The Expected Impact of Oil Limitations on the Property-Casualty Insurance Industry

By Gail E. Tverberg, FCAS, MAAA

Abstract

Using the principles of Biophysical Economics, together with the issue of resource constraints that the world is already facing (particularly with respect to oil), we show that the financial crisis that affected many industries in the 2008 -2009 period, including the property-casualty insurance industry, was not a one-off event. Instead, the financial crisis was closely tied to inadequate growth in world oil supplies, leading to higher prices of crude oil, which in turn affected credit markets, creating recessionary impacts.

If the growth in world oil supplies continues to be constrained, this analysis indicates that the recently-experienced financial crisis can be expected to be repeated, and get worse, resulting in impacts affecting many of the same lines of insurance as those affected during the 2008-2009 crisis.

As the restriction in oil supply becomes greater, we show bond default rates can be expected to increase greatly. These high default rates can be expected to lead to the eventual bankruptcy of companies writing financial guarantee insurance and result in erosion of capital of property-casualty insurers. An increase in bankruptcies of property-casualty insurance companies is indicated, quite possibly exceeding the capacity of guarantee funds.

Keywords: Biophysical Economics; bond default rates; financial crisis; oil; peak oil; recession; resource constraints; world oil supply

1. INTRODUCTION

There is a popular view of the recent financial crisis based on one set of economic theories ("classical" or "orthodox" economic theory) and one view of the importance of energy for future GDP (not very important, based on classical economic theory). Holders of these views tie the financial crisis to the subprime mortgage crisis which in turn was related to too loose credit policies in the 2002-2005 period, combined with the fall in housing prices, starting in late 2005 or early 2006.[1] Securitization of loans was also a factor, because banks could easily make more loans than were prudent, package them and resell them to unwise investors, and make a profit on the fees they received.[2] When all of the problems with these loans surfaced, banks required major bailouts, and a major financial crisis ensued. We are now working through the aftermath. With better financial regulation, the crisis should not happen again—or so the story goes.

[1] "Subprime Crisis Impact Timeline," *Wikipedia,* http://en.wikipedia.org/wiki/Subprime_crisis_impact_timeline.

[2] Shah, Anup, "Global Financial Crisis." *Global Issues,* 22 Aug. 2010, http://www.globalissues.org/article/768/global-financial-crisis#Securitizationandthesubprimecrisis.

There is another version of the story as well—one based on a different view of the economics ("biophysical" or "ecological" economics) and a different view of the importance of energy supplies to the economy (very important – a decline, even if only in oil production, is likely to have serious economic consequences—and even level oil production is a serious problem).

With the biophysical economic view of the story, while there may have been contributions to our problems caused by the subprime crisis, securitization of loans, and lax regulation, the real underlying issue was increasingly tight oil supplies—a problem that started about late 2004, when oil prices began to rise, and oil production started entering into a production plateau lasting from 2005 to 2010.

The problem can be viewed as one of peak oil supply or peak oil demand—it really doesn't matter which one chooses. Above a certain price, higher oil prices have a crushing effect on the economy, as illustrated by exhibits from Energy Secretary Steven Chu's presentation at the US Energy Information Administration's 2009 Energy Conference:

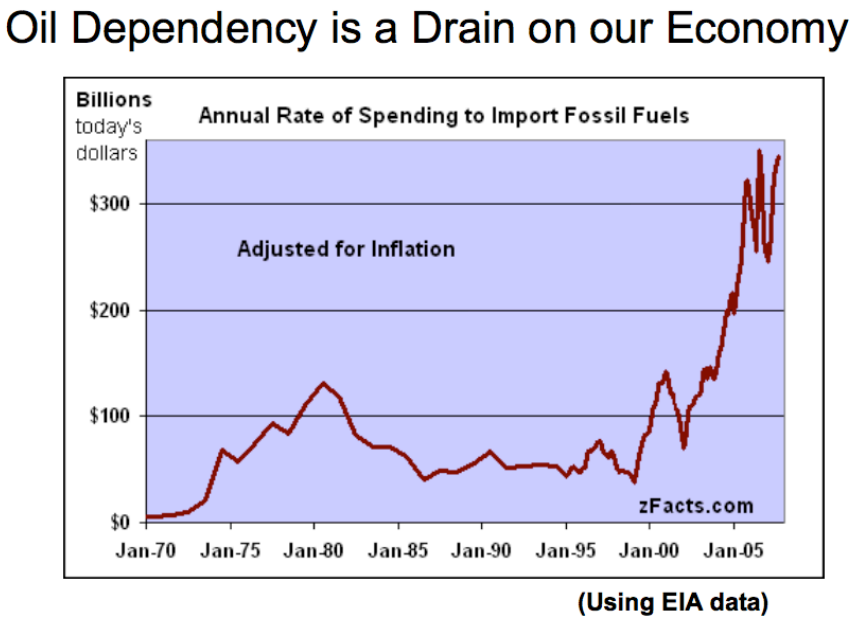


Figure 1 – Graph from Steven Chu presentation showing that high oil prices are a drain on the economy.[3]

[3] Chu, Steven, Presentation from 2009 Energy Conference, 7 Apr. 2009, http://www.eia.doe.gov/conference/2009/plenary/Chu.pdf.

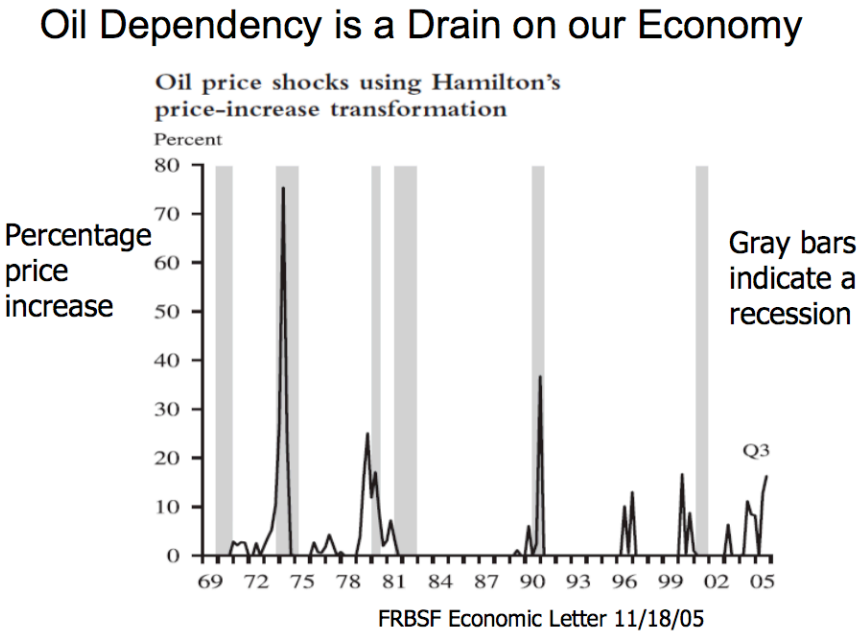


Figure 2 – From Steven Chu Presentation, showing that recessions generally follow oil price shocks.[4]

James Hamilton, referenced in the slide, is an Economist at the University of California, San Diego, known for his work tying oil prices to recessionary impacts. Prior to the latest recession, he developed a model of economic activity, with and without oil price shocks. He found in his model that oil prices seemed to explain the latest downturn, as shown in Figure 3. [5]

[4] Chu, Steven, Presentation from 2009 Energy Conference, 7 Apr. 2009, http://www.eia.doe.gov/conference/2009/plenary/Chu.pdf.

