekers occurred to California. This increased California's population from 15,000 in 1848 to 300,000 by 1854.

JAPANESE ASSET BUBBLE, 1985-1990

Japan suffered a twin bubble in real estate and equities. Between 1985 and 1990, Japanese stocks quadrupled in value. They crashed in 1990 and their price languished at a low level for 20 years until 2010.

SECOND USA GOLD RUSH, 1974-1980

As inflation reached high levels in the 1970s, a rush into gold as an inflation hedge ensued. American households were able to invest in gold for the first time since the Great Depression in the 1930s. The price increased from \$100 / ounce in 1974 to \$850 / ounce in 1980. The price of gold remained low for about 25 years.

INTERNET STOCKS BUBBLE, 1997-2000

The greatest speculative bubble since the Great Depression in the 1930s occurred in theoretically promising, yet worthless and profitless internet-advertised businesses. It is designated as the dotcom bubble for the .com identifier for businesses on the internet's world-wide-web, www. The party crashed in 2000 with those smoke and screen companies becoming worthless.

REAL ESTATE BUBBLE, 2003-2007

What was considered as a conservative investment, the home, became the subject of rampant speculation with the assumption that home prices would continue increasing to unrealistic level. With people trading in homes just to resell, or "flip" them, an oversupply occurred in association with the overpricing.

The collapse of that housing bubble in 2008 crashed the stock market with it in 2007.

THIRD USA GOLD RUSH, 2008-2013

With world-wide depreciation of the currencies and massive money creation by the central banks worldwide, investors sought refuge gold as an alternative to fiat currencies. Gold reached a price of \$1,400 / ounce and continued rising and falling in step with currency debauchment or appreciation.

EURO ZONE BUBBLE COLLAPSE, NEETS, 2012

Greece's Prime Minister, Lucas Papademos in 2012, described what an orderly default on Greece's sovereign debt would mean:

“The savings of the citizens would be at risk. The state would be unable to pay salaries, pensions, and cover basic functions, such as hospitals and schools, and...the country — public and private sector alike — would lose all access to borrowing and liquidity would shrink. The living standards of Greeks would collapse. The country would drift into a long spiral of recession, instability, unemployment and prolonged misery. These developments would lead, sooner or later, to exit from the euro.”

The New York Times reported about the wider situation then in Europe in 2012:

“Perhaps the most debilitating consequence of the euro zone's economic downturn and its debt-driven austerity crusade has been the soaring rate of youth unemployment. Spain's jobless rate for people ages 16 to 24 is approaching 50 percent. Greece's is 48 percent, and Portugal's and Italy's, 30 percent. Here in Britain, the rate is 22.3 percent, the highest since such data began being collected in 1992. (The comparable rate for Americans is 18 percent.). Classified by statisticians as NEETs (Not in Education, Employment or Training), they number about 1.3 million, or one of every five 16-to-24-year-olds in the country.”

As of 2012, only four Western nation-states and Japan had an under-25 years-old unemployment rate of under 10 percent: Germany, the Netherlands, Austria and Norway. More than half the nations of Europe have a rate over 20 percent. Greece is nearly 50 percent, and in Spain the youth unemployment surged to over 50 percent at the end of 2011. While the USA government squanders away its nation's wealth on military adventurism around the globe, Europe has opted instead into building a cradle-to-grave welfare society.

PANICS OF 1807, 1827, 1837, 1857, 1873, 1907, USA

A financial panic started on May 10th, 1837, as the banks in the USA stopped issuing gold and silver against USA currency.

Initially, USA banks were without form or regulation. The lack of regulation begat panics in 1807, then in 1827 when President Andrew Jackson was forced to cancel the charter for the Bank of the USA. Then there were the panics of 1857, 1873 and the panic of 1907. Over time, to avoid the occurrence of any more panics, the Federal Reserve Bank and then the Federal Deposit Insurance Corporation, FDIC were formed.

The government then avoided any interference in the economy, and this started a depression period which lasted for 5 years. Washington Irving who originated the term: "The Almighty Dollar," describes it in his own words:

"“Every now and then the world is visited by one of these delusive seasons when “the credit system”, as it is called, expands to full luxuriance; everybody trusts everybody; a bad debt is a thing unheard of; the broad way to certain and sudden wealth lies plain and open; men are tempted to dash forward boldly from the facility of borrowing.”

“Promissory notes, interchanged between scheming individuals, are liberally discounted at the banks, which become so many mints to coin words into cash; as the supply of words is inexhaustible, it may readily be supposed what a vast amount of promissory capital is soon in circulation. Everyone now talks in thousands; nothing is heard but gigantic operation in trade, great purchases and sales of real property, and immense sums made at every transfer. All, to be sure, as yet exists in promise, but the believer in promises calculates the aggregate as solid capital and falls back in amazement at the amount of public wealth, the ‘unexampled state of public prosperity!’”

“Now is the time for speculative and dreaming or designing men. They relate their dreams and projects to the ignorant and credulous, dazzle them with golden visions, and set them maddening after shadows. The example of one stimulates another; speculation rises on speculation; bubble rises on bubble; everyone helps with his breath to swell the windy superstructure and admires and wonders at the magnitude of the inflation he has contributed to produce.”

“Speculation is the romance of trade and casts contempt upon all its sober realities. It renders the stock jobber a magician and the exchange a region of enchantment. It elevates the merchant into a kind of knight-errant, or rather a commercial Quixote. The slow but sure gains of snug percentage becomes despicable in his eyes: no ‘operation’ is thought worthy of attention that does not double or treble the investment. No business is worth following that does not promise an immediate fortune. As he sits musing over his ledger with pen behind his ear, he is like La Mancha’s hero in his study dreaming over his books of chivalry. His dusty counting-house fades before his eyes, or changes into a Spanish mine: he gropes after diamonds or dives after pearls. The subterranean garden of Aladdin is nothing to the realms of wealth that break upon his imagination.”

“Could this delusion always last, the life of a merchant would indeed be a golden dream; but it is as short as it is brilliant. Let but a doubt enter, and the ‘season of unexampled prosperity’ is at an end. The coinage of words is suddenly curtailed; the promissory capital begins to vanish into smoke; a panic succeeds, and the whole superstructure, built upon credit and reared by speculation, crumbles to the ground, leaving a scarce wreck behind.”

The Panic of 1857 was engineered by the collapse of the grain market and by the sudden collapse of the Ohio Life and Trust, for a loss of 5 million dollars. With this collapse 900 other American companies failed. The Bank of England, in secrecy, lent George Peabody and

Company, the predecessor of J. P. Morgan five million pounds during the panic of 1857, but to nobody else, making it the only banking firm surviving the panic purchasing highly depreciated securities and selling them after sanity prevailed later. For the Bank of England, “secrecy was more profitable than valor.”

Beyond World War II, there were no worries about bank deposits as they were adequately covered by the FDIC. The USA enjoyed an era of stability until 2008-2009. The stable situation did not repeal the business cycle and prevent recessions, but it did stop major bank runs and banking panics. Financial crises could occur, but not at the same level and nature as those that happened during the Great Depression. According to Hyman Minsky, stability eventually breeds instability as a result of an accumulation of carelessness and complacency into the system.

USA PANIC OF 1907

In October 1907, a major brokerage house: Gross & Kleeberg, collapsed after a stock cornering speculation scheme failed. This was similar to September 2008, when a major investment bank: Lehman Brothers, collapsed after a hyper leveraged real estate speculation scheme failed. Both events led to a cascading loss of confidence among investors and bankers. The bankers became too frightened to lend, resulting in credit becoming scarce. Then selling begot more selling, mushrooming the panics, until everyone remotely interested in selling had sold.

In the 19th century, Yale professor William Graham Sumner defined a panic as: “A wave of emotion, apprehension, alarm. It is more or less irrational. It is super induced upon a crisis, which is real and inevitable, but it exaggerates, conjures up possibilities, takes away courage and energy. A panic can be partly overcome by judicious reflection, by realization of the truth, and by measurement of facts.”

The Panic of 1907 shook the USA economy to its core. Wall Street brokerages failed, depositors ran on banks, well-known companies went under, and the market's liquidity was in question.

The financier J.P. Morgan and friends famously put together \$25 million to keep the market afloat; a role now occupied by the Federal Reserve.

By 1909, the Dow Jones index had more than recovered from pre panic highs.

GREAT WAR 1914 USA PANIC

In 1914, the year the Great War began in Europe, the USA stock markets actually closed for nearly four months after foreign investors began pulling their money out of USA equities *en masse*.

When it reopened, the market was devalued about 30 percent, but sustained rallies doubled that opening by the end of 1916.

WEIMAR REPUBLIC GREAT GERMAN INFLATION, 1914-1923

In 1913 Germany had a prosperous, advanced culture and population. It was a monarchy under its Kaiser. Following the assassination of the Archduke Franz Ferdinand in Sarajevo in 1914, the world moved toward war starting with the Austro-Hungarian Empire, with the encouragement of the Kaiser Wilhelm II from Prussia against Serbia. Kaiser Wilhelm II was

blamed for playing a key role in starting World War I by granting the Austro-Hungarian Empire his support for the invasion of Serbia. The German General Staff thought the war would be short and that they could finance the costs with the post war reparations that they, as victors, would exact. Instead, Germany lost and had to pay reparations rather than receive them. The USA in the spring of 1918, sent some 1.3 million men to Europe and turned the tide of the War.

On November 10, 1918, the House of the Hohenzollern had been overthrown, the Weimar Republic was established in Berlin, and Germany had to accept the Armistice and cease-fire at the Treaty of Versailles while trusting the magnanimity of its opponents. France got back the Alsace-Lorraine territory, which it had lost to Germany in the Franco-Prussian War of 1870-71.

Financial compensation was imposed on Germany by French Prime Minister Georges Clemenceau. Under Article 231 of the Versailles Treaty, Germany was forced to concede that it was solely responsible for the war, as Georges Clemenceau was interested in weakening Germany.

In 1922, the German Central Bank and the German Treasury took a step in the process of jump-starting a stagnant economy using easier money. Economic stagnation continued at the same time as the money growth. They decided to devalue the mark currency. The new value would be 2 billion marks to a dollar. At the start of World War I the exchange rate had been a mere 4.2 marks to the dollar.

In the German Weimar Republic, which later evolved into Nazi Germany, Art Cashin describes the situation using a loaf of bread and USA dollars as an illustration:

“In 1920, a loaf of bread soared to \$1.20, and then in 1921 it hit \$1.35. By the middle of 1922 it was \$3.50. At the start of 1923 it rocketed to \$700 a loaf. Five months later a loaf went for \$1,200. By September it was \$2 million. A month later it was \$670 million (wide spread rioting broke out). The next month it hit \$3 billion. By mid-month it was \$100 billion. Then it all collapsed.

In 1913, the total currency of Germany was a grand total of 6 billion marks. In November of 1923 that loaf of bread we just talked about cost 428 billion marks. A kilo of fresh butter cost 6,000 billion marks (as you will note, that kilo of butter cost 1,000 times more than the entire money supply of the nation just 10 years earlier).”

In Weimar Republic Germany, high inflation lasted two years followed by hyperinflation for another two years. According to Stefan Zweig in “The World of Yesterday, 1944”:

“Unemployed men took one or two rucksacks and went from peasant to peasant. They even took the train to favorable locations to get foodstuffs illegally which they sold afterwards in the town at three or fourfold the prices they had paid themselves. First the peasants were happy about the great amount of paper money which rained into their houses for their eggs and butter. However, when they came to town with their full briefcases to buy goods, they discovered to their chagrin that, whereas they had only asked for a fivefold price for their produce, the prices for scythe, hammer and cauldron, which they wanted to buy, had risen by a factor of 50.”

After World War I, Germany was forced to sign the Treaty of Versailles, which required it to pay punishing war reparations. Up until 1919, the German mark fell rapidly and remained stable till the second half of 1921. In 1923 Germany could no longer pay its war reparations. In retaliation, the French and Belgian armies moved in and occupied the Ruhr Valley; Germany's main industrial area.

Besides losing 13 percent of its territory and 10 percent of its population according to the Treaty of Versailles, Germany had exorbitant reparations imposed on it by the Allied victors worth almost 37,000 metric tonnes of gold which was about 1/3 of the world's above ground supplies at the time.

The Germans hoarded capital equipment in an attempt to preserve the purchasing power of their rapidly depreciating currency. The initial effects of inflation in seemed to be prosperity. The engineering industries were stimulated during the fall of the mark. Demands for the capital goods converged on the market for iron and coal, which became a great boon for these industries. There was a continuous reallocation of resources from the consumer goods industries to the capital goods industries. The expansion resulted in Germany reconstructing its industrial capacity after the war. However, rather than produce consumer goods such as food, housing and clothing for its population, Germany exhausted its energy in the manufacture of machines and the building of factories, setting the stage for building a war machine later used in territorial expansionism and eventually World War II which resulted from a ten year effort by the Nazis to come to power by exploiting the ensuing chaos and street rioting.

Expected to settle the final payment seven decades later, the German government opted to pay it early by printing worthless money. The volume of Reichsnote in issue rose from 35 billion times over the period 1918 – 1924.

The monthly rate of inflation reached 3.25 billion percent, equivalent to prices doubling every 49 hours. The USA dollar to mark conversion rate peaked at 80 billion. Equity prices in Berlin rose some 2,772,164 percent by the time a loaf of bread cost a wheel barrow full of banknotes. The value of the printed Reichsnote sunk from 8.0 per USA dollar to 4.2 billion per dollar.

In 1914, holding 4.2 billion marks, the equivalent of \$1 billion in safe government bonds, would be worthless 9 years later, payable by a 50 billion-mark banknote signed by Reichsbank President Rudolf Havenstein. One would also need 45.8 billion marks in change.

Rudolf Havenstein justified the runaway purchasing of government debt on the grounds that there was little choice given the national emergency and he thought that the real sources of inflation were the legislature's inability to balance its budget and the burden of reparations placed on Germany by the Allies at the end of World War I.

With millions of people starving, demobilized millions of soldiers, and a civil war in the Ruhr Valley, inflation crept up from 1919 to 1922 when it into hyperinflation as Germany refused to continue payments on the 132 billion gold marks levied on it at the London Ultimatum of May 1921. Germany halted reparation payments, and France used it as a pretext to confiscate goods in kind and occupied the Ruhr Valley, the center of German coal and steel wealth, in January 1923. Germany responded with a campaign of passive resistance that eventually destroyed its mark currency.

Under hyperinflation, people on fixed incomes such as pensions suffered the most. An elderly lady, had her life savings in Deutsche Bank wiped out, but the bank did not inform her because the stamp would cost too much. The propertied middle class lost their savings after suffering deprivation throughout the war. Many sold possessions to raise cash for increasingly

expensive real goods such as bread or meat. Housewives stood outside factories to collect their husband's pay and spend it as quickly as possible. Businesses needed sacks of cash to pay workers. Money was carted in wheelbarrows. A story has a robber stealing the wheelbarrow rather than the money.

The German currency hyperinflationary events with a doubling time of 4 years following World War I and ending in 1932 are related to the current state of affairs by Alexander Jung [36]:

"The current debt crisis in Europe evokes painful memories of the German hyperinflation. Price increases began with the start of World War I in 1914 and ended in disaster in 1923. The event still influences sentiment about monetary policy in the country today.

There is a number that illustrates the brutal dynamics of the hyperinflation of 1923 better than anything else. It's the number four. In the fall of 1923, prices were doubling in Germany approximately every four days.

Grotesque price increases have occurred in other countries and at other times, such as in Greece in 1944, China in 1949 and Zimbabwe in 2008. But hyperinflation has left behind deeper scars in Germany than anywhere else. Three generations after the collapse of the German mark, the fear of hyperinflation is more alive today than ever before.

The global glut of money as a result of the financial crisis has evoked painful memories of the great inflation that began with the beginning of World War I in 1914 and ended in chaos in 1923. Each new report on the need for billions in Europe's crisis-ridden countries reignites concerns over the stability of money. According to a poll by the Allensbach opinion research firm, Germans fear inflation even more than life-threatening diseases like cancer.

Worried citizens are fleeing into tangible assets, buying gold and silver bars, houses and apartments -- or at least books with grim titles like "National Bankruptcy is Coming!" The paradoxical aspect of the inflation debate is that so far only the warnings have been inflationary. The euro has proven to be more stable than the deutsche mark ever was. Economists are more concerned that prices will decline on a broad scale, crippling the economy. It makes no sense to invoke terrible visions of 1923 today, says economic historian Hans-Joachim Voth. "A repeat is unthinkable," he notes. The Germans suffer from a sort of "collective psychosis," concludes Voth, who teaches in Barcelona.

Jens Weidmann, president of the German central bank, the Bundesbank, also views the inflation of the 1920, along with the 1948 currency reform, in which Reichsmark savings were converted to deutsche mark at a ratio of 100 to 6.50, as "historically unique events." Both, says Weidmann, were primarily a consequence of paying for the war by printing money. And, according to Weidmann, they also highlight the risks that occur "when a bank subordinates the goal of securing monetary value to securing the solvency of the state."

A later phase in economic history is of greater importance to the president of the Bundesbank. "For us today, the lessons of the 1970s and early 1980s are far more important, because the independent Bundesbank was more effective than other central banks in controlling the inflation triggered by the oil price shocks." So why do citizens still react so sensitively, if not hysterically, when it comes to 1923?

Perhaps the most important reason is that the middle class suffered the most from the hyperinflation of 1923: white-collar workers, government employees and the self-employed, all diligent savers, who became completely impoverished and drifted into the "delirium of billions," as the later Foreign Minister Walter Rathenau described the state of emergency.

Families today still remember the horrifying reports of what once happened to grandparents and great-grandparents. The fate of someone like Berlin author Maximilian Bern illustrates the extent of despair.

In 1923, Bern withdrew his savings, more than 100,000 marks, from the bank. But 100,000 wasn't much compared with the 2.5 quintillion marks in circulation at the end of October. Years earlier, the money would have been enough to pay for Bern's retirement, but now it was worth no more than the price of his last subway ticket. Bern went home, locked his door and died of hunger.

Doctors, teachers and professors had not only lost everything they owned, but also their confidence in the state. In 1914, many had gone to war with enthusiasm, and they had bought bonds, which generally yielded a five-percent return. The government collected 98 billion marks, but not a pfennig of the money was repaid.

People felt cheated, both of victory in the war and their money in the bank. The same bitter experience was repeated a generation later, when the Third Reich came to an end.

This double loss of confidence shaped the civil society of the postwar period. Its members yearned for stability and order and were sharply opposed to experiments, especially with their money. This need for security -- in other words, their aversion to risk -- is practically proverbial to this day in Germany.

A pronounced emphasis on security in monetary matters also shapes behavior in the business community. Particularly companies in key industries, such as machine building and plant manufacturing, have a very strong interest in a stable currency, because of their need to estimate long-term costs. Years often pass between the receipt of an order and the delivery of products.

"We need patient capital for our type of production," says Werner Abelshauser, an economic historian from the western city of Bielefeld. For this reason, he explains, German business owners still harbor a deep fear of inflation. Southern European economies are more trade-oriented, says Abelshauser, and they have shorter turnaround times and are therefore less sensitive to inflation.

But probably the greatest impact of the experiences of 1923 is on German monetary policy, even if Bundesbank President Weidmann tends to downplay this today. The Bank of the German States, the precursor to the Bundesbank, also set clear priorities. The stability of the currency was paramount, while stimulating the economy and fighting unemployment were secondary. The first Bundesbank president, Wilhelm Vocke, was all but obsessive in pursuing this course.

Vocke became the director of the Reichsbank, Germany's central bank, in 1919 at the age of only 33 and would stay until 1945. He was appalled at how, in 1923, the central bank leadership focused its energy on the smooth operation of the printing presses, and at how spending policy in the Third Reich led "straight to

inflation." Vocke was subsequently forced to leave the Reichsbank. After the war, he was in a perfect position to help launch the new currency.

In 1948, the Allies had decreed that the Bank of the German States was not to be "subject to the directives of any political entities or public agencies, with the exception of the courts." It was something then Chancellor Konrad Adenauer could never accept. He persistently tried to exert pressure on Vocke, such as in May 1956, when the Bundesbank tightened the reins as the economy threatened to become overheated. Vocke, as self-confident as the chancellor, remained unimpressed. The chancellor, he later joked, was "a complete novice in this difficult field. I let him talk." The Bundesbank's independence promoted so much confidence in the currency that the Germans, despite their fears of inflation, became a nation of savers.

"Independence and the clear mandate to ensure price stability remain the conditions of success for a central bank," says Weidmann. "This also, and particularly, applies to the euro system." Of course, this makes him part of a minority on the executive board of the European Central Bank (ECB), because the ECB is literally flooding markets with cheap money, even to an "unlimited" extent if necessary, as ECB President Mario Draghi has stated.

This is the irony of history: Washington and Paris, the Western wartime allies, once decreed complete independence and strict budgetary discipline for the Bundesbank, but now the mentors are violating their own principles."

Industrialists gave up paying in marks, creating their own substitute or paying workers in "three breads." Cities and organizations also created their own currencies. Retailers continually adjusted prices. In November 1923, mobs attacked Jewish shops around Alexander Platz in Berlin. Speculators, bankers, and black-market dealers came in for particular hatred. The hyperinflation fomented activism in German politics. The prime minister of Bavaria declared martial law. In October 1923, federal troops marched into Saxony and Thuringen to depose radical communists from government. In November 1923, Adolf Hitler and General Erich Ludendorff attempted a march on Berlin, known as the Beer Hall Putsch. It failed and Adolf Hitler was sent to prison where he wrote his "Mein Kampf." He gained power in January 1933, using reparations, the financial crisis and the destruction of the mark as rhetoric to slowly gather his followers.

Hyperinflation undermined the legitimacy of the democratic Weimar Republic. Millions of disaffected middle-class voters drifted parties on the right. The center hollowed out, and subsequent coalition governments ruled on a tolerated-minority basis. German politics never really regained its balance in the mid-1920s, until the Great Depression, government austerity packages and, ultimately, the rise of the Nazi Party.





Figure 77. Weimar Republic one (eine) trillion (1,000 milliarden (European) = 1,000 billion (American) = 1 trillion) mark note and five (funf) rentenmarks bills. The 1923 twenty (zwanzig) million mark is stamped into a higher value of two (zwei) billion (milliarden) marks.





Figure 78. Stacks of German Weimar Republic marks, 1923-1924, were replaced by Reich marks.

The chaos that ensued is blamed for the rise of the Nazi regime during the Great Depression of the early 1930s. Large sections of society became impoverished; food riots became common and money became worthless. It was not a vanishing of demand that caused the Great Depression, but a destruction of capital.

During World War II, Germany had to learn its lesson a second time when it issued worthless coupons to its citizens. Its government converted its debts into bank notes, inflating the volume of currency in circulation up from 11 billion Reich marks in 1939 to more than 70 billion by the end of the war. People were forced to use cigarettes, chocolate, canned meat and soap for bartering instead of money.

As the lessons were learned, the inflation fighting Bundesbank of the 1970s and 1980s, staffed by bankers and academics who had lived through both the Weimar Republic inflation and its World War II sequel, the West German central bank refused to devalue the German mark alongside the USA dollar, British pound and French franc by setting interest rates at a low level. The Bundesbank kept inflation far below the double digit rates suffered by the UK and USA economies.

With the birth of the Euro currency in 1999, the new European Central Bank took charge and its money supply growth target of 4.5 percent per year slipped to 10.3 percent per year by 2007.

INFLATION STABILIZATION, THE RENTENMARK INDEX CURRENCY, 1924

After the peak of hyperinflation in 1922, the Weimar Republic of Germany established a new currency, the Rentenmark, backed by the country's major agrarian and industrial assets and issued by a new bank, the Rentenbank. The new currency with a fixed parity to the dollar, immediately halted hyperinflation and placed Germany on a stable financial footing.

In the words of the economist, Robert Rene Kuczynski, "the most important and the most characteristic element to German stabilization was the Rentenmark miracle, a monetary innovation without parallel in monetary history."

In 1922 a private rye "rentes" bank or "Roggenrentebank" was founded. It issued its first bill of exchange denominated in pounds of rye in December of 1922. In the beginning of 1923 several public bodies including cities, states and public utilities companies, started to issue loans denominated in commodities such as rye, wheat, coal, lignite, coke, gold, sterling pound, Swedish Crown, and others but priced and serviced in marks according to the current commodities prices.

In 1924, representatives of Germany's major agriculture, commercial and industrial interests became subscribers to the new bank of issue, the Rentenbank. The subscription was

made in paper marks or papier marks. The participation of each group of subscribers in the new bank was proportional to their respective wealth or property and a mortgage on this wealth served as a guaranty against the failure of the new institution. The Rentenmark was originally to be indexed to the commodity of rye like several previous types of private and semi-official, commodity backed currencies utilized successfully during the period of hyperinflation.

After a Cabinet change the Rentenmark was indexed to gold, which was adjudged to be a superior price index. The Rentenmark also had a fixed parity with the dollar. The advance of dollarization was significant because it meant that the fix of the exchange rate ceased hyperinflation instantaneously.

The Rentenmarks "real" backing was the mortgaged property of Rentenbank subscribers. With a fractional reserve the Rentenmark was not convertible or redeemable for mortgaged property.

The value of these bonds remained stable for no other reason than the fact that holding these notes was equivalent to holding commodities with stable dollar prices often quoted in international markets. The important fact was that these notes were not really convertible in the commodities of reference. The commodities served only to provide a price index to which the notes were pegged, the payments were actually made in depreciated marks at the current quotation of the commodity. These loans represented a very interesting class of indexed bond, not only in view of the type of price index used but mainly because their small denominations gave them functions of a means of payment.

Being reserves of value and means of payments, these loans circulated as unrestrictedly as money but with the important feature of being "stable-valued." These loans enjoyed great popularity, unaffected by the fluctuations in the prices of commodities concerned, and the practice of expressing the values in terms of commodities had a long vogue. These notes appeared to have all characteristics of money in addition to being "stable valued" or "wertbeständiges."

The introduction of the rentenmark or the fact that the public saw it as a "stable valued" currency, allowed the authorities an opportunity for the fixing of the exchange rate. The second fundamental feature of the rentenmark experiment was that the exchange rate between the old paper mark and the rentenmark was fixed at the convenient rate of a trillion to one. The German government simultaneously employed its international reserves to intervene in the foreign exchange market and sustain the rate of 4.2 trillion paper marks to the dollar.

Germany's total war reparations reached the sum of 132 billion gold marks paid in 66 annual installments, in addition to 26 percent of the value of its exports. Germany suffered the consequences until 2010, when it made its last interest payment on foreign bonds it had issued after its defeat in World War I to satisfy the Allies' demands for war reparations. Germany paid more than 163 billion deutsche marks to the rest of Europe between 1958 and 1992. British economic historian Niall Ferguson estimated another 379.8 billion in "transfer payments without counter-performance."

CRASH OF 1929, GREAT DEPRESSION 1929-1941

The Great Depression is considered the single most important economic event in the USA's history. It started with the stock market crash of 1929 and ended as the USA joined the European powers in World War II in 1941.

Before the onset of the Great Depression, President Calvin Coolidge was telling the USA citizens at the end of his presidency in 1929 that everything was just fine: "In the domestic field,

there is tranquility and contentment and the highest record of prosperity in years,” and no decisive action was taken. He was followed by President Hoover who tried to balance the budget instead of stimulating the economy, making matters get worse. The Smoot-Hawley protectionism act was passed into law, resulting into a global massive implosion of capital. Without growth in the money supply, the banks runs and closures became frequent.

In 1932, the total unemployment had reached 24.9 percent. More than 9,000 banks failed during the 1930s. There were no federally insured deposits until the Banking Act of 1933 created the Federal Deposit Insurance Corporation, FDIC. When a bank failed, the depositors’ savings and money evaporated with it.

At the height of the Great Depression, in 1933, President Roosevelt was coming into his first term, fully 37 percent of non-farm workers became unemployed. A total of 4004 banks failed and \$3.6 billion of depositors’ funds were lost. Bread and soup lines helping the unemployed prevailed, and the stock market kept falling down.

President Roosevelt responded with a massive job creation program designated as The New Deal. People seeking jobs were put to work on infrastructure building such as roads, drainage ditches, canals, bridges and, parks. A government owned electric production utility using hydroelectric power and coal plants was initiated as The Tennessee Valley Authority.

In 1937, with the economy somewhat on the mend, President Roosevelt acted too early and tried to balance the budget, raised taxes in a weak economy, and reduce deficit spending. Another deep recession resulted and unemployment jumped back up to 20 percent. It was hard to pull the economy from this second deep hole back out.

Wall Street's future and the economic model of capitalism came into question.



Figure 79. Friday, October 25, 1929, stock market crash was the ringing bell to the Great Depression.

JAPAN ECONOMY SLUMP, 1990-2008

In January 1990 Japan's miracle economy reached its peak and started teetering down. Bankruptcies rose and profits fell. The Bank of Japan responded by cutting its key lending rate from 5 percent down to effectively zero. Fiscal stimuli were implemented by Japan's government. It went on a spending spree in the 1990s, taking its budget deficit to a 5 percent of Gross Domestic Product (GDP) in 2002. Roads were built to nowhere, shorelines were lined with concrete, and numerous bridges and dams were built, supposedly as rebuilding its infrastructure. Japan covered 30 times as much surface per square mile in concrete as in the USA. The Shimizu Corporation in 1996 was inspired to develop plans to build a hotel on the moon using specially developed techniques for

making cement on the lunar surface. Only meaningless consequences resulted, and Japan's economy remains in a slump without significant growth as of 2008.

LONG TERM CAPITAL MANAGEMENT LTCM COLLAPSE, 1998

Long Term Capital Management, LTCM was run by two of Nobel Prize winning economists, Black and Scholes, who believed they could use past financial patterns to model the future and eliminate risk by modeling historic price movements and holding stocks for the long term. They traded futures options on securities using a model based on just 5 years of prior data.

Their infamous Black-Scholes option pricing modeling methodology attempted at deriving the value of an option price from the known price behavior of a share and a bond. In a way, they thought that they deduced a formula for working out the price of a fruit salad from the prices of its apples and oranges ingredients, while assuming that the fluctuations in the option prices followed the physics equations that describe the process of heat diffusion.

They considered that the idea behind quantitative finance is to manage risk. They thought that they would make money by assuming known risks and hedging the rest to others. What they may have missed is that if the risks were known to everybody, then an option becomes a 50/50 probability proposition; which is not a sure formula for winning any bet.

The hedge fund LTCM went bankrupt when the future turned out to be different from the past in the summer of 1998 when the USSR defaulted on its foreign debt and sent the financial markets into turmoil. It had bought ruble denominated assets on a 30 to one leverage basis. When the Russian central bank failed to defend the ruble, LTCM went bust within a few days and had to be bailed out with \$3.6 billion in loans from the New York banks.

If weather patterns were independent of human decisions; market patterns are not. The financier George Soros was sought as a white knight to LTCM, but he declined. Instead, 14 Wall Street banks were induced by the Federal Reserve central bank to buy its remaining assets to avoid a financial meltdown of the rest of the financial system.

CREDIT AND ASSETS BUBBLE, GREAT DELEVERAGE, PANIC OF 2007-2009

During the subprime housing mortgages bubble starting in 2007 that spread from the USA to the rest of the world, the USA Federal Reserve was not concerned about the economy and inflation, but its primary concern was to carry out its primary function of keeping the banking system that it represents solvent and afloat. It not only bailed out, at the expense of the American tax payers, the large commercial banks, but also the investment bankers such as Bear Stearns (BS), and mortgage funding companies Fannie Mae (Federal National Mortgage Association, FNMA) and its brother Freddie Mac (Federal Home Mortgage Association, FHMA) as privately held Government Sponsored Enterprises (GSEs) that were effectively socialized with profits going to their shareholders, and nationalized with their losses covered by the USA taxpayers. The premise was that if the banking and investment system would collapse, everything else will follow.

Funding facilities were set up such as the Term Auction Facility (TAF) to lend good liquidity as treasury bills to the banks, and taking in return as collateral mortgage backed securities regardless of their rating or marketability, to the point where they were designated by some as "toxic waste."

If this were not done, the banking system would have probably collapsed as happened in the 1930s with the broad collapse of the money supply and the deflationary Great Depression.

The Federal Reserve had a balance sheet holding about \$800 billion in assets as the collateral for the currency in circulation. These assets were primarily Treasury securities. They have been mostly been exchanged for illiquid mortgage backed securities.



Figure 80. Bank run lines forming hoping to withdraw funds from the failed Indymac bank in Pasadena, California, July 2008.



