

## **Cycles, Trends and Financial Crisis**

### **Understanding the Impacts of Monetary Policies**

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## **Abstract**

Low interest rate environment encourages borrowing. During inevitable downturns in business cycles, heavy borrowing makes it more vulnerable to financial crisis. Low interest rate environments also favor high fixed cost investments, which have low variable costs and hence, have more significant scale economy than low fixed cost investments. In a large and growing economy, high fixed cost investments earn higher rates of returns than low fixed cost investments. During last several centuries, fueled by the abundant cheap nonrenewable resources, the global economy has been expanding more or less uninterrupted. In such a growth economy, low interest rate policy, which favors high fixed cost investment, has been mostly beneficial to overall economic activities, although it also induces financial crisis from time to time. However, many signs indicate that the upward trend of economic output will end soon. In the new environment, higher and stable interest rates will narrow the gap between cost of borrowing and expected rate of inflation, which will reduce the incentive for speculation. A high interest rate environment will also enhance the competitiveness of small firms as low fixed cost entities. Small firms are more labor intensive and less resource intensive, which is especially helpful in a world with increasing resource scarcity and high unemployment rates.

## **I. Main Policy Analysis**

Any organisms or organizations need to make a fixed investment before earning a positive return. What types of fixed investment and how much to invest depend on the forecasting of future demands. Since building up required fixed assets takes time and effort, businesses and societies cannot respond to unexpected changes immediately. The necessity of fixed cost in an economic system is the most important reason why economic activities fluctuate, sometimes violently, over time.

The fixed costs of production systems can be high or low. Lower fixed cost systems can respond more flexibly to unexpected changes. Hence they are less affected by business cycles. However, higher fixed cost systems have lower variable cost and hence have more significant scale economy than lower fixed cost systems. When the size of the economy is large, higher fixed cost systems provide higher rates of return. Therefore, companies or societies may choose to adopt higher fixed cost systems, despite their potentially higher instability.

When the market size for a product or a service is large, a small number of large projects provide higher returns than a large number of small projects. Financial markets provide an effective way to increase the fixed investment of economic systems and have been instrumental in accelerating economic development in the past. However, higher fixed cost systems require a higher level of output to breakeven than lower fixed cost systems. When economic output shrinks, high fixed cost investments are affected more than low fixed cost systems. Since financing is intimately related to high fixed cost investments, an economic downturn is often manifested as a financial crisis.

Factors in economic activities are intimately related. It is through these relations that government agencies try to adjust aggregate economic activities and individual consumer behaviors. For example, central banks often change the levels of interest rates, in an attempt to influence the level of total economic outputs and the price levels. However, the precise relations among different factors are not well understood. This is why the consequences of financial policies often surprise policy makers. Therefore it is highly desirable to develop a quantitative theory to provide a more precise understanding of the relations of major factors in economic activities.

Recently, a mathematical theory of economics of human society and life systems has been derived from the laws of statistical thermodynamics (Chen, 2005; Chen and Galbraith, 2009). The main result is a formula of variable cost as a mathematical function of product value, fixed cost, uncertainty, discount rate and project duration. From this formula of variable cost, together with fixed cost and volume of output, we can compute and analyze the returns and profits of different production systems under various kinds of environment in a simple and systematic way. The results are highly consistent with the empirical evidences obtained from the vast amount of literature in economics and biology. In this paper, we will apply the theory to understand business cycles and financial crisis.

From this theory, it can be calculated that when interest rates are lower, investments with higher fixed costs and longer duration will benefit more. Intuitively, in a low interest rate environment, the rate of depreciation is low. Therefore investments with high fixed costs and long durations will benefit. Since loans are fixed income instruments for buyers, they are fixed costs for issuers. Hence, mortgages with long maturity and low initial payments are long duration, high fixed cost investments. They tend to do well in a low interest rate environment. With the bursting of the stock market bubble in early 2000, interest rates were lowered by the central banks to stimulate economy. While the monetary policy was aimed to help economy in general, high leveraged

investments, such as commodity trading and low down-payment and long duration mortgage businesses will benefit most and hence attract large amounts of capital. This is the source of the financial crisis induced by high commodity prices and subprime mortgages. Indeed low interest rate policy is responsible for many bubbles and subsequent bursts in the history. If this is the case, why has the low interest rate policy been widely adopted by many governments for such a long time?