[5] Hamilton, James D., "Causes and Consequences of the Oil Shock of 2007-08," 27 Apr. 2009, http://dss.ucsd.edu/~jhamilto/Hamilton_oil_shock_08.pdf

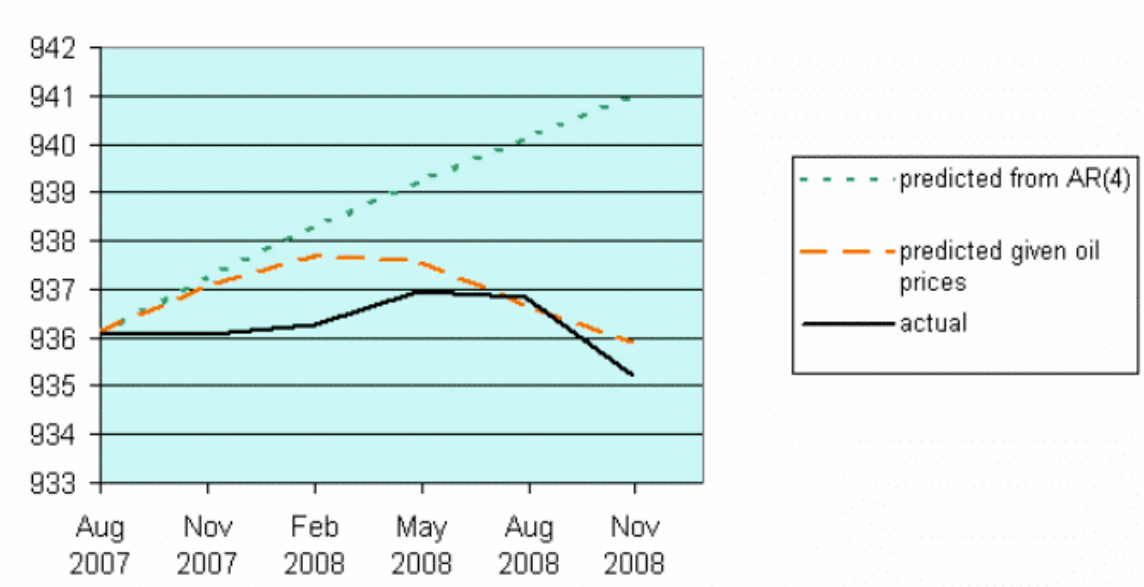


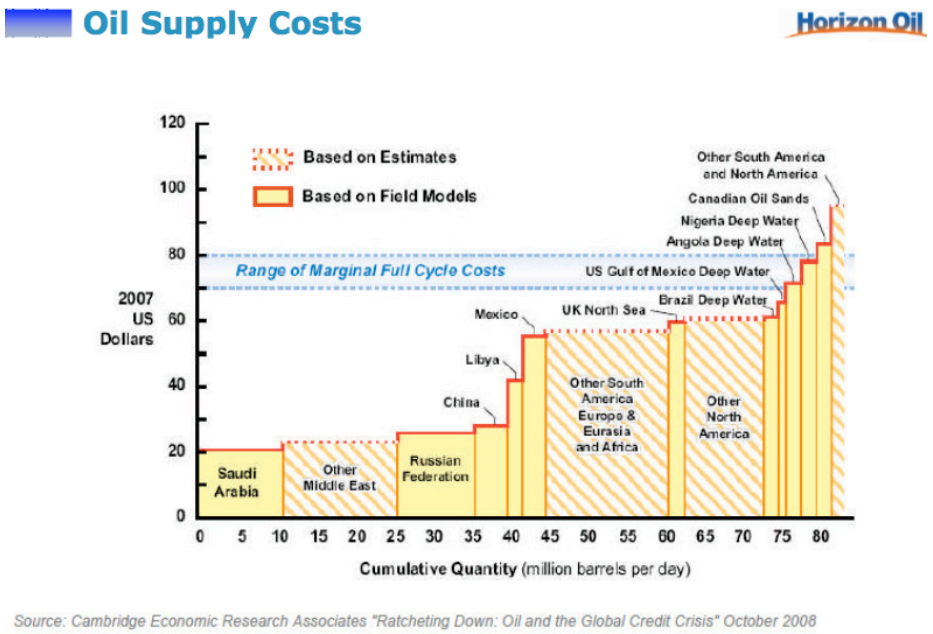
Figure 3. Conditional forecasting of GDP, by James Hamilton.