Figure 81. Orderly free-soup lines during the Great Depression.



Figure 82. Street riots and social collapse, Greece 2012.

The New York Federal Reserve Bank called upon Lehman Brothers and a handful of other major players on Wall Street to rescue the high flying hedge fund. The firms initially balked, but they came up with \$3.7 billion to rescue it. Its positions were unwound slowly and there was no panic, and the financial engineering geniuses on Wall Street went back to their standard business of separating naïve investors from their hard earned savings and turning them into bonuses, high end salaries, and when everything else fails; into severance payments to enrich its executives for being the smartest people on the planet.

All good things come to an end, especially if they were too good to be true. In September 2008 the great credit bubble popped out, and the Lehman Brothers investment bank that survived the Civil war, the bankruptcies of the railroads, the Panics, World War I, the Great Depression, World War II, and the Cold War; filed for Chapter 11 bankruptcy protection with \$613 billion in debt. After being worth \$45 billion in February 2007, its shares traded at 29 cents. The Merrill Lynch brokerage, in a shotgun marriage deal, sold itself to Bank of America for \$50 billion to avoid the same fate after it was worth \$86 billion in 2007.

During the two terms of President George W. Bush, as he wished to be remembered as “a war president,” the USA government has borrowed more money from foreign governments and banks than all other American administrations put together, from 1776 to 2000. More debt was added in the eight George W. Bush administration years than in the previous two hundred years of the USA Republic. Over his tenure, the trade deficit tripled from 150.7 to 756.8 billion, and reached \$830 billion in 2006. As he came to power, the USA was a creditor. At the end of his tenure, it is a debtor, with more than \$11 trillion worth of USA assets in foreign hands, a more than 500 increase from 1987 to 2008. He has outdone the Roman emperor Nero in debasing the USA currency and squandering its people’s wealth in financing foreign adventures.

BANK REFORM, 2015-2018

The Basel Committee on Banking Supervision (BCBS) comprises high-level operatives from 27 countries. They met in seclusion on September 12, 2010 in the mountain town of Basel in Switzerland. Those in attendance were USA Federal Reserve Chairman Ben Bernanke, New York Fed chief William Dudley, FDIC head Sheila Bair. European, British, and German central bank luminaries represented their countries' wealthy interests, as well.

What they decided will reverberate through credit markets for years to come: Banks will be required to double their capital reserves.

In practical terms, that means they cannot leverage higher than 22-to-1... and if they want to pay out dividends, they cannot leverage higher than about 14-to-1. This requirement will take effect in 2015. Any sooner and “the measures would make short-term borrowing prohibitively expensive,” as explained by the UK’s Financial Times.

In the same spirit, further measures aimed at reducing banks’ dependence on short-term funding would not come into effect until 2018. The rules do not address the items left off the banks’ balance sheets.

UNFUNDED GOVERNMENT LIABILITIES UNSUSTAINABILITY. DEFAULT OR HYPERINFLATION?

In August, 2012, Prof. Lawrence Kotlikoff of Boston University and financial writer Scott Burns published an article on the increase of the unfunded liabilities of the USA government. The

general public is generally unaware of this off-budget debt. It comprises mainly the obligations of the government for Medicare, Social Security, and the federal pensions. These debts extend out for 75 years.

The present value of the total obligation of the federal government to voters that is not funded at the present time as of 2012 is \$222 trillion. This means that the government is supposed to set aside \$222 trillion immediately, invest this money in non-government projects that will pay a positive rate of return, and will therefore fund the amortization of this debt.

Concurrently, the USA government is running annual on-budget deficits of about \$1.2 trillion. It spends about \$3.7 trillion. Yet it needs to have \$222 trillion to invest in private markets. These markets could not absorb \$222 trillion and be able to gain a constant rate of return of 5 percent per year. Lawrence Kotlikoff suggests that the federal government at some point will have to default on large portions of the long-term debt.

The Congress of the United States could not come to an agreement in 2011 on how to solve an official deficit of \$1.2 trillion per year. It kicked the can down the road until January 1, 2013. At that point, the government will have to slash spending, according to the agreement made in 2011. The Bush tax cuts of 2002 will expire unless Congress extends them.

Lawrence Kotlikoff and Scott Burns reveal indicate that the actual increase of the federal deficit is in the range of 10 times greater than the increase in the official government deficit. This means that the compounding process that is taking place in the area of unfunded liabilities dwarfs the compounding process that exists in the on-budget statistics.

This is not just an American problem, it is a problem of the whole western world economic system which has overpromised what each national government is going to be able to deliver in the future.

The Federal Reserve central bank is incapable of solving the problem of the 75-year debt which has unfunded liabilities in the present of \$222 trillion. It does not pay for the Federal Reserve to adopt a policy of hyperinflation, which is necessary to destroy the debts of the various levels of civil government in the USA. It may adopt a policy of mass inflation in which rates of consumer price increases of about 25 percent. This would enable Congress to sell some of its rollover debt as this debt matures. The average maturity of the federal debt now is about eight years.

This would not solve the major problem, which is the unfunded liability of the federal government for long-term old-age retirement programs. The central bank could hyperinflate for a few years, and enable Congress to kick the can down the road for another three or four years. But this does not solve the fundamental problem facing the federal government, namely, that it has overextended its promises vastly beyond its ability to deliver on these promises. In addition, the privately-owned Federal Reserve, unless nationalized, will not adopt a policy of hyperinflation that would be to the detriment of the banking system that owns it in the first place.

The USA government cannot get out of its obligations issuing fiat money and hyperinflation, because hyperinflation will only last a few years, but the obligations last for the next 75 years. The USA government, like the Greek government will have to renege on promises made to the vast majority of people who are now dependent on the federal government for their retirement income, and it will also default on the workers who are still in the workforce, who are paying each payday into Social Security and Medicare.

If Congress nationalizes the Federal Reserve Bank, then hyperinflation, could just meet its current present bills. This will not solve the long-term problem of government unfunded liabilities. Even after the currency is debauched, the debt will still exist.

The most probable recourse to respond to the created unsustainable situation will follow the following directions:

1. In the short term, depreciating the value of the currency to decrease the value of the wages received by American workers and the costs of the products they produce competitive on the world stage and hence increase exports.
2. In the intermediate term, this would return the lost manufacturing capability and full employment that was exported to other lower wage nations.
3. In the long term that would make it possible for the impossible promises to be repaid in form but not in substance to both American and foreign savers in USA issued debt and bonds. This would result in a massive redistribution of wealth and decrease the value of the savings of American households and retirees; the analog of a “reset” button on the whole society in a deeply unfair world.

SAVINGS VERSUS SPENDING

Economic historians and mainstream data sources, for both the Great Depression and the Great Recession support savings and investment as the key drivers of economic growth and the business cycle. Progressive economist Jeffery Sachs writes: “Crude Keynesians believe that for all intents and purposes, 'spending is spending.' ... Spending is not spending. The USA needs productive public investments, not wasteful spending.” This is consistent with the Law of Markets: real growth comes from value-adding investment and production.

Economists adopted sophisticated mathematical modeling in their efforts to be more scientific. Economist Ed Leamer noted that there is a lot of “con” going on in “econometrics.” The process of building the models is rife with biasing judgment calls about how to input and manipulate the “data.” When studying a complex system, especially an entire economy, there is essentially an infinite amount of “data” from which to choose. Attempts to infer correlations often fall victim to confirmation bias. What is often talked about as “data” is not real data, but just computer simulations. When the Congressional Budget Office attempted to determine the impact of the 2009 American Reinvestment and Recovery Act “stimulus” legislation, which was dominated by temporary transfer payments aimed at encouraging consumption spending, they concluded that the program “increased the number of people employed by between 0.4 million and 2.4 million,” a factor of $2.4 / 0.4 = 6$ in the spread of the results.

Consumption, not savings, is claimed to be the engine of growth. Economies did grow rapidly and recover from recession without a central bank or active government intervention on behalf of stimulating recovery. Classical economic theory asserts that: “The production of goods always generated enough income in the form of profits and wages to pay for all the goods produced, to clear the market at remunerative prices.” The law of markets is not that “supply creates its own demand.” Economist David Ricardo noted that: “Men err in their productions. There is no deficiency of demand.” His point is that if goods are collecting on the shelves it is not because of “overproduction,” but because the wrong goods were produced and thus could not be sold at remunerative prices. His solution was to restructure production.

Many modern students of the Great Depression suggest that the devaluation of the dollar was the main action, which finally ended the Federal Reserve's deflationary spiral, caused the end of the Great Depression in 1933, not some sudden increase in consumption. Consumers have to earn an income before we can have an income to spend. Real incomes are best understood as the

actual goods and services people ultimately consume, not the pieces of currency that help us do it. Nations as well as individuals cannot consume their ways to prosperity.

VON MISES (1881- 1973) CRACK-UP BOOM, INFLATIONARY CYCLE

Inflationary monetary and credit expansions grow exponentially and lead to unsustainable economic booms, which inevitably turn into manias and bubbles that eventually collapse. Austrian economist Ludwig von Mises comments on such monetary unsustainability:

“The boom can last only as long as the credit expansion progresses at an ever accelerated pace. The credit expansion boom is built on the sands of banknotes and deposits. It must collapse. There is no means of avoiding the final collapse of a boom brought about by credit expansion.”

He describes the stages of a typical inflationary cycle:

“This first stage of the inflationary process may last for many years. While it lasts, the prices of many goods and services are not yet adjusted to the altered money relation. There are still people in the country who have not yet become aware of the fact that they are confronted with a price revolution which will finally result in a considerable rise of all prices, although the extent of this rise will not be the same in the various commodities and services. These people still believe that prices one day will drop. Waiting for this day, they restrict their purchases and concomitantly increase their cash holdings. As long as such ideas are still held by public opinion, it is not yet too late for the government to abandon its inflationary policy.”

“But then, finally, the masses wake up. They become suddenly aware of the fact that inflation is a deliberate policy and will go on endlessly. A breakdown occurs. The crack-up boom appears. Everybody is anxious to swap his money against ‘real’ goods, no matter whether he needs them or not, no matter how much money he has to pay for them. Within a very short time, within a few weeks or even days, the things which were used as money are no longer used as media of exchange. They become scrap paper. Nobody wants to give away anything against them.

“It was this that happened with the Continental currency in America in 1781, with the French Mandats Territoriaux in 1796, and with the German mark in 1923. It will happen again whenever the same conditions appear. If a thing has to be used as a medium of exchange, public opinion must not believe that the quantity of this thing will increase beyond all bounds. Inflation is a policy that cannot last.”

Describing how bubbles and booms eventually collapse:

“There is no means of avoiding the final collapse of a boom brought about by credit expansion. The alternative is only whether the crisis should come sooner

as a result of a voluntary abandonment of further credit expansion, or later as a final and total catastrophe of the currency system involved.”

DISCUSSION

The growing and existing debt in the world today is unsustainable and will never be liquidated through the normal processes of debt retirement. It will have to be liquidated through the painful abnormal processes of either:

1. Deflation corresponding to default,
2. Inflation corresponding to depreciation.

The exponentially growing debt pyramid cannot continue to grow indefinitely. All debt will be eventually liquidated through default dilution by being inflated away.

Seventy years before the French Revolution, France experimented with an exponentially growing fiat currency under the management of the Scottish adventurer, John Law of Lariston and his Banque Royale notes. When the unsustainable system unraveled people wanted to guillotine him. He had to escape Paris under the cover of night disguised as a woman.

Syndicated columnist Alan Guébert best describes how it can be done: “Easy, you travel the country (on the taxpayer tab) to speechify from flag-draped stages (where you begin and end by invoking God’s blessing on the nation) and then you lie.” “That’s how you do it: You artfully deceive a blissfully misinformed nation that the medicine now needed is a large dose of spending cuts while you quietly slip the country’s best-off two more spoonfuls of sugar.” “The scam will only work up until the moment that it doesn’t.”

An insight from philosopher John Stuart Mill is: “Panics do not destroy capital; they merely reveal the extent to which it has been previously destroyed by its betrayal into hopelessly unproductive works.”

John Maynard Keynes, in 1919 in his book: “The Economic Consequences of the Peace,” wrote: “Lenin is said to have declared that the best way to destroy the capitalist system was to debauch the currency. By a continuing process of inflation, governments can confiscate, secretly and unobserved, an important part of the wealth of their citizens. By this method, they not only confiscate arbitrarily, and, while the process impoverishes many, it actually enriches some.”

There is no clear solution in sight, and the status quo is likely to persist. Sir Walter Scott also said: “Oh what a tangled web we weave, when first we practice to deceive.” Winston Churchill also comes to mind: “The inherent vice of capitalism is the unequal sharing of the blessings. The inherent blessing of socialism is the equal sharing of misery.”

7.32 DEPLETION TIME

The “depletion time” is also known as the “exponential expiration time” if an exponential model is used in the analysis as suggested by Albert Bartlett from the University of Colorado. A model using a normal distribution as suggested by M. King Hubbert could also be used. A growth model reaching a saturation level is suggested for renewable resources such as agricultural land. However that model becomes questionable if the considered resource is in itself dependent on a depletable one such as oil, in which case it would follow the depletion curve of the depletable resource.



Figure 83. Albert Bartlett, University of Colorado.

We consider the question of how long a finite resource would last if the rate of consumption is growing exponentially according to Eqn. 9. Physicists, geologists and engineers agree, but not economists, that the world's resources, particularly mineral and energy resources, except for sunlight are finite in size. If we consider the curve for the rate of consumption $R(t)$ and integrate it from the present time ($t = 0$) to sometime $t = T$, we get the total resource consumption up to a time T in metric tonnes as:

$$\begin{aligned}
 S(T) &= \int_{t=0}^{t=T} R(t)dt \\
 &= \int_{t=0}^{t=T} R_0 \cdot e^{+kt} dt \\
 &= \frac{R_0}{k} (e^{kT} - 1)
 \end{aligned} \tag{24}$$

If we know the size of the resource C , T becomes the depletion time of the resource $T_{\text{depletion}}$:

$$C = S(T_{\text{depletion}}) = \frac{R_0}{k} (e^{kT_{\text{depletion}}} - 1) \tag{25}$$

We can solve for an expression for the depletion time of a resource of size C as a function of the fractional growth per year, k :

$$T_{\text{depletion}}(k) = \frac{1}{k} \ln\left(\frac{kC}{R_0} + 1\right) \tag{26}$$

This equation is valid for all positive values of k and also for those negative values of k for which the argument of the natural logarithm is positive. The equation for the depletion time is an important equation pertaining to resource management and sustainability.

When the fractional yearly growth rate is zero, Eqn. 19 yields an indefinite quantity of 0/0. Applying L'Hospital's Rule by differentiating both numerator and denominator then taking the limit of k tending to zero, we get:

$$\begin{aligned}
 T_{depletion}(k=0) &= \lim_{k \rightarrow 0} \frac{\frac{d}{dk} [\ln(\frac{kC}{R_0} + 1)]}{\frac{d}{dk} [k]} \\
 &= \lim_{k \rightarrow 0} \frac{\frac{C}{R_0} \frac{1}{(\frac{kC}{R_0} + 1)}}{1} \\
 &= \frac{C}{R_0}
 \end{aligned} \tag{27}$$

7.33 EXPONENTIAL GROWTH FOLLOWED BY DECAY MODEL

A model that best fits the actual data of oil depletion reaches a peak exponentially at half the size of the resource C/2, and then decay exponentially for the other half of the resource. In this case Eqn. 26 can be rewritten as:

$$T'_{depletion}(k) = 2T_{\frac{1}{2}depletion}(k) = \frac{2}{k} \ln(\frac{kC}{2R_0} + 1) \tag{26}'$$

For a zero growth rate we apply l'Hospital Rule to obtain:

$$\begin{aligned}
 T_{depletion}(k=0) &= 2 \lim_{k \rightarrow 0} \frac{\frac{d}{dk} [\ln(\frac{kC}{2R_0} + 1)]}{\frac{d}{dk} [k]} \\
 &= 2 \lim_{k \rightarrow 0} \frac{\frac{C}{2R_0} \frac{1}{(\frac{kC}{2R_0} + 1)}}{1} \\
 &= 2 \frac{C}{2R_0} = \frac{C}{R_0}
 \end{aligned} \tag{27}'$$

giving the same result as Eqn. 27.

The modified model would lead to a depletion time, for values of k not equal to zero, that is longer than the simple exponential by a factor of:

$$f = \frac{T'_{depletion}(k)}{T_{depletion}(k)} = \frac{\frac{2}{k} \ln(\frac{kC}{2R_0} + 1)}{\frac{1}{k} \ln(\frac{kC}{R_0} + 1)} = 2 \frac{\ln(\frac{kC}{2R_0} + 1)}{\ln(\frac{kC}{R_0} + 1)} \quad (28)$$

7.34 COMPUTATIONAL PROCEDURE

To estimate the depletion time for different resource parameters, the following free format Fortran procedure was written using the simple growth model of Eqn. 19'.

```

!      Depletion time for a resource
!      Model uses an exponential growth to half the depletion period
!      followed by a mirror image exponential decay
!      T(k)=(2/k)*ln(((k*C)/(2*R0))+1) years
!      When k=0, T(0)=C/R0
!      k = fractional growth per year, [year]-1
!      P = Percent annual growth rate = 100/k [year]
!      C = remaining resource size, Billion barrels (Bp), Billion metric tonnes (Bmt)
!      R0 = initial annual production rate (Bb or Bnt)/year
!      This output file can be exported to a plotting routine
!      Dr. M. Ragheb
!
program depletion_time
!      Initialize variables
!      real :: C = 93.4
!      real :: C = 103.4
!      real :: C = 183.4
!      real :: R0 = 3.29
!      integer :: steps=15
!      real T(16), k(16), P(16)
!      write(*,*) C,R0
!      Open output file to display in Excel
!      open(10,file='output2.xls')
!      Calculate ratio depletion time T as a function of fractional growth per year k.
!      Special case of k=0
!      P(1)=0.0
!      T(1)=C/R0
!      Write results on output file
!      write(10,*) P(1), T(1)
!      Display results on screen
!      write(*,*) P(1), T(1)
!      Other values of k
!      steps = steps + 1
!      do i = 2, steps
!          P(i) = i - 1
!          k(i) = P(i)/100.0
!      Simple exponential growth
!          T(i) = (1.0/k(i))*log((k(i)*C/R0)+1.0)
!      Exponential growth followed by exponential decay
!          T(i) = (2.0/k(i))*log((k(i)*C/(2.0*R0))+1.0)
!      Write results on output file
!      write(10,*) P(i), T(i)
!      Display results on screen

```

```

!           write(*,*) P(i), T(i)
           pause
           end do
           end

```

Figure 84. Free format Fortran procedure for the estimation of the depletion time of a resource. Model considers exponential growth to half the depletion period followed by a mirror image exponential decay.

7.35 FOSSIL FUELS DEPLETION DATA

For illustrative purposes, Table 41 shows estimates from different sources for the data pertaining to the derived equations.

Table 41. Data for USA fossil fuel reserves.

Quantity	USA lower 48 states crude oil	USA including Alaska's oil (10 Bb)	USA including Alaska's oil and potential oil shale (80 Bb)	World Crude Oil	World Crude Oil and oil shale (190 Bb)	USA coal, low estimate	USA Coal high estimate
Historical percent annual growth rate, P, percent/year	8.27	8.27	8.27	7.04	7.04	6.69	6.69
Doubling time $T=69.31/P$, years	8.38	8.38	8.38	9.845	9.845	10.36	10.36
Fractional growth per year, $k=P/100$ year ⁻¹	0.0827	0.0827	0.0827	0.0704	0.0704	0.0669	0.0669
Recoverable ultimate production, $C_{ultimate}$	190 Bb	200 Bb	280 Bb	1952 Bb	2142 Bb	390 Bmt	1486 Bmt
Already Produced, $C_{produced}$	96.6 Bb	96.6 Bb	96.6 Bb	261 Bb	261 Bb	50 Bmt	50 Bmt
Percent already produced, $(C_{produced}/C_{ultimate}) \times 100$, percent	50.84	48.3	34.5	13.37	12.18	12.82	3.36
Remaining resource, $C =$	93.4 Bb	103.4 Bb	183.4 Bb	1691 Bb	1881 Bb	340 Bmt	1436 Bmt

$C_{\text{ultimate}} - C_{\text{produced}}$							
Initial annual production rate, R_0	3.29 Bb/year	3.29 Bb/year	3.29 Bb/year	16.7 Bb/year	16.7 Bb/year	0.5 Bmt/yr	0.5 Bmt/yr

Bb = Billion barrels = 10^9 barrels.

1 barrel = 42 USA gallons = 158.98 liters.

Bmt = Billion metric tonnes = 10^9 metric tonnes.

7.36 COMPUTATIONAL RESULTS

We use the data of Table 41 and the computer procedure of Fig. 84 to estimate the depletion time of different resources. Figure 85 compares the depletion times as a function of the percent annual growth rate P for three situations. The lower curve shows the depletion time in years for the oil supplies in the lower 48 states, excluding Alaska. At the present annual growth rate of 8.27 percent, about 18 years are left. Adding the Alaska supplies in the second higher curve raises the depletion time only minimally to 20 years. Even with the supply of shale oil, at the present supply depletion time is just about 28 years. Any rates of production increases say to 15 percent would decrease the depletion time to the range of 15 to 22 years. Only drastic conservation measures decreasing the growth rate to zero, would extend the depletion time to from 28 to 55 years.

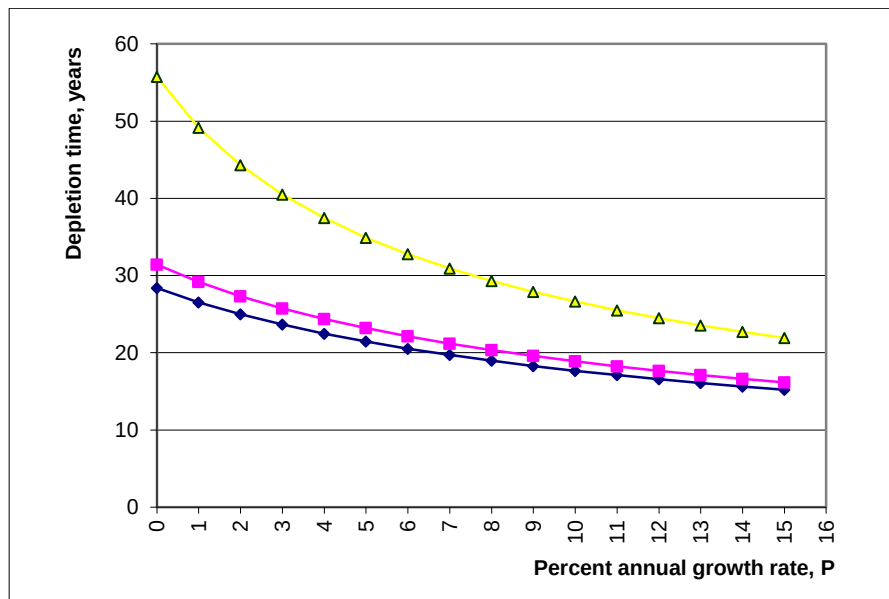


Figure 85. Crude oil depletion time as function of the percent annual growth rate, lower 48 states, USA including Alaskan oil, and USA including shale oil.

Since the USA imports more than a half of its oil supply (55 percent) from the rest of the world, we consider the depletion time for the whole world under two scenarios. The first scenario considers only oil, and the second scenario considers also oil shale deposits. Figure 86 compares

the depletion times as a function of the percent annual growth rate P for two scenarios. At the present annual growth rate of 7.04 percent, about 42 years are left. Adding the oil shale supplies in the higher curve marginally raises the depletion time to 44 years.

Our estimate here uncannily matches that of the British Petroleum (BP) oil company which states in its 2005 annual review: “At *current consumption rates*, we estimate that the world has a 40-year supply of oil and almost 70 years of natural gas. The future of fossil fuels will be defined as much by resourcefulness as by resources.”

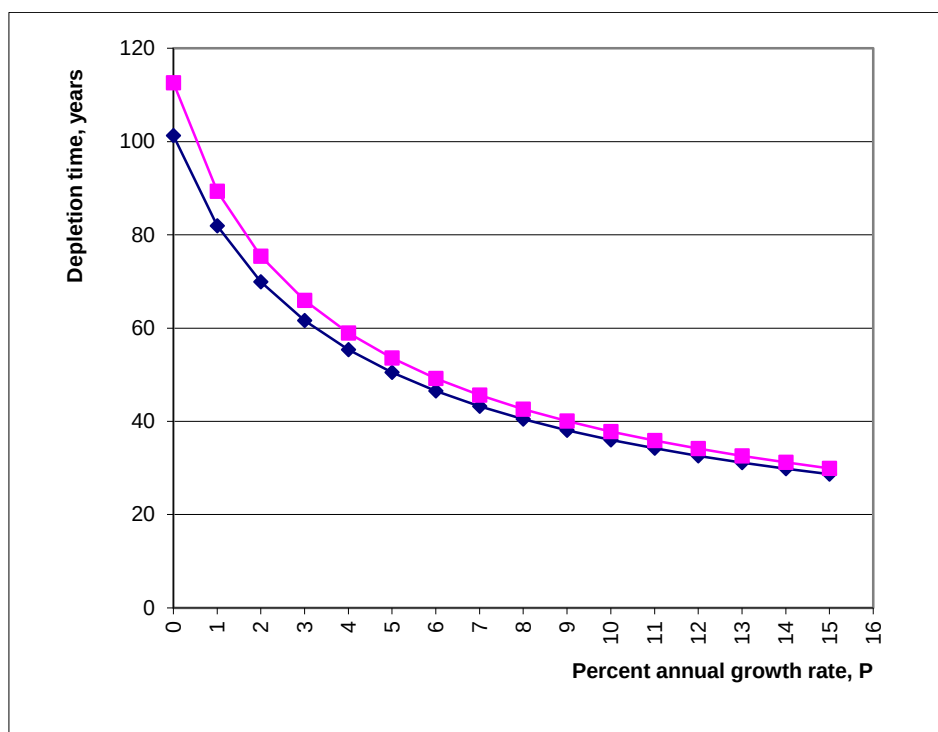


Figure 86. Global crude oil depletion time as function of the percent annual growth rate, lower curve: crude oil, upper curve includes shale oil.

Irrespective of the global climatic change effects, we are informed by some coal company experts that the USA possesses huge amounts of coal that can last for thousands of years. We consider the low estimate and high estimate of coal reserves from Table 41 and estimate the depletion times as a function of percent annual rates for both cases in Fig. 86. These experts are basing their estimates on a zero growth rate that in fact would yield a depletion time of 2,872 years for the high estimate and 680 years for the low estimate. However if we take the present growth rate of 7 percent we find that the depletion time is just 90-120 years from the low to the high estimates of the recoverable reserves. Remarkably, if the annual growth rate increases to 15 percent the depletion time estimates range from just 70 years for the low estimate, to 80 years for the high estimate.

The conclusion from the analysis here is that the time to depletion of a resource is more sensitive to the annual growth rate in its use, rather than it is to just its size.

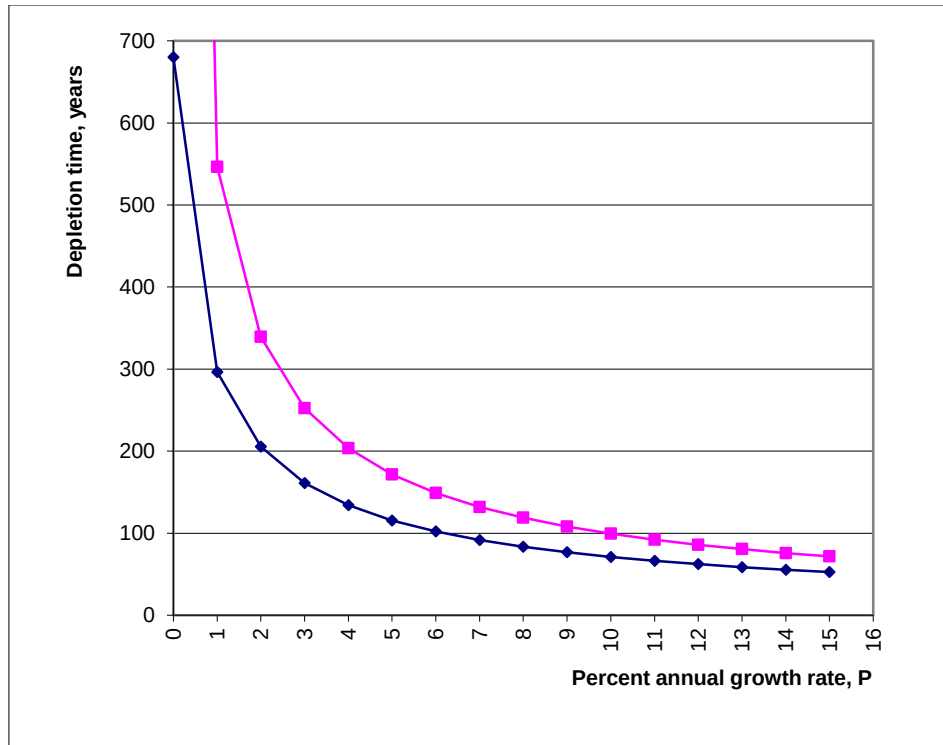


Figure 87. USA coal supplies depletion time as function of the percent annual growth rate, lower curve: low estimate, upper curve high estimate.

7.37 REGENERATION FACTOR

Fissile fuel resources possess a unique feature in that a fissile fuel could be bred from a fertile or fissionable material that is otherwise unsuitable for energy production. This makes nuclear energy an expandable rather than just a renewable resource if used adequately.

By irradiating U^{238} or Th^{232} in a nuclear reactor, neutrons are absorbed in them breeding Pu^{239} and U^{233} respectively as fissile fuels.

The first parameter of importance is the fission neutron yield:

ν = The average number of prompt neutrons emitted per fission event in the fuel .

Its value is a function of the neutron energy, but is shown at the neutron thermal energy of 0.025 eV in Table 42. It can be observed that for the fissile isotopes shown, its value exceeds 2 in magnitude.

Table 42. Values of ν and η for thermal neutrons in fissile fuels.

Fissile isotope	Fission neutron yield ν	Regeneration factor η
U^{233}	2.49	2.285
U^{235}	2.42	2.07
Pu^{239}	2.87	2.11

Pu ²⁴¹	2.93	2.145

Only a proportion of the thermal neutrons absorbed in the fuel give rise to fissions. The regeneration of neutrons is described by a second parameter; the regeneration factor:

η = the number of fast neutrons emitted per thermal neutron absorbed in the fuel .

If the fuel consists of a single fissile isotope it is given by:

$$\eta = \nu \frac{\sigma_f}{\sigma_a}$$

σ_f is the microscopic fission cross section [barns] (29)

σ_a is the microscopic absorption cross section [barns]

The parameter α is defined as the ratio of the neutron capture to neutron fission cross section:

$$\alpha = \frac{\sigma_c}{\sigma_f} \quad (30)$$

From which we can write:

$$\eta = \nu \frac{\sigma_f}{\sigma_a} = \nu \frac{\sigma_f}{\sigma_f + \sigma_c} = \nu \frac{1}{1 + \alpha} \quad (31)$$

The values for η are shown in Table 42. These values were constructed using the cross section data from Table 43.

Table 43. Nuclear cross section for some fissile and fissionable nuclides at the thermal energy of 0.0253 eV.

Nuclide	Absorption cross section [barn] σ_a	Fission cross section [barn] σ_f	Radiative capture cross section [barn] σ_c	Capture to fission ratio α
Th ²³²	7.4			
Th ²³³	1515	15		
Th ²³⁴	1.8			
Pa ²³³	41	<0.1		
U ²³³	579.1	531.1	48	0.0904
U ²³⁴	100.2			
U ²³⁵	681	582	99	0.1701
U ²³⁶	5.2			

U^{238}	2.70			
U^{239}	36	14		
Np^{239}	45	<1		
Pu^{239}	1011.5	742.5	269	0.3622
Pu^{240}	289.5	0.030		
Pu^{241}	1377	1009	368	0.3647
Pu^{242}	18.5	<0.2		

1 barn= 10^{-24} cm².

Despite the high values of neutron fission yield for the Pu isotopes than the U isotopes in Table 43, their corresponding higher values of the capture to fission ratio result in their thermal regeneration values being roughly equal to those of the U isotopes.

At higher energies, the fission neutron yield increases with energy, and the behavior of the regeneration factor depends on the energy dependence of the fission and absorption cross sections as shown in Fig. 88.