High fixed cost production systems, which are favored under a low interest rate environment, have lower variable costs and hence have more significant scale economy than lower fixed cost systems. In a large and expanding economy, higher fixed cost systems offer higher rates of return than low fixed cost systems. Most of the world economic activities are sustained by nonrenewable resources. With the increasing input of nonrenewable resources as raw materials, the world economic output has been increasing more or less uninterrupted for the last several centuries. Because of the general trend of the expanding economy in the past, the low interest rate environment, which promotes investments with high fixed costs and long durations, has been beneficial to economic development most of the time.

However, there are already many signs that the high consumption rate of human societies strains the capacity of nature. In the early 1970s, the delinkage between the world's major currencies and gold, a major commodity, signaled that a stable relation between economic activities and resource input was no more possible. Since then, many social adjustments have been made. The most important one has been the drop of fertility rates below the replacement rate in most wealthy countries, which have high resource consumption rates, as well as in some poor countries. This signals that economic growth can no longer be sustained. However, there is a time lag between the drop in fertility rate below the replacement level and the drop in economic output. The initial drop in fertility rate reduces the number of dependant children. Many more adults become

available as labor forces. As a result, countries in demographic transition often enjoy a high level of growth in economic output (Arnott and Casscells, 2003). Since most economic observers focused on the economic output alone, information implicit in the demographic transitions was often ignored.

Eventually, the scarcity of natural resources began to be reflected in their prices. Before the current economic recession, commodity prices had increased relentlessly under the low interest rate environment. In 2009, commodity prices have increased substantially despite the continued low level of economic activity. These events show that the constraint of natural resources has been widely recognized by the financial and broader community.

In the past, the effectiveness of low interest rate policy was largely due to the abundance of the low cost nonrenewable resources, which limits the level of inflation. In the future, the average cost of producing nonrenewable resources will continue to grow, of which we will discuss in greater detail later. With this background in mind, we propose a policy of steady and higher interest rates and analyze its impact.

First, a higher and steady interest rate will reduce speculation. When the cost of borrowing is substantially lower than the expected inflation rate, speculation becomes impossible to curb. Speculation increases the rate of inflation and further increase the incentive to short currency and long commodities and other assets. Low interest rates provide strong incentives for financial institutions to engage in highly leveraged financial activities, which are at the heart of the current financial crisis (D'Arista, 2009). In the future, speculation could intensify because of the increasing scarcity of most commodities. A higher interest rate will narrow the gap between the borrowing cost and the expected inflation rate, which will reduce the incentive for speculation.

Second, a higher interest rate will force banks to actually lend to businesses. When the cost of financing is very low for banks, banks can make a profit simply by trading other financial instruments. For example:

The recovery took root anyway, and one can pinpoint the date it really began --- precisely --- to February 4, 1994. On that date, Alan Greenspan raised the short-term interest rate, allowing short rates to begin to catch up to the rise in long-term rates that had been under way for some months by that time. Normally, raising short-term interest rates is a contractionary measure, with negative consequences for growth. But the circumstances in 1994 were special. The nation's largest banks by that point had been in a state of near-insolvency for half a decade and had been slowly rebuilding their balance sheets by a simple device: milking the government for high interest rates on long-term bonds while paying out very low rates to their depositors. The very steep yield curve then prevailing ... meant that a bank could do this, and make at least a modest profit, without lending to business at all. The rise in short rates squeezed the banks' costs, which had the effect of forcing them to cover their costs with riskier commercial and industrial loans, which up to that moment they had not been willing to make. (Galbraith, 2008, p. 60)

During this financial crisis, many of the technically insolvent banks quickly return to highly profitable positions by actively trading financial instruments backed by a large amount of low interest rate funding provided by the governments. They can make not so modest profit, without lending to business at all.

