Discontinuity Ahead – Oil Limits will Adversely Affect the Economy

What will the world economy be like ten years from now? Or fifty years from now? Is it something that we can forecast by looking at the past, assuming that past tends will continue?

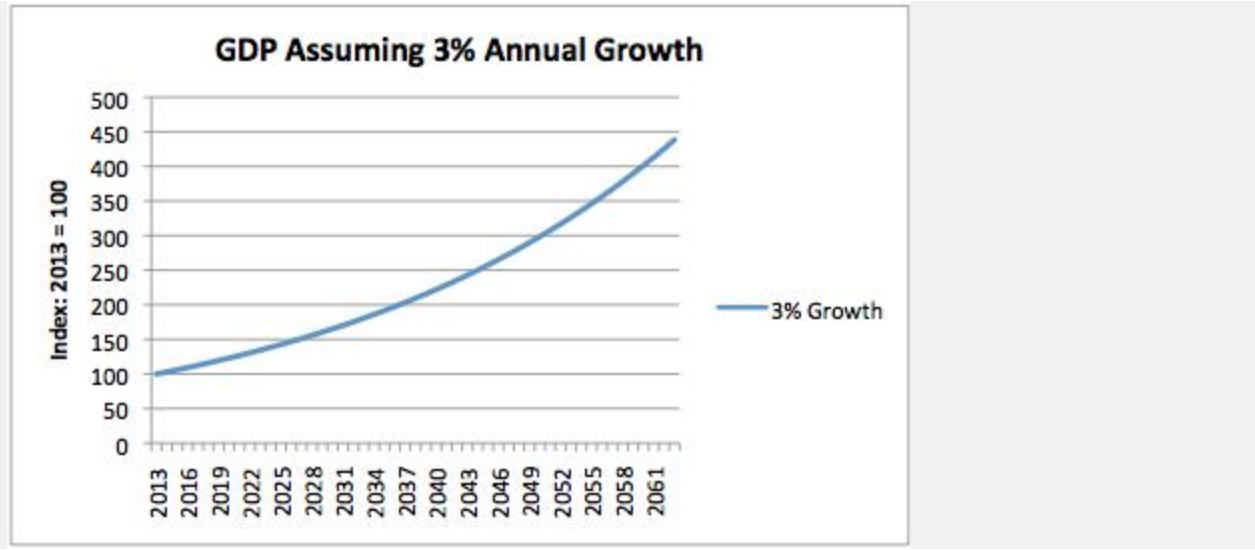

Figure 1

Most economists today seem to think we can rely heavily on past patterns. If we can really assume that the economy will grow at 3% per year (over and above inflationary increases), then in 50 years, GDP (Gross Domestic Product) will be 4.38 times as high as it is today. Economists might assume a 3.0% growth rate in a developed country, like the US, and a higher annual growth rate in a country like China, India or Brazil.

It seems to me that this standard view is incorrect. There is a substantial chance of a sudden shift toward a less favorable growth pattern (which I refer to as a "discontinuity"). This possibility is not obvious though, if a person bases his models on the growth that took place between 1940 and 2000, as economists today often seem to. In this post, I describe an alternate view showing how such discontinuities can occur.

The Current (or Recent Past) "Standard" View of the Economy

Most economists today seem to believe a whole collection of theories and models that basically support the view that humans (and in particular, politicians and Federal

Reserve Officials) are in charge of the economy. With this view, natural resources are not very important. If there is a shortage, either (a) alternatives will take over quickly or (b) prices will rise for a short time, leading to more extraction, thereby eliminating the shortage.

Productivity is expected generally to trend upward. In other words, the expectation is that there will be increasing output per unit of input. Part of this increase in output comes from improvement in technology. This improvement in productivity is expected to lead to increased profits for companies and higher wages for workers.

If the economy is not performing optimally, demand (that is, the ability and willingness to buy more "stuff") can be increased through deficit spending or by very low interest rates, or both. For example, deficit spending might be used to give a worker who has been laid off unemployment benefits, so he can buy food, clothing, and other goods and services. (Without money, the laid-off worker has no demand, according to the standard economic definition.) Very low interest rates tend to make a new car or new home more affordable, or might allow an oil and gas producer to drill more wells inexpensively.