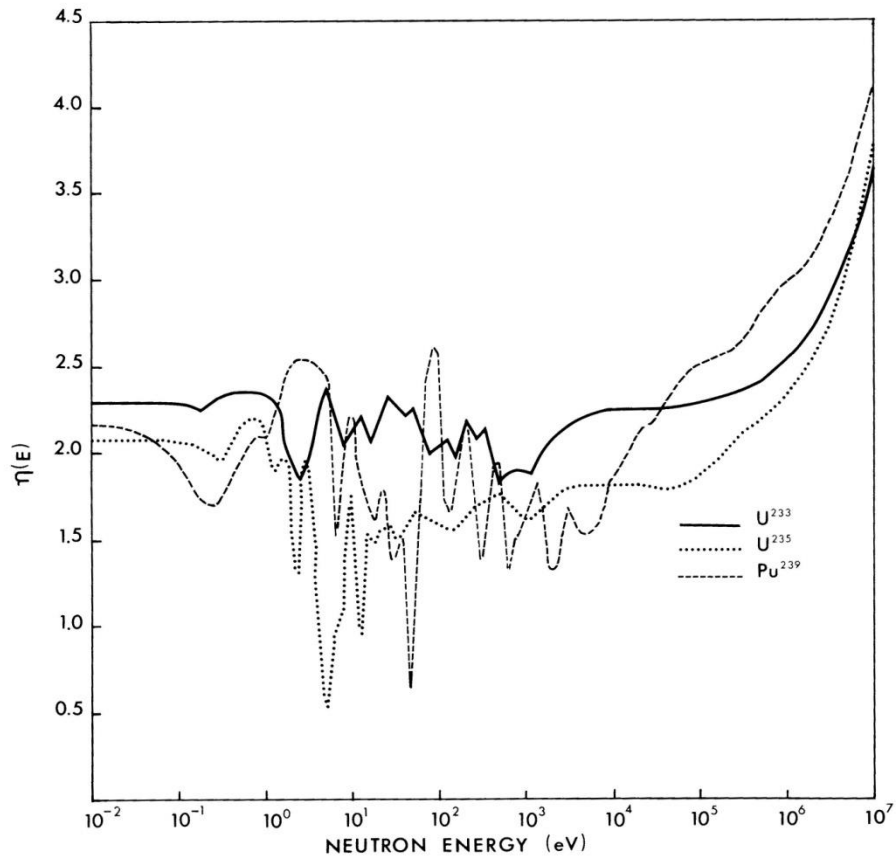


Figure 88. Energy dependence of the regeneration factor for the fissile isotopes U^{233} , U^{235} and Pu^{239} .

In Fig. 88, one observes that over the thermal neutron energy region U^{233} has the highest regeneration factor, whilst Pu^{239} becomes more dominant at higher neutron energies, or the fast

neutrons region. The regeneration factor depends on the fuel composition, particularly its enrichment in the different fissile and fertile isotopes.

EXAMPLE

To calculate the regeneration factor for natural uranium we know that the natural abundance of U^{235} is 0.72 a/o, and U^{238} is 99.28 a/o. From the data in Table 42, we can deduce that:

$$\begin{aligned}
 \eta &= \nu^{U^{235}} \frac{\gamma^{U^{235}} \sigma_f^{U^{235}}}{\gamma^{U^{235}} \sigma_a^{U^{235}} + \gamma^{U^{238}} \sigma_a^{U^{238}}} \\
 &= 2.42 \frac{\frac{0.72}{100} \times 582}{\frac{0.72}{100} \times 681 + \frac{99.28}{100} \times 2.70}^2 \\
 &= 2.42 \frac{419}{490.32 + 268.056} \\
 &= 1.337
 \end{aligned}$$

7.38 THERMAL AND FAST NEUTRON FISSILE BREEDING

The minimum requirement for the generation of more fissile material by neutron capture in fertile isotopes than is consumed in fission or the process of “breeding” is:

$$\eta > 2 \quad (32)$$

In practice, because of the leakage of neutrons and their capture in the structural components of a nuclear reactor the regeneration factor must be appreciably larger than 2 before breeding can be achieved. For a thermal neutrons spectrum reactor, breeding is effectively restricted to the Th^{232} - U^{233} fuel cycle shown in Fig. 89, where Th^{232} is used a fertile fuel, producing U^{233} as a fissile fuel.

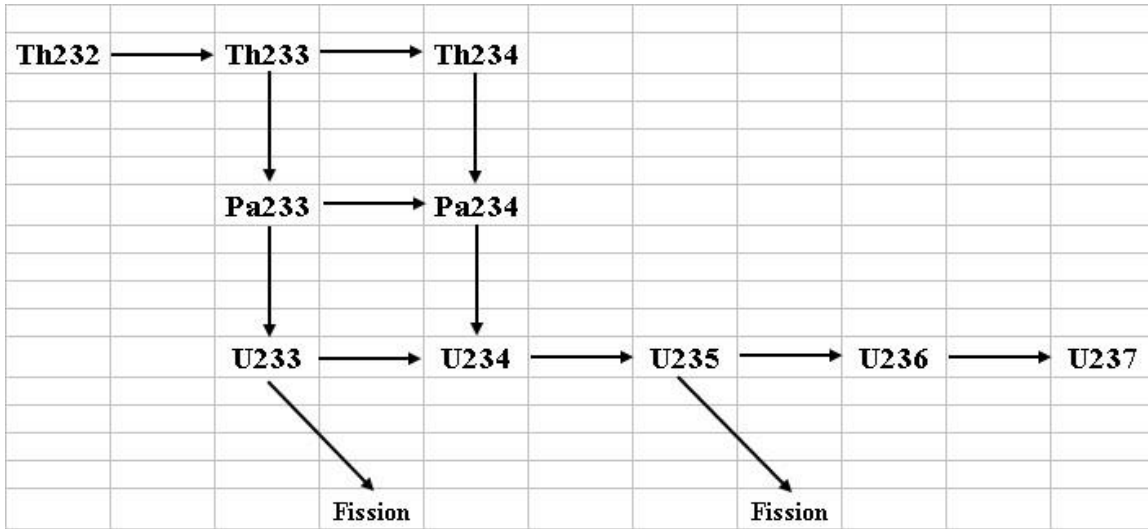


Figure 89. The $\text{Th}^{232}\text{-U}^{233}$ thermal neutrons fuel cycle.

At high neutron or fast neutron energies, breeding is possible with all three fissile fuels, but is particularly more effective with Pu^{239} as a fissile material produced from U^{238} as a fertile material as shown in Fig. 85.

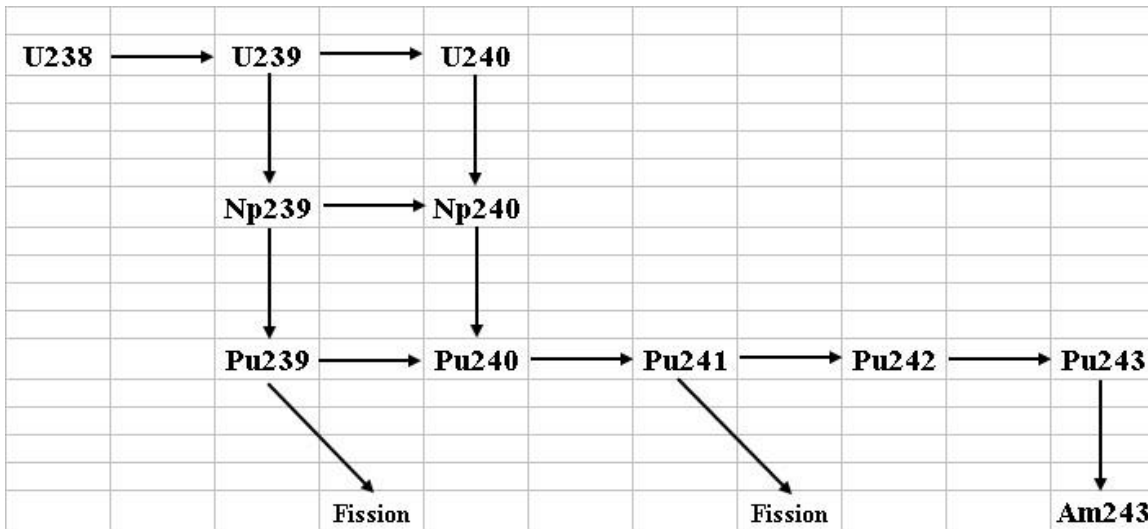


Figure 90. The $\text{U}^{238}\text{-Pu}^{239}$ fast neutron fuel cycle.

In a fast neutron spectrum, because of the existence of (n, 2n) reactions with the U^{238} isotope, another breeding cycle using Neptunium²³⁷ or a mixture of Pu and Np, can also be envisioned, and needs detailed study. In addition, in a fast neutron spectrum, the isotopes Pu^{240} and Pu^{242} would significantly contribute to the fission process. In fact, using a fast spectrum is a good way of extracting energy from these isotopes and the other actinides by burning them and effectively recycling them rather than storing them in a waste disposal site.

7.39 CONVERSION OR BREEDING RATIO

We define the conversion ratio C as:

$$C = \frac{\text{average number of fissile nuclides produced}}{\text{average number of fissile nuclides consumed}} \quad (33)$$

When N nuclei of fissile fuel are consumed, NC nuclei of fertile fuel are converted into fissile nuclei. If the process is repeated, the consumption of N fuel nuclei results in the conversion of a total number of fissile nuclei as:

$$\begin{aligned} N_{total} &= N + NC + NC^2 + NC^3 + NC^4 + \dots \\ &= N(1 + C + C^2 + C^3 + C^4 + \dots) \\ &= N \frac{1}{1-C}, \forall 0 < C < 1. \end{aligned} \quad (34)$$

When $C = 1$, an infinite amount of fissile fuel can be converted from a starting amount of fertile fuel. When $C > 1$ the sequence diverges since more than a fissile nucleus is created from a fertile nucleus and cannot be summed mathematically. In this case C is designated as B, the breeding ratio.

If only n recycles are involved, due to the accumulation of undesirable isotopes affecting the recycling process, Eqn. 34 reduces to:

$$\begin{aligned} N_{total} &= N + NC + NC^2 + NC^3 + \dots + NC^n \\ &= N(1 + C + C^2 + C^3 + \dots + C^n) \\ &= N \frac{1 - C^{n+1}}{1 - C}, \forall 0 < C < 1. \end{aligned} \quad (34)'$$

7.40 BREEDING GAIN

The breeding gain describes the extent to which breeding is occurring in a breeder reactor and is defined as:

$$G = B - 1, \text{ for } B > 1. \quad (35)$$

The breeding of fissile fuel is described by the doubling time, which is defined as the time interval during which the amount of fissile material in a breeder reactor doubles in magnitude.

7.41 CONVERSION AND BREEDING

The fission process releases about 200 MeV per fission event of which 10 MeV, or 5 percent, are in the form of antineutrinos whose energy is not extractable.

For a reactor generating a thermal power of P MWth, the fission rate of an extractable fission energy yield of 190 [MeV / fission], is given by:

$$\begin{aligned}\frac{d(\text{fissions})}{dt} &= P \text{ MW}_{\text{th}} \times \frac{10^6 \text{ W}_{\text{th}}}{\text{MW}_{\text{th}}} \times \frac{1 \text{ Joule}}{\text{W}_{\text{th}} \cdot \text{sec}} \times \frac{\text{MeV}}{1.6 \times 10^{-13} \text{ Joule}} \times \frac{\text{fissions}}{190 \text{ MeV}} \times \frac{24 \times 60 \times 60 \text{ sec}}{\text{day}} \\ &= 2.7 \times 10^{21} P \frac{\text{fissions}}{\text{day}}\end{aligned}$$

This fission rate can be expressed in terms of Avogadro's law as:

$$\begin{aligned}\frac{d(\text{fissions})}{dt} &= \frac{g[\text{grams/day}]}{A} A_v \\ \text{where : } A &= 235 \text{ amu, } A_v = \text{Avogadro's number}\end{aligned}$$

The fuel burnup rate, is “g” and is given by:

$$\begin{aligned}g &= \frac{A}{A_v} \frac{d(\text{fissions})}{dt} \\ &= 2.84 \times 10^{21} \frac{235}{0.6021 \times 10^{24}} P \frac{\text{fissions}}{\text{day}} \\ &= 1.11 P \frac{\text{gm}}{\text{day}}\end{aligned} \tag{36}$$

One MWth of power burns up 1.11 gm of U^{235} per day. If a reactor operates at 3,000 MWth, its fuel burnup is 3,015 grams or 3.330 kgs of fissile U^{235} per day.

Not all the fissile nuclei undergo fission to produce power. A fraction of them undergo a radiative capture process, in which a neutron is absorbed with the emission of a gamma photon, without fissioning. Thus we define the fuel consumption rate as a function of its microscopic radiative capture cross section σ_c and its microscopic fission cross section σ_f as:

$$\begin{aligned}\text{consumption rate} &= \frac{\sigma_c + \sigma_f}{\sigma_f} \text{ burnup rate} \\ &= 1.11 \left(1 + \frac{\sigma_c}{\sigma_f}\right) P \\ &= 1.11(1 + \alpha) P\end{aligned} \tag{37}$$

The ratio of microscopic capture to fission cross sections is:

$$\alpha = \frac{\sigma_c}{\sigma_f} = \frac{99}{582} = 0.17, \text{ for thermal fissions in } \text{U}^{235}.$$

Thus the fuel consumption rate is about $1.11 \times (1 + 0.17) = 1.30$ grams per MWth per day for U^{235} .

7.42 EXPONENTIAL DOUBLING TIME

The reactor power that can be produced is proportional to its fissile fuel content M :

$$P \propto M$$

Using a proportionality constant α , we can write:

$$\begin{aligned} P_0 &= cM_0, \text{ at time } t = 0 \\ P &= cM, \text{ at time } t. \end{aligned} \quad (38).$$

The rate of increase in the mass of fissile fuel is given by:

$$\begin{aligned} \frac{dM}{dt} &= 1.11G(1 + \alpha)P \\ &= 1.11G(1 + \alpha)cM \end{aligned} \quad (39)$$

Separating the variables we get:

$$\begin{aligned} \int_{M_0}^{M(t)} \frac{dM}{M} &= 1.11G(1 + \alpha)c \int_0^t dt \\ \ln \frac{M(t)}{M_0} &= [1.11G(1 + \alpha)c]t \\ M(t) &= M_0 e^{+[1.11G(1 + \alpha)c]t} \end{aligned} \quad (40)$$

Thus, in breeding, the fissile fuel inventory grows exponentially, and one is interested in determining the time T_d at which the fissile fuel inventory doubles in magnitude:

$$2M_0 = M_0 e^{+[1.11G(1 + \alpha)c]T_d} \quad (41)$$

Taking the natural logarithm of both sides leads to:

$$T_D = \frac{\ln 2}{[1.11G(1 + \alpha)c]} \quad (42)$$

We can substitute for the value of $c = P_0/M_0$, to get:

$$T_D = \frac{M_0 \ln 2}{[1.11G(1 + \alpha)P_0]} \text{ [days]} \quad (43)$$

We can express the growth in the fissile fuel inventory in terms of the doubling time as:

$$M(t) = M_0 e^{+\ln 2 \frac{t}{T_D}} \quad (44)$$

The doubling time is a measure of the performance of a breeder reactor, and breeding is a unique property of nuclear fission and fusion energy systems.

EXAMPLE

A breeder reactor containing a mixture of U^{238} and Pu^{239} consumes about 1,000 grams of Pu^{239} per day. At startup its initial Pu^{239} loading was $M_0 = 500 \text{ kgs} = 500,000 \text{ gms}$ of fissile Pu^{239} . Its breeding ratio $B = 1.2$.

The breeding gain is:

$$G = B - 1 = 1.2 - 1 = 0.2$$

The rate of fissile fuel production is:

$$G[1.11(1 + \alpha)P_0] = 0.2 \times 1,000 \frac{\text{gm}}{\text{day}} \times \frac{365 \text{ days}}{\text{year}} = 73,000 \frac{\text{gm}}{\text{year}}$$

The doubling time is:

$$\begin{aligned} T_D &= \frac{M_0 \ln 2}{G[1.11(1 + \alpha)P_0]} \\ &= \frac{500,000 \times \ln 2}{73,000} \frac{\text{gm}}{(\text{gm} / \text{year})} \\ &= 4.75 \text{ years} \end{aligned}$$

The larger the breeding ratio B and the breeding gain G , the shorter the fissile inventory doubling time.

7.43 ANATOMY OF ENERGY CRISES

INTRODUCTION

In a power grid failure event on August 14, 2003, an electrical power blackout encompassed almost the entire Northeast USA, luckily during daylight. Nevertheless, the effects were immediate on over 50 million people in the USA and Canada. Skyscrapers were left without working elevators, no lights, and no water. Hospital operating rooms went dark. Traffic signals stopped functioning and people found themselves in the midst of an instant traffic jam. There was no power for the pumps at the gas stations. Refrigerators stopped running and refrigerated food spoiled. Rail systems stopped operating. Flight controllers had to communicate with airborne pilots via battery powered walkie talkies and sewage systems shut down and backed out.

PROJECTED BROWNOUTS AND BLACKOUTS

As of 2007, there were about 144 needed new coal fired power plants and about 20 nuclear power plants on the drawing boards of the USA electrical utilities, but probably only a handful will be eventually built for lack of available capital. The electric industry in the USA is not in good health and local and regional brownouts and blackouts should soon become common occurrences around 2012. Isolated instances of brownout and blackout are expected to occur earlier.

It is thought that this is a consequence of the botched deregulation process of the 1990s which resulted in slowed capital investment, increased prices and higher financial uncertainty, Electrical utilities are unable to take political, regulatory, technical or financial risks and their long range planning cycle has broken down.

Capital costs are exploding, particularly for new construction. Most power plant construction cost projections have doubled.

The prospect of environmental regulations also adds to the uncertainty. Utilities cannot invest in power plants and face the prospect in 5-10 years that environmental regulations could shut them down.

ALTERNATIVE SOURCES

The nascent alternative energy industry with wind, solar and geothermal also faces challenges. The most salient issue is cost competitiveness since alternative systems provide power at costs that are higher than traditional power coal or nuclear power plants.

Production reliability is also an issue due to the intermittent nature of wind and solar electricity and the need for energy storage and backup systems.

The rates that the regulators will allow the utilities to charge their customers are another issue. If utilities invest in alternative power systems that produce electricity at 20-30 cents per kw.hr, they need the regulators to allow reimbursement of these relatively high costs for a long enough time span so that the utilities can amortize their capital cost. Currently, the base line cost of electricity is set against the cost to produce comparable coal or natural gas based electricity, and this cost setting occurs even though there is a growing bias against carbon in the USA political and regulatory culture for global climatic change considerations.

Another issue includes the lack of adequate grid transmission capability from the remote sites of wind and solar facilities to the population and industrial consumption centers.

Within a decade, the price for electricity will about double on average throughout the USA. This would put the cost of electricity about on par, as a percentage, with where it was back in the 1950s; but only if investments are made in new power systems capacity and the conservation and efficiency measures are implemented. Absent these measures, brownouts and blackouts should be expected.

The electrical power industry is paralyzed by the uncertainty of financial risks and cannot embark on the needed capacity addition. As old power plants age and are retired, there will be less available reserve power.

CALIFORNIA'S ENERGY CRISIS

The State of California in the USA, the world's sixth largest economy, at the dawn of the 21st century, faced an energy crisis in the early part of 2001. It was not caused solely by a lack of energy supplies, but among others, by a convergence of political regulatory and badly underestimated electricity demand factors. These factors are worth studying for an understanding of what can lead to energy crises.

The USA's president George W. Bush, at the end of the year 2000 expressed concern that an USA Energy crisis “may be looming.” This was suggested by the State of California's precarious energy situation. The then USA's Energy Secretary and later governor of the state of New Mexico, Richard (Bill) Richardson seconded him by suggesting that California's power utilities are “running out of cash” due to rocketing power costs. Being unable to pass on these costs to consumers, they were forced to lay off employees. Repairs and maintenance at key facilities had to be curtailed, leading to possible unsafe situations and accidents. The governors of the Western States supplying power to California gathered in Denver, Colorado, and met with the Secretary of Energy who urged them to implement a price cap on the tripling of electrical rates to consumers. Meanwhile the utilities in California were allowed to increase their rates by 10-15 percent to avoid insolvency.

CAUSES OF THE CRISIS

California, the USA's most populous and richest state, started the new millennium in the year 2001 under a daily threat of energy blackouts. Its utilities, including Pacific Gas and Electric (PG&E) and Edison International's Southern California Edison, were facing runaway prices for the wholesale energy that they have to purchase for distribution from the power producing companies. The PG&E utility suggested it was unable to recover \$ 4.5 billion in wholesale power purchases through November, 2000.

The following causes can be suggested as combining to bring California dangerously close to a situation of rolling electrical blackouts:

1. Heavy power demand from California's Silicon Valley and its emerging Information Technologies.
2. The lack of new construction and addition of power plants capacity. Stringent environmental laws precluded the construction of new power plants in California.
3. The unexpected tight supplies from the hydroelectric electricity sources in the neighboring Western states under the situation of a persistent drought.
4. A run-up in the price of Natural Gas, the favored fuel for the California utilities.
5. An illusion pertaining to the belief that conservation measures alone are sufficient to create virtual otherwise nonexistent electrical power capacity.
6. Over-regulation disguised as a deregulation law passed in 1996 at a time of relatively low energy costs and surplus electrical capacity, forcing utilities to sell the power they produce on the open market.

The two main California utilities had been forced to pay more than \$ 1,400 per Megawatt-hour (MWhr) for wholesale electrical energy to the electrical energy producers on the spot market from corrupt trading companies such as Enron which later went into bankruptcy proceedings, compared with just \$ 34 per MWhr, a year earlier. This is an astounding 41-fold increase in the price of electricity.

Under California's deregulation rules, its utilities were not permitted to pass along increasing energy costs to consumers. However they were importing their electricity from

producers outside the state. This way, California thought that it could continue economic growth and progress while maintaining excessively superior environmental conditions within its borders, and getting away with exporting the pollution and other environmental impacts from power production to other distant states. In fact, so much water was being drawn from the Pacific Northwest to produce hydroelectric power for export to California, that the migrating salmon was being stranded in its streams and rivers, threatening the fishing industry. In addition, with increased water withdrawal from its reservoirs in the fall and winter, the stage was being set for an even more serious situation in the upcoming summer months when the air conditioning season further strains the electrical energy needs.

However, as out-of-state generators of electricity and marketers became concerned that they will not be paid for their product, they started curtailing the power supply to California.

For this reason, the Secretary of Energy was forced to invoke some rarely-used emergency powers, and ordered 75 power generators and marketers in the West to ignore their own credit discipline and continue supplying California with electrical power. California regulators set a soft price cap on the wholesale rates and let the California utilities keep the limited amount of power that they produce, rather than forcing them to sell it on the open market. These were political stop-gap measures that did not provide a long term solution to the problem.

The only obvious way out was to allow the electrical rates to float freely in order to curtail energy consumption by consumers who were using more power than California can produce, or beg for from other neighboring states.

POWER PRODUCERS AND POWER DISTRIBUTORS

Other than invoking the temporary emergency powers from the Secretary of Energy, and realizing that emergency powers and conservation measures cannot produce electrical power that does not exist out of thin air, the governor of California at the time, Gray Davis sought the help of the Federal Energy Regulation Commission (FERC). The FERC was asked, as an overseer of the wholesale power market, to force the power producers to keep their prices down. Its chairperson, James Hoecker, wisely refused such an action, which would surely bankrupt or at least discourage any power producers from investing in building the future power plants capacity that will satisfy the West's and California's hunger for plentiful and artificially cheap energy. The reason for such a denial was politely reported as being related to the need to maintain the main goal of deregulation: competition among the power producers and utilities, eventually leading to cheaper supplies; "Competition has not failed in principle because it was never well-conceived or fully tried."

California's governor responded as a solution to the crisis with the suggestion of parceling out the damage with a modest rate hike of 10 percent, with the utilities' shareholders bearing in return half the cost overruns.

ELECTRICITY AS SERVICE OR A COMMODITY

The main falsehood that most of the players in the deregulation game were trapped into is the consideration that electricity is just a commodity like corn, soybeans, or wheat. Whereas in fact electricity is more than just a commodity: it is a *service*. Like telephone, insurance, health or banking services, consumers as households or commercial establishments, do not pay just for the amount of power in kiloWatt-hours (kW.hrs) that they withdraw from their electrical outlets, but

also for the utilities to be ready to *serve* them with their electrical needs at all times when they need it.

This practically implies that utilities are being paid by consumers to maintain an excess capacity in addition to their base load needs, and to plan for the anticipated future needs. This situation existed when the utilities were their own power producers. This could not occur with the utilities divesting themselves of their power plants, at rock bottom prices, to a small group of power producers under the pressure of deregulation.

Based on the premise that electricity is just a commodity, California's regulators thought that they could further competition and extract rock bottom electricity prices from the existing electrical power generators. This works perfectly well if a situation of a surplus exists, which was the case. Supply and demand did stabilize at a low rate for electricity. But then let us note how the tables get turned around when the oversupply situation ended and a state of scarcity replaced it: supply and demand were now trying to stabilize, but at a higher price level for the electricity. In the oversupplied energy market place, the California's state-run Power Exchange placed the power generators in the unenviable situation of competing against each other and indeed succeeded in extracting lower electrical energy costs from them.

Utilities with power plants were forced to sell them to far-sighted groups of producers who foresaw the appetite for energy and anticipated the future scarcity situation. Instead of producing their own power needs, the California utilities bought all their power supply one day at a time on the state-run Power Exchange. Since the market was oversupplied, the game worked well. This was a perfect formula for robbing the owners of power plants, but just for a while.

What was unexpected was that the oversupply situation could not continue to exist forever. In fact, the demand for electricity in California started growing at a rate of 8 percent per year.

The utilities became placed in a precarious situation in which they lost their ability to structure their supply to *serve* and match the demand of the power users. They discovered that electricity is not just a commodity to be purchased on the commodities' exchanges, but a *service* that has to be matched to the needs of their customers. By the summer of 2000, the tables were fully turned around. The oversupply situation was replaced by a scarcity situation. Power producers, who were earlier robbed of their capital, noticed the new facts on the ground and started extracting top dollars for their scarce commodity; up to 40 to 50 times the price of a MW.hr of energy in 2000 compared with the price in the year 1999. Since California produces half its electricity from natural gas, the fact that natural gas prices increased in 2000 to \$ 10 per million British Thermal Units (BTUs) compared with \$ 3 in the year 1999, created a more precarious situation.

By stripping the utilities of their ability to respond to the market place, and planning the service needs of their customers, what is called De-regulation now showed its true face as, in fact, Over-regulation.

REMEDIES

It is ironic to note that the inspiration for the way out of the situation that California's regulators have thrown their state into comes from the experience of one of California's utilities: San Diego Gas and Electric.

Because of a technicality in the 1996 California deregulation act, this utility escaped from the rate freeze that was associated with the law. To curb the consumers' appetite for energy, and being free from deregulation, the utility increased its electrical rates to triple what they were the

previous year. Two main responses to its action occurred in textbook fashion, as supply and demand stabilized at a higher price for electricity. First, consumers responded by curbing their usage, and second, industrial and commercial users installed their own electrical generators capacity to economically satisfy their own needs.

The remedies for California and other states became clear:

1. Regulators as well as utilities needed to treat electricity for what its true nature really is, not as just a commodity but as a service. To effectively perform such service, utilities must be allowed to plan for the present and future needs of their consumers, and should be given the chance to own their own generating capacity if it suits them. Or they could buy it on the open market as matches their special circumstances, without undue economical penalty. The recent fragmentation of the power production industry into power producers and power distributors is counter to its present and future viability.

2. Supply and demand need to be allowed to balance out at a comfortable price level, by eliminating the self-defeating urge to freeze rates through Over-regulation.

3. In return for the benefit of electrical supplies for consumers and industrial and commercial entities, states must be willing to accept the cost of the environmental impacts from energy generation within their own borders. If they wish to export pollution and the environmental impacts to other states, they must be willing to fairly compensate them accordingly, and share the convenience, the wealth, and the benefits that accrue to them from abundant electrical energy.

4. Real rather than fictitious or virtual sources of electricity in the form of new electrical power plants must be built to provide the needs of the market place.

FAILURE OF DEREGULATION

Reality shows that the dream that deregulation would deliver a competitive efficient and lower price electric energy system, was a myth. The proponents of deregulation predicted that electricity generators freed from state regulation would invest in new technology and create more efficient markets. A myth of deregulation was the development of a national grid that would allow the purchase of electricity from low cost producers wherever the generator plants were located. A universal lack of competition made those dreams unrealizable.

Electricity prices have increased faster in the 20 deregulated states than in the regulated ones. The real pain would appear after the removal of implemented rate caps. In the states where the caps have been removed such as in suburban Maryland, the cost of electricity has increased by 38 percent in 2006. Baltimore saw a 72 percent jump, and Washington DC, 12 percent. A 25 percent increase is expected for Illinois.

CONCLUSION OF CRISIS

Having taken over the responsibility of its utilities amid the power blackouts of early 2001, as energy traders demanded financial guarantees to deal with the struggling utilities, the State of California closed the most chaotic chapter of its energy crisis and handed off this responsibility to its utilities at the end of 2002. New power plants were commissioned or built, older plants retrofitted, and consumption brought under control with higher prices. During the height of the energy crisis, the average daily cost of wholesale power increased tenfold, topping out at 300 dollars per Megawatt-hour of energy. At times, the wholesale price of energy spiked to as much

as 3,800 dollars per Megawatt-hour. The Department of Water Resources, which bought most of California's electricity the two years previous to the crisis and negotiated 43 billion dollars in controversial long-term energy contracts, lost its emergency authority for the job. California is now relieved of a job it did not want, and its critics say it did poorly.

Power buying on a minute-by-minute basis now returned to its utilities: Pacific Gas and Electric Co., Southern California Edison and San Diego Gas and Electric Co. The voters in California elected as a new governor the previous actor Arnold Schwarzenegger of the "Terminator I, II, III, etc." sequel of movies fame, and terminated the shortsightedness of their previous governor Gray Davis.

7.44 CONFLICTING VIEWS

The French philosopher and writer La Rochefoucauld said: "The brain is merely the heart's dupe." What he meant was that our reason is a slave to our hopes and wishes, not the other way around and that our minds work for the benefit of our desires. Examples abound such as the Y2K scare of 1999 when all the world computers were supposed to shut down, and in World War II, the Nazis' lies of racial superiority and the need for Lebensraum or living room in the East ended at Stalingrad and Berlin. The moral is that we have to be suspicious of what people tell even when they are characterized as facts.

Dr. M. King Hubbert commented about the possibility of maintaining a high-energy industrial civilization indefinitely:

"Whether this possibility shall be realized, or whether we shall continue as at present until a succession of crises develop-overpopulation, exhaustion of resources and eventual decline-depends largely upon whether a serious cultural lag can be overcome. In view of the rapidity with which our transition to our present state has occurred, it is not surprising that such a cultural gap should exist, and that we would continue to react to the fundamentally simple physical, chemical, and biological needs of our social complex with the sacred cow behavior patterns of our agrarian and pre scientific past. However, it is upon our ability to eliminate this lag and to evolve a culture more nearly in conformity with the limitations imposed upon us by the basic properties of matter and energy that the future of our civilization largely depends."

The work of Campbell and Laherrère about the global oil peak is criticized by Lynch in relation to the proprietary nature of the database being used. The "Petro Consultants" company, or now "IHS Energy" database is high quality, however, since it is only available for a large fee, few have been able to access it and double check the results which Campbell and Laherrère have achieved. That lack of access has served as the first line of defense for the two, who often respond to criticism with comments such as (in response to Lynch): "Your problem is that you do not have any reliable database (and the experience to use it)."

Many economists are skeptical and some, like M.A. Adelman, believe in an Earth that is a cross between some sort of magic pudding and a cargo cult. The Magic Pudding is an Australian children's story of a pudding which never runs out: you can always scoop out some more. The cargo cults were a belief by uninformed tribes in Papua New Guinea that the goodies of modern

civilization were to be had by just digging a hole in the ground for these to come spurting out. These economists have been called by their critics as: “Flat Earth Economists.”

According to the economist M. A. Adelman:

“Minerals are inexhaustible and will never be depleted. A stream of investment creates additions to proved reserves from a very large in-ground inventory. The reserves are constantly being renewed as they are extracted. How much was in the ground at the start and how much will be left at the end are unknown and irrelevant.”