Note by J. Hamilton: Solid line: 100 times the natural log of real GDP. Dotted line: dynamic forecast (1- to 5-quarters ahead) based on coefficients of univariate AR(4) estimated 1949:Q2 to 2001:Q3 and applied to GDP data through 2007:Q3. Dashed line: dynamic conditional forecast (1- to 5-quarters ahead) based on coefficients reported in equation (3.8) in Hamilton (2003) (which was estimated over 1949:Q2 to 2001:Q3) applied to GDP data through 2007:Q3 and conditioning on the ex-post realisations of the net oil price increase measure.[6]

Without the oil price rise in 2007-2008, GDP would have been predicted to rise as shown with the dotted green line. The actual behavior of the economy fairly closely matched what was expected based on the rise in oil prices. While this was a surprising conclusion, there were a lot of reasons why there might have been a connection. Higher oil prices caused a run-up in both food and energy prices. These had the biggest impact on the part of the population who were most vulnerable—subprime borrowers, living in distant suburbs, and this is precisely where there were the biggest loan problems, early on.

[6]Hamilton, James D., "Oil Prices and the Economic Recession of 2007-2008," *Vox* 16 June 2009, http://www.voxeu.org/index.php?q=node/3664.

Going forward, there is fairly good consensus that the oil prices can be expected to continue to rise, if oil production is to increase, because much of the cheap oil has already been extracted. Figure 4 shows a graph published by Cambridge Energy Research Associates (the largest consulting firm doing work for the oil and gas industry), showing oil prices needed to justify extraction of oil from various locations.



Source: Cambridge Economic Research Associates "Ratcheting Down: Oil and the Global Credit Crisis" October 2008

Figure 4 - CERA estimates of full costs of oil production, from a Horizon oil presentation. The CERA graph was put together when oil was about $90 barrel. The dotted line indicates the highest cost types of production that would be profitable at that price.

Figure 4 indicates that part of the capacity of oil that we are accustomed to using is high priced oil—oil that it does not even make sense to pump when oil is $90 barrel. There is other oil that may be available—oil in ultra-deep water; oil near the North Pole; more oil from the Canadian oil sands, and perhaps oil from oil shale, but all of these are high cost resources. If they had been cheap resources, we would have extracted them earlier, when prices were lower.

As recently as 2002, oil was sold for under $20 a barrel. [7] Now much of the inexpensive-to-extract oil is gone, and we need to keep moving toward more and more expensive oil, meaning that as we demand more oil, it becomes more expensive.

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[7] "Cushing, OK WTI Spot Price FOB (Dollars per Barrel)," *U.S. Energy Information Administration* 22 Sept. 2010, http://tonto.eia.doe.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=M.

Higher oil prices seem to affect the economy in two ways. First, since higher oil prices tend to affect expenditures that we think of as necessities (food and gasoline prices especially), buyers tend to cut back on discretionary spending—an action that tends to lead to recession. Second, some buyers find themselves with inadequate funds to make debt repayments. This leads to higher default rates. I have illustrated this in Figure 5.