Debt, or "leverage" as it is often called, seems to be seen as beneficial. Debt is seen to being able to increase indefinitely. The primary measure of how the economy is functioning, GDP, completely ignores debt. For example, if a person goes to college for a year, tuition will be part of GDP, whether or not the individual takes out a loan to pay tuition, room, and board. If the college builds a football stadium, the amount paid to the contractors for building the stadium is part of GDP, but the loan the college takes out to finance the stadium is not considered in the calculation.

Needless to say, if politicians want to increase GDP, the easiest way to do so is to encourage everyone to "max out all their credit cards," or do the equivalent with other types of loans. Of course, doing this in the early 2000s helped lead to the subprime debt bubble–not exactly the effect one wants.

With the foregoing view of the economy, economists can talk about substituting one energy source for another over a very long time frame. The reason economists can think in these very long time frames is because the economy is seen to always be growing, thanks to productivity growth, more human laborers, technology growth, and occasional stimulus, if needed. In this model, there is nothing to challenge the growth of the economy, so no turning points are anticipated. Thus, we can undertake very

long projects, such as trying to swap low-carbon energy sources for other energy sources.

Discontinuity: Why might economic growth "misbehave" going forward?

We are aware of many situations in the physical world where there is a sudden change of behavior. We pull on a rubber band for a while. At first it stretches; then it breaks. We skate on thin ice for a while. At first the skating goes fine; then we fall through the ice, into the water. We throw a ball up in the air. It rises for a while; then it stops and falls back to the ground.

Another example is a little closer to the economic growth model we are looking at here. Yeast transforms sugars in grape juice into alcohol. Alcohol is in fact a waste product, made by the yeast, as it metabolizes the sugar. At some point, the concentration of alcohol in the wine becomes too high for the yeast to survive, and the yeast die off. Growth of yeast population, instead of continuing to rise rapidly, suddenly turns negative and the population falls to zero.

In a model such as the wine and yeast model, it is not until the pollution level becomes too high that the adverse effects are seen. We can encounter somewhat of a similar problem with our economy, with pollution of various kinds.

A similar turning point can appear with resource extraction of various kinds, such as oil. When we begin extracting resources, the cost of extracting those resources is not very high. In fact, the cost of extracting the resource may even fall, with greater use of fossil fuels and improved technology. This growing productivity enables a rising standard of living.

At some point, however, the cost of extraction begins to rise, because the easy-to-extract resource (such as oil) has already been extracted. This higher cost of extraction may set up negative feedback loops, throughout the economy. This occurs partly because resources must be diverted toward oil extraction, rather than being used for other productive purposes. From the point of view of the worker, he finds it necessary to lower his standard of living, because he spends more of his total income on the same (or a lesser amount) of oil, leaving less income for other purchases.

The original factors of production were land, labor and capital. This simplified model did not consider natural resources, or pollution caused in extracting and using the natural resources, or the role of debt. It also did not consider the fact that we live in a finite world, so that even if growth can go on for a while, there are likely to be barriers

at some point. If the economic model economists are using misses important variables, it is easy for the model to miss problems that haven't come up to date, but can be expected to come up in the future. The model may have, in fact, worked well in the 1940 to 2000 period, because resource limits did not start raising resource prices significantly until after the year 2000.

A related issue is that if economists are overly convinced that their models are correct, they may miss seeing important trends that suggest their models are incomplete.