According to the economist Julian Simon in 1995:

“We have in our hands now, actually in our libraries, the technology to feed, clothe, and supply energy to an ever-growing population for the next 7 billion years. Even if no new knowledge were ever gained we would be able to go on increasing our population forever.”

According to Colin Campbell, 1997:

“The world's economy has been driven by an abundant supply of cheap oil-based energy for the best part of this century. The coming oil crisis will accordingly be an economic and political discontinuity of historic proportions, as the world adjusts to a new energy environment.”

According to B. J. Flay:

“By 2050 the Golden Age of Oil, the world we know today, will be over. The risk of chaos, disorder and destruction could face us if we fail to adapt appropriately in time. We are confronted with the greatest transformation of human affairs in all history.

From the work of Campbell and Laherrère, 1998:

"The world is not running out of oil at least not yet. What our society does face, and soon, is the end of the abundant and cheap oil on which all industrial nations depend."

Based on unpublished proprietary models and data, Cambridge Energy Research and Consultants (CERA) from Cambridge, Massachusetts, has released an analysis concluding that Peak Oil is a “Simplistic model based on flawed logic and incomplete data that has consistently produced inaccurate forecasts.” On Dec. 7, 2005, Robert Esser, from CERA, testified before the USA House Energy and Air Quality Subcommittee hearing on “Understanding the Peak Oil Theory.” He noted that the term Peak Oil “is not a very helpful concept, nor one that provides much descriptive power. Rather than an imminent ‘peak,’ we envision an ‘undulating plateau’

two-four decades away. We at CERA have been conducting continuing research on future oil supplies, working up from a field-by-field basis.” Commenting on the issue of future oil supplies:

“ ... is an issue that needs most serious consideration. After all, the planet has a finite resource, and the world is consuming 30 billion barrels a year. But the understanding of the situation needs some clarification. Key considerations include technology, economics, timing, fiscal and regulatory terms, and a comprehensive understanding of current and future productive capacity. As we see it, the model for Peak Oil has been and continues to be flawed. The resource base is still poorly understood and it appears to continue to expand.”

The “expanding” resource base is due to redefining the word “oil.” The term “oil” has expanded to include large volumes of resources such as heavy oil, tar sand, oil shale, and even coal that can be turned into synthetic liquid fuel. The problem is that the recovery of these resources is quite energy inefficient. It takes almost as much energy input to obtain liquid fuel from these energy diffuse sources as their potential energy output.

Robert Esser listed six key aspects on which CERA is focused:

1. The world is not running out of oil in the near or medium term. ... field-by-field activity-based analysis points to a substantial buildup of liquid capacity over the next several years.
2. An increasing share of supplies will come from nontraditional oils, from the ultra-deep waters, oil sands, natural gas liquids, gas-to-liquids, coal-to-liquids, etc. As time goes on, these nontraditionals will become more traditional.
3. Rather than a peak, we should expect an undulating plateau, perhaps three or four decades from now.
4. One reason for the pessimism about future supplies is that the reserves disclosure rules mandated by the Securities and Exchange Commission are based upon three-decades-old technology and need to be updated. ...
5. The major risks to this outlook are not below ground, but above ground, in such forms as political turbulence, abrupt changes in contract terms, and controversy over fiscal terms.
6. Meeting the energy needs of a growing world in an environmentally sound fashion will be a major challenge. Doing so will require substantial investment and continuing technological innovation and will more likely be achieved through an open global economy.

Since the 1950s, the Olduvai Gorge in Tanzania has been strongly associated with human origins and the Stone Age way of life. The “Olduvai Theory” is a metaphor that suggests the impending return of the human race to a Stone Age way of life. In a lecture series titled, “Of Men and Galaxies,” given at the University of Washington by cosmologist Sir Fred Hoyle in 1964, he mentioned:

“It has often been said that, if the human species fails to make a go of it here on Earth, some other species will take over the running. In the sense of developing high intelligence this is not correct. We have, or soon will have, exhausted the necessary physical prerequisites so far as this planet is concerned. With coal gone, oil gone, high grade metallic ores gone, no species however

competent can make the long climb from primitive conditions to high-level technology. This is a one shot affair. If we fail, this planetary system fails so far as intelligence is concerned. The same will be true of other planetary systems. On each of them there will be one chance, and one chance only.”

The primary criticism by the economists of the geologists Hubbert-type models is a reliance on the Ultimate Recoverable Reserves (URR) as a static number rather than a dynamic variable, changing with technology, knowledge, infrastructure and other factors, but primarily growing. Campbell and Laherrère suggest that they have developed proprietary better analytical methods to resolve this problem.

In the 1970s, the economist Paul Ehrlich, rediscovering Malthus wisdom, foresaw a crowded, hungry world. In his popular book: “The Population Bomb,” he suggested that hundreds of millions of people would starve to death. This was a world in which England could not even exist and would disappear by the year 2000.

Another economist, Julian Simon challenged him, arguing that a free economy always reduces real prices. On September 29th, 1980, the two economists made a famous wager on whether the prices for 5 basic metals: chromium, copper, nickel, tin and tungsten, would actually go down, inflation adjusted, in the following ten years, despite population growth.

The winner on the bet was Julian Simon. On the September 29, 1990, the prices of all five metals were lower. Paul Ehrlich was richer with a check for \$576.07. In theory, Julian Simon will always win such a bet since competition and technology always force prices down. But while Julian Simon is right in theory, the guiding invisible hand of the market is not always gentle, where the price drops are associated with poverty, deflation, depression and war.

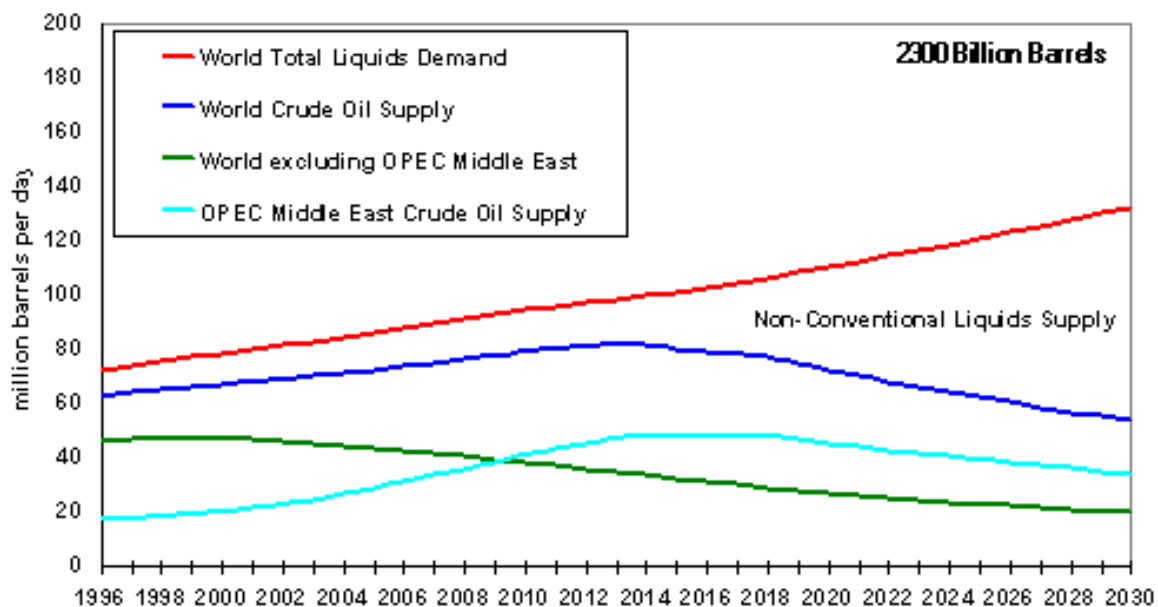


Figure 91. International Energy Agency (IEA) prediction of oil supply and demand up to 2030.

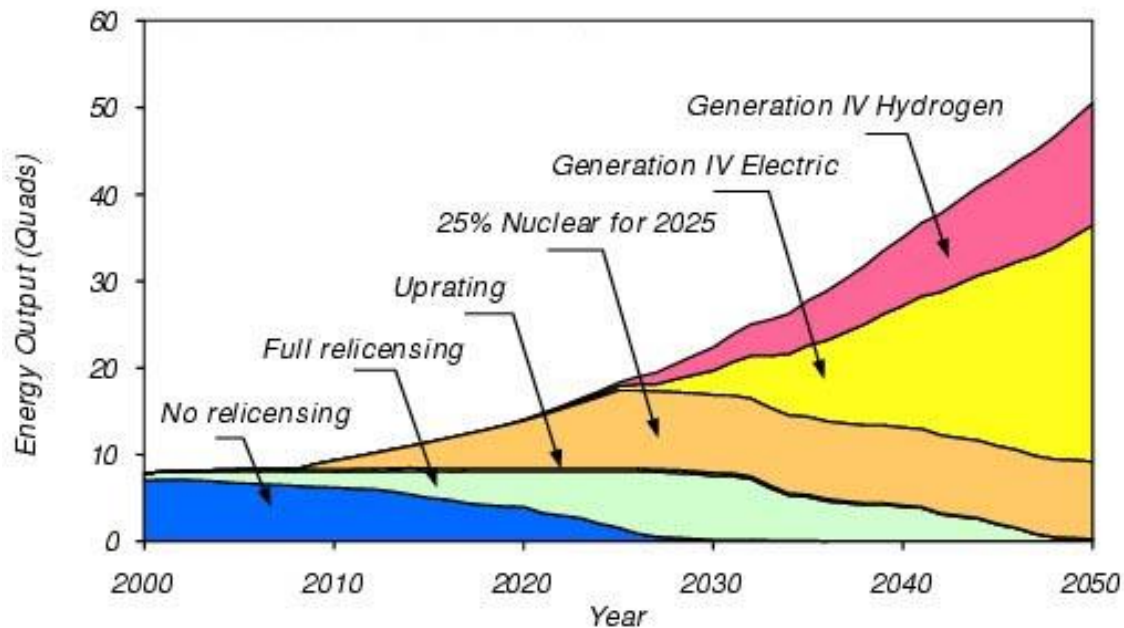


Figure 92. Possible contribution of nuclear energy to energy output to the year 2050. Source: Argonne National Laboratory, ANL.

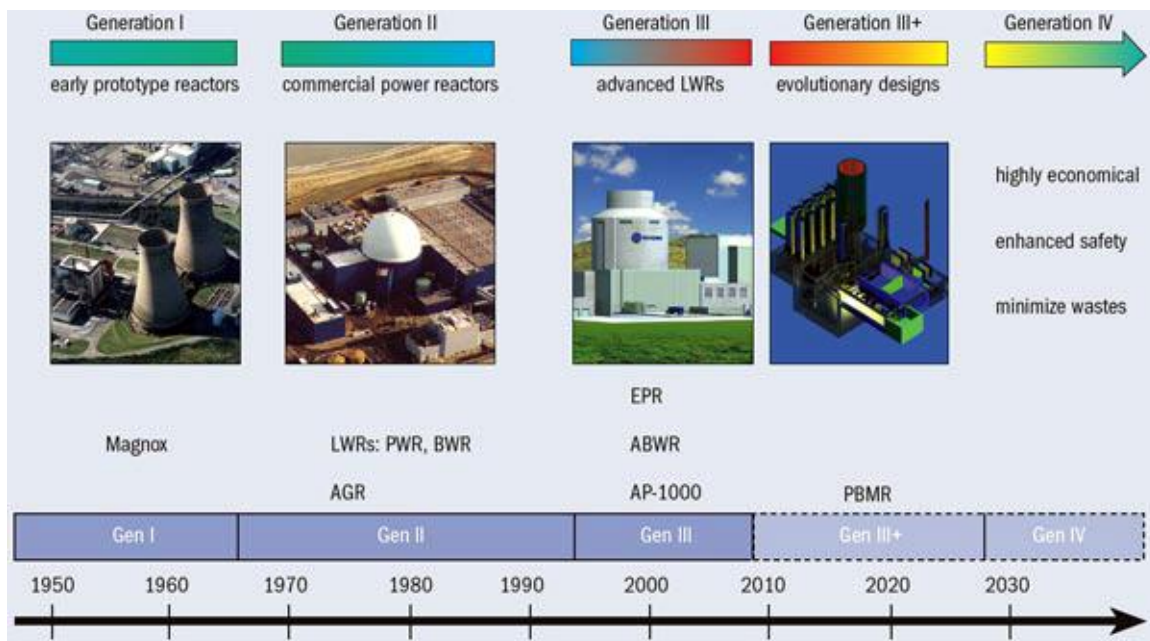


Figure 93. Evolution of reactor concepts and their deployment. Source: Argonne National Laboratory, ANL.

The problem is that everybody who has formed an opinion, through the concept of confirmation bias, is too sure of the opinion. Sir Francis Bacon described such a situation about 400 years ago: “The human understanding when it has once adopted an opinion, either as being the received opinion or as being agreeable to itself, draws all things else to support and agree with

it. And though there be a greater number and weight of instances to be found on the other side, yet these it either neglects and despises, or else by some distinction sets aside and rejects; in order that by this great and pernicious predetermination the authority of its former conclusions may remain inviolate.”

7.45 SOIL AND WATER SUSTAINABILITY

INTRODUCTION

A long term perspective of sustainable food production faces a dualism that pits production against conservation. Natural ecosystems where conservation is a consequence of production are advocated. A dramatic shift in policy must be associated with a shift in practices centered on soil and water conservation as opposed to fuel production.

Soil is a non-renewable resource much like fossil fuels. It is even more important because without it no food would be available whether petroleum is available or not. Offenses against soils have led to the decline and eventual collapse of civilizations that depleted their top soils such as the Carthagian Civilization in North Africa at the site of present day Tunisia.

A recent discovery that goes against what conventional wisdom has preached is that the heavy use of nitrogen from fossil fuels can harm carbon sequestration in the soil and decrease its organic content, hence its water retention ability and its fertility. The giant anhydrous ammonia (NH_3) that is manufactured from natural gas tanks injecting nitrogen in the fall and spring of each year in ground being prepared for corn planting, should be viewed as literally soil burners pulled by red (Case), green (John Deere) and blue (New Holland) shiny air conditioned tractors; not as soil enhancers, destroying farmers' and humanity's most valuable resource.

THE MORROW PLOTS

The USA's first experiment on the sustainability of cropping systems and fertilization practices is The Morrow Plots. These are located at the heart of the Urbana-Champaign campus of the University of Illinois. Established in 1876, they are predated only by the Rothamsted Field in England, which was started in 1843. The site was designated a National Historical Landmark on May 23, 1968.

The need to protect this invaluable source of data has been duly recognized over the years. The University of Illinois Undergraduate Library, which is located directly to the west of the plots, was intentionally built underground so as not to disturb the physical setting in terms of insolation of the plots.

They were founded by Manley Miles, a professor in agriculture, and George Morrow, the first dean of agriculture at the University. Only three of the ten original plots survive, with an observatory claiming two plots in 1895 and five others being given back as grassy areas in 1903. Little has changed since 1903 and over almost 150 years of use, the plots have provided invaluable data on the effects of crop rotation, natural soil nutrient depletion, and effects of various man-made and natural fertilizers on crop yield.



Figure 94. University of Illinois Morrow plots looking north. The University of Illinois Undergraduate Library, to the west of the plots, was intentionally built underground so as not to disturb the plots' sun exposure. Photo: University of Illinois at Urbana-Champaign.

The long term studies underway at the Morrow Plots on the impact of both fertilizer treatment and crop rotation on corn yield have proved particularly instructive in helping to shape the world agricultural practices. Comparison of corn yields in the Morrow Plots in relation to the crop sequence is possible only every six years, when all the plots are planted with corn.

The most recent available data come from 1997. In that year, continuous corn that had never been fertilized yielded only 54 bushels per acre. The two year sequence of corn and soybean that had never been fertilized yielded 94 bushels per acre, and the three year sequence of corn, oats, and hay reached 110 bushels per acre. The subplots treated with the recommended soil test level of fertilizer since 1955 jumped to 151 bushels per acre in continuous corn, to 191 bushels per acre in the two-year sequence, and to 200 bushels per acre in the three year sequence. Yields were consistently the lowest in continuous corn and the highest in the three-year sequence, whether or not the soil was fertilized.

ORGANIC SOIL CONTENT

With a starting level of about 6.0 percent organic matter in the surrounding grassy areas, the soil in the continuous corn plot had dropped to 4.1 percent by 1904. The two-year rotation of corn and oats measured about 4.5 percent organic matter, and the three-year sequence of corn, oats, and hay was measured at about 5.9 percent, indicating a differential drop in organic matter related to the crop sequence. Soil samples have been collected at least at 10 year intervals since 1904. Soil organic matter contents have been consistently higher in plots under the corn, oats, and hay sequence than in soils under the other two cropping systems. In plots where no fertilizer has been applied, the organic matter content first declined rapidly and then continued to decline at a slower rate under all cropping systems. Organic matter level losses have generally occurred more slowly in the south plots treated with manure. The only plots that no longer appear to be losing organic matter are the two and three year rotation plots that are treated with both the manure and inorganic fertilizer.



Figure 95. Tractor pulling an anhydrous ammonia applicator and liquid NH₃ tank in corn on corn ground. Photo: USDA/NRCS.

MYTH OF NITROGEN FERTILIZATION FOR SOIL CARBON SEQUESTRATION

The common practice of adding nitrogen fertilizer is believed to benefit the soil by building organic carbon, but this view has been disputed based on analyses of soil samples from the Morrow Plots. The research was conducted by the University of Illinois soil scientists Saeed Khan, Richard Mulvaney, Tim Ellsworth, and Charlie Boast and published in a paper: “The Myth of Nitrogen Fertilization for Soil Carbon Sequestration” in the November/December 2007 issue of the Journal of Environmental Quality.

The researchers were intrigued that corn growth and yields had been about 20 percent lower during the past 50 years since the onset of synthetic nitrogen fertilization in 1955 for the north continuous corn plots than for the south corn/oats/hay end of the Morrow Plots, despite considerably greater inputs of fertilizer nitrogen and residues.

After five decades of massive inputs of residue carbon of 90-124 tons per acre, all of the residue carbon had disappeared, and there had been a net decrease in soil organic carbon that averaged 4.9 tons per acre. Regardless of the crop rotation, the decline became much greater with the higher nitrogen rate.

The findings have troubling implications for corn production due to the widespread use of yield based nitrogen recommendations since the 1970s. The one-size-fits-all approach was intended to minimize the risk of nitrogen deficiency as insurance for high yields. Unfortunately, the usual result is over-fertilization, because of the assumption that the fertilizer supplies more nitrogen than the soil. The opposite is true in most cases, and especially for the highly productive soils of the USA’s Corn Belt that receive the highest nitrogen rates.

Excessive application rates cut profits and are disadvantageous for soils and the environment. The loss of soil carbon has many adverse consequences for productivity, one of which is to decrease water storage. There are also adverse implications for air and water quality,

since carbon dioxide will be released into the air, while excessive nitrogen contributes to the nitrate pollution problem.

PERENNIAL VERSUS MONOCULTURE AGRICULTURE

Despite the doubling of yields of major grain crops since the 1950s, more than one in seven people in the world suffer from malnutrition. As the global population is growing to the level of 7 billion in 2011, demand for food, especially meat, is increasing. Most of the land that is suitable for annual crops is already in use; and production of nonfood goods such as biofuels increasingly competes with food production for land.

The best lands have soils at low or moderate risk of degradation under annual grain production but make up 12.6 percent of global land area or 16.5 million km². Supporting more than 50 percent of the world population is another 43.7 million km² of marginal lands constituting 33.5 percent of the global land area is at high risk of degradation under annual grain production but otherwise capable of producing crops.

The global food security depends on annual grains as cereals, oilseeds, and legumes that are planted on 70 percent of croplands. Combined, they supply 70m percent of human calories.

Annual grain production compromises essential ecosystems, pushing some beyond their sustainable boundaries. To ensure food and ecosystem security, farmers need more options to produce grains under different less favorable circumstances than those under which increases in food security were achieved in the past century. Development of perennial versions of important grain crops could expand the available options.

It must be recognized that nature covers much of the Earth's surface with perennials. They are efficient users of solar radiation, water, and soil nutrients. They provide cover against wind and water erosion and efficiently sequester carbon.

Monoculture annuals such as corn, rice, wheat and soybeans are dependent on hydrocarbon-based energy and fertilizers. They are unable to deliver the needed food without further eroding the key elements of their production: water and soil. Such a practice is unsustainable and doomed to eventual failure.

Perennial grain crops could expand opportunities to rotate perennial and annual crops or to grow multiple crops together. For some traits, perennial crops have advantages over their annual counterparts. Wild perennials are often used as sources of disease resistance in annual crop breeding. Offspring from crosses between annual wheat and its perennial relatives are often resistant to diseases to which annual wheat is susceptible.

Plant breeding programs are working to domesticate intermediate wheatgrass, "*Thinopyrum intermedium*," and to develop perennial wheat by crossing it with wheat [29].

ADVANTAGES OF PERENNIAL CROPS

Perennial crops have advantages over annuals in maintaining important ecosystem functions, particularly on marginal landscapes or where resources are limited. Perennial grain crops would have similar advantages and also produce food. Compared with their annual counterparts, perennial crops tend to have longer growing seasons and deeper rooting depths, and they intercept, retain, and utilize more precipitation.

Longer photosynthetic seasons resulting from earlier canopy development and longer green leaf duration increase seasonal light interception efficiencies, an important factor in plant

productivity. Greater root mass reduces erosion risks and maintains more soil carbon compared with annual crops. Annual grain crops can lose five times as much water and 35 times as much nitrate as perennial crops. Perennial crops require fewer passes of farm equipment and less fertilizer and herbicide which are important attributes in regions most needing agricultural advancement.

Past efforts to develop perennial grain crops were limited by technologies and resources of the time. Efforts in the former Soviet Union and the USA to develop perennial wheat in the 1960s were abandoned in part because of plant sterility and undesirable agronomic characteristics. Recently, programs have been initiated in Argentina, Australia, China, India, Sweden, and the USA to identify and improve, for use as grain crops, perennial species and hybrid plant populations derived from annual and perennial parents: rice, wheat, maize, sorghum, pigeon peas, and oilseed crops from the sunflower, flax, and mustard families [29].

Lower-yield perennial crops could be options where higher-yield annuals cannot reliably achieve full yields. In semiarid regions of sub-Saharan Africa, annual crops often use less than 30 percent of rainfall owing to high rates of water draining below the root zones, evaporation, and runoff, which partly explains the meager 1 metric ton/ha yields of annual grains common in such regions. Perennial crops can reduce surface and subsurface water losses and be grown on highly erodible sites. For instance, perennial types of pigeon peas, important food crops and sources of biologically fixed nitrogen, are grown on steep slopes in regions of Malawi, China, and India.

As they intercept sunlight over long periods of the year and their roots take up deep-soil water and nutrients, many perennials can sustain greater aboveground production per unit land area than our most widely grown annual crops on fertile landscapes. For instance, with no fertilizer inputs and without the benefits of centuries of domestication, the perennial grass *Miscanthus* has 61 percent greater annual solar radiation interception efficiency by the plant canopy and can produce 59 percent more above ground biomass than heavily fertilized, highly domesticated annual maize. Regrowth of perennial crop stems and leaves after seed harvest may allow for additional harvests of biomass for livestock feed or biofuels.

The perennial grain crops could expand opportunities to rotate perennial and annual crops or to grow multiple crops together. These are important strategies in reducing pests and diseases.

For some traits, perennial crops have advantages over annual counterparts. Wild perennials are often used as sources of disease resistance in annual crop breeding. Offspring from crosses between annual wheat and its perennial relatives are often resistant to diseases to which annual wheat is susceptible.

Perennial grain crops could help meet a wide array of domestic and international challenges in food security, climate change, and energy supply. Along this line, the International Rice Research Institute initiated perennial rice research that was subsequently transferred to scientists in China with funding from China's National Natural Science Foundation.

DISCUSSION

The overuse of nitrogen fertilizer in the form of NH_3 or anhydrous ammonia from natural gas creates soil microbes that burn more organic matter in the soil than they add. This cannot be continued if a sustainable food production system is sought.

Incidentally, liquid ammonia has a history of 50 years of use, can be moved in pipelines like motor gasoline, has an octane value of 111, and can be used to fuel an engine replacing

gasoline. It can be produced, other than from natural gas, from ocean energy systems using wave energy, tidal energy or just ocean thermal processes.

The myth continues in that farmers sell carbon credits to heavy carbon emitters such as coal power plants operators giving the appearance to the carbon emitters as “green.” Since the corn farming method burns rather than banks carbon in the soil, the trading practice amounts to misrepresentation, to say the least.



Figure 96. First 100 billion dollars Zimbabwe currency issued by the Reserve Bank of Zimbabwe, July 1st, 2008; enough to buy two loaves of bread and worth 4 USA dollars. The feat was later surpassed a thousand times by the 100 trillion dollars bill.

Sustainability was on the mind when the University of Illinois was founded. The first agricultural building built in 1867, Davenport hall, has chiseled in stone on the building's west façade the following inscription:

“The wealth of Illinois is in her soil, and her strength lies in its intelligent development.”

This applies to the green fields of Illinois as well as those of Iowa, and farther away on the banks of the Nile, Danube, Euphrates and Ganges Rivers.

7.46 COMPETITION FOR RESOURCES, ARCTIC OCEAN CARVING

Geologists have identified 115 billion barrels of oil and 633 trillion cubic feet of natural gas reserves in the Outer Continental Shelf surrounding the USA's coastlines alone. As of 2008, there were 450 operating drilling platforms in the North Sea, and several thousands in the Gulf of Mexico.

There are numerous competing claims to the Arctic. Under international law, no country owns the North Pole and the region of the Arctic Ocean around it. Russia, Canada, Norway, Denmark (Greenland) and the USA are limited legally to 200 nautical miles from their coasts. Beyond that, the waters are considered “high seas”.

There are potentially huge reserves of oil and gas in the Arctic. All are making claims as to ownership. Russia, Canada and Norway in particular are claiming ownership of vast regions because of underlying continental shelves. In order to defend their claims. Canada is sending Arctic patrol ships and building an army training center in Resolute Bay and is refurbishing existing deep-water ports.

There are real tensions in the Arctic although those tensions are not at the same level as in East China and the South China Sea where large reserves of both oil and gas have been discovered in the East China Sea. Ownership of the fields is the source of conflict between China, Japan, the Philippines and Vietnam. China claims the region as theirs. There has been a large naval buildup by the USA in the region to protect Japan, the Philippines and Vietnam from what is being deemed Chinese aggression. USA warships are in both the East China and South China Sea and down through a major choke point, the Straits of Malacca. Japan is also rebuilding its military. China continues to press its claims in the East China and South China Sea.

In the summer of 2007, Russia laid claim to 460,000 square miles or 1.2 million square kilometers of the Arctic, using a submersible to drop a flag made out of titanium 2.5 miles beneath the ice at the bottom of the Arctic Ocean at the magnetic North Pole and planting the seed for future conflict about its potential energy resources among the countries surrounding the Arctic: the USA, Russia, Canada, Norway, Greenland and Denmark. It sent a nuclear powered ice breaker to map a subsea link between the North Pole and Siberia in an effort to circumvent a UN convention limiting resource claims beyond 200 miles offshore.

The United States Geological Survey (USGS) estimated that there could be 1.7 trillion cubic feet of natural gas and 90 billion barrels of oil. This amount of oil expected to be in the Arctic is more than all the known reserves of Nigeria, Kazakhstan and Mexico combined, and could meet current world oil demand of 86.4 million barrels a day for almost three years, or the USA for 12 years. This also includes 1,670 trillion cubic feet (tcf) of natural gas which is 1/3 of the world known gas reserves. This is equal to 2/3 the proved gas reserves in the Middle East and 4 times the current USA oil reserves. That does not include other resources such as manganese nodules, oil shale, coal bed methane and methane gas hydrates.

A USGS study took in all areas north of latitude 66.56 degrees north, and included only reserves that could be tapped using existing techniques. More than half of the undiscovered oil

resources are estimated to occur in just three geologic provinces: Arctic Alaska at 30 billion barrels, the Amerasia Basin at 9.7 billion barrels and the East Greenland Rift Basins at 8.9 billion barrels. More than 70 per cent of the undiscovered natural gas is likely to be in three provinces: the West Siberian Basin at 651 tcf, the East Barents Basins at 318 tcf and Arctic Alaska at 221 tcf.

Not to be outdone in the summer of 2008, the USA Coast Guard Cutter Healy left Barrow, Alaska on a mission to create a three dimensional map of the Arctic Ocean floor in the unexplored Chukchi borderland. During the three weeks mission, the crew was assigned the task of mapping the ocean floor and collecting data that will help oil and gas exploration projects and define the borders in the increasingly open waters due to global warming of the Arctic.

The Healy would be joined by Canadian scientists aboard an icebreaker to collect data on the thickness of sediment in the region. The real goal is to lay claim to a USA continental shelf north of Alaska extending to 600 nautical miles or 322 kilometers, rather than the customary 200 miles where coastal countries have sovereign rights over natural resources. It may even plant an underwater flag next to the one that the Russians planted down in the previous summer.

A quiet military buildup is occurring in the Arctic. Russia is planning to create a new northern frontier guard service to control its northern coast, which now looks suddenly vulnerable. Right now, it is covered with ice, but if the ice caps melt, it will be uncontrolled, and any ship capable of navigating there could reach any point on the northern Russian coastline. The other four nations bordering the Arctic: Canada, USA, Denmark, Iceland and Norway face a similar challenge.

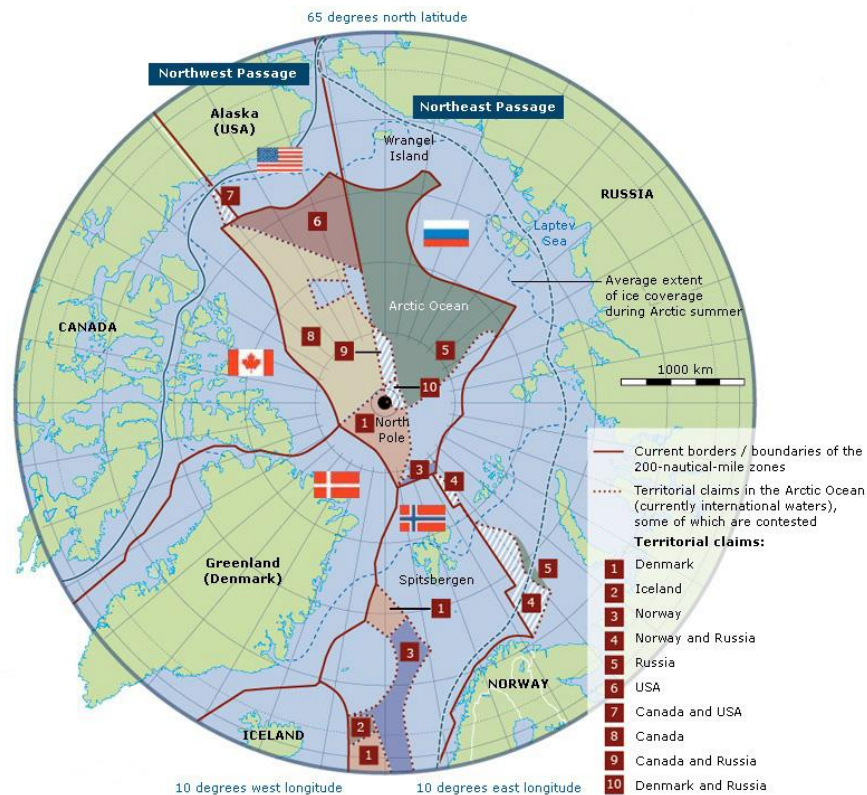


Figure 97. Arctic overlapping claimed territories. Russia claims an underwater mountain range that extends beyond the 200-mile line that is a natural extension of Siberia's continental shelf:

the Lomonosov Ridge. Source: International Boundaries Research Unit, Durham University, der Spiegel.

