



Systemic Risk Arising from a Financial System that Requires Growth in a World with Limited Oil Supply

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I received an e-mail from an actuarial group (Joint Risk Management Section of the Society of Actuaries (SOA), the Casualty Actuarial Society (CAS), and the Canadian Institute of Actuaries (CIA) in collaboration with the SOA Investment Section, the International Network of Actuaries in Risk Management ("IN-ARM") and the Enterprise Risk Management Institute International ("ERM-II")) asking for essays relating to "Systemic Risk, Financial Reform, and Moving forward from the Financial Crisis."

Below the fold is the essay I submitted. It is called, "Systemic Risk Arising from a Financial System that Requires Growth in a World with Limited Oil Supply". Essays were limited to 1,500 words. The group calling for essays is made up of people who for the most part know very little about peak oil, or about oil in general. It is likely that actuaries who will eventually read the essays will be equally unknowledgeable. So the challenge was to describe the nature of the problem, starting from a knowledge level of close to zero, in as few words as possible.

The point I try to make in the essay is that the financial system requires economic growth, but oil supply seems to be flat, or even declining in the not too distant future. Because of the many benefits oil provides, this loss can be expected to constrain economic growth. If the economic system cannot grow, there are likely to be widespread debt defaults and other problems similar to the 2008 crisis. These problems can be expected to affect all types of financial institutions, including insurance companies.

Systemic Risk Arising from a Financial System that Requires Growth in a World with Limited Oil Supply

By Gail Tverberg, FCAS, MAAA

In July of this year, Lloyds of London issued a white paper on the risks of peak oil, noting that we are headed toward a global supply crunch.¹ In September, 2010, a paper was published in *Energy Policy* called "Global oil depletion: A review of the evidence."² It concludes, "A peak of conventional oil production before 2030 appears likely, and there is a significant risk of a peak in oil production before 2020." In other words, the world's conventional oil production may start declining in not too many years.

It seems to me that if we are in fact reaching limits with respect to oil supply, this should be of considerable concern. We have a financial system that demands economic growth, for reasons that will be discussed later in this paper. At the same time, as we approach limits with respect to oil production, the ability of the world's economy to grow becomes constrained, because in order for economic growth to occur, we will need to do more and more, with less and less oil.

The conflict of these two forces – a need for economic growth in a world that can no longer provide growing oil supply – sets the financial system up for a systemic risk of collapse. Furthermore, there is significant evidence that the financial problems of 2008 were early signs of this systemic risk affecting the financial system. If oil supply should actually begin to decline in the future, we can expect financial problems of 2008 to return and worsen.

Oil's Connection to the Economy

Oil is used for a huge number of purposes—transportation fuel, heating fuel, fuel for extracting minerals of all types, lubricant, and raw material for asphalt for road paving, plastics, synthetic cloth, medicines, fertilizer, pesticides, and herbicides, to name a few things. A declining oil supply, or even a level supply, should be a serious concern, with the world's rising population.

In recent years, there have been many attempts to try to find substitutes for oil, but with very limited success. Ethanol from corn has probably been the biggest success, but in 2009, its use in the US amounted to only 660,000 barrels a day³, compared to total consumption of oil products of 18.8 million barrels a day⁴, or 3.5% of the total. Raising this percentage is proving difficult for several reasons: manufacturers' warranties only permit the use of 10% ethanol in gasoline; ethanol tends to be more expensive than gasoline without subsidies; and there are relatively few stations offering E-85 gasoline.

Other so-called replacements for oil are only very partial replacements, and are still very far away from being full-scale solutions. Biofuel from algae is being investigated, but it is still very expensive, and not yet scalable. Electric cars are being developed, but they still are many years from being ready to replace our huge fleet of cars with internal combustion engines.

It should be noted that the problem with oil supply is really an economic one. There is a huge amount of oil theoretically available—in the oil sands in Canada, for example, and in the oil shale in the US west, and perhaps in the Middle East. But in order for this oil to be available now, huge investments would need to have been made starting at least 10 years ago. Also, in order to justify this investment, the cost of the finished oil products would need to be very high—high relative to the energy required to extract the oil, and high relative to people's salaries. At some point, limits are reached in the amount people can afford to pay for oil, and we may already be approaching those limits.⁵

Timing

Many observers would like us to believe that limits on oil and other resources are still a long way off, but this is not really true. World crude oil production has already stopped rising. Oil production has been essentially flat from 2005 to 2010,⁶ meaning that more and more cars and trucks must compete for the same fuel supply.