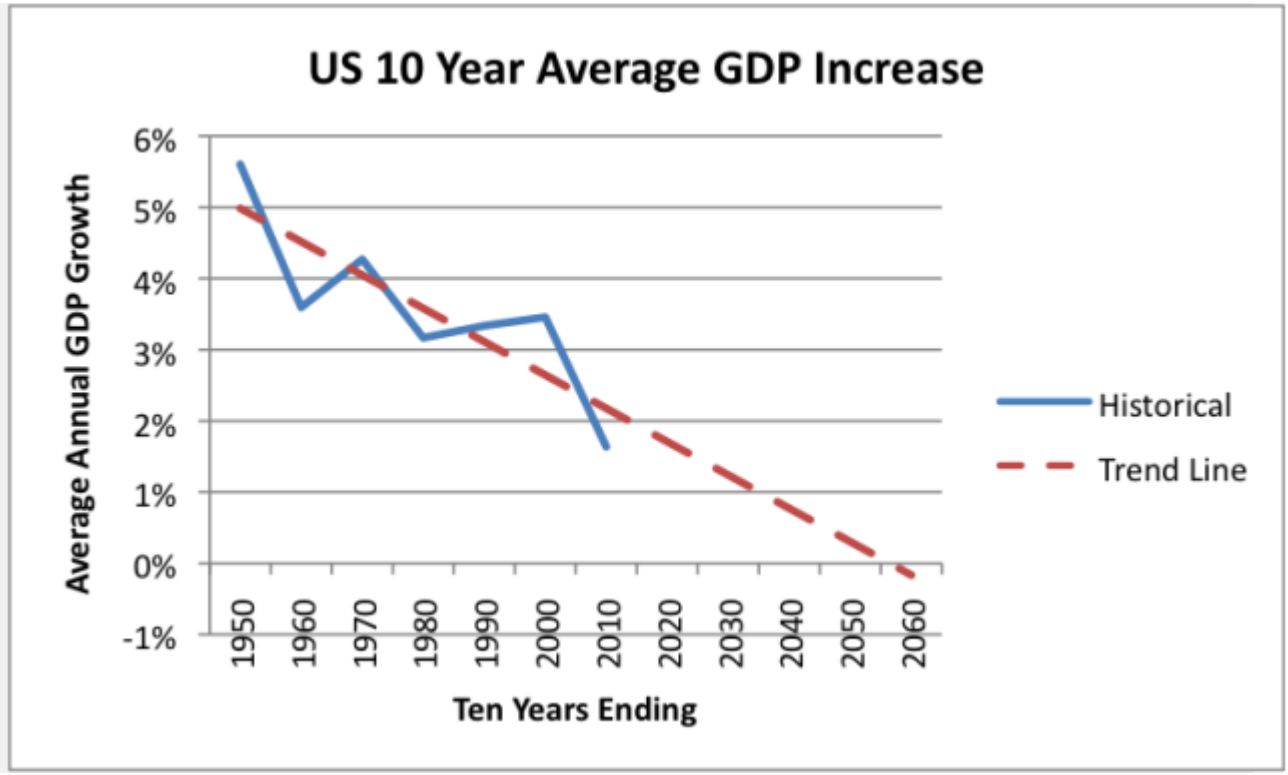

Figure 2. US Ten Year Average Real GDP growth, based on BEA data.

If we look at the trend line related to US GDP growth (Figure 2), we see that there is a decided downward trend to it. While an estimate of 3% per year going forward might have made sense based on the experience through 2000, this estimate seems increasingly less likely, based on recent experience. In fact, if experience since 2010 were included, it would further emphasize the downward trend. The IMF projects that US economic growth in 2013 will amount to 1.7%, and for advanced economies together will amount to 1.2%.

Besides slower than expected economic growth, there are many other parts of the theory that are not holding up very well now, either. Wages of the common worker have not been rising as planned. Oil prices have not come down, even with

considerable success in US oil production. The Federal Reserve has needed to keep interest rates very low, and even with that, the economy is limping along. The Federal Reserve keeps printing money. In fact, it announced today that it is continuing its Quantitative Easing at $85 billion a month, because the economy is not yet doing well enough to get along without it.

What is Missing in Economic Models

What is missing is a broader view of how the economy really works. The economy is far more than land, labor, and capital. The economy includes a huge number of players–governments, businesses, and individuals, each deciding what action to take based on how the system behaves at a given time–for example, what products and services are available at a given time, at what prices. Resources of many different types play a role in this system, as does pollution, and the cost of mitigating this pollution. This complex economy has been built up over the years, by the gradual addition of new layers of businesses, governments, government rules, and consumers. Unneeded older parts drop out, as new parts are added. A system such as this is sometimes referred to as a Complex Adaptive System.

There are two parts of this system that play a special role. One part is **energy products that are needed to make anything "happen."** These energy products are of many different types, including oil, natural gas, coal, geothermal energy, captured wind energy, even food. For example, if goods are to be transported, some sort of energy product is needed. It might be oil used to fuel a car or truck. Or it might be food fed to a horse pulling a cart. It might even be food fed to a human being, who is then able to carry the goods as he walks.

As another example, if heat is to used for some process such as baking, some energy product is required. It might be heat from burning oil or coal, or it might be heat from the sun captured by a solar cooker. Energy for heat might even come from food. For example, a chicken, after eating appropriate food, is able to sit on an egg and provide heat to incubate it.