Third, a higher interest rate will increase the competitiveness of small companies as low fixed cost systems. In the current financial crisis, most problems are caused by losses from large companies, such as AIG, Citigroup, Merrill Lynch and General Motors. Compared with large

companies, small companies are less resource intensive and more labor intensive. This is especially beneficial in an environment with scarce natural resource and high unemployment. It is often suggested that lower interest rates will reduce costs for all companies. However, the profit levels of different companies are mainly determined by their level of competitiveness in the market. For example, lower interest rates may initially lower the monthly mortgage payment. But soon the real estate price will increase as the result of the lower interest rate. Higher real estate prices will benefit parties with more capital and make housing less affordable to parties with less capital. Similarly, lower interest rate policy will reduce the competitiveness of small companies.

Raising interest rates will strengthen the competitiveness of small companies, which indirectly lower the fixed cost of societies. We also recommend policies to directly reduce the fixed cost of the society. There are many ways to reduce the fixed cost. We will only discuss two methods. The first is to relax zoning rules for residential, office and commercial areas. Residential, office and commercial areas are often segregated in many communities for various reasons. Because of this segregation, most people have to rely on cars as transportation tools to and from work, which has a high fixed cost compared with walking or bicycling. By relaxing the zoning rule so residential, office, commercial and shopping areas are close to each other, more people will have the opportunity to walk or bike. This will help reduce the fixed cost of the society.

The second is to reduce the employment age. Many thirteen-year-olds are physically stronger and can handle many types of work better than their middle aged parents. However, under the current labor rules, they are unable to perform regular works and live in an enforced idleness. To allow thirteen-year-olds to work will help them gain valuable real life experience and become a productive part of the society. It will also greatly enhance their self esteem. Reducing the number of years of mandatory education will greatly reduce the fixed cost of a society.

The ongoing financial crisis provides a natural opportunity to scale down the sizes of high cost industries. Currently, most stimulus money goes to banking and auto industries, whose employees represent the highest income groups among white collar and blue collar workers. For many years, the viability of the high cost auto and banking industries is due to the active policy support from the government. Instead of bailing out the oversized auto industry, which is the principle source of pollution, we can fund projects to transform communities into walking and biking friendly ones. Instead of subsidizing risky trading activities, we can transform the banking industry into a utility just like electricity and gas, as many have already suggested. However, the government financial policies, which are largely determined by representatives from the financial industry, aim at preserving instead of reforming the current financial system. This sows the seed of a new financial crisis in the future.

We have argued for a policy of lower fixed costs and higher interest rates. This seems to contradict Keynes' theory to stimulate economy by governments during economic downturns. However, Keynes was prescribing for an economy in a youthful growing stage. After listing many sound economic indicators despite the persistent high unemployment figures, he declared:

We are suffering from the growing pains of youth, not from the rheumatics of old age.  
We are failing to make full use of our opportunities, failing to find an outlet for the great increase in our productive powers and our productive energy. Therefore we must not draw in our horns; we must push them out. Activity and boldness and enterprise, both individually and nationally, must be the cure. (Keynes, 1932, p. 156)

Indeed, the decade of 1930 was the decade of largest discovery of oil reserves (Deffeyes, 2001). The transformation from the coal based economy, which centered on railways, to oil based

economy, which centered on cars, was partially responsible for the Great Depression. The abundance of oil also set the stage of economic boom in 1940s and beyond.

Today, with fertility drops below the replacement rate for several decades in most wealthy, as well as some poor, countries, it is difficult to argue that we are suffering from the growing pains of youth. Therefore we have to take a different approach. Many people have already provided detailed discussions to prepare for the long term slide at personal and policy levels (Odum and Odum, 2001; Kunstler, 2005; Hall and Klitgaard, 2006; Heinberg, 2007). Our theory provides specific recommendations about monetary and fiscal policies for the future.

Trends are often superposed with cycles. The existence of business cycles makes it difficult to detect the underlying trend and the reversal of trend. But it is crucial to detect the trend of economic activities before developing sound policies.

The detailed calculation on the relations of different factors is provided elsewhere (Chen and Galbraith, 2009). In the rest of the paper, first we will provide an intuitive discussion on how systems of different fixed costs respond to cycles. Then we will discuss many signs of strains between high consumption levels of human societies and capacity of natural resources.