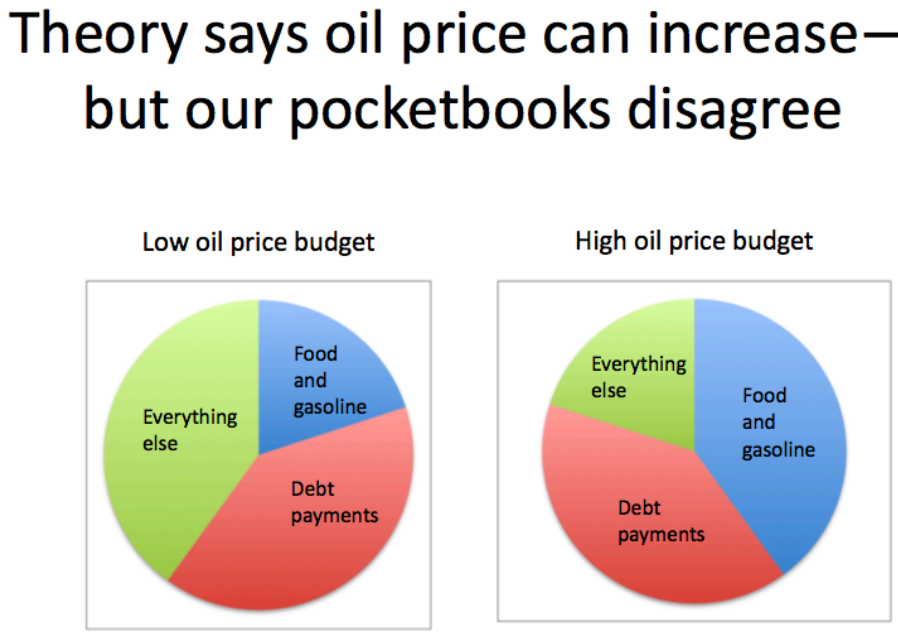

Figure 5 – Graphic by author illustrating that if the price food and gasoline increase, either debt repayment must suffer, or there must be a cut back in discretionary spending. Not to scale. If consumer actually had savings, this might also be affected.

While classical economic thinking says that economic growth is largely dependent on labor and capital as input, biophysical economics says that resource inputs, and in particular oil inputs, are very important to economic growth. A strong relationship between economic growth and real work provided by energy was shown by Robert U. Ayres and Benjamin Warr in "Accounting for Growth: The Role of Physical Work" in 2004.[8]

[8] Ayres, Robert A. and Benjamin Warr, "Accounting for Growth: The Role of Physical Work," *International Energy Agency,* http://www.iea.org/work/2004/eewp/Ayres-paper1.pdf.

This model looks at the amount of work (in a physics sense) that is done by energy. Thus, it considers both the amount of energy used and how productive that energy is. For example, power stations in 1900 converted only 4% of the potential energy in coal to electricity, but by 2000, the conversion efficiency was raised to 35%. This model explains the vast majority of US real economic growth between 1900 and 2000, except for a residual of about 12% after 1975.