Another critical part of the system, besides energy resources, is the financial system. The financial system ties everything else together through its pricing mechanism. By knowing prices, we can tell how society values many very different types of resources and products (such as a bushel of wheat, a barrel of oil, and an hour of a common laborer's time). Because of its tie to all of the other resources, the financial system is likely to be one of the systems that is stressed earliest, if there is a major change to the system.

Besides tying the system together, money produced by the financial system also acts a "pseudo resource". It is not the money itself that has value–it is the fact that it can be exchanged for a resource of real value, such as a bushel of wheat, a barrel of oil, or an

hour of a common laborer's time. When the amount of resources is not expanding rapidly, printing money can temporarily inject pseudo resources into the system, making things temporarily look better than they are. Of course, when this money printing stops, the temporary improvement is likely to disappear.

Oil Has Caused Recent Stresses to the Financial System

When recession hits, the financial system gives a hint that this networked system of businesses, governments, consumers, and resources is being stressed. What causes this stress on the financial system? Recently, evidence seems to suggest that **rising oil prices**are a major contributor. For one thing, economist James Hamilton has shown that 10 out of the last 11 US recessions were associated with oil price spikes. He has also directly shown that the oil price in the run-up in the 2005-2008 period was sufficient to explain the Great Recession. I have also written an academic article called, Oil Supply Limits and the Continuing Financial Crisis.

Oil is part of the constellation of energy resources that allows things to happen within this complex networked system. It is not easy to substitute away from oil in the short term, because the cost of the vehicles and other equipment that we have today is extremely high. If we were to transition to other types of vehicles (say natural gas operated or electric), the cost of building new fueling stations and vehicles would be very high, and take many years. Customers would also find the new vehicles unaffordable, unless the old ones could be phased out as they wore out.

What Can Go Wrong In This More Complex System?

The problem with this more complex system is that everything depends on everything else. Things that seem obvious, such as how much oil reserves a company can expect to extract in the future, no longer are obvious, because the prices of resources can go down as well as up. This happens because prices of resources depend upon (a) the amount buyers can afford to pay for these resources, as well as (b) how much it costs to extract the resources. If the cost of extracting resources increases, the question is whether workers will really be able to afford the cost of higher-priced resources.

There can also be conflict between the amount of debt outstanding and the amount of products (made from resources) available to repay that debt. There is no limit on debt issued, but the amount of resources extracted in a given year eventually slows down, as the inexpensive to extract resources are depleted.

Interest rates on debt are important as well. If interest rates remain very low, interest payments do not "squeeze" prospective buyers of goods too much, so they can afford additional goods. But if interest rates rise, then the financial situation changes at many points in the system. The cost of buying homes and cars increases. The resale value of homes likely drops.

Another issue with the networked system that we are operating in is that shortages in one area tend to get transferred to other parts of the system, stressing the system as a whole. For example, when we discovered a few years ago that oil supply could not grow as rapidly as desired, we started using food crops (primarily corn and sugar) to produce ethanol, as a substitute for oil. When we did that, the additional demand for food tended to raise food prices. Thus the stresses from one part of the system were spread more broadly. This can be a temporary help to oil prices, but it can eventually lead to widespread system failure.

Because of the interlinkages in the system, we should not be surprised if what looks like a problem in one part of the system–high oil prices–has an adverse impact on other parts of the system. The financial system, since it connects everything else together, would be especially likely to be stressed. Governments, because they act as a safety system for unemployed workers, would also seem to be at risk.

We have many real-life examples of civilizations that grew for a time, then reached limits and collapsed. These civilizations were agricultural civilizations, so admittedly not exactly like ours. But the symptoms prior to collapse were disturbingly similar to the symptoms we are seeing today. As I have discussed previously, there was a growing disparity of wages between the common workers and the elite, and increasing use of debt. Food prices often spiked. Eventually, it was the inability of governments to collect enough taxes from increasingly impoverished workers that brought the system down. Workers also became more subject to disease, because low pay and high taxes did not allow for adequate nutrition. The collapse came over a period of years–typically 20 to 50 years.

We don't know exactly what kind of discontinuity we are headed for, but we have some clues, based on the risks we are facing and on what happened in the past. The discontinuity will likely play out over a period of years. Financial systems and political systems are likely to be involved. Because of the networked nature of the system, it will not be just one type of energy that will be in short supply–more likely, there will be problems affecting nearly all types of energy.

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