Period	World Crude Oil Supply in Million Barrels per Day ⁷	Cost per Barrel of West Texas Intermediate ⁸
1970	45.9	
1975	52.8	
1980	59.6	
1985	54.0	
1990	60.5	\$24.53
1995	62.4	\$18.43
2000	68.5	\$30.38
2005	73.7	\$56.64
2010 YTD	73.4	\$77.70

Impacts

While crude oil supply has not yet begun declining, it had been essentially flat since 2005, and this lack of growth is putting tremendous pressure on the world's financial system, since we now must do more and more with essentially the same oil supply. Oil prices have risen, and this is one source of financial problems, because higher oil prices have a disruptive impact on balance of payments, and can also cause a reduction in profits of companies.

But higher oil prices can also lead to recession and debt defaults. High oil prices don't give ordinary citizens more salary to spend, so they have to cut back on something else. One possibility is a cutback in discretionary spending, which will tend to lead to recession. If the cutback is in buying new homes, the price of new homes can be expected to drop. James Hamilton wrote a paper called, "Causes and Consequences of the Oil Shock of 2007-2008" showing that the run up in oil prices in the years prior to 2008 was sufficient to cause the major recession we have recently experienced.⁹

If oil prices rise, they may also cause debt defaults. This occurs because people's salaries don't rise correspondingly, so they need to cut back somewhere, and some will default on debts. Businesses may also be more at risk of debt defaults, if their cash flow is declining. The lower values of homes may also play a role in increasing defaults.

While one cannot prove that the aforementioned problems were the only causes of the financial crisis of 2008, there is certainly a strong similarity between the expected problems and the types of problems we have recently seen.

It should be noted, too, that a seeming over-supply of oil should not be surprising. As higher prices give rise to recession, this causes a cutback in demand. Reduction in credit availability also tends to reduce demand. So the oil available may be more expensive than what individuals and businesses can afford. If the oil available were cheaper, the oversupply would disappear.

Economic System's Need for Growth

Our current economic system includes a huge amount of debt. Money is loaned into existence. Debt is used to finance many business expansions. Governments rely heavily on debt.

The US economy has been growing for many years, with only brief interruptions, so nearly all of our experience with borrowing money, and paying it back with interest, has been during periods of economic growth.

Borrowing from the future is relatively easy when the economy is growing, because when the time comes to pay back the debt, the debtor's economic condition is likely to be as good as it was when the loan was taken out, and may even be better. So defaults are relatively uncommon, and the growth in the economy between the time the loan was taken out and the time it is repaid provides some contribution toward the interest payments.

But what if we start encountering a very different kind of world, one with a decline in oil supplies? If oil resources constrain economic growth, debt defaults can be expected to rise, and the whole debt system underlying our financial system is at risk. Insurance companies are very much at risk too, because many of their assets are bonds. In the past, these bonds would have been repaid with interest, but in a world with little economic growth, and perhaps economic decline, the risk of default becomes much higher.

Even if we should discover a way around our problems—say a new technology, which permits more oil extraction at lower cost, or a better substitute for oil, financial institutions--including insurance companies--are still likely to encounter substantial systemic risk related to debt defaults in the next few years.

Notes

¹Lloyds of London, Sustainable Energy Security: Strategic risks and opportunities for business, Chatham House, London.
http://www.chathamhouse.org.uk/files/16720_0610_froggatt_lahn.pdf

²S Sorrel, J Spiers, R Bentley, A Brandt, and R Miller, Global Oil Depletion: A review of the evidence, *Energy Policy*, Vol 38, Issue 9, 5209-5295.

³US Energy Information Administration, refiners inputs of ethanol,
http://www.eia.gov/dnav/pet/pet_pnp_inpt_dc_nus_mbbldp_a.htm

⁴US Energy Information Administration, product supplied,
http://www.eia.gov/dnav/pet/pet_cons_psup_dc_nus_mbbldp_a.htm

⁵David Murphy, "Further Evidence of the Influence of Energy on the US Economy", *The Oil Drum*, April 16, 2009. <http://netenergy.theoil Drum.com/node/5304>

⁶US Energy Information Administration, *International Petroleum Monthly*, Crude and Condensate from Table 1.1d. <http://www.eia.doe.gov/ipm/supply.html>

⁷US Energy Information Administration, *International Petroleum Monthly*, Crude and Condensate from Tables 1.1d and 4.1d. <http://www.eia.doe.gov/ipm/supply.html>

⁸US Energy Information Administration, Cushing , OK WTI spot price FOB.
<http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=rwtc&f=a>

⁹James Hamilton, Causes and Consequences of the Oil Shock of 2007-2008, *Brookings Papers on Economic Activity*, 2009.



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