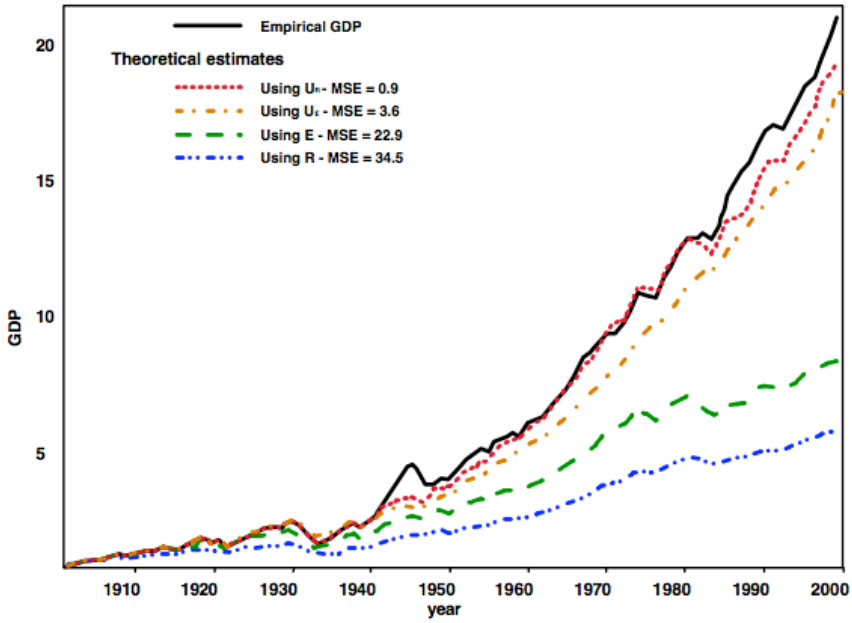

Figure 6 - Results of model by Ayres and Warr. The selected model is the dotted red line, which includes biomass and animal labor, as well as other types of fuels (fossil and nuclear) – From link above.

Oil is the single largest source of energy today, and type of energy source upon which 98% of the world's transportation system depends. Oil is also very critical for food production, since farm equipment uses diesel to operate, transportation of food (and refrigeration during transport) requires oil products, and oil is used in irrigation, fertilizer production and transport, and in the manufacture of insecticides and herbicides.

Recent analyses show a high correlation between world GDP growth and increases in world oil usage.

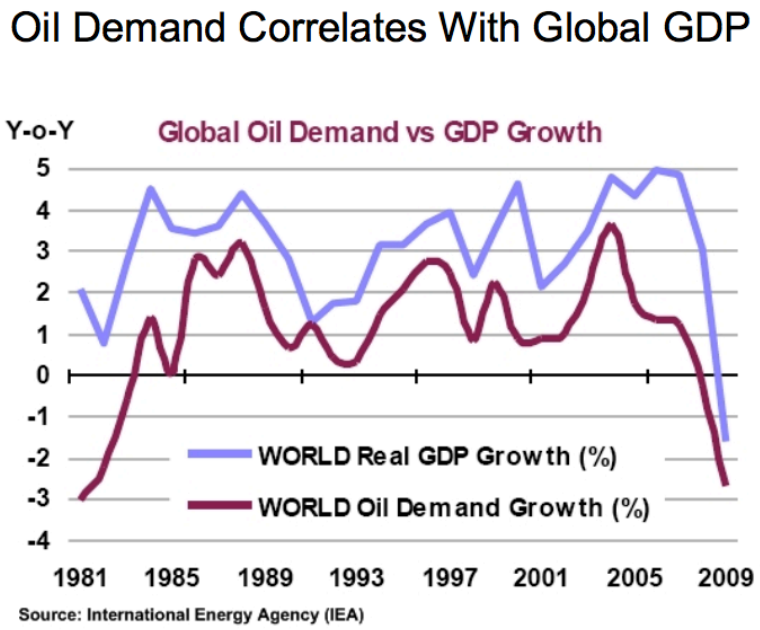

Figure 7 – Graphical relationship of world real GDP growth and world oil demand (usage) growth) by David Cohen, Association for the Study of Peak Oil Conference October 2009, Denver, Colorado [9]

World oil production has been on a plateau since 2005. The real issue is the oil supply really needs to grow, in order to support a growing world economy, and this is no longer happening.

There are different views regarding future oil supply. Figure 8 illustrates one of them, and the huge mismatch that results between the amount of oil that is needed to sustain growth, and the amount that may be available.

[9] Cohen, Dave, "The Aftermath of the Great Recession," Association for the Study of Peak Oil and Gas 5th Annual Conference, 12 0ct. 2009, http://www.aspousa.org/2009proceedings/Dave_Cohen_Oct_12_2009.pdf