## **2. Cycles and Responses by Organisms and Organizations**

There are many cycles in nature. Resources are not evenly distributed at different phases in a cycle. For example, there is more light energy at daytime than at night time, at summer time than at winter time. For organisms and organizations, there are two main strategies dealing with external fluctuations. The first strategy is the low fixed cost strategy. Under this strategy, the internal environments of an organism or an organization fluctuate more with the external

environment. In this way fewer resources are spent on maintaining the internal environment. But the internal environment may not stay in a desirable condition, which makes this type of organisms or organizations less competitive than those whose internal environments are maintained in more desirable conditions. For example, cold blooded animals do not actively regulate body temperature with the chemical energy stored in their bodies. In this way, the energy expenditure of cold blooded animals is low compared with warm blooded animals. But cold blooded animals are very sluggish at night and only turn active at day time after the sun warms up their bodies.

The second strategy is the high fixed cost strategy. Under this strategy, organisms or organizations maintain a stable internal environment at more desirable condition. They are more competitive and as a result control larger share of resources than the low fixed cost systems. But their resource requirement is high and more vulnerable to decline in resource availability. Warm blooded animals keep themselves warm at night and at cold weather by burning extra chemical energy stored in their own bodies. They are more effective in obtaining resources but also require more resources to sustain themselves than the cold blooded animals.

There are parallels in human societies. To keep warm in a cold weather, we can either wear more clothes, which has low fixed cost or heat the entire building, which has high fixed cost. With heating, the temperature of the entire building can be kept at the level that is most comfortable to human beings. As a result we can work effectively in winter time to maintain a similar pace in economic activities as in mild weather. However heating a building is energy intensive and a year round fast pace economic activity needs more resource input than seasonal economic activities. We can also wear a lot of clothes to keep ourselves warm without heating the entire building. In that way, the energy expenditure is low. But we will be clumsy and work at slower pace.

In most poor countries, there are few social welfare programs. As a result, fixed costs in poor countries are low, with corresponding high variable costs. The major costs in such economic systems are variable costs. Hence, the impact of business cycles in poor countries will be less pronounced. In most wealthy countries, there are many social programs to reduce uncertainty in life. As a result, fixed costs in wealthy countries are high, with corresponding low variable costs. In wealthy countries, during an economic downturn, social services are maintained at a regular level. Some expenditure, such as unemployment benefits, is even higher than in good times. This means that the government expenditure increases as its revenue decreases. It will be very difficult to stay in such condition for a prolonged period. Because of the serious damage caused by a prolonged downturn in a wealthy society, when economic activities slow down, governments try to generate extra activities to keep the total economic output stable. Similarly, in cold weather, warm blooded animals shiver to generate extra heat to maintain a constant body temperature. High fixed cost organisms and organizations actively regulate their internal environments at more desirable conditions with extra resource consumption.

Most cycles are driven by resource availability and technology innovation to consume resources. Daily and annual cycles of biological activities are driven by the level of light energy. The rise and fall of giant animals are closely linked to the rise and fall of oxygen levels in atmosphere (Lane, 2002). The rise and fall of the levels of atmospheric carbon dioxide, which provides the raw material for all plants, is behind the plant evolution and productivity (Beerling, 2007). The rising yield of the crops in the last few decades mirrors the rising levels of carbon dioxide in the atmosphere.

Business cycles and financial crisis are rarely discussed in terms of resource abundance and utilization in the mainstream economic literature. Indeed, mainstream economic theory specifically denies a fundamental role of resources in business cycles. For example, it was often

argued that it was not the rise of the oil price itself, but the inappropriate policy response to oil price changes in the 1970s, that caused the stagflation in that period. Because of their confidence about their ability to control the economy, the policymakers were surprised by the magnitude of the current economic downturn, despite the steady rise of the commodity prices before the recession.

Social structures and economic developments are strongly affected by the abundance and quality of natural resources. In the next section, we will provide a more detailed discussion about the relations among abundance of resources, population dynamics and economic growth.