The Exxon-Mobil has boosted its Russian oil assets by 450 percent in 2015, despite sanctions imposed on Russia because of its annexation of the Crimea Peninsula and the Ukraine crisis. So direct participation and execution is forbidden, but not investment. The Exxon-Mobil Corporation continued to purchase rights to develop Russian oil deposits despite the imposed sanctions. It actually increased the area of purchased energy rights from 11.4 million acres to 63.7 million acres in 2014, which happens to be larger than the entire UK land mass. In 2014, the company added projects in the Laptev and the Chukchi Seas to ones in the Kara and Black Seas, which it owns jointly with Russia's Rosneft. The East Siberian Sea is adjacent to the Laptev Sea, which itself is adjacent to the Kara Sea. By contrast, the Chukchi Sea divides Siberia from Alaska in the Arctic region north of the Bering Strait. In 2012, the Russian officials argued the potential to be so high that their regional development will require new airports capable of handling thousands of drillers, as well as the arrival of scores of offshore platforms. Rosneft estimates that the development costs in the Kara and Black Seas alone will be around \$350 billion. A significant amount of future oil output is required to offset that cost, which is on par with the entire Russia-China energy pact called the Holy Grail announced in 2014.



Figure 98. USA Coast Guard cutter Healy. Reuters Photo.



Figure 99. Russian titanium flag dropped in the summer of 2007 by a submersible equipped with a robotic arm at the bottom of the Arctic Ocean, staking its claim to the Lomonosov Ridge.

7.47 NO-PEAK URANIUM IN SIGHT

The expected global nuclear-power renaissance means that a large number of nuclear power plants will be built in coming years. Some nuclear operators are worried about their uranium fuel supply. For instance, Japan's Kansai Electric Power, which accounts for nearly 1/3 of Japan's total uranium demand plans to buy uranium mines to ensure its long term supply of the fuel. Its chief manager said he worried that in coming years he would not be able to buy what he needs "no matter how much you are willing to pay."

Worries about long term uranium supplies surface every so often; talk of a global nuclear revival fans the flames.

However, the International Atomic Energy Agency (IAEA) and Nuclear Energy Agency (NEA) assert that there is enough uranium to power the existing plants for 100 years.

About 40 percent of the current uranium supplies come from stockpiles and old weapons, not from uranium mines, so new sources need to be developed soon to avoid uranium supply shortfalls.

As nuclear power's growth is expected to nearly double, the world's appetite for uranium by 2030, according to the IAEA/NEA "Red Book," but there should be enough in the ground to go around:

To fuel this expansion, annual uranium requirements are anticipated to rise to between 94,000 metric tonnes and 122,000 metric tonnes, based on the type of reactors in use today. The currently identified resources are adequate to meet this expansion. Recent years have seen an explosion in uranium exploration after two quiet decades, adding to the global reserves.

Higher uranium prices just encourage even more exploration. The World Nuclear Association suggests that if the uranium prices would double, the recoverable reserves will rise ten-fold, provided that the environmental concerns about uranium mining do not affect new projects.

What uranium-supply fears could do is stoke more interest in fuel recycling and the use of alternative fuel cycles such as breeding from both the U^{238} fuel cycle and the Th^{232} which is three times more abundant than uranium, fuel cycle. The current once through fuel cycle in the USA uses 1/2 of a percent of the potential energy content of the fuel. The use of fissile breeding can extend the present uranium and thorium supplies 50-100 fold.

Considering alternate supplies from sea water at ten times the present cost of uranium, and since and phosphate rocks would increase the long-term availability of nuclear energy from a century to thousands of years. Nuclear fuel costs are about 10 percent of the total electricity cost. The actual uranium cost is about 25 percent of the fuel cost. Even if uranium from seawater and phosphate rocks is 10 times the cost of mined uranium, this increases the cost of nuclear generated electricity only by: $10 \times 0.10 \times 0.25 = 0.25$ or just 25 percent. As of December 2008, base load power production considerations have encouraged USA utilities to submit to the Nuclear Regulatory Commission, NRC for review, applications to build 21 nuclear power plants that would cost about \$112 billion.

7.48 WORLD'S ECONOMY

The world's economy is polarized into two groups. The most populous emerging group of 7 nations or E7 constitutes 49 percent of the world's population, and controls just 18 percent of its wealth. The group of industrialized nations G7, on the other hand, constitutes 11 percent of the world's population but controls a whopping 53 percent of its wealth.

Table 43. Emerging economies E7 countries population and Gross Domestic Product (GDP), 2009.

Country	Population [million]	Nominal GDP [\$ billion] 2009
China	1,324	4,985
India	1,157	1,310
Indonesia	240	540
Brazil	199	1,572
Pakistan	181	167
Russia	140	1,231
Mexico	111	875
Total	3,352	10,679
Percent of world's total	49	18

Table 44. Industrialized economies G8 countries population and GDP, 2009.

Country	Population [million]	Nominal GDP [\$ billion] 2009
USA	307	14,256
Japan	127	5,068
Germany	82	3,347
France	64	2,649
UK	62	2,175
Italy	58	2,113
Canada	33	1,336
Total	734	30,943

Percent of world's total	11	53

Many of the emerging economies are averaging 6 percent GDP growth and personal incomes are rising at around 8 percent per year. The emerging economies host 27 percent of the world's purchasing power, and these countries are growing with free market economies and huge infrastructure spending. This is generating a present and future stiff competition for the world's capital, food, mineral, fresh water and energy resources.

7.49 UNSUSTAINABLE DEBT

In 1903, the USA's government spending was 6.8 percent of GDP at \$25.9 billion. By 1940 it accounted for 20.14 percent of GDP at \$100 billion. In 2010, it reached 43 percent of GDP.

On January 10, 2011, the USA Treasury Department reported the following debt figures:

Debt held by the public: \$9,382,983,184,150.78

Intragovernmental Holdings: \$4,631,361,824,867.85

Total Public Debt Outstanding: \$14,014,345,009,018.63

This is about $\$14 \times 10^{12}$ or \$14 trillion. The dimensions in inches of the dollar bills are: $2.6 \times 6.14 \times 0.0043$ in. Stacking the total public debt as one dollar bills atop each other leads to the following height:

$$\begin{aligned}
 14.01 \times 10^{12} \times 0.0043 &= 6.02 \times 10^{10} \text{ inches} \\
 &= \frac{6.02 \times 10^{10}}{12} = 5.02 \times 10^9 \text{ feet} \\
 &= \frac{5.02 \times 10^9}{3} = 1.67 \times 10^9 \text{ yards} \\
 &= \frac{1.67 \times 10^9}{1,760} = 9.49 \times 10^5 \text{ miles} \\
 &= 949,000 \text{ miles}
 \end{aligned}$$

To place this into perspective, the circumference of the Earth is 24,902 miles and the distance from the Earth to the moon is 238,857 miles.

What is even more compelling is that the mountain of debt keeps increasing in height through the interest payment on this very debt. According to the USA Treasury Department, this amounts to \$1.13 billion / day or \$413 billion in the year 2010 alone. This interest payment would not be a real problem if the tax revenue exceeded the spending. Even if Americans were taxed 100 percent of their income for an entire year, the debt could not be repaid.

For a USA population of 312 million persons, each citizen's share of the debt is:

$$\frac{\$14.01 \times 10^{12}}{312 \times 10^6 \text{ persons}} = 4.49 \times 10^4 = \$44,900 / \text{person}$$

The average USA family of 2.8 has just \$7,918 in savings to offset that $44,900 \times 2.8 = \$125,720$ per family debt. Such unsustainable situation can only be remedied either by debt default or through repayment using an inflated debauched and depreciated currency.

7.50 UNSUSTAINABLE GRIDLOCK DEBT PARADIGM

The EU and the USA are following an unsustainable model of borrowing money and creating debt to boost their economic development. However they are borrowing money from the future. They mortgage a virtual fortune that they may, or may not earn for their credit worthiness and their current consumption. This has been the adopted model since World War II. However, this model became obsolete in the financial debt crisis of 2008. The authorities chose to substitute the credit of the states for the credit of the financial system that had collapsed under the weight of that debt. This may be artificial life-support but is not an addressing the real problem. Continuously creating demand for credit to enlarge capital and cash flow is unsustainable for countries that adopted the strategy. It used up their credit worthiness, and is depreciating their currencies. The model of economic development in the Western capitalist countries must be rethought.

The only alternative is to return to the previous Western experience of a real sustainable economy that creates values and money through real economic development as production in industrial manufacturing and agriculture. Revenue and expenditures must be balanced for concrete sustainable economic development not smoke and mirrors in debt creation.

The analysis of John Maynard Keynes of government deficit spending during periods of economic contraction may still be relevant with one basic difference between the present and the past in the 1930s. In the 1930s, governments had practically no debt and could therefore run deficits and then replace it with surpluses in periods of economic growth. A basic modification of John Maynard Keynes' ideas would be that if governments can still benefit from running fiscal deficits, the new debt has to be invested in a way that will pay for itself with the money spent strictly to increase productivity.

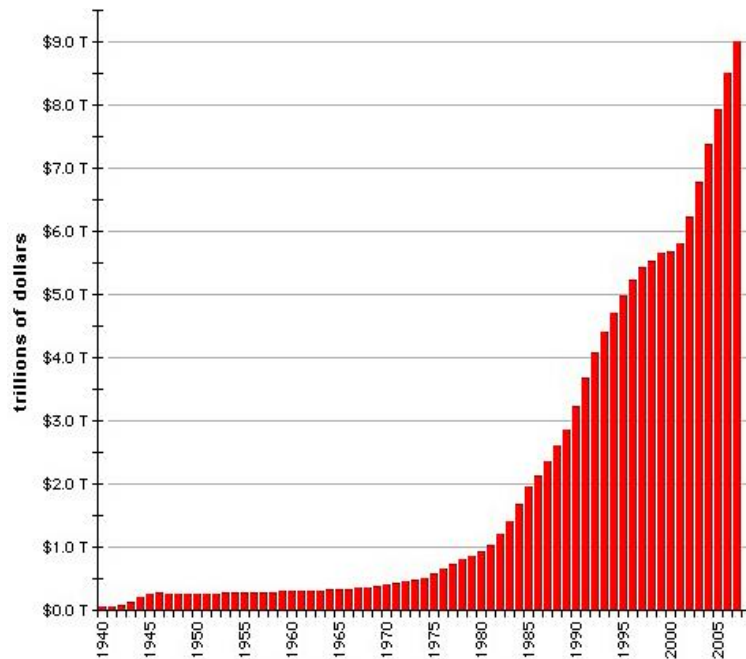


Figure 100. Growth of USA national debt 1940-2010. Source: USA National Debt Clock.

Table 45. Debt accumulation in the USA. The 42.7 percent largest debt accumulation was during President George W. Bush's tenure.

Time period	Share of USA debt [percent]
Up to 1981, Prior to Ronald Reagan	7
1981-1989, Ronald Reagan	13.2
1989-1993, George W. H. Bush	10.5
1993-2001, Bill Clinton	9.8
2001-2009, George W. Bush	42.7
2009-2011, Barack Obama	16.8
Total, 2011	100.0

Table 46. Growth of USA debt from 2000 to 2011.

Budget item	2000 [\$ billion]	2011 [\$ billion]	Increase [percent]
Social security	409	748	82
Health care	352	882	150
Defense and funds for veterans	341	910	167

The 42.7 percent largest debt accumulation by the USA was during President George W. Bush's tenure and is continued by President Barack Obama who faces political gridlock and is unable to muster a majority to extricate the nation from his predecessor's established policies.

The USA is faced with a serious choice of either to continue with a program of trying to police the entire world or defend only its cherished way of life within its own territory. If it continues to police the world, it will face the inevitable fate of previous empires, including that of the Soviet Union in recent history: it will face bankruptcy, will not be able to finance an ever expanding military, and will face disintegration along with its economy and its currency. If it remedies the situation, it can save its currency, economy, and way of life. In a choice between guns or butter a rational historical choice is without doubt butter over guns. Unsustainably defending a great temporary empire is a sure death wish. The majority of Americans never supported the concept of an empire anyway.

Table 47. Revenue and Expenditures of the USA government. Source 2011 Budget.

Revenue [percent]		Expenditures [percent]	
Income tax	53	Defense and funds for veterans	24
Social insurance contributions	37	Health care	23
Other revenue	10	Social security	20
		Other	33
Total	100		100
	\$2.2 trillion		\$3.8 trillion
Deficit: \$1.6 trillion			

Table 48. USA Creditors.

Creditor	Share of USA debt [percent]
Foreign countries	29.0
Public debtors: Pension funds, USA banks	26.0
Social security trust funds	19.6
Other government trust funds	13.8
Federal Reserve Central Bank	11.6
Total (\$14.3 trillion)	100.0

Table 49. USA Foreign Creditors.

Creditor	Share of USA debt, July 2011 [percent]
China	26.7
Japan	20.3
UK	7.7
Brazil	4.7
Taiwan	3.4
Russia	2.8

Hong Kong	2.7
Switzerland	2.4
Luxembourg	1.5
Germany	1.3
Other	26.5

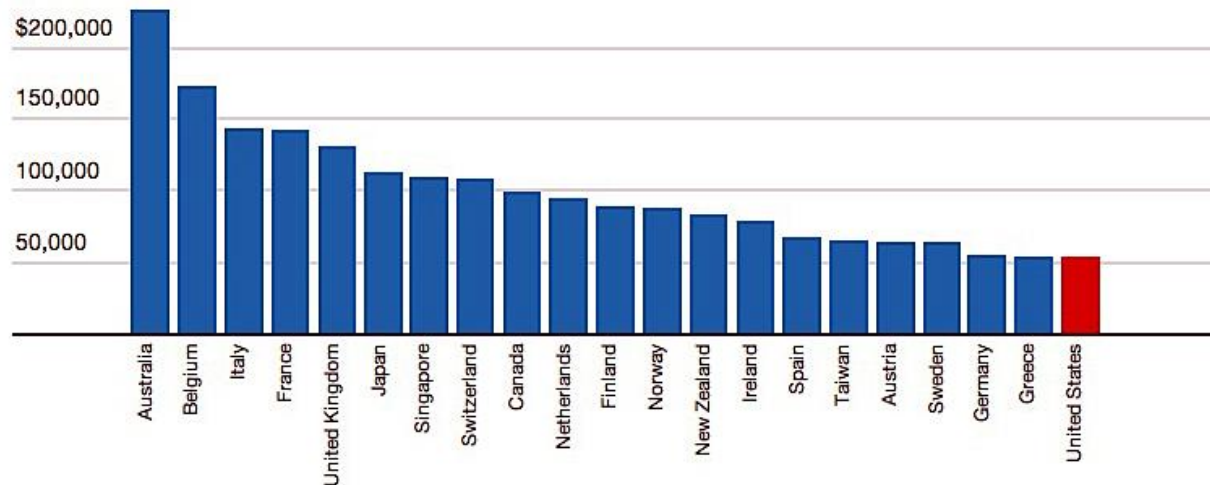


Figure 101. Median individual wealth in different countries. In 2008, 53 percent of Americans considered themselves as “Middle Class.” In 2014, the number fell to 44 percent, with 50 million Americans receiving government help as “food stamps.”

7.53 CENTRALIZED VERSUS DECENTRALIZED PLANNING

Economist F. A. Hayek wrote an article “The Use of Knowledge in Society,” during World War II in 1945. He argues that the economic problem is radically misconstrued. According to F. A. Hayek, Economics was not really about how best to employ social resources. He reasons that the economic problem is about finding a distributed system that made the best possible use of the various forms of knowledge of time and place that exists in the minds of individuals. This knowledge cannot be possibly accessible to central planners:

“The peculiar character of the problem of a rational economic order is determined precisely by the fact that the knowledge of the circumstances of which we must make use never exists in concentrated or integrated form, but solely as the dispersed bits of incomplete and frequently contradictory knowledge that all the separate individuals possess. The economic problem of society is thus not merely a problem of how to allocate ‘given’ resources — if ‘given’ is taken to mean given to a single mind, which deliberately solves the problem set by these ‘data.’ It is rather a problem of how to secure the best use of resources known to any of the members of society, for ends whose relative importance only these individuals know. Or to put it briefly, it is a problem of the utilization of knowledge which is not given to anyone in its totality.”

An example of the gaffes of central planners occurred between the years 1999-2002 when the British government sold a large amount of its national gold: nearly 395 metric tonnes at a measly price of about \$275 per ounce. The Bank of England used the proceeds to purchase “high-yielding” assets, like bonds. The British used to fight wars for gold such as the Boer War. Here they sold gold to buy bonds. Then precious metals staged an advance until gold touched the \$1,000 mark in March 2008. After which the price retreated 25 percent during that year’s debt crisis. Even at this price gold was still almost three times what the British government took in less than a decade earlier.

Economist Murray Rothbard describes in his essay: “Anatomy of the State”:

"...the State is that organization in society which attempts to maintain a monopoly of force and violence in a given territorial area ... [it] provides a legal, orderly, systematic channel for the predation of private property; it renders certain, secure, and relatively 'peaceful' the lifeline of the parasitic caste in society...[and] the majority must be persuaded by ideology that their government is good, wise, and, at least, inevitable ... ideological support being vital to the State, it must unceasingly try to impress the public with 'legitimacy,' to distinguish its activities from those of mere brigands."

Fredéric Bastiat puts it: "The state is the great fiction by which everyone seeks to live at the expense of everyone else." The process works well through a carefully-inculcated reverence for 'democracy'. The state grows to the point where a bloated majority of its citizenry are dependent on the state in some way or the other, as government bureaucratic employees, welfare recipients, and the military and police forces, and there will naturally be an in-built electoral majority in favor of state predation; an obviously unsustainable state of affairs.

George Bernard Shaw similarly suggests: "A government which robs Peter to pay Paul can always depend on the support of Paul."

7.52 FUTURE OUTLOOK

NEW TECHNOLOGIES

At the University of Chicago Business School in the 1970s, monetary economist Milton Friedman used the aphorism: “Predictions are extremely difficult, especially when they are about the future.” Most economical predictions are not truly predictions but just extrapolations into the future. They end up occurring, but only for a while, before following their own inherent paths. The better predictions in economics usually follow the basic assumption that prices and growth rates will go back to their historic averages, or “revert to the mean.” The difficulty is guessing when that will happen. The timing is unpredictable, even though it eventually occurs.

In the last 240 years, the world economic system evolved technologies that grew over a human average lifetime of 60 years, became obsolete, and were superseded by alternative technologies.

Table 50. Replacement technologies 60-year cycle in the last three centuries [31].

Period	Technologies
1771-1829	Industrial Revolution, machinery, factories, canals
1829-1875	Steam Engine, coal, iron, railroads
1875-1908	Heavy Engineering, electrical, chemical, naval, civil
1908-1971	Transportation, cars, oil, petrochemicals, mass production
1971-2012	Information Technology, Telecommunications, Hydrocarbons Energy
2012-????	Robotics, Green Technologies, Renewable Energy, Nuclear Energy, Biotechnology, Nanotechnology, Bioelectronics, Engineered materials

Scientists, as physicists, biologists and engineers are from another perspective pursuing newer approaches to secure energy supplies for the future. Nuclear energy in addition to wind, direct solar heating and photo-voltaic and indirect solar hydroelectric, wind and biomass sources will be inevitably pursued in the immediate future, and nuclear fusion for the longer term. Considerations of environmental pollution and global warming suggest in particular a new energy economy using hydrogen as a nuclear, solar or wind energy carrier, for transportation and residential electricity use. In this future energy scenario, internal combustion engines will be supplemented and gradually replaced by fuel cells producing electricity through an electro chemical process using hydrogen, and releasing nonpolluting water vapor as a reaction product.

Energy crises can and did in fact happen in the world and in the USA. Oil production in the USA is known to have already peaked around 1974, and now about 55 percent of the oil consumed in the USA is imported. The Global Hubbert Peak curve based on the ultimate recovery of world liquid hydrocarbons including conventional oil and natural gas liquids hydrocarbons of 2,000 Giga barrels (Gb), and non-conventional oil of 750 Gb, predict that the global production of oil liquids will also peak around 2015-2020. Knowledge about these predictions among well informed oil industry experts in the governments of industrialized nations is sending them into a scramble, using diplomatic means, economic incentives, and military means when deemed necessary, to secure access to the remaining large oil basins in the world.

With 7 billion people in the world in 2011, by 2030 this number is expected to reach 8 billion. The global economy will then double in size with a growing number of energy users with a common quest for improved standards of living. By 2030, energy demand is expected to increase by 50 percent from today's level, driven by economic expansion and population growth, with about 80 percent of the growth in energy demand occurring in the non-Opec nations. Oil, gas and coal will probably remain dominant at about 80 percent of the total energy consumed, with increased carbon dioxide emissions from both developed and developing nations. New technological advances are critical to successfully meet the energy demand and supply challenges.

Should the renewable resources in hydroelectricity, solar, wind, biomass and geothermal not be able to replace the depleting oil, nuclear energy would inevitably have to be brought in to replace the disappearing resources. By energetic technological development of a fourth generation of fission power plants for hydrogen production, by 2050, 50 percent of the electricity

production in the USA could be nuclear compared with the present 19 percent. With the use of nuclear energy for hydrogen production for transportation, using fuel cells, nuclear energy could contribute 25 percent of the transportation fuel needs.

About 3 percent of the USA automotive fuel supplies coming from corn ethanol could be supplied several times over at a fraction of the cost, by raising the auto fuel efficiency standards by 20 percent. This has been resisted by the auto manufacturing companies, preferring to produce flexible fuel vehicles that will burn either gasoline or ethanol, to avoid retooling their production lines.

Solar and wind farms and nuclear power plants can feed cheap electricity into the USA electrical grid. The USA could have cars running primarily on nuclear, solar and wind energy, and at the gasoline equivalent of less than \$1/gallon. A shift can be achieved to gas electric hybrid plug in cars for short-distance driving, such as the daily commute or grocery shopping.

UNSUSTAINABLE EXTRACTIVE ECONOMIES

Economist Paul Craig Roberts observed:

“Great empires, such as the Roman and British, were extractive. The empires succeeded, because the value of the resources and wealth extracted from conquered lands exceeded the value of conquest and governance.

Washington’s empire extracts resources from the American people for the benefit of the few powerful interest groups that rule America. The USA Constitution has been extracted in the interests of the Security State, and Americans’ incomes have been redirected to the pockets of the 1 percent.”

Tens of trillions of dollars are being extracted from the USA. The “extraction” process involves an entire integrated system: financial system, trading system, taxing system that was created by both political parties over a period of two decades. A class of financial engineers are intentionally stripping the productive classes of their remaining savings, wealth and retirement assets with the status quo operational machine retaining all the power.

In “Confessions of an Economic Hit Man,” John Perkins suggests:

“This empire, unlike any other in the history of the world, has been built primarily through economic manipulation, through cheating, through fraud, through seducing people into a way of life.”

Civil liberties blogger and former constitutional litigator Glenn Greenwald speaks of a “Palpable lack of elite fear”:

“Even in the wake of the oligarch-caused 2008 financial crisis that has spawned extreme levels of sustained suffering around the globe, and even as social unrest emerges in several places in the Western world as a result of this insecurity and sense of outrage and betrayal, the American elite class still seems remarkably free of any such fear.

Their ability to rope themselves off from the society they are degrading, combined with the para-militarization of domestic police force, and the rapidly increasing domestic powers of surveillance and detention, have convinced them, I think, that they need not fear any protest movements or social unrest, that America can and will become more and more of a police state to suppress it.”

The Central banks perspective to cure the debt problem is to buy bonds issued by their treasuries using printed fiat currency. The Treasury’s debt is cancelled, although it can still be technically recorded as debt, it is effectively cancelled. This leads to a lowering of the interest rates. Debtors refinance at lower interest rates. Debt investors, such as retirement funds lose out when this occurs. Savers and retirees receive lower returns. Wealth is transferred from savers to debtors, and the economy would recover.

The fallacy here is that without savers, there is no capital formation since capital is saved labor. Without productivity gain there would not be any real economic growth. Without economic growth the nation becomes impoverished. This leads to a long period of meager growth, high unemployment and periodic financial crises. With a time delay, this evolves into social upheaval with sections of society turning against others, starvation, revolution, rebellion and war. The ruling elite in the USA is aware of this possibility and is prepared for it with a large supply of stored “casket liners.”

MIRED IN DEBT

In the USA, people used to own about 70 percent of their homes as owner equity and 30 percent was a mortgage owned by a financial institution such as a bank or a Savings and Loan Company. In an unsustainable fashion, home owner equity in their homes is down to 52 percent, just about half the house. The neighborhood bank has divided the mortgage into “tranches” that were sold to some financial company, which in turn sold it to some global hedge fund. The remaining 48 percent of the home may be in the hands of a German financier or a British speculator.

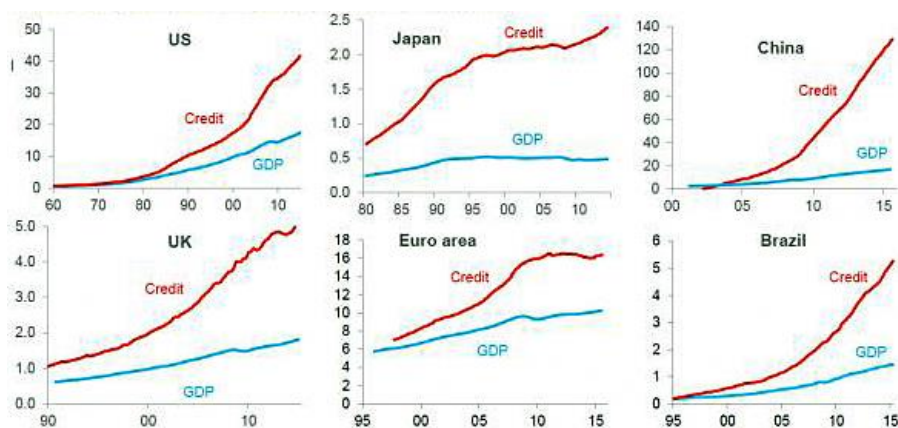


Figure 102. Debt relative to Gross Domestic Product (GDP) in major economies identifies a solvency rather than a liquidity situation.

“THE EUTHANASIA OF THE RENTIER”, UNSUSTAINABILITY OF ZERO-INTEREST RATE POLICY, ZIRP

British economist John Maynard Keynes is quoted with a phrase that has recently revealed its true meaning: “the euthanasia of the rentier.” It gives away the well-kept secret of the redistributive society: stripping its elderly pensioners and retirees of their savings and use the proceeds for other favorite social programs including financing conflicts and wars.

A direction of the USA Federal Reserve central bank taking shape as "extended forward rate guidance" of a zero-interest-rate policy (ZIRP) through 2017, is expected to lead to significant unintended consequences. In “The General Theory of Employment, Interest and Money,” published in 1936, John Maynard Keynes referred to what he called the "euthanasia of the rentier." John Maynard Keynes argued that interest rates should be lowered to the point where they secure full employment through an increase of the ensuing investments. At the same time he pointed out that such a policy would destroy the livelihoods of the “rentiers” who lived off of their investment income. This describes the implications of the “Quantitative Easement” or QE policy.

This neo-Keynesian central banking policy suggests that low interest rates would encourage consumer spending and increase employment and should thus be promoted at the expense of savers, pensioners, and retirees. A forgotten fact is that savers, pensioners and retirees would now have less to spend and therefore less propensity to do it. This financial repression is advocated in the name of the greater good. It hurts those who played by the rules, working and saving all their lives, only to see the rules of the game changed.

The destruction of the present and future returns of pension funds is unavoidable and will require massive restructuring by both beneficiaries and taxpayers. People who have made retirement plans based on past return assumptions will be fully disappointed.

TRILLION DOLLAR PLATINUM COIN, DEBT CEILING

For the USA government to go around its debt ceiling, a suggestion was made by economist Paul Krugman in the New York Times for the USA Treasury to mint a trillion dollar platinum coin and then deposit it with the Federal Reserve Bank. By this “circus trick” and “executive overreach,” the government can spend the created new money. If the government goes through the Federal Reserve, it is borrowing money. If it goes through the USA Mint, it is making money.

Paul Krugman
New York Times
January 7, 2013

“There's a legal loophole allowing the Treasury to mint platinum coins in any denomination the secretary chooses. Yes, it was intended to allow commemorative collector's items – but that's not what the letter of the law says. And by minting a \$1 trillion coin, then depositing it at the Fed, the Treasury could acquire enough cash to sidestep the debt ceiling – while doing no economic harm at all.”



Figure 103. Suggestion for a \$1 trillion platinum coin to “sidestep the debt ceiling.”

In the past, money was considered as something of value and that value requires effort in the form of human energy. Metals have been money for centuries because they have to be mined which requires human effort. Everything produced and tangible is money because it too takes human energy to produce. Currency on the other hand can be created without effort and then spun as money by creating value by imposing the power to tax in that currency. Money cannot be created out of thin air, but currency can.

In the modern banking system, money is primarily a medium of exchange. Currency, as in cash coins and reserves are one form of “outside money.” In the banking system money is primarily entries in accounting software running on computer systems denominated in USA dollars created by banks. This is designated as “inside money.” These electronic deposits give access to real goods and services at a certain value. Presently, money is primarily bank deposits in a scheme which can buy things that the depositors can afford.

The idea is an ingenious use of the law to avoid a ridiculous and irresponsible situation in which the country would be driven to default. Another borrowing scheme would involve the Treasury and the Federal Deposit Insurance Corporation, which could potentially allow ready access for the government to an infinite amount of spending funds.

According to Philip N. Diehl, 35th director of the United States Mint, this is how the process would work:

“I am the former Mint director and Treasury chief of staff who, with Rep. Mike Castle, wrote the platinum coin law and produced the original coin authorized by the law. Therefore, I am in a unique position to address some confusion I have seen in the media about the \$1 trillion platinum coin proposal.

In minting the \$1 trillion platinum coin, the Treasury Secretary would be exercising authority which Congress has granted routinely for more than 220 years. The Secretary’s authority is derived from an Act of Congress (in fact, a GOP Congress) under power expressly granted to Congress in the Constitution (Article 1, Section 8).

What is unusual about the law (Sec. 5112 of title 31, United States Code) is that it gives the Secretary complete discretion regarding all specifications of the coin, including denominations.

Moreover, the accounting treatment of the coin is identical to the treatment of all other coins. The Mint strikes the coin, ships it to the Fed, books \$1 trillion,

and transfers \$1 trillion to the treasury's general fund where it is available to finance government operations just like with proceeds of bond sales or additional tax revenues. The same applies for a quarter dollar.

Once the debt limit is raised, the Fed ships the coin back to the Mint, the accounting treatment is reversed, and the coin is melted. The coin would never be "issued" or circulated and bonds would not be needed to back the coin.

There are no negative macroeconomic effects. This works just like additional tax revenue or borrowing under a higher debt limit. In fact, when the debt limit is raised, Treasury would sell more bonds, the \$1 trillion dollars would be taken off the books, and the coin would be melted.

This does not raise the debt limit so it can't be characterized as circumventing congressional authority over the debt limit. Rather, it delays when the debt limit is reached.

This preserves congressional authority over the debt limit in a way that reliance on the 14th Amendment would not. It also avoids the protracted court battles the 14th Amendment option would entail and avoids another confrontation with the Roberts Court.

Any court challenge is likely to be quickly dismissed since (1) authority to mint the coin is firmly rooted in law that itself is grounded in the expressed constitutional powers of Congress, (2) Treasury has routinely exercised this authority since the birth of the republic, and (3) the accounting treatment of the coin is entirely routine.

Yes, this is an unintended consequence of the platinum coin bill, but how many other pieces of legislation have had unintended consequences? Most, I'd guess."

Some consider the debt ceiling as a legitimate democratic tool and that refusing to raise it is not equivalent to default. It imposes a future spending limit on the government in power. Others hold the view that not raising the debt ceiling would constitute a default, because it would force the Treasury to stop payments on things that have already been appropriated by Congress.

The system is unsustainable because fiat currency systems always break down, due to fraud and the misallocation of capital such as into inflated bonuses to management teams. There exists no incentive to make money when creating currency is easier. In the end the system becomes devoid of enough money to operate due to the abundance of currency leading to a crisis without advance warning.

CURRENCY WARS, FINANCIAL WARS, BEGGAR THY NEIGHBOR, DEGLOBALIZATION

Currency wars refer to the process of central banks printing up their own currencies and buying trading competitors' assets, mostly government bonds. An instance of this war is the Swiss National Bank (SNB) operating like a hedge fund, buying mostly foreign assets, including French government bonds. The SNB's balance sheet has grown fivefold since 2008, and became loaded with non-Swiss assets. If the values of the assets fall, the normal central bank response is to print even more currency and redouble efforts to support the prices for those assets. So much new currency leaks into the financial system that its value falls.

Other central banks then worry about the ‘strength’ of their own currencies. They then retaliate, beef up their trading desks, print their own currencies and buy bonds and other assets denominated in the trade competitors’ currencies.