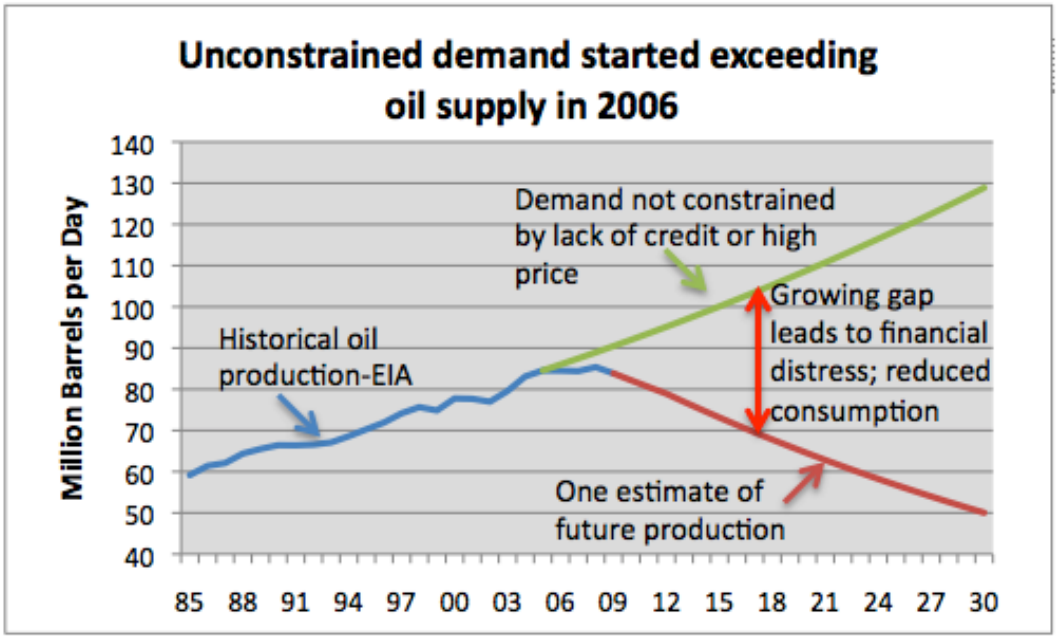

Figure 8 – Illustration that may be ahead, by the author. Historical oil production is "all liquids" (including substitutes, such as ethanol), based on data by the US Energy Information Administration (Table 4.4, International Petroleum Monthly)[10] *Green line represents what supply would need to be, to match historical growth of 1.8% per year.*

Note that oil production does not actually need to drop for economic distress to occur—lack of growth in oil supplies can be expected to have an adverse impact of world real GDP, as illustrated in Figure 7.

Estimates of future oil production vary, but none of them are terribly optimistic. The US Energy Information Agency forecasts oil production below the green line shown (reaching 106 in 2030), but at higher prices. [11]

The Natural Petroleum Council put together for a report for then-Energy Secretary on the issue of future supplies, which they called "Facing Hard Truths about Energy".[12]

The United States Joint Forces Command (which provides planning advice for all areas of the US Military) put out a report earlier this year that says, on page 29, "By 2012, surplus

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[10] "International Petroleum Monthly," *U.S. Energy Information Administration* 10 Sept. 2010, http://www.eia.doe.gov/ipm/supply.html.

[11] "International Energy Outlook 2010," *U.S. Energy Information Administration* 27 July 2010, http://www.eia.doe.gov/oiaf/ieo/graphic_data_liquidfuels.html.

[12] "Facing the Hard Truths about Energy," *National Petroleum Council,* http://www.npchardtruthsreport.org/.

oil production capacity could entirely disappear, and as early as 2015, the shortfall in output could reach nearly 10 million barrels a day."[13]

All of this is not an issue if one believes classical economics, and its view that only labor and capital (and innovation) are important. If one believes the tenets of Biophysical Economics, the likely inadequate growth in oil production in the next few years (which may in fact be a decline in oil production) is likely to cause serious financial disruption.

2. WHAT DOES THIS HAVE TO DO WITH THE PROPERTY CASUALTY INSURANCE INDUSTRY?

Most readers have already been through one financial crisis, and have a good idea what a similar one would look like for their company. Some of the impacts experienced in the