### **3. Abundance of Resources, Population Dynamics and Economic Growth**

In nature, there are organisms with a wide spectrum of fixed costs from bacteria to whales. This indicates that systems of widely different levels of fixed costs are viable. But at different times and different environments, some systems are more viable than other systems. For the most time of the past several centuries, the main trend in human population dynamics has been the expansion of the high fixed cost groups, which require more resource input, with respect to low fixed cost groups, which require less resource input. However, the changes in the supply and demand of natural resources gradually alter the competitive balance between high resource users and low resource users.

Among nonrenewable energy resources, high quality, low cost nonrenewable resources are extracted and consumed earlier than low quality, high cost nonrenewable resources. For example, natural gases have higher hydrogen content than coal and hence is a cleaner energy. Therefore, natural gases become a preferred choice for home cooking and heating and its rate of depletion is faster than coal. Petroleum has higher hydrogen content and higher energy density than coal.

Therefore petroleum becomes the choice of energy in transportation industry, which causes petroleum to be depleted faster than coal.

After many years' global mining activities, high quality mines, which have low production costs and usually are extracted first, have been seriously depleted. In an earlier period, the discovery of new reserves was faster than production. Later, the discovery of new reserves slows down but the production increases continuously. With the declining reserve of the low cost energy resources and other natural resources, high cost energy sources, such as oil sands, have been developed on a large scale. As a result, the average production cost of energy and other natural resources has been increasing, making nonrenewable resources a less attractive substitute for human labor in many cases.

On the demand side, the rising living standard, which requires more resource consumption, in many countries and the increase of global population has greatly increased the demand for resources. As a result of the changes in supply and demand of natural resources, the population dynamics of high resource users and low resource users have reversed in the past several decades. The population of low resource users has increased much faster than the high resource users.

Japan, which has very high living standard and very little natural resources, provides a good example to help us understand the relation between living standard, resource availability, fertility and long term economic output. Japan is often cited as an example on the irrelevance of natural resources in the technology age. However, without much natural resource on its own land, Japan has to purchase natural resources at the market price instead of extracting resource below the cost of the market price. Therefore, Japanese people have to work extra hard to maintain a high living standard. Inevitably, it cuts into the amount of time they can spend on raising children and lead to below replacement fertility. Eventually, the decline of ratio of workers to dependents drags down

the economic output. The change of outlook on the Japanese society can be best illustrated from the change of the Japanese stock market valuation. In 1989, Nikkei 225 index was near 40,000. Twenty years later, the index stands around 10,000. Most commentators of the Japanese economy often attribute the decline of Japan to mismanagement at various levels. However, the same types of management were hailed as the models for others to emulate in Japan's miracle years. It is more natural to understand the change in Japan's economic performance as part of a larger social evolution under resource constraint.

Once we understand the Japanese economy from the resource perspective, it becomes the harbinger to the future of the global economy instead of an irrelevant example of failure. It suggests that we are around the peak in a big cycle of the nonrenewable resource based civilization.

#### **4. Concluding Remarks**

With the help of an analytical theory about the relation of major factors in economic activities, we were able to understand the precise effects of the monetary policies. Specifically, we understand why the low interest rate policy was effective in a world of increasing energy supply, even though the low interest rate policy was also responsible for many financial crises. We further argue that with the rising physical cost in extracting nonrenewable resources, a higher interest rate and lower fixed cost economy will be more stable and sustainable.

The reduction of fixed cost, with the corresponding increase of variable cost, will make our daily life less convenient. The reduction of resource consumption will reduce our living standard. Hence it is often difficult to adopt policies that will reduce the fixed cost of a society. So far, it is mainly through the natural selection instead of adaptation that low fixed cost communities spread

out. In biological systems, low fixed cost systems have higher fertility than high fixed cost systems. The same is true in human societies (Rushton, 1996). Low fixed cost communities generally have higher fertility rates than high fixed cost communities. With currently low mortality rates among both high fixed cost and low fixed cost communities, low fixed cost communities spread out with respect to high fixed cost communities. Both selection and adaptation are at work in the evolution of human societies, like any other biological systems (Jablonka and Lamb, 2006).

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