Rather than trench warfare, as in WW I, economic competitors are funding each other’s budget deficits through their own central banks. This leads to a continued growth of the bankrupt welfare state and a slow suffocation of the private sector. Governments borrow at near-zero rates of interest from eager bond buyers at central banks, while international trade grinds to a halt amid the chaos.

Currency wars are different than financial wars. A currency war is an economic policy countries use to fight deflation and encourage inflation by cheapening the currency and creating inflation in the form of higher import prices. It is a way of creating monetary easing. It is an age-old economic policy, used in the late 1920’s and 1930’s in what became known as the “beggar thy neighbor” policy. Countries were stealing growth from each other by debasing their currencies, trying to import inflation and improve their trade balances by causing cheaper exports to foreign buyers and more expensive imports for domestic buyers. That combination was seen to bolster growth.

In the different financial war, countries that are traditional economic rivals, for instance the USA, Russia, and China, with competing interests everywhere from Eastern Europe to the South China Sea, are involved. Countries have fought wars in the past using traditional kinetic methods involving standing armies, navies, air forces, missiles, and submarines. In the present age, asymmetric forms of warfare are used, like chemical, biological, guerilla warfare, proxy and mercenary factions, terrorism, cyber and financial warfare. China buying gold and selling the dollar is not a currency war; it was a financial war. The objective is to destroy the economy of your opponent, which is a very different situation.

A reversal of globalization ensues with the central banks ushering in the end of the ‘global economy’ and leading to the resurgence of intra-country trade within closed borders. Nobody can predict how the process will end, possibly as chaos in the foreign exchange markets. The academic arguments to take fiat currencies seriously, already losing credibility, will become untenable.

EXPORTING AND IMPORTING OF INFLATION

As the USA’s Central Bank was maintaining zero interest rates over the period 2008-2014 and adding \$85 billion per month to the exploding money supply, the world currencies competed in depreciation against the USA dollar to an average of 20 percent over the two-year period of 2012-2013, on a population-weighted basis.

The dollar’s purchasing power has lost more than 98 percent of its value since the USA Federal Reserve was established in 1913. This decrease has accelerated since the abandonment of the gold standard in 1971. Since then, the USA’s national debt surged from \$200 billion to \$17 trillion, excluding \$5 trillion of off-balance-sheet debt held by Fannie Mae and Freddie Mac; whilst CPI inflation has exploded.

The nations included in Table 51 include 62 percent of the world population. China has pegged the Yuan currency to the dollar over a decade and exposed itself to the USA Federal Reserve Bank exported inflation. A handful of bankers may benefit; but others feel weaker buying-power and economic activity.

Table 51. Increased global inflation through the decrease of the world currencies values in comparison to the USA dollar, 2012-2013.

Country	Population [10 ⁶]	World Population [percent]	Currency unit	Value 2012-2013 [percent of USA \$]
India	1,250	17.9	Indian Rupee	-32
Europe	475	6.8	Euro	-8
Indonesia	240	3.4	Rupiah	-32
Brazil	201	2.9	Real	-33
Pakistan	187	2.7	Pakistani Rupee	-10
Nigeria	173	2.5	Naira	-28
Bangladesh	152	2.2	Taka	-7
Russia	143	2.0	Ruble	-10
Japan	128	1.8	Yen	-23
Mexico	117	1.7	Mexican Peso	-8
Philippines	92	1.3	Philippines Peso	-6
Vietnam	89	1.3	Dong	-1
Ethiopia	87	1.2	Birr	-11
Egypt	83	1.2	Egyptian Pound	-15
Turkey	76	1.1	Turkish Lira	-16
Iran	75	1.1	Rial	-16
Thailand	66	0.9	Baht	-8
UK	62	0.9	UK Pound	-5
South Africa	53	0.8	Rand	-32
Myanmar	53	0.8	Kyat	-28
South Korea	50	0.7	Won	-4
Columbia	47	0.7	Columbian Peso	-9
Ukraine	45	0.6	Hryvna	-1
Tanzania	34	0.6	Tanzanian Shilling	0
Kenya	44	0.6	Kenyan Shilling	+9
Argentina	40	0.6	Argentinian Peso	-36
Sudan	38	0.5	Sudanese Pound	-70
Algeria	38	0.5	Algerian Dollar	-14
Iraq	35	0.5	Iraqi Dinar	0
Canada	35	0.5	Canadian Dollar	-8
Uganda	34	0.5	Ugandan Shilling	+3
Morocco	33	0.5	Dirham	-6
Peru	30	0.4	Nuevo Sol	-3
Malaysia	29	0.4	Ringitt	-12
Australia	25	0.4	Australia Dollar	-20
Total	4,370	62.0	-	-20

RESERVE CURRENCY PRIVILEGES

For a country to issue the world's reserve currency bestows on it unlimited privileges. It does not need to accumulate foreign reserves for trade since its currency is the reserve proper. It means that it does not need to produce goods for trade since it can conveniently pay for imported goods by issuing new fiat currency. Its interest rates levels would be lower and the currency values would be higher than if did not issue the reserve currency. It can wage wars without paying for them by financing them through issuing more currency. Its standard of living would be much higher than its world competitors.

Countries do not give up their reserve-currency status willingly. Resort to war, invasion, occupation, regime change and removal and assassination of political leaders faces those that threaten such status as occurred in Iraq and Libya. Losing the status leads to an immediate devaluation of the currency and hence inflation in the country losing the privilege. If the reserve currency is replaced, foreign central banks will immediately sell it and replace it with whatever the new reserve currency is. The purchasing power of the reserve currency would be pushed down. The currency would flood back to the issuer country increasing the price of goods in it and causing hyperinflation.

If the currency continues to exist, it will need to be eventually be killed through inflation to repay the accumulated debt and be replaced by a newly issued currency.

REHYPOTHECATION OF ASSETS

The word "rehypothecation" refers to assets pledged by counterparties are reused as collateral or repledged. In effect, the same assets are pledged as collateral multiple times.

Rehypothecation occurs when a broker, to whom securities that are hypothecated, or pledged as collateral for a margin loan, pledges those same securities to a bank or other lender to secure a loan to cover the firm's exposure to potential margin account losses. When a margin account is opened, an investor signs a general account agreement with his broker, in which he authorizes the broker to rehypothecate.

A sum of money deposited at a bank allows the bank to borrow it, while paying a small interest as a rental fee. The bank can use the money as it pleases, while giving the depositor a small percentage of the gains that it will earn. A bank could loan the money to a home buyer or a business. The bank can lend all the money in excess of its requirement to hold some cash as reserves in the range of 10 percent. The bank now has 90 percent of the deposit to invest. The bank can offer it to another bank to "hold", if that other bank does not have enough money to meet its required reserves.

GOLD REHYPOTHECATION

During World War II, many foreign countries feared that their gold reserves, which at the time backed their currencies, might be taken by an invading enemy. In 1939, the USA was a neutral country with the Atlantic Ocean as a barrier shielding it from the European conflicts. Many countries sent their physical gold for safe-keeping in the USA. As the war was over they were convinced to leave it in the USA with the Cold War continuing to rage.

It cost money to protect the gold, and the USA was paying a small sum in interest, while getting a smaller sum back in safekeeping fees. The Federal Reserve central bank issued paper on that stored gold to earn money on the side as the USA went off the gold standard in 1971 during President Richard Nixon's Administration.

Each bar of gold in storage in a bank's vault has a unique mark on it identifying who owns it. The Cold War was still raging and no one asked for it to be returned. Some of the gold was melted down and sold in the form of bullion after erasing the special marks on the bars. Paper promises were sold of the gold being held in the vaults at a reported level of 140 percent of the physical gold.

Cognizant of what was occurring, under public demand, Germany asked to audit their gold at Fort Knox and were denied, so they asked for their gold back. The USA Federal Reserve central bank could not immediately deliver the gold to Germany and promised to return it over a twenty years period. This was not challenged by Germany, preferring to eventually get the gold back over a long time period, rather than none at all.

The reason the gold was not immediately available is rehypothecation. Germany knew the situation since it has been doing the same thing with the gold stored in the USA. It has been sold to multiple organizations at the same time, under the theory that not everyone will want it at the same time, so it can just be moved around at will in a game of musical chairs.

Considering the 140 percent rule, if the Federal Reserve only kept 60 percent of the 100 percent that the paper gold was written on, there is an 80 percent inventory shortage. It is theoretically possible that each paper gold promise is possibly backed by 20 percent or less of physical gold.

CLIODYNAMICS, SOCIAL UPHEAVAL CYCLES

Joseph Tainter in his book: "The Collapse of Complex Societies," suggests that a tipping point is reached causing the collapse of complex societies. The tipping point is defined as a fundamental change or assumption level in the underlying costs of running the society. According to Joseph Tainter, every great society is driven to the heights of its organizational society by leveraging the use of a free form of energy input:

"Unlimited access to this energy resource allows them essentially 'free' problem solving and rapid recovery from mistakes. However, once that 'free' energy becomes erratically available or expensive, the cost/benefit equations of many (if not most) of that social system's evolved solutions turn decidedly negative. Collapse, at that point, is inevitable. In our case, this 'free' energy input would be fossil fuels (the negligible cost of which underwrites all social solutions)."

According to Peter Turchin, the USA is drawing near to an ominous timeframe. He suggests that the USA is approaching a period of violent upheaval, basing his prediction on a field of study called, "Cliodynamics," which identifies significant behavioral patterns in a nation's history. USA behavior, according to Turchin, operates on a 50-year pattern. He compiled copious historical data about major violent incidents in USA history between 1780 and 2010 and concluded that a cycle of violence repeats itself every 50 years in America.

Circa 1870, the North fought the South in the Civil War. Half a century later, around 1920, worker unrest, racial tensions and anti-Communist sentiment caused another nationwide upsurge of violence. Then, 50 years later, the Vietnam War and the Civil Rights Movement triggered a third peak in violent political, social and racial conflict.

"Fed up with what it sees as Washington's malign neglect of the dollar, China is busily promoting the cross-border use of its own currency, the yuan. Displacing the dollar, Beijing says, will reduce volatility in oil and commodity prices and belatedly erode the 'exorbitant privilege' the United States enjoys as the issuer of the reserve currency at the heart of a post-war international financial architecture it now sees as hopelessly outmoded."

**~Alan Wheatley
Reuters**

Figure 104. Avoidance of the dollar as a global reserve currency.

The explanation for the 50 years cycle is explained on the basis that after a period of sustained violence, citizens begin to yearn for the return of stability and an end to fighting. The prevailing social mood swings toward stifling the violence at all costs, and those who directly experienced the civil violence maintain the peace for about a human generation of 20 - 30 years. The stability does not last. Eventually, the conflict-scarred generation dies off or retires, and a new cohort arises. As a result, periods of intense conflict tend to recur with a period of roughly two generations of 40-60 years.

The model suggests that the predicted next peak in violence around 2020 will be worse than the one in 1970 because the demographic variables such as wages, standards of living and a number of measures of intra-elite confrontation are all much worse this time.

A silver lining exists: After the next peak in civil upheaval, an average 50-year break is reached until the next one.

THE "ICELAND OPTION", DEFAULT

In the debt crisis of 2008, Iceland ingenuously decided to renounce the "loss guarantees" imposed on its debt that it considered as fraudulent in the first place. Iceland was able to escape the choke-hold and "debt-slavery" of the European banking system while its economy and its people still retained enough residual prosperity to tough it out. Through default on the debt imposed on it, Iceland was able to absorb the shock of walking away from its debts and the penalty of being shut out of the international debt markets.

Around the world, unsustainable debt creation and over-leveraging backlashed, currency was devalued, "experts" called for bailouts, and the world stock markets tanked in 2008. Iceland, with its small 300,000 population, was small and efficient enough to make a true correction to their economy and government. And while they were the pariah for years since, in 2013, the debt-rating agency, Fitch upgraded their bond status back up to investment grade. Their future looks optimistic. Unlike the USA, whose officials were praised for bailouts, and whose CEOs were rewarded with unprecedented bonuses, Iceland rose up and forced the resignation of both the prime minister and the effective government. New elections were held and new means were employed of choosing their leaders.

The Icelandic people took to the streets in 2010 and had high-level bankers and executives arrested. The Interpol dictated an order to force all implicated parties to leave the country. They

wrote a new constitution that had built-in mechanisms to avoid entrapments of debt-based currency and foreign loans.

Greek philosopher Plutarch wrote 2,000 years ago that “ an imbalance between rich and poor is the oldest and most fatal ailment of all Republics.” Plutarch was not airing any socialist dogma, he was instead expressing a basic principle of economics. The wisdom of Plutarch is that an economy will always be healthier with its wealth in the hands of its Middle Class and its poor, rather than of its being hoarded by its rich elite.

MUNICIPAL AND STATE BANKRUPTCIES

In the USA, the state and local pension funds are underfunded. The five heavily populated states of California, Illinois, Ohio, New Jersey, and Texas lack \$431.5 billion as obligations that they have promised but cannot paid to pensioners. Accounting for low interest rates, the true extent of the underfunding is \$1.26 trillion. There exists a lot of political maneuvering among pensioners, union representatives, taxpayers, corporations, and politicians themselves, but very little progress has been made to find a long-term sustainable solution to the pension problem.

In a report: “The Plot against Pensions,” columnist David Sirota suggested redirecting the “\$80 billion a year states and cities spend on corporate subsidies” toward the \$46 billion annual public-pension shortfall. Corporate leaders suggest that reducing corporate subsidies or raising corporate taxes would hamper business development and lead to lower employment rates.

In 2011, the School District 300 in the state of Illinois rallied to end \$14 million in annual tax benefits for Sears Holding Corp., the parent company of Sears, Kmart, Land’s End, and other brands. Sears promptly countered by threatening to move its corporate headquarters out of Illinois if the state ended the tax advantages it had enjoyed for 23 years. Office Max, which merged with Office Depot, started moving 1,600 jobs out of Illinois in 2014 after the state refused millions in tax breaks the company had requested. The 100-job business, Food Warming Equipment Company was moved to Tennessee to escape Illinois’ 2011 income tax increase and its hefty corporate income tax; the highest in the nation.

In the book “How Money Walks,” author Travis H. Brown writes that from 1992 to 2011, Illinois lost \$31.27 billion in taxes per year because former residents left the state and refused to put up with its predatory taxation. According to wealth management firm Regent Atlantic Capital, New Jersey lost \$5.5 billion in taxable income in 2010 because residents moved out of state, often fleeing the state’s “n’s tax.” States and cities cannot tax their way out of the public pension crisis.

During his election campaign, Illinois’ Governor Pat Quinn pledged to cut government expenses instead of raising taxes. After taking office, overstaffed Governor Pat Quinn gave raises averaging 11.4 percent to 35 staffers. The public protested, so Governor Pat Quinn gave the staffers 24 days off without pay so their salaries would ultimately stay the same.

Federal law allows local governments to seek Chapter 9 bankruptcy protection so long as state law permits it where the municipality is located. Cities like Stockton, CA, San Bernardino, CA, and most famously Detroit have already taken this path.

USA Federal Law does not offer states bankruptcy protection, but State-level bankruptcy is not far-fetched. Politicians like former House Speaker Newt Gingrich and former Florida Governor Jeb Bush have both supported it. The USA Congress would first need to amend the bankruptcy code, individual states would need to authorize application of that hypothetical law, and the Supreme Court would have to rule on whether the contracts clause prohibits states from declaring bankruptcy even if Congress allows it.

MONEY IDOLATRY

Pope Francis in June of 2014 warned about the possible collapse of the world economy, saying that: “our world economic system cannot take it anymore.” The Pope based his warning on the belief that the world economy has fallen into the sin of idolatry, not of a golden calf, but of dollars, euros and pounds. He explained in an interview to La Vanguardia magazine, that the center of the economy needs to be about man, woman and the family.

Pope Francis warned that the economy was now dependent on war, that great powers have been using war as a means of sustaining the current system: “We discard a whole generation to maintain an economic system that no longer endures, a system that to survive has to make war, as the big empires have always done. But as a Third World War cannot be done, they make zonal wars. What does this mean? That they produce and sell weapons, and with this the balance sheets of the idolatrous economies, the great world economies that sacrifice man at the feet of the idol of money, obviously they are sorted.”

The Pope did not name specific conflicts or economic powers when discussing the world economy. This is not the first time the Pope has made waves with his economic views. In November of 2013, Pope Francis denounced “trickle-down” economics, saying it was encouraging “a new tyranny.” He also made numerous denunciations of inequality in the economy.

KONDRATIEV CYCLES

Nikolai Kondratiev, a Russian economist in the early 1900s pointed out that the capitalist economies represented by the prices of commodities follow human demographic, birth rates, migration or generational cycles referred to as Long-Wave cycles or “K-cycles.” These waves are related to the birth rate and wars, associated with the accumulation of debt, and are triggered by technological innovations as suggested by Shumpeter such as the steam engine, railroads, automobiles and electricity. The first cycle began with the onset of the industrial revolution in 1789, and that these cycles last 54 - 60 years. Some suggest that the K-cycle lasts about 80 years or the average length of a human lifetime.

In a typical cycle, the price of goods goes way to high as a result of inflation, people pay more for food above 40 percent of their income, people invest less, businesses have less money going bust, debt grows, governments need more revenue for favorite spending programs, higher taxes are imposed, people are dissatisfied and rioting occurs, new restrictive laws are imposed, economic and societal collapse occur, wars erupt, death and destruction prevail, new powers emerge, peace is reestablished, and a new age begins with innovation and rebirth. It must be noticed that other cycles with different periods, such as the 11-22 years solar cycle, superimpose themselves on the main cycle.

Those 60-year cycles can be divided into four ‘seasons.’ The spring is the re-birth of the economy where debt has been wrung out, and now the economy can start to function again. Then comes summer, when the economy reaches its full functioning and is the inflationary period of the cycle. Autumn arrives as the speculative period in an economy. It is the biggest boom in stocks, bonds, and real estate in the cycle. Peaks, such as in 1873, 1929, and 2000, indicate that the economy is getting into the winter. That is the payback period where debt gets wrung out of the system. The winter phase ends when all the bad debt burns out of the system. During the

winter, things associated with debt go down in value; things with inherent value such as gold and land go up. The Jubilee year in the Bible (49 years) absolved all debts. This would tend to level out the K-cycle because people would start to back away from debt in anticipation of the Jubilee. In the present unsustainable system, the crash is made worse by ramping up the debt before the winter phase.

The market peaked in the ‘dot com’ bubble of 2000, but central banks forestalled winter by printing up trillions of dollars in paper money and effectively reducing interest rates to zero, between 2000 and 2002. From 2002 to 2007, interest rates rose in synchrony with the stock market. At the peak of 2007, interest rates were around 6 percent. Since then, interest rates went to zero again, but never came back up, even as the stock market took off after 2009. That created massive amounts of debt that needs to be wrung out of the system.

Edward R. Dewey identified common economic cycle harmonics around 17.75 years related by multiplication and division by factors of 2 and 3, with the following periods:

142.0	213.9	319.5	479.3
71.0	106.5	159.8	
	35.5	53.3	
		17.75	
	5.92	8.88	
	1.97	2.96	4.44
	0.66	0.99	1.48
	0.22	0.33	0.49
			0.74
			1.11

Strong cycles periods were identified around 4.44, 5.92, (7.15?) and 8.88 years; as multiples or fractions of 17.75.

FINANCIAL REPRESSION, CREEPING EXPROPRIATION

Financial repression is a technical term for policies that are intended to fuel a domestic wealth effect and force savers to take on more and more risk over time to maintain a manageable level of income. Former Treasury Secretary Larry Summers described it as: “I think the instinct to financial repression is there. But it strikes me that the world is pretty global and there are a lot of places to put money, and even if one wanted to financially repress, I don’t think that [in] most of the industrialized world is going to be that easy on a large scale.”

By trying to shore up their rich-world economies with unconventional policies such as ultra-low nominal interest rates; outright balance-sheet expansion; and aggressive, open-ended forward guidance, major central banks dramatically widened international real interest-rate differentials and forced savers to seek out higher and far riskier returns.

The financial repression of the ordinary individual in the USA and other nations is conducted at three levels

1. The economic level: A large injection of cash into the economy with a \$3.8 Trillion Quantitative Easing (QE) program. The idea was initiated in Japan where two decades ago the Bank of Japan suggested it was not workable, but the politicians insisted on it. After two decades it still was not working, creating a liquidity trap and a distortion that is crushing savers.

2. The financial level: The Zero Interest rate Policy (ZIRP) is penalizing savers, whilst savings form the investment for the future. As 62 percent of employment comes from small businesses, this needs capital from savings. With increasing regulation, this is killing the consumer and the incentive to start a small business which is the key to the creation of jobs in the economy.

3. The political level: Governments are increasing their power every day and repressing the public individual and particularly the rights of the individual. The published government statistics are tweaked and are highly questionable, forcing people out of using cash.

Central banks are known to manipulate gold prices down because rising gold prices provide an alternative to bonds. When bond returns are lower than what could be had by appreciating gold, then governments cannot easily sell their bonds. Bonds will sell at steeper and steeper discounts until equilibrium is reached again. The increasing discounts represent higher interest rates. An increase in the price of gold would also soak funds from stock markets; but the main emphasis is on the ability of governments to borrow by selling their bonds. The USA government had by 2015 about \$17.5 trillion in debt. This national debt equals about $\$17.5 \times 10^{12} / 3 \times 10^6 = \$55,555$ for each person in the USA.

Governments have occasionally banned the possession of gold during currency crises, forcing citizens to exchange the precious metal for the depreciating fiat national currency. The savings of individuals would shrink in real terms because the central banks would inflate the currencies by flooding the markets during financial crises with currency and lowered-interest rates to nearly zero. After the interventions, citizens realize with dismay that their life and retirement insurance policies will pay out much less than what was originally promised. Many of them discover that they will have to tighten their belts upon retirement and accept a lower standard of living than originally planned or promised. This form of creeping expropriation is designated by economists as "Financial Repression."

The Economist magazine describes Financial Repression as:

"Political leaders may have a strong incentive to pursue it. Rapid growth seems out of the question for many struggling advanced economies, austerity and high inflation are extremely unpopular, and leaders are clearly reluctant to talk about major defaults. It would be very interesting if debt (rather than financial crisis or growing inequality) was the force that led to the return of the more managed economic world of the postwar period."

The term "Financial Repression" was first coined by Shaw and McKinnon in works published in 1973, and it described the dominant financial model used by the world's advanced economies around 1945 and 1970 - 1980. In 2011 a study of Financial Repression, "The Liquidation of Government Debt", authored by Harvard economics professor Carmen Reinhart and M. Belen Sbrancia, was published by the National Bureau of Economic Research. The core point of the Reinhart and Sbrancia paper is that to pay down government debt, the advanced economies of the world quite effectively squeezed an average of 3-4 percent annually out of investor real net worth for a period of 25 years, using a wide assortment of overt and less overt controls over interest rates and investor behavior.

Financial Repression possesses five core characteristics:

- 1) Inflation of the money supply and depreciation of the currency;
- 2) Governmental control of interest rates to guarantee negative real rates of return;
- 3) The funding of government debt by financial institutions;
- 4) Capital controls; and,
- 5) Discouraging or outlawing precious metals as savings.

According to the Carmen Reinhart and M. Belen Sbrancia paper, the USA and the UK used the combination of inflation and Financial Repression to reduce their debts by an average of 3-4 percent of GDP per year, while Australia and Italy used higher inflation rates in combination with Financial Repression to more swiftly drop their outstanding debt by about 5 percent per year in GDP terms.

By creating inflation in the money supply and, and concurrently holding interest rates beneath the rate of inflation, this generates a transfer of wealth on a wholesale basis from savers to the government that has created a hidden \$500 billion a year tax on savers in the USA.

The government establishes incentives for financial institutions such as banks, savings and loans, credit unions and insurance companies to hold substantial amounts of government debt. This can be publicly phrased as "mandating financial safety", instead of the more accurate description of mandating that investments be made at below-market interest rates to help overextended governments recover from financial difficulties. This third element of Financial Repression is to make sure that all savers are lending to the government at artificially low interest rates; even though they never directly purchase a government security. Savers are forced to make deposits which pay very low rates of return, with the banks using those very low cost deposits to purchase government debt that similarly pays a very low rate of return. The USA Federal Reserve has purchased about \$2.4 trillion in USA Treasuries at extremely low interest rates, and it has financed these purchases by borrowing about \$2.4 trillion from USA banks at even lower interest rates, which the banks are financing by paying virtually no interest rates to depositors. The banks and the Federal Reserve central bank drop out of the picture, and savers are left financing the USA Treasury, with essentially no interest income gained, and an annual reduction in the value of the investment principal within an environment of ongoing inflation.

Reinhart and Sbrancia describe the "creation and maintenance of a captive domestic audience." The government creates controls that will keep the savers in line, while the purchasing power of their savings is systematically and deliberately destroyed. This takes the form of explicit capital and exchange controls, in addition to other subtle methods. This can be achieved through a combined structure of tax and regulatory incentives for institutions and individuals to keep their investments "domestic" and in the proper categories for manipulation, as well as punitive tax and regulatory treatment of those attempting to escape the Financial Repression.

An "inflation tax" on precious metals savings complements the process of Financial Repression. Even in bullion form, gold is currently taxed as a "collectible" in the USA, with a 28 percent capital gains tax rate, or almost half again the highest long-term capital gains tax rate of 20 percent on most investments, and close to double the 15 percent long-term capital gains tax rate paid by most investors.

Using Financial Repression, governments of the world wipe out most of the value of their debts, without raising taxes to the degree needed to pay the debts off at fair value. An annual real inflation rate of only 4-5 percent would reduce people's savings by 50 percent within just 15 years. But as inflation eats up savings, it also reduces government debts. This is how the euro-zone

countries, the USA, the UK and Japan, hope to relieve themselves of the crushing weight of their debts. The outlook is grim for ordinary savers and pensioners, who are caught in a trap. Wealthy individuals can spread the risk and find safe havens by investing on different continents and in different types of assets. Some people will emerge from the financial crises having increased their assets, or at least maintained them, while the vast majority become significantly poorer.

LIQUIDITY TRAP

A liquidity trap occurs when there is so much created debt money around, that if the central banks try to raise the interest rates they would discourage people from spending. They become trapped in a financial repression mode and a zero interest rate stagnant economy. Ordinary individuals have low wages, yet the number and magnitude of federal, state and municipal taxes are going up, as well as charges as licenses and fees.

RENTIER CLASS EUTHANASIA

British economist John Maynard Keynes used a term he intended to be pejorative, “the rentier,” to refer to the class of people who suffer the most from financial repression. These are the retirees who live on a fixed income. These are people who worked and saved their whole lives, and now depend on interest to buy groceries and heat their homes. For them, zero interest rates is a slow financial death.

In John Maynard Keynes’ view, those who invest capital to earn a yield are parasites. In “The General Theory of Employment, Interest, and Money,” he asserts that the rentier is a “functionless investor”: he gets paid for doing nothing. John Maynard Keynes called for “the euthanasia of the rentier” by government suppression of the interest rate.

THE CANTILLON EFFECT, NEGATIVE INTEREST RATE POLICY, NIRP WORLD

Irish-French economist Richard Cantillon observed in the 18th century, that when free money is handed out at below the real rate of interest, it pays to be in the front of the line. The money borrowed at a negative real rate of interest can be invested at a higher rate of interest, then repaid later with depreciated currency as a result of inflation. As more units of currency are created, each one translates to a smaller slice of all goods and services produced. Expansionary monetary policies constitute a transfer of the purchasing power away from those who hold old money to those who get new money.

At some point at the end of 2015, the European Central Bank (ECB)’s key lending rate was set at a negative 0.4 percent. The thought was to discourage people and financial institutions like banks and corporations from saving their cash and earning interest on it, and instead invest in more productive, and risky, endeavors in the wider economy.

These negative rates suggest an impossibility: That the value of money is less than zero. Consequently, the value of everything money buys; including labor, must also be negative, which is such a strange and preposterous thought that it cannot be meaningful.

In fact, it amounts to a tax that is imposed on the depositors that is paid to the banks, instead of to governments, a new authority that they were granted by their central banks. Under these circumstances, there is no logical reasoning behind investing in government bonds. A better

and safer decision is to hold capital in cash in home safe deposit boxes or under mattresses. No logical person would buy bonds with negative rates. It leaves central banks, affiliated institutions and a number of pension funds forced by legislation to do so, wasting retirees and savers funds. Saving is thus discouraged and confiscated, and acquiring debt is encouraged.

Keeping interest rates negative are meant for the disposal of the debt accrued over the earlier 45 years. With negative interest rates and with 4-8 percent inflation rate, the amount of debt in relation to GDP will drop. Savings of the middle classes become devalued simultaneously with the debt. Borrowers are enriched at the expense of savers. Private and public pensions are crushed, placing millions of pensioners into retirement poverty.

People orchestrating the monetary system are aware that the hunger for debt at all levels; consumer, corporate and governmental has reached its limits. To reduce its levels they can either increase the interest rates and risk mass bankruptcies, or introduce a hidden inflation tax. The latter is more desirable as the population does not understand how inflation functions. Mass bankruptcies would incite a social unrest and the central banks may end up in losing their control.

An alternative plausible interpretation for negative interest rates is that the present value of money today is inherently worth more than the same amount of money a year into the future. That is because something could happen in the intervening period preventing a person from benefiting from the money. For instance, somebody else could buy a house that one wanted to purchase. That is why lenders needed to be paid for the risk that something may go wrong and that they would never see their money repaid to them again.

Central banks in Sweden, Denmark, Switzerland, the euro zone, and Japan have all pushed their target lending rates into negative territory by 2016. All that has been learned is that this does not work. Purchases of home safes went up in Japan as people take out cash and keep it at home. Negative interest rates are a tax on savings. People now pay to save instead of being paid to save. People hoarding cash are worried about the prospect of paying a negative interest rate tax on their bank deposit, and anticipating some more awful crisis.

During the regime of ultra-low interest rates, over the 2008-2016 period, about \$8 trillion has been confiscated from savers. This is money they should have earned in interest.

In the long run, this clearly is unsustainable. Spending credit is essentially spending someone else's money, and sooner or later one would run out of other people's money. To paraphrase John Maynard Keynes: "In the long run, we are all dead anyway."

ONE-OFF CAPITAL LEVY, BANKS BAIL-INS, WEALTH TAX, "DEBT SUSTAINABILITY" JUBILEE

In the International Monetary Fund (IMF) October 2013 publication "Taxing Times" on page 49, an "One Off Capital Levy" is proposed:

"The sharp deterioration of the public finances in many countries has revived interest in a 'capital levy' -- a one-off tax on private wealth -- as an exceptional measure to restore debt sustainability. The appeal is that such a tax, if it is implemented before avoidance is possible and there is a belief that it will never be repeated, does not distort behavior (and may be seen by some as fair)."

An article by the Reuters News Agency commented: "EU Executive See Personal Savings Used to Plug Gap":

"The savings of the European Union's 500 million citizens could be used to fund long-term investments to boost the economy and help plug the gap left by banks since the financial crisis."

"The Commission will ask the bloc's insurance watchdog in the second half of this year for advice on a possible draft law 'to mobilize more personal pension savings for long-term financing,' the document said."

Following the experience of the bank "Bail-ins" in Cyprus, the European finance ministers have agreed to a plan that would make "bail-ins" the standard procedure for rescuing "too big to fail" banks in the future. Bondholders and shareholders would take the hit for bank rescues ahead of taxpayers. The new framework requires bondholders, shareholders and large depositors with over 100,000 euros to be first to suffer losses when banks fail. Depositors with less than 100,000 euros will be protected. Taxpayer funds would be used only as a last resort. What this means is that those who have over 100,000 euros in a bank account in Europe could lose every single bit of the unprotected amount if their bank collapses.

Poland announced in September 2013 that it will transfer to the state many of the assets held by private pension funds, slashing public debt but putting in doubt the future of the multi-billion-euro funds, many of them foreign-owned. The changes went deeper than many in the market expected and fueled investor concerns that the government is ditching some business-friendly policies to try to improve its flagging popularity with voters. The Polish pension funds' organization said the changes may be unconstitutional because the government is taking private assets away from them without offering any compensation. Announcing the long-awaited overhaul of state-guaranteed pensions, Prime Minister Donald Tusk said private funds within the state-guaranteed system would have their bond holdings transferred to a state pension vehicle, but keep their equity holdings. He said that what remained in citizens' pension pots in the private funds will be gradually transferred into the state vehicle over the last 10 years before savers hit retirement age.

President Barack Obama in the USA introduced in 2014 the "MyRA" saving account setting the stage for eventually exchanging pension and retirement programs funds for USA Treasury Bonds that the Federal Reserve Central Bank apparently has increasing difficulty selling to foreign countries because of currency depreciation. This would correspond to a "Biblical Jubilee" where the USA government can astutely gradually eliminate its unsustainable deficit-spending debt to foreigners and its citizens.

Table 52. Composition of the "dollar index" in foreign currencies. Aggressive depreciation of foreign currencies result in a relative appreciation of the dollar index. Debt in the USA sits at 334 percent of GDP, while the Eurozone is at 460 percent and Japan is 655 percent.

Currency	Percentage
Euro	57.6
Japanese Yen	13.6
UK pound	11.9
Canadian dollar	9.1
Swedish krona	4.2
Swiss franc	3.6

SUSTAINABILITY CRITERIA

Sustainable system can be identified as those systems that:

1. Fulfill basic human needs in food, water, health, lodging, and global social interconnections.
2. Are adaptable, robust to unforeseen perturbations, and “antifragile” thriving on change, particularly in technology and communications.
3. Create economic abundance in new life sustaining technologies such as nanotechnology, robotics and biotechnology.

CAPITAL FORMATION AS SAVED LABOR, SUSTAINABILITY MODEL

The greatest fallacy that some economists harbor is the illusion that economic growth and progress come from increased consumers spending and that they can control consumers spending by adjusting the interest and lending rates. The greatest reality is that capital formation defined as saved labor is what matters. A sustainably wealthy society is one with a large stock of capital that is used to generate more capital. The missed great reality is that it is what is saved that creates wealth and sustainability by producing more than what is consumed and not vice versa.

There are three approaches of flattening a mountain of unsustainable debt:

- 1) Maintaining economic growth at a sufficient rate to service the debt. This is usually unlikely.
- 2) Repudiate the debt, defaulting on it and starting anew. Some government had no choice but to follow that route.
- 3) Inflate the debt away. This is usually the most likely approach.

The world, backed into a corner, needs to assess the unsustainability trap in using fossil fuels it has fallen into, and free itself from it. USA Major General Oliver Smith decided to withdraw his forces after facing 1,500 casualties and 4,000 wounded among his troops in the mountainous north-eastern coast of the Korean Peninsula, and came up with the quote: “Gentlemen, we are not retreating. We are merely attacking in another direction.” After regrouping, reassessing his strategy, and with fresh troops, ample supplies and ammunition, he regained the initiative and was eventually victorious.

Around 1962, the USA Gross Domestic Product (GDP) totaled fully 46 percent of the world GDP. By 2010 the USA percentage of world GDP was only 22.9 percent; half of the 1962 value. The relative decline is both the result of other countries imitating USA virtues, and the USA imitating other countries’ flaws. The USA has lost her way and diverged from the path that produced her prosperity.

Successful capitalistic economies facilitate the failure of unsustainable economic structures so that sustainable structures can emerge in their place. While leveraging using debt enables financial companies to multiply their potential gains on investments, it also makes them far more vulnerable to losses that can wipe out capital. For a company that borrows \$20 for every \$1 it holds in shareholder equity, a 5 percent decline in those assets can render the company insolvent. The banks’ insatiate appetite for using borrowed money, known as leverage, for investing in complex, illiquid securities contributed to the worst credit crisis since the Great

Depression in 2008. This is leading to an unsustainable situation of cyclic crises occurring with a 5-7 years period. The economic cycle could be simplistically described by the common saying:

“Rags make paper,
Paper makes money,
Money makes banks,
Banks make loans,
Loans make poverty,
Poverty makes rags,
Rags
... ..”

Most countries offer government-funded social programs designed to help retirees enjoy their golden years after productive working years. An aging population means rising health care costs along with declining tax revenues. This is an unsustainable situation. In Europe, rioting erupted in the streets, as people protested retirement age hikes in France and cuts to retirement benefits and services in Greece. In the USA, starting 2011, 10,000 people per day will reach the retirement age of 65 for 19 years without having enough money saved to live the way they used to live before retirement.

American companies are following a practice of outsourcing to distant shores manufacturing and even services without regard for employees or communities benefiting from cheaper wages at 80 cents per hour with no benefits, and avoiding the hiring of workers in the USA at \$20 per hour, plus benefits. Without government protectionism, shareholder pressure for short term profits encourages this unsustainable trend. Without jobs, as of 2011, the 14.8 million unemployed people in the USA cannot pay taxes or buy goods for their average families size of 2.8 persons for a total of $14.8 \times 2.8 = 41.44$ million or $41.44 / 370 = 0.112$ or 11.2 percent of the 370 million USA population; an unsustainable situation.

The University of Chicago's economist Milton Friedman said: “Nations are not ruined by one act of violence, but gradually and in an imperceptible manner, by the depreciating of their circulating currency, through excessive quantity.”

Fixing the financial system could be compared to the successful measures that were adopted to reducing fatalities in automobile accidents. Mandating seat belts, antilock brakes, air bags, guard rails and speed limits on highways proved more effective in reducing damage caused by crashes than trying to prevent reckless driving. There is a need for approaches to financial regulation that seek to make the world safer for ignorance and stupidity, which are inevitable, rather than relying on our ability to correct them. Requiring financial institutions to hold more capital is like placing seat belts on careless drivers, helping them withstand serious errors.

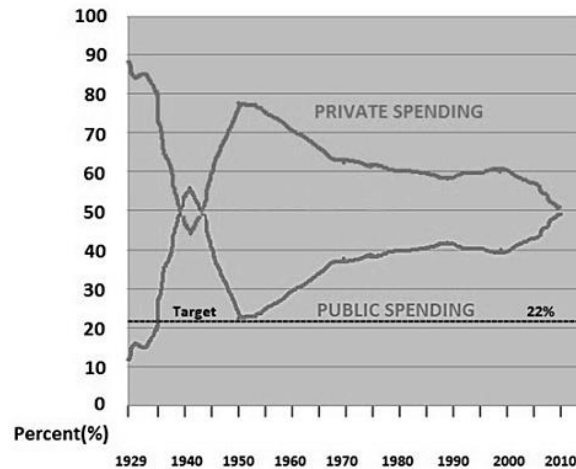


Figure 105. Public spending is increasing as private spending is decreasing in the USA to the 50-50 percent partition.



Figure 106. Income shift from individuals to corporations in the USA. Source: Bureau of Economic Analysis, New York Times.

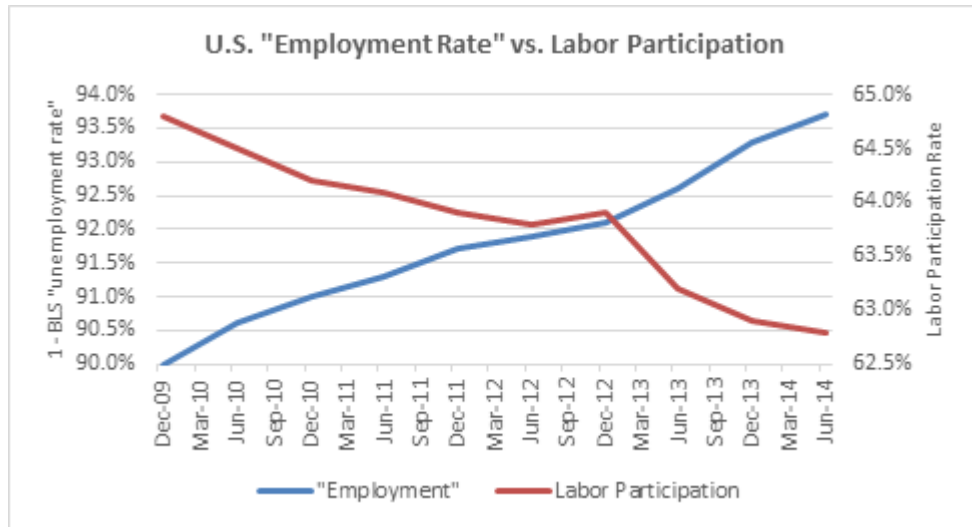


Figure 107. Decreasing labor participation rate in the USA is associated with decreased unemployment rate statistics. BLS: Bureau of Labor Statistics.



Figure 108. Top one percent of the USA population share of USA wealth.

In the USA, government spending is increasing, whilst individual spending is decreasing. Public spending is becoming 50 percent of the USA economy. A transfer of wealth is coincidentally occurring with the national income shifting from its impoverished individuals to its increasingly richer corporations. The share of national income going to the USA corporations is at its highest level since 1950. The fraction going to individuals is at its lowest level since 1966. Other parts of the national income include proprietors and rental income.

Ralph Gomery warned that the damage done to USA labor by jobs offshoring was about to be superseded by robotics. The ownership of the technology patents is highly concentrated and that breakthroughs have made robots increasingly human in their capabilities. Consequently, the prospect for employment of humans is dismal. Along this line, the computer and robotic experts

at Harvard University have constructed mobile machines programmed with the logic of termites to be self-organizing and able to complete complex tasks without central direction or oversight.

The technology means that humans will no longer be needed in the workforce and that emotionless robotic armies will take the place of human armies and have no compunction about destroying the humans on whom they are unleashed. Faced with little demand for human labor, little wonder thinkers predict that the rich intend to annihilate the human race and live in an uncrowded environment served by their robots. Instead of being used for humanity, the technology will be used for the profits of a handful. According to economist Paul Craig Roberts:

“International capitalism has raised greed to a determinant force in world history. Unregulated greed-driven capitalism is destroying the jobs prospects of First World labor and the ability of Third World countries, whose agricultures have been turned into export monocultures serving the global capitalists, to feed themselves. When the crunch comes, the capitalists will let the ‘other’ humanity starve.

As the capitalists declare in their high level meetings, ‘there are too many people in the world’.”

TIGHT OIL PRODUCTION

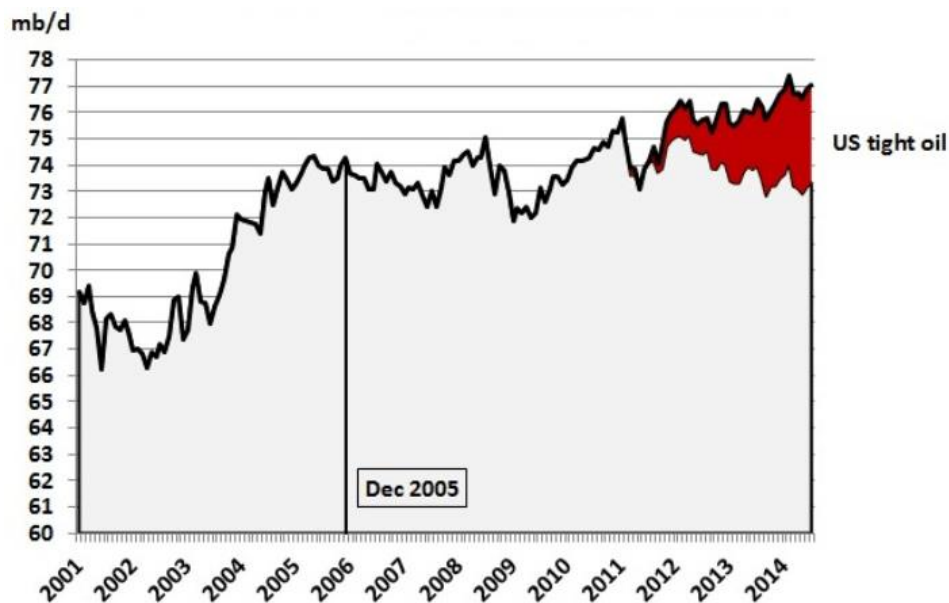


Figure 109. World crude petroleum production January 2001 – July 2014. Source: CrudeOilPeak.info

It is not realized that if the USA expensive tight petroleum production was removed from the global supply, world oil production has declined since 2011. The belief that tight shale oil would make the USA energy independent, is misinformed.

SAY'S LAW

Jean Baptiste Say, a French economist, originated “Say’s Law” that states that: “Products are paid-for with products,” not merely with money. What he meant is that one needs to produce things to buy things, and cannot just produce money. John Maynard Keynes replaced Say’s logic with the notion that there is no need to make things in order to spend, so long as the state provides the money to spend.

The key to changing course from repetitive cycles of economic booms and busts is not printing money and encouraging borrowing, instead, people should instead be encouraged to save. Say’s Law can then operate, with people only spending what they can truly afford. Cash-strapped governments should be dropping taxes on savings to encourage them.

WAR ON CASH TRANSACTIONS, LAW ENFORCEMENT THROUGH THE BANKING SYSTEM, BANK SECRECY ACT/ANTI MONEY LAUNDERING (BSA/AML), KNOW YOUR CUSTOMER (KYC) DILIGENCE POLICIES

Transactions in cash makes those transactions a lot more flexible regarding taxes which is why governments realize they are missing out on. The banks operating in the USA, especially the larger ones, are under intense pressure from the Federal Reserve Bank, the OCC and other members of the Washington bureaucracy to increase its role as an arm of law enforcement through ever-more-stringent "money laundering" controls. This is what banks means when they say they have to spend a lot of money on "BSA/AML compliance." (Bank Secrecy Act / Anti Money Laundering). Under federal regulations, they have to have "KYC" (Know Your Customer) and "diligence" policies -- in other words, they are required to spy on their customers as a prerequisite to doing business with them. This applies across the board, regardless of the risk presented by the customer or the transaction. Failure to file "suspicious activity reports" (the report may be nothing more than moving \$10,000 or more from one account to another, or a series of moves of somewhat smaller amounts) can subject a bank to severe regulatory penalties and reputational damage (that is, the regulators will shame the bank publicly and sanction it).

Cash, because of its relative anonymity, is considered as one of the "warning signs" of possible illicit activity that these banks are expected to root out on behalf of the government. As a result, banks face added costs and added compliance burdens and risks to the extent they deal in cash. In Canada, it is a common practice to see signs at businesses saying that they do not accept \$50 or \$100 bills.

With the passage of House Bill 195 into law, the state of Louisiana in the USA has banned the use of cash in all transactions involving second-hand goods. State representative Ricky Hardy, a co-author of the bill, claims that the bill targets criminals who traffic in stolen goods. According to Ricky Hardy, “It is a mechanism to be used so the police department has something to go on and have a lead.” The bill prohibits cash transactions by "second-hand dealers," defined to include garage sales, flea markets, resellers of specialty items, and even non-profit resellers like Goodwill. Curiously, it specifically exempts pawnbrokers from the ban, despite the belief that pawn shops - and not rented stalls at local church flea markets- are notorious as places that criminals frequent to convert stolen goods into quick cash.

Chase Manhattan Bank, the largest bank in the USA and a subsidiary of JP Morgan Chase and Co. is the world's third largest public company. It received \$25 billion in bailout loans from the USA Treasury as a bailout. To curry favor with its regulators and political supporters and to ensure its own stability, it is helping to stamp out the use of cash. For the very existence of cash places the power over fractional-reserve banks squarely in the hands of their depositors who may

withdraw their cash in any amount and at any time, bringing even the mightiest bank to its knees literally overnight such as in the case of the Washington Mutual bank.

As of March 2015, Chase began restricting the use of cash in selected markets, including Greater Cleveland, Ohio. The new policy restricts borrowers from using cash to make payments on credit cards, mortgages, equity lines, and auto loans. Chase even goes as far as to prohibit the storage of cash in its safe deposit boxes. In a letter to its customers dated April 1, 2015 pertaining to its "Updated Safe Deposit Box Lease Agreement," one of the highlighted items reads: "You agree not to store any cash or coins other than those found to have a collectible value." Whether or not this pertains to gold and silver coins with no numismatic value is not explained.

TOBIN'S Q-RATIO

The Q-ratio is a valuation tool that was developed by James Tobin, a Nobel Prize-winning economist at Yale University who died in 2002. According to Tobin's Q, equities in the USA as of 2015 were valued about 10 percent above the cost of replacing their underlying assets; higher than any time other than the Internet bubble and the 1929 peak.

The Q-ratio is an indicator whose time has come, because it illuminates the distortions caused by Quantitative Easing (QE) as an unsustainable policy because it pushes asset prices higher up; and high asset prices, as known from history, can lead to a stock market that is 80 percent over-priced.

The ratio doubled from 2009 to 2015 into the 1.10 range as a symptom of companies diverting money from their businesses to the stock market, choosing buybacks over capital spending. Six years of around zero-percent, from 2009 to 2015, interest rates have driven investors into riskier investments such as equities, elevating the paper value of assets over their tangible worth.

The Q-ratio rose to 58 percent above its average of 0.70 since 1900. Readings above 1 are considered by some to be unsustainable and the ratio has exceeded that threshold only 12 percent of the time mostly between 1995 and 2001. This may be caused by the American economy becoming more oriented towards services rather than manufacturing with companies like Apple and Facebook dominating growth, while decades ago, it was railroads and steelmakers, which relied heavily on manufacturing and capital.

THE PARETO PRINCIPLE, THE 80-20 RULE, VITAL FEW AND TRIVIAL MANY RULE

Italian Economist Vilfredo Pareto (1848-1923) in 1906 observed that twenty percent of the Italian people owned eighty percent of their country's accumulated wealth. Over time and through application in a variety of environments, this analytic has come to be called the Pareto's Principle, the 80-20 Rule, and the "Vital Few and Trivial Many Rule."

The mix of 80 percent-20 percent suggests that the relationship between input and output is not balanced. This rule of thumb is a useful heuristic that applies when there is a question of effectiveness versus diminishing returns on effort, expense, or time.

Pareto's rule states that a small number of causes is responsible for a large percentage of the effect, in a ratio of about 20:80. Expressed in a management context, 20 percent of a person's effort generates 80 percent of the person's results. A corollary is that 20 percent of one's results

absorb 80 percent of one's resources or efforts. For the effective use of resources, the manager's challenge is to distinguish the right 20 percent from the trivial many.

To reduce costs, businesses identify which 20 percent of their customers are using 80 percent of the resources. If members of this segment are not top profit generators, consider charging them for the resources they consume or shift services away from this sector. To increase profits, businesses focus attention on the vital few top 20 percent by first identifying and ranking customers in order of profits and then focusing sales activities on them. The 80-20 rule predicts that 20 percent of the customers generate 80 percent of the revenues, and 20 percent yield 80 percent of the profits, but these two groups are not necessarily the same 20 percent. Eighty percent of a teacher's time is taken up by 20 percent of the students.

In a debt jubilee, through inflation and market manipulations, governments in association with the banking system eliminate the savings, pensions, retirement funds, jobs, benefits and wealth of the 80 percent of the supposedly unproductive population in favor of the remaining twenty percent of the well-connected and informed elite population as well as the government itself, whose debts are eliminated.

The confiscating the customer deposits in Cyprus banks designated as "bail-in" was not a one-off, desperate idea of a few eurozone troika officials scrambling to salvage their balance sheets. A joint paper by the USA Federal Deposit Insurance Corporation (FDIC) and the Bank of England dated December 10, 2012, shows that these plans have been long in the making; that they originated with the G20 Financial Stability Board in Basel, Switzerland; and that the result will be to deliver clear title to the banks of depositor funds. New Zealand has a similar directive.

Few depositors realize that legally, the bank owns the depositor's funds as soon as they are put in the bank. The depositor's money becomes the bank's own, and he becomes unsecured creditors holding IOUs. Until now, the bank has been obligated to pay the money back as cash on demand. Under the FDIC-BOE plan, the depositors' IOUs will be converted into "bank equity." The bank will get the money and the depositors will get stock in the bank.

The 15-page FDIC-BOE document called "Resolving Globally Active, Systemically Important, Financial Institutions," begins by explaining that since the 2008 banking crisis, it has become clear that some other way besides taxpayer bailouts are needed to maintain "financial stability." Anticipating that the next financial collapse will be on a grander scale than either the taxpayers or Congress is willing to underwrite, the authors present this alternative:

"An efficient path for returning the sound operations of the G-SIFI to the private sector would be provided by exchanging or converting a sufficient amount of the unsecured debt from the original creditors of the failed company [meaning the depositors] into equity [or stock]. In the U.S., the new equity would become capital in one or more newly formed operating entities. In the U.K., the same approach could be used, or the equity could be used to recapitalize the failing financial company itself--thus, the highest layer of surviving bailed-in creditors would become the owners of the resolved firm. In either country, the new equity holders would take on the corresponding risk of being shareholders in a financial institution."

No exception is indicated for "insured deposits" in the U.S., meaning those under \$250,000, the deposits we thought were protected by FDIC insurance. This can hardly be an oversight, since it is the FDIC that is issuing the directive. The FDIC is an insurance company

funded by premiums paid by private banks. The directive is called a "resolution process," defined elsewhere as a plan that "would be triggered in the event of the failure of an insurer and would facilitate [the failed bank's] resolution in a controlled manner, avoiding systemic disruption and use of public funds." The only mention of "insured deposits" is in connection with existing UK legislation, which the FDIC-BOE directive goes on to say is inadequate, implying that it needs to be modified or overridden.

If the IOUs are converted to bank stock, their marketability is questioned since they will no longer be subject to insurance protection but will be "at risk" and vulnerable to being wiped out, just as the Lehman Brothers shareholders were in 2008.

Imposing losses on depositors is not a "wealth tax" but is a tax on the poor, since wealthy people do not keep most of their money in bank accounts. They keep it in the stock market, in real estate, in over-the-counter derivatives, and in gold and silver. Even gold and silver is not safe if it is stored in a safety deposit box in the bank. Homeland Security has reportedly told banks that it has authority to seize the contents of safety deposit boxes without a warrant when it is a matter of "national security," which a major bank crisis no doubt will be.

President Barack Obama acknowledged that bank nationalization had worked in Sweden, and that the course pursued by the USA Federal Reserve Bank had not worked in Japan, which wound up instead in a "lost decade." He opted for the Japanese approach because "Americans will not tolerate nationalization."

HIGH FREQUENCY TRADING, (HFT), ALGORITHMIC TRADING (AT), WEAPONS OF FINANCIAL DESTRUCTION, HOUSE OF CARDS COLLAPSE

Automation, computers and applied artificial intelligence algorithms programmed by financial institutions allow trading to be faster and cheaper with better price discovery. A trading entity (Virtu) had one trading day of losses in six years operating on trading exchanges around the globe. However, they operate within a complex and non-linear system that is not adequately described by the existing mathematical models. The rise of the machines resulted in times when practically 70-100 percent of market volume was just machines playing against each other with no actual investors involved. As long as there was ample liquidity, then the machines were content to just play ping-pong with each other within the markets boundaries.

A concern centers on the fact that events that should never happen in true markets are happening in today's markets all the time. A measure of this is how many standard deviations an event is away from the mean. For instance, if the price of a financial asset moves an average of 1 percent per year, with a standard deviation of 0.25 percent, then it would be slightly unusual for it to occur at 2 percent, or 3 percent. However it would be highly unusual if the machines moved the markets as much as 6 percent or 7 percent. Statistics tells us that 3 standard deviations movements are very unlikely, having only a 0.1 percent chance of happening. By the time we get to 6 standard deviations, the chance is so small that what we are measuring should only happen about once every 1.3 billion years. At 7 standard deviations, the chance climbs to an unrealistic once every 3 billion years.

The rapid rebalancing of "risk-control funds" has been suggested as a reason for extreme market volatility. These technical flows are determined by algorithms and risk limits, and can push markets away from fundamentals. Great risk arises if the technical flows outsize the fundamental buyers. In an environment of low liquidity, this will cause a "flash crash."

Unsustainable market volatility leading to mini crashes such as on Monday, August 24 2015 are caused by three groups of investing entities (quants / algos): Trend Following strategies or Commodity Trading Advisors (CTA), Risk Parity portfolios, and Volatility Managed strategies. These investing entities follow different signals and have different rebalancing time frames which influence how much longer the ensuing selling pressure lasts.

The inability of hedgers to short futures spills over into large capitalization stocks that are still trading and could be used as a proxy hedge. Without a futures limit-down circuit-breaker trigger, the selloff would likely be devastating.

1. Volatility Target or Volatility Control strategies provide a most immediate selling as a reaction to the increase in volatility. These strategies adjust equity leverage based on short-term realized volatility. Typical signals are 1-, 2-, or 3-month realized volatility. Volatility target products are provided by many dealers, index providers and asset managers. Volatility targeting strategies also became very popular with the insurance industry. After the 2008 financial crisis, many Variable Annuity (VA) providers moved from hedging their equity exposure with options to investing directly in volatility target indices such as the 10 percent volatility target Standard and Poor (S&P) 500. It is estimated that VA issuers have ~\$360bn in strategies that are managing volatility; some of these use options to manage tail risk, some buy low volatility stocks, and some invest in volatility target strategies. Strategies that are targeting a particular level of volatility or managing to an equity floor control \$100-\$200 billion of assets. This could have contributed to the ‘unexpected’ selloff that happened in the last hour of Tuesday, August 24, 2015’s trading session. While these flows may continue to have a negative impact over a few days, they would be the first to reverse and start buying the market when volatility declines.

2. Trend Following strategies/ Commodity Trading Advisor (CTA) funds have an estimated ~\$350bn in Assets Under Management (AUM). The rebalance time frame for CTA momentum-chasing strategies is typically longer than for volatility control strategies. CTA funds may act on their signal in a period that ranges from several days to a month. Exchange Traded Funds (ETFs) need to rebalance their portfolios by selling. Increased default risk is causing derivative holders of Credit Default Swaps (CDS) to up their cash by selling equities, and Momentum (Momo) funds need to rebalance by selling due to the drop. This initiates a positive feedback loop which initiates market collapses only stopped by limit=moves circuit breakers.

3. Risk Parity is one of the most popular and historically successful portfolio construction methodologies. Risk Parity allocates portfolio weights in proportion to assets’ total contribution to risk, with a simplified version, called Equal Marginal Volatility allocating funds inversely proportional to the asset’s realized volatility. Estimated assets in Risk Parity strategies are ~\$500 billion and about 40 percent of these assets may be allocated to equities. Risk Parity portfolios may also incorporate leverage, often 1-2 times. Risk parity funds often rebalance at a lower frequency at a monthly, rather than a daily for volatility target, and use slower moving signals, such as 6 months or 1 year realized volatility. The increase in equity volatility and correlation would cause Risk Parity portfolios to reduce equity exposure.

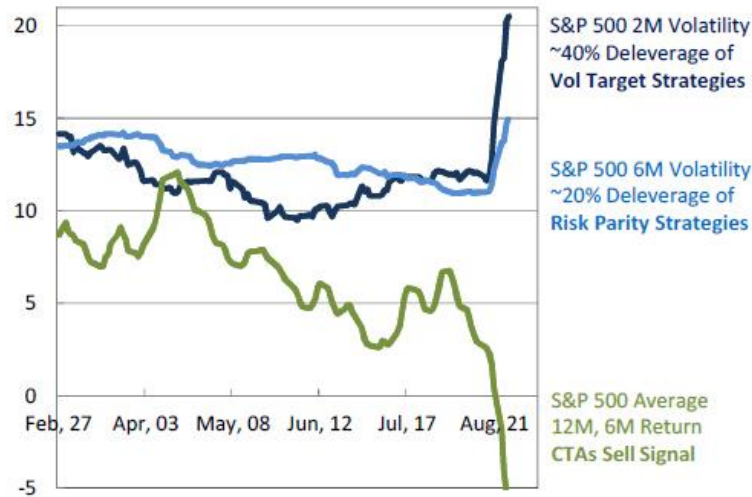


Figure 110. Trading signals prior to the Monday, August 24, 2015 flash crash. Source: J. P. Morgan Equity Derivatives Strategy.

GRESHAM'S LAW

Gresham noted that if people had two different kinds of money available to them, they would spend the weakest of them first and keep the good money in storage, hence Gresham's Law: "Bad money drives out good."

In the Old Testament, the Books of Law mention the 50-year jubilee where all debt is forgiven in order to keep the excessive burden of debt from building up in the economic system. A lesson must here be learned from history that excessive debt must be extinguished to allow the economy to break free and move forward. After this debt is finally allowed to wash out, the economy will be capable of achieving its greatest advances.

Patrick Barron, an economics professor at the University of Wisconsin's Graduate School of Banking in a paper published at the Ludwig von Mises Institute, states:

"Like previous hyperinflations throughout time, the actions that produce an American hyperinflation will be seen as necessary, proper, patriotic, and ethical; just as they were seen by the monetary authorities in Weimar Germany and modern Zimbabwe. Neither the German nor the Zimbabwean monetary authorities were willing to admit that there was any alternative to their inflationist policies. The same will happen in America."

In a letter to President James Madison, George Washington wrote:

"No generation has a right to contract debts greater than can be paid off during the course of its own existence."

One can foresee that the era of the fiat-issued dirty float and pegged currencies is unsustainable and is expected to eventually fade away. A new sustainable monetary system can

be foreseen where currencies would float freely against one another, while concurrently physical gold and silver as true asset money that is free of the shackles of paper derivatives, will themselves float freely on the surface of the ocean of free floating currencies.

According to economist John Maynard Keynes: "If economists could manage to get themselves thought of as humble, competent people on a level with dentists; that would be splendid." A saying in Africa is: "It is not the lion you can see that is the danger, instead it is the one hidden in the grass that leaps out at you as you try to escape the one you see." According to Leonardo da Vinci: "He who does not punish evil, commands it to be done," and Mark Twain: "It is easier to fool people than to convince them that they have been fooled." One can also quote the inventor of the geodesic dome concept, Bucky Fuller: "You never change anything by fighting the existing reality. To change something, build a new model and make the existing model obsolete." Finally, one is warned by Yogi Berra: "In theory there is no difference between theory and practice. In practice there is."

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APPENDIX I: PETROLEUM RESERVES ESTIMATES

Petroleum reserves are divided into three generally recognized categories. The first category is called Proven Reserves (PR), and is defined as: “The estimated quantities of oil which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under current economic and operating conditions.” That means that the economic conditions determine the category of some oil to some extent.

The second is category called Estimated Ultimately Recoverable (EUR) or in another designation: Ultimately Recoverable Reserves (URR) oil. This is oil that is unfeasible to recover for reasons that are either economic or technical. This category also includes yet to be found oil.

The third category is designated as Non Conventional (NC) oil. This includes oil from coal, oil shale, oil sands, tar sands, bitumen, heavy and extra heavy oil, deep water oil, polar oil, and natural gas condensates.

The Organization of Petroleum Exporting Countries (OPEC) members have agreed among themselves to quotas that are proportional to their proven reserves. That creates an incentive to overestimate these reserves. For instance this gave Venezuela a motivation to restate its proven reserves by including heavy oil as a proven reserve in 1988. The United Arab Emirates (UAE), Iran, and Iraq responded immediately and Saudi Arabia followed suit two years later.

Conflicting data about ultimately recoverable oil reserves exist. The United States Geological Survey (USGS) reports in the "World Petroleum Assessment 2000" that world reserves of conventional crude oil total 3,000 billion barrels. This estimate is an increase from a similar estimate in 1994 of 2,400 billion barrels, up from 1,500 billion barrels in 1990.

A December 2003 report in Oil and Gas Journal notes that Canada's oil reserves now total more than 180 billion barrels of oil, with most found in economically recoverable oil-tar sand deposits. Saudi Arabia's reserves are estimated at 264 billion barrels.

The oil companies, not to be outdone by the OPEC nations artificially inflating their reserves, are using the tar sands and oil shale as a means to show that they are replacing their production, as a way of pleasing investors and the financial community. In its 2005 summary annual report, the ExxonMobil oil company reports that: “ExxonMobil has added 19 billion oil-equivalent barrels to proven reserves over the last 10 years, more than replacing production. ExxonMobil proved reserve base of 22 billion oil-equivalent barrels equates to a reserve life at current production rates, of 14 years.” This reserves replacement is satisfactory to the financial circles on Wall Street. In honesty, though, the report adds in fine print that: “Exxon Mobil has significant interest in proven tar-sands reserves in Canada.” The definition of liquids and natural gas proved reserves include the tar-sands and are described as follows:

“Liquids and Natural Gas Proved Reserves

In this report, we use the term “proved reserves” to mean quantities of oil and gas that ExxonMobil has determined to be reasonably certain of recovery under existing economic and operating conditions on the basis of our long-standing, rigorous management review process. We only book proved reserves when we have made significant funding commitments for the related projects. In this report, we aggregate proved reserves of consolidated and equity companies, excluding royalties and quantities due others, since ExxonMobil does not view these reserves differently from a management perspective. To reflect management’s view of ExxonMobil’s total liquids reserves, proved reserves in this

report also include tar-sands reserves from Canadian Syncrude operations, which are reported separately as mining reserves in our SEC filings. Tar-sands reserves included in this report totaled 738 million barrels at year-end 2005, 757 million barrels at year-end 2004, 781 million barrels at year-end 2003, 800 million barrels at year-end 2002, and 821 million barrels at year-end 2001. For our own management purposes and as discussed in this report, we determine proved reserves based on our long-term view of future price levels consistent with our investment decisions. Based on Securities and Exchange Commission guidance, ExxonMobil also began in 2004 to state our results to reflect the impacts to proved reserves utilizing December 31 liquids and natural gas prices (“year-end price/cost revisions”). On this basis, year-end proved reserves, including year-end price/cost revisions, totaled 22.4 billion oil-equivalent barrels in 2005 and 21.7 billion oil-equivalent barrels in 2004. Excluding year-end price/cost revisions, 2005 proved reserves also totaled 22.4 billion oil-equivalent barrels, while 2004 proved reserves totaled 22.2 billion oil-equivalent barrels.

Resources, Resource Base, and Recoverable Resources

Resources, resource base, recoverable oil, recoverable hydrocarbons, recoverable resources, and similar terms used in this report are the total remaining estimated quantities of oil and gas that are expected to be ultimately recoverable. In addition to proved reserves, the resource base includes quantities of oil and gas that are not yet classified as proved reserves, but which ExxonMobil believes will likely be moved into the proved reserves category and produced in the future.

Proved Reserves Replacement Ratio

Proved reserves replacement ratio is a measure that is calculated using proved oil-equivalent reserves additions divided by oil-equivalent production. Both proved reserves additions and production include amounts applicable to equity companies. The ratio usually reported by ExxonMobil excludes sales and year end price/cost revisions, and includes Canadian tar-sands mining operations in both additions and production volumes. See the definition of “liquids and natural gas proved reserves” above. When reporting the ratio, the inclusions and exclusions are listed, as shown on page 42.

Finding and Resource-acquisition Costs

Finding and resource-acquisition costs per oil-equivalent barrel is a performance measure that is calculated using the Exploration portion of Upstream capital and exploration expenditures and proved property acquisition costs divided by resource additions (in oil-equivalent barrels). ExxonMobil refers to new discoveries and acquisitions of discovered resources as resource additions. In addition to proved reserves, resource additions include quantities of oil and gas that are not yet classified as proved reserves, but which ExxonMobil believes will likely be moved into the proved reserves category and produced in the future.”

The discoveries of oil on the oil companies' balance sheets are declining and they are replacing oil production with natural gas reserves. This is somehow subtle because most oil companies present their data in barrels of oil equivalent (boe), which is oil and gas combined and published in barrels. This is a slick way to not tell the reader that they are actually finding natural gas and not oil.

The Canadian Association of Petroleum Producers sees the oil sand reservoir at 2,000 billion barrels of crude, of which 315 billion barrels is currently recoverable. This is oil economically viable at prices between \$18 and \$20 per barrel. Worldwide, recoverable reserves of oil found in oil sands are currently reported in excess of 1,000 billion barrels.

The USA Department of Energy, in a March 2004 study, reports oil shale reserves in the USA alone of over 2,000 billion barrels. Worldwide, oil-shale reserves are estimated as high as 14,000 billion barrels. USA oil shale reserves alone are suggested to be sufficient to provide 100 percent of USA crude oil consumed at current usage for over 200 years.

Table A1. Assessments of Reserves and Ultimately Recoverable Resources (URR) in billion barrels of oil (bb) for different locations.

	URR 1997 [bb]	Discovered 2002 [bb]	URR 2002 [bb]
Saudi Arabia	300.00	299.00	320.00
Former Soviet Union	275.00	239.15	271.00
Russia		187.00	200.00
USA lower 48 states	210.00	189.00	195.00
Iraq	115.00	121.00	135.00
Iran	120.00	123.00	130.00
Venezuela	90.00	88.00	95.00
Kuwait	85.00	86.00	90.00
Abu Dhabi	80.00	77.00	80.00
Mexico	50.00	54.00	62.00
China	55.00	52.00	57.00
Nigeria	40.00	50.00	52.00
Libya	45.00	48.00	51.00
Kazakhstan		30.00	40.00
Norway	27.00	31.00	34.00
UK	30.00	30.00	32.00
Indonesia	25.00	28.00	30.00
Algeria	23.00	27.00	30.00
Canada	28.00	27.00	28.00
Azerbaijan		15.00	18.00
Neutral Zone	12.00	15.00	15.50
Oman	12.00	13.00	15.00
Egypt	11.00	13.00	14.00
Qatar	10.00	12.00	13.00

India	11.00	11.00	12.00
Australia	7.00	10.00	11.00
Argentina	10.00	11.00	11.00
Colombia	10.00	9.50	10.00
Malaysia	8.50	8.60	10.00
Angola	9.00	8.40	9.50
Romania	7.00	6.90	7.50
Ecuador	5.50	7.09	7.50
Brazil	12.00	6.00	7.00
Syria	5.50	5.60	6.00
Turkmenistan		4.50	6.00
Dubai	5.00	4.50	4.75
Brunei	4.00	4.40	4.50
Trinidad	3.75	4.15	4.50
Gabon	3.75	3.77	4.00
Ukraine		3.40	4.00
Peru	3.50	3.26	4.00
Yemen	4.00	2.80	3.50
Vietnam	1.50	2.68	3.00
Uzbekistan		2.65	3.00
Denmark	2.00	2.40	3.00
Congo	2.50	2.18	2.50
Germany	2.30	2.30	2.40
Tunisia	1.75	1.85	2.20
Italy	1.75	1.60	1.75
Bahrain	1.20	1.38	1.60
Thailand	0.75	1.20	1.50
Sudan		0.95	1.50
Cameroon	1.20	1.27	1.30
Netherlands	1.10	1.13	1.25
Bolivia	0.70	1.07	1.20
Turkey	1.10	1.07	1.20
Croatia		0.86	1.00
France	0.90	0.88	0.95
Austria	0.90	0.90	0.95
Papua	1.10	0.80	0.90
Hungary	1.00	0.81	0.90
Albania	0.80	0.72	0.80
Sharjah	1.20	0.60	0.80
Pakistan	0.70	0.71	0.75
Chile	0.60	0.50	0.50
Total	1,777.6	1,760.5	1,898.2

The current USA geological Survey (USGS) world estimate of 3,000 billion barrels of conventional crude is probably conservative. Consider Iraq. Only 2,300 oil wells have been

drilled in Iraq, compared with over 1 million wells drilled in Texas, USA. Furthermore, only 22 of the more than 80 major Iraqi oil fields have been fully explored. Iraq is reported to have 112 billion barrels of oil reserves. But based on unexplored reserves, many geologists believe that the actual number is more than twice the current estimates.

North American reserves of conventional oil are probably understated since recent deep oil exploration in the Gulf of Mexico has identified a supply of oil that may be as large as 56 billion barrels. Deep oil wells are drilled to 25,000 feet below the ground surface and represent a new frontier in oil exploration.

The understatement of oil reserves sometimes occurs. An example of such case is the Kern River field in California, where production wells were first drilled in 1899. By 1942, after 43 years of continuous pumping, the remaining Kern River oil was estimated at 54 million barrels. Pumping continued, and over the next 50 years, the field produced over 736 million barrels. In 1986, using three dimensional (3D) mapping technologies, the reservoir was reported to contain an additional reserve of over 970 million barrels.

The 2002 USGS estimates are shown in Table A2.

Table A2. USGS major assessment of world oil ultimately recoverable resources (URR), 2000.

	Oil				Natural gas liquids				Total petroleum			
	95%	50%	5%	Mean	95%	50%	5%	Mean	95%	50%	5%	Mean
Undiscovered	394	683	1202	725	101	196	387	214	495	879	1589	939
Reserve growth	255	675	1094	675	26	55	84	55	281	730	1178	730
Proved reserves	884	884	884	884	75	75	75	75	959	959	959	959
Cumulative production	710	710	710	710	7	7	7	7	737	737	737	717
Total	2244	2953	3890	2994	210	334	553	351	3287	3287	4443	3345

From an opposite perspective, pessimists dispute the USGS estimates based on the following arguments:

1. The reserve growth methodology is biased.
2. The OPEC nations greatly overstate their proven reserves.
3. The range of uncertainty is exaggerated.
4. The unconventional resources are much smaller than estimated.

A more realistic estimate of the ultimately recoverable resources is given in Table A3.

Table A3. Estimates of ultimately recoverable resources (URR).

Resource	Estimate (Bb)
Conventional oil	
Known fields produced	896
Known fields future production	871
New fields future production	133
Deep water future supplies	60
Polar areas future production	30
Gas liquids	400
Total conventional sources	2,390
Unconventional heavy oil	300

Some facts help to visualize the numbers:

1. The world's annual oil consumption would fill the volume of a cube 1 mile on the side or 1 cubic mile.
2. Each person in the USA consumed about 1,000 gallons of oil in 2002, for a total of 7.2 billion barrels for the USA's population.
3. The oil producing areas of Saudi Arabia, Kuwait, UAE, Iraq, and Iran combined contain 75 percent of the world reserves in a triangle the size of the state of Oklahoma in the USA.

APPENDIX II: THE CHESSBOARD LEGEND

The game of chess originated in India about 2,000 BC and was called "Chaturanga." The name still is used in eastern languages such as in Arabic: "Chatarang." A spinoff of the name is the Arabic word: "Chater" meaning: "Skillful." Initially, Chaturanga had only the four pieces of: elephants, chariots, horses and foot soldiers.

A version of the chessboard legend or parable is told as follows:

"A long time ago Sissa Ben Dahir, the Grand Vizier to the Indian king, Shirham, presented his latest creation to his ruler. It was a game called "Chess." The king was so pleased, that he told Sissa that he could name his own reward. Sissa replied: "Majesty, give me the sum of 10,000 rupees; or give me some wheat in the following manner: I need 1 grain to place on the first square of the chessboard, 2 grains to place on the second square, 4 grains for the third square, and 8 grains for the 4th square; and to continue in like manner, oh Mighty and Generous One, let me cover each of the 64 squares of the board."

Now, King Shirham was not too good at arithmetic; that is why he had advisors, you see. And his realm was famous for its wheat production; the storage bins were always full. And as many kings are, he did not wish to part with so much money either. So he decided on the choice of the wheat and exclaimed: "Is that all you wish, Sissa, you fool? I shall grant your wish of the wheat."

So the king ordered a bag of wheat to be brought to the throne room, and the counting began. 1, 2, 4, 8, 16, 32, 64, 128, and so on. Before long the bag was empty. And then one bag, two bags, four bags, and so on were soon necessary, sometimes not even being sufficient for one square. This process did begin to take a long time; in fact, they soon quit counting individual grains, instead they were counting by bags. Later, believe it or not, even an entire granary bin was not sufficient.

When the king began to realize just how much wheat was involved, his heart sank. He knew it was he who was the fool. Sissa then admitted, "Oh Sire, I have calculated that more wheat is needed than you have in your kingdom, nay, more wheat than there is in the entire world, verily, enough to cover the whole surface of the Earth to the depth of the twentieth part of a cubit."

At this point in our story, we are sad to say, nothing much is known of the whereabouts of that clever inventor of chess or whatever happened to him. There is no mention of his name in the official court records. Kings are not known for treating their subjects in a kindly and loving manner when the latter have made a fool of the Royal Sovereign. Some are of the opinion that Sissa Ben Dahir was banished from the kingdom forever. Others feel he is languishing in some dark and remote prison. Yet many people

who know more about the inner workings of the court are sure that Sissa ben Dahir was beheaded.”

APPENDIX III: UNSUSTAINABLE HISTORICAL EVENTS RESULTING IN SOCIETAL AND CIVILIZATION COLLAPSES

Location	Date	Event	Description
Syracuse, Greece	400 BC	Currency devaluation, Inflation	Dionysius confiscates gold and silver coins. They are reminted keeping the weight the same but changing the denomination from one to two drachmas. First recorded official sovereign currency devaluation and sovereign default.
Ephesus, Greece	377 BC	Sovereign default	As reported by Greek philosopher Aristotle, the citizens' gold and silver jewelry was confiscated without compensation to owners to pay sovereign debt and cover budget deficit to prevent collapse of the city state.
Rome	241-146 BC	Punic Wars inflation	Debasement of gold and silver coinage content to finance continuous wars against Carthage. Indebted low-income masses supported the process at the expense of the wealthy class.
Miletus, Greece	200 BC	Sovereign debt default	First historical forced public bonds subscription to cover the debt of a city-state. Resulted in economic depression.
Rome	64 AD	Inflation	Roman emperor Nero debased gold, silver and copper coins. Action caused inflation and poverty among the lower classes.
Rome	301 AD	Inflation	Roman emperor Diocletian minted a depreciated silver denarius. Inflation, speculation and social collapse ensued.
China	1020 AD	Inflation	Sung Dynasty first fiat paper currency printing scheme to buy-off foreign invaders. Resulted in inflation.
China	1166 AD	Hyperinflation	Chin Dynasty developed a paper money printing scheme based on a sovereign monopoly on the trading of tea and salt to finance a war against the Mongols.
China	1296, 1309, 1350, 1374 AD	Inflation	Debased currencies issued by various dynasties resulted in inflationary crises leading to economic collapses.
China	1455 AD	Inflation	Inflation caused by excessive issuance of paper currency. Paper currency was banned as a means for payment for several hundred years.
Florence, Italy	1494 AD	Bank Collapse	The Medici Family, engulfed in corruption, political intrigues, bad investments and incompetent

			management, collapsed the Medici Bank. Large taxes imposed on citizenry.
Spain, Europe	1520-1640 AD	Hyperinflation, sovereign debt defaults	The looted silver and gold from the New World lead to a European hyperinflation. Spain was forced to default on its sovereign debt in 1557, 1560, 1575 and 1596.
Holy Roman Empire, Europe	1621 AD	Tipper and See-Saw debt crisis.	The European states minted debased coinage touching off an inflationary crisis followed by riots, collapsed social structures and economies.
Holland	1637 AD	Tulip Mania Bubble	Thousands of speculators ruined after a bubble in tulip bulbs trading burst.
UK	1720 AD	South Sea Bubble	Bubble in trading of shares of the fictitious and unprofitable South Sea Company collapsed and financially ruined the late-coming speculators.
France	1720 AD	Mississippi Bubble	British financier John Law generated in France a money scheme based on inexistent wealth and trading opportunities in Louisiana, USA. The bubble burst and collapsed the French economy.
UK	1772 AD	Banking crisis	Crisis initiated by the collapse of a prominent London banking establishment.
USA	1779 AD	Continental Currency Collapse	The first USA Continentals currency collapsed through is rapid debasement. A Spanish silver dollar was equivalent to 1.25 Continentals in 1777 and to 500 Continentals in 1781. According to George Washington: "A wagon load of money will scarcely purchase a wagon load of goods."
France	1789 AD	Inflation, French Revolution	Excessive issuance of fiat currency led to a decade of inflation culminating into the French Revolution.
USA	1792 AD	Money Panic	Rapid credit expansion by the newly formed Bank of the United States and excessive speculation by private bankers.
USA, UK	1796 AD	Money Panic	Inflated land prices collapsed; causing a money panic.
Denmark	1813 AD	Debt Panic	Sovereign debt default created money crisis.
USA	1819 AD	Money Panic	Excessive money and debt issuance by Second Bank of the United States. Speculation was encouraged, leading to financial collapse.
UK	1825 AD	Money Panic	Stock market crash caused by excessive speculation and widespread failures of British banks. Bank of England almost collapsed.
USA	1837 AD	Money Panic	Deflationary collapse resulted in a 25 percent unemployment level, business and bank failures.

UK	1847 AD	Money Panic	Following the 1840s railroad boom, a deflationary collapse resulted in bank and business failures and high unemployment.
Global	1857 AD	Money Panic, USA Civil War	First global economic breakdown. The financial sector in New York recovered only after the American Civil War of 1866.
USA, Europe	1873 AD	Money Panic	The “Long Depression” lasted 20 years. It was initiated by financial failures in Vienna, Austria and propagated to the rest of Europe and the USA. Railroad bankruptcies and bank failures resulted.
USA	1884 AD	Money Panic	The depletion of the gold reserves in Europe and the failure of two New York banks caused a ripple effect to other banks and tight credit.
UK	1890 AD	Money Panic	Barings Bank faced bankruptcy caused by failed investments in Argentina. The Bank of France bailed out the British Central Bank.
USA	1893 AD	Money Panic	Stock market collapse similar to 1873 caused by failed railroad investments and a military coup in Argentina. “Gilded Age” collapse in the USA with a run on gold at the USA Treasury.
USA	1896 AD	Money Panic	A drop in the USA silver reserves and commodities prices deflation ended with a stock market collapse and an economic depression.
USA	1901 AD	Money Panic	New York Stock Exchange first crash; resulting from excessive speculation in railroad stocks.
USA	1907 AD	Money Panic	Followed the creation of the Federal Reserve central bank. Bank panic and run on deposits. Stock market collapse. Financier J. P. Morgan organized a private rescue bank bailout to contain the financial collapse.
USA	1910 - 1911 AD	Money Panic	The Sherman Anti-Trust Law and the break-up of the monopoly of Standard Oil, caused a short depression.
Hungary, Poland, Austria and Soviet Union	1920s AD	Hyperinflation	Caused by excessive money printing following World War I.
Germany	1923 AD	Hyperinflation	The excessive reparations imposed on Germany by the Treaty of Versailles after World War I were paid-off by money printing. At its peak, the inflation rate reached 3, 250,000 percent.
USA	1929 AD	Stock Market Crash	This event launched the Great Depression in the 1930s, and was a harbinger of World War II.
Greece	1944 AD	Hyperinflation	After liberation from German occupation during World War II, the Greek citizens refused to trade

			with the drachma currency. Economic collapse ensued.
Hungary	1946 AD	Hyperinflation	Doubling time of increasing prices of goods was fifteen hours; wiping out savings.
USA, Global	1971, 1973	Stagflation	Global inflation rates in the double digits coupled with high unemployment rates caused the decoupling of gold from the dollar as a reserve currency and was associated with two major USA dollar devaluations in 1971 and 1973.
Latin America	1982	Debt Crisis	Sovereign debt defaults, currency devaluations resulted from excessive external debt and capital crisis.
Global	1987	Stock markets crash	Starting in Hong Kong, stock markets crashes spread to Europe and the USA. On “Black Monday” the largest single-day decline in values occurred in the Dow-Jones Industrials Average.
USA	1989-1991	Disinflation, Savings and Loans Crisis	One fourth of the USA’s Savings and Loans Associations failed and were merged with larger banks as a result of a real estate bubble crash associated with bad loans.
Japan	1990	Deflationary Asset Bubble collapse	Real estate and stock prices collapsed resulting in “Japan’s Lost Decade.”
Sweden, Finland	1990	Scandinavian Banking Crisis	Real estate bubble collapse was associated with a currency and financial institutions breakdown.
UK	1992-1993	Pound Sterling Crisis	Speculative attack on British Pound by financier George Soros and his associates forced the UK to withdraw from the European Exchange Rate Mechanism and resulted in a recession.
Mexico	1994	Currency Collapse	In the “Tequila Crisis” a sudden devaluation of the Mexican peso resulted in inflation, bank runs, asset destruction with a bailout by the USA.
Asia	1997	Asian Financial Crisis	Several Asian countries were affected by a financial crisis involving bank collapses, stock market crashes, high unemployment, inflation and a real estate bust.
Russia	1998	Russian Monetary Crisis	Russia defaulted on its debts and devalued its ruble currency resulting in global effects and the collapse of the Long Term Capital Management (LTCM) firm and a drop of 11.5 percent in the Dow Industrials Average index within 3 trading sessions.
Argentina	1999	Economic Collapse	Default on sovereign debt caused bank runs, street rioting, and capital flight. All bank accounts were frozen for 12 months, bringing the economy to a halt.

USA	2001	Dot-com Bubble collapse	Internet stocks speculation resulted in a stock market collapse and financial stagnation lasting for a decade.
Iceland	2008	Bank Crisis	Depositor runs on banks caused their collapse and a devaluation of the kronor currency.
Zimbabwe	2008	Hyperinflation	The largest of all inflation known episodes reached a 79.6 billion percent inflation rate at its peak in 2008.
USA, Global	2008-?	Debt Crisis	A real estate bubble collapse and bad debt resulted in a near collapse of the global financial system. Government bailouts of the banking system resulted in a currencies devaluation war among the world central banks.
European Union	2010-?	European Sovereign Debt Crisis	Debt repayment crisis started in Greece and spread to the southern European countries. The euro currency financial block was threatened with dissolution.

APPENDIX IV: CASSANDRA’S GIFT: CLAIRVOYANCE

In Greek antiquity’s great legend, the role of Cassandra was a thankless one. She was the daughter of Priam, king of Troy, and his queen, Hecuba.

Cassandra fell asleep at the temple of the god Apollo, who fell in love with her. He offered to give her the ability to foretell the future or the gift of clairvoyance, only if she were to return his love. She promised to do that, but when time has come to deliver on the promise, she reneged.

The god Apollo became furious, but there was no way for him to take back the gift of clairvoyance. What he could do was to make other people disbelieve her prophecies. According to legend, Apollo gave Cassandra the gift of prophecy. When she refused him, he spat into her mouth so she would never be believed.

When she foresaw the rape of Troy by the Greeks after a ten year siege, she was ridiculed, discredited, and declared insane by the Trojans.

APPENDIX V: DEFUNCT FIAT CURRENCIES

Cai Lun in China invented paper in 105 AD. China introduced the first paper bank notes in 806 AD. After Marco Polo returned from his stay in China, he described its use as currency:

“All these pieces of paper are issued with as much solemnity and authority as if they were of pure gold or silver; and on every piece a variety of officials, whose duty it is, have to write their names, and to put their seals. And when all is duly prepared, the chief officer deputed by the Khan smears the Seal entrusted to him with vermilion, and impresses it on the paper, so that the form of the Seal remains printed upon it in red; the Money is then authentic. Anyone forging it would be punished with death.”

Examples are shown of some defunct and contemporary Central Banks inflated depreciated fiat “currencies,” in contrast to “money,” that perform their intended temporary purpose of stealth generalized taxation during their short lifetimes, and then meet their predetermined ultimate fate and pass into oblivion. Some disappear with the demise of their associated political and national entities and the emergence of new ones. For instance, with an official inflation rate of 20 percent, 21,000 Vietnamese dong were equivalent to one USA dollar in 2011, higher than 16,000 in 2008.

As a typical example, Argentina, South America’s second largest economy after Brazil, has had 5 different currencies in the past century, averaging a currency collapse every about twenty years. In 1970, the “peso ley” replaced the “peso moneda nacional” at a rate of 100 to 1. The “peso ley” was in turn replaced by the “peso Argentino” in 1983 at a rate of 10,000 to 1. That lasted for two years, and was then replaced by the “Austral,” at a rate of 1,000 to 1. The “Austral” was itself replaced by the “peso convertible” at a rate of 10,000 to 1 in 1992. During the past four decades, after the various changes of currency and slicing of zeroes, one “peso convertible” in 2012 is equivalent to 10,000,000,000,000 (10^{13}) or ten trillion original “peso moneda nacional” at the 1970 time-frame.

Argentina unraveled with the biggest default on sovereign debt in history at the level of \$100 billion. The bank dollar deposits were converted into pesos. Overnight, a peg of one-to-one with the dollar was broken. The unpegged currency immediately devalued. Citizens’ savings were wiped out. The local residents rioted into the streets in protest setting the banks on fire.

Some famous fiat currency quotes are:

Ernest Hemingway: “The first panacea for a mismanaged nation is inflation of the currency; the second is war. Both bring a temporary prosperity; both bring a permanent ruin. But both are the refuge of political and economic opportunists.”

Adam Smith, “The Wealth of Nations”: “...for in every country of the world, I believe, the avarice and injustice of princes and sovereign states, abusing the confidence of their subjects, have by degrees diminished the real quantity of metal which had been originally contained in their coins.”

John Maynard Keynes, “Economic Consequences of Peace”: “By a continuing process of inflation, governments can confiscate, secretly and unobserved, an important part of the wealth of their citizens.” “There is no subtler, surer means of overturning society than to debauch the currency. The process engages all the hidden forces of economic law on the side of destruction and does it in a way that not one man in a million is able to diagnose.”

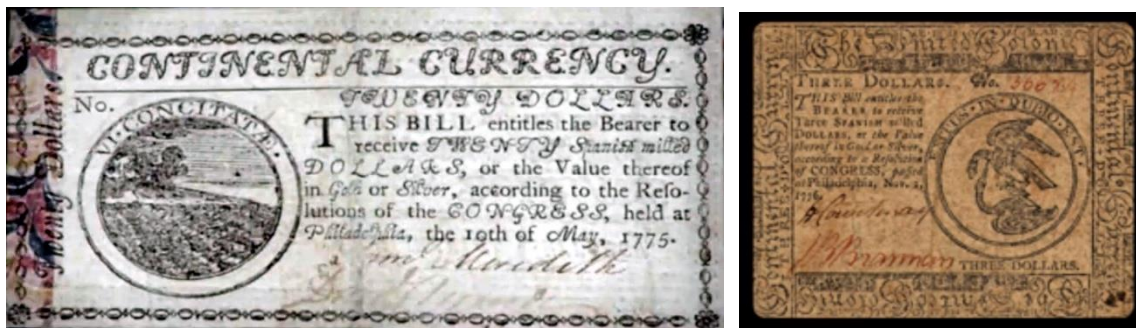
Voltaire, French poet: “In the end all paper money returns to its intrinsic value: worthless.”

Nicholas Copernicus: “Nations are not ruined by one act of violence, but gradually and in an almost imperceptible manner by the depreciation of their circulating currency, through excessive quantity.”

J. P. Morgan, USA financier: “Gold is money, everything else is just credit.”

Thomas Jefferson, USA president: “Paper is poverty. It is only the ghost of money, and not money itself.”

Sir Josiah Stamp, Former Director of the Bank of England: “The modern banking system manufactures money out of nothing. The process is perhaps the most astounding piece of sleight of hand that was ever invented. Banking was conceived in iniquity and born in sin. Bankers own the Earth. Take it away from them, but leave them the power to create money and control credit, and with the flick of a pen, they will create enough money to buy it back again... But if you want to continue as the slaves of bankers and pay the cost of your own slavery, let them continue to create money and to control credit.”













In 2012, with the inflation rate at 25 percent and the purchasing power of the peso decreasing by $\frac{1}{4}$ each year, a shadow economy thrived and backstreet currency exchange was back to the streets of Argentina's capital, Buenos Aires. The official exchange rate was subject to capital controls at 4.4 pesos to a dollar. However the unofficial exchange rate 6.7 pesos to the USA dollar. The official inflation rate was 9.9 percent. The government outlawed the calculation or the quote of any other inflation rate. Accordingly, 40 percent of the bank dollar deposits have

been withdrawn from Argentina's banks. With capital controls a special permission is needed to transfer bank deposits abroad.

Real estate became the store of value with cash transactions taking place in dollars with a 25 percent discount, even though the process is outlawed. Asset outflow occurred with middle-class people taking ferry day trips to Uruguay to place their savings in deposit boxes. Companies bought financial instruments locally in pesos and then resold them in New York for dollars.

Argentina became frozen out of the international debt markets. The government did not reach a settlement with the Paris Club group of creditors, so the banking system lacked the deposits to stay afloat. In 2010, President Kirchner seized private pension accounts to lend \$4.4 billion of this money, at a rate of one-tenth the inflation rate, to new home buyers through a lottery, rather than through the capacity to repaying the loan. Land used in cattle farming was contracting as the cattle producers faced large and complicated export tariffs and were forced to sell cheaply into the domestic market. Government spending has to be funded from printing presses, taxes, and expropriation of personal or company assets. The country ran out of hard currency and there was no money to pay for crucial imports, grinding to a halt industry, manufacturing and agricultural markets.

APPENDIX VI: CONVERSION FACTORS AND ABBREVIATIONS

Notation	Description
bbls	barrels
bbls/day	barrels per day
mbbls/d	thousand barrels per day
mmbbls	million barrels
boe	barrel of oil equivalent 1 boe = 6 mcf of natural gas
mmboe	million barrels of oil equivalent
mcf	thousand cubic feet
mmcf	million cubic feet
bcf	billion cubic feet
liquids	natural gas liquids

APPENDIX VII

BRILLIANT ANALOGY

An analogy describing unsustainable government and household budgets and futile budget cuts by an unknown author was communicated by Dr. Thomas Dolan:

USA Government Budget (2013)

Tax Revenue	$\$2.17 \times 10^{12}$
Federal Budget	$\$3.82 \times 10^{12}$
New Debt	$\$1.65 \times 10^{12}$
National Debt	$\$14.271 \times 10^{12}$
Budget Cut	$\$38.5 \times 10^9$

By dividing the figures into 10^8 , we obtain:

Equivalent Household Budget

Annual Income	\$21,700
Family Spending	\$38,200
New Credit Card Debt	\$16,500
Outstanding Credit Card Balance	\$142,710
Budget Cut	\$385

APPENDIX VIII

THE TALENT PARABLE

The "Parable of Talents" is part of the New Testament Bible in Matthew 25, verses 14-30. It tells of a master going on a trip and leaving with three of his servants several bags of gold to care for while he is away. To one he gave 10, to another he gave 2 and to the third servant just one bag. He acted this way based upon his judgment of their abilities to handle money.

When the master returned, the servant who was given 10 bags, returned 20 bags and the servant given two bags returned four bags. The last servant, who dug a hole in the ground and buried his bag of gold, dug it up and returned it intact. The last servant was scorned and called lazy for doing nothing with his "talent".

In those days, "talent" was considered as weight or coinage but can be looked at today as one's talent or ability that should not be wasted.

EXERCISES

1. Prove that the two forms of the resources use equations are equivalent:

a) In terms of the number of doubling times n : $R(n) = R_0 \cdot 2^n$

b) In terms of the time t : $R(t) = R_0 \cdot e^{+kt}$.

2. Prove that the exponential growth model:

$$R(t) = R_0 \cdot e^{+kt}$$

and the linear growth model:

$$R(N) = R_0 \cdot (1+i)^N$$

are equivalent if the time t is replaced by the number of years N , and the growth rate is replaced by:

$$k = \ln(1+i)$$

where i is the annual percentage rate.

3. It is suggested that the Earth can support a maximum population of 9 billion persons. Its population in 2001, according to the United Nations was 6.1 billion. If the annual rate of increase is maintained at 0.7 percent, or at the rate of 1.9 percent.

a) Calculate the corresponding doubling times for the world population.

b) In how many years will the maximum level be reached if the rate of increase of 0.7 percent in each case?

4. Double the amounts of the estimated recoverable supplies for USA oil, world oil and USA coal then calculate the corresponding estimates of the depletion times as a function of the production annual growth rates. For the current growth rates how does the doubling of the recoverable supplies affect the depletion times?

5. Compare the amplification in the fissile inventory in:

a) A converter PWR or BWR reactor with a conversion ratio $C=0.55$.

b) An advanced converter such as the CANDU concept with $C=0.9$.

6. An infinite number of recycles of nuclear fuel cannot be achieved because of the buildup of radioactive isotopes that would require expensive shielding and radiation protection measures. If the number of recycles is limited to n recycles, derive the expression for the fissile fuel inventory.

7. A breeder reactor containing a mixture of U^{238} and Pu^{239} consumes about 1 kg of Pu^{239} per day. At startup its initial Pu^{239} loading was $M_0 = 500$ kgs of fissile Pu^{239} . Its breeding ratio is B . Plot the doubling time as a function of the breeding ratio B if it varies from 1.1 to 1.5.

8. If the number of recycles of fissile fuel is not infinite and is limited to a number of n recycles, derive the expression for the fissile fuel inventory for a nuclear reactor with a conversion factor C .

Compare the amplification in the fissile inventory for a number of recycles $n = 5$ in:

a) A converter Pressurized Water Reactor (PWR) or Boiling Water Reactor (BWR) reactor with a conversion ratio $C = 0.5$.

b) An advanced converter such as the Canadian Deuterium Uranium (CANDU) concept with $C = 0.9$.

9. An executive at an electrical utility company needs to order uranium fuel from a mine. The utility operates a single 1000 MWe power plant of the CANDU type using natural uranium, and operating at an overall thermal efficiency of 33 percent. What is the yearly amount of:

1. U^{235} burned up by the reactor?

2. U^{235} consumed by the reactor?

3. Natural uranium that the executive has to contract with the mine as feed to his nuclear unit?

Consider that natural uranium has a content of 0.72 percent in U^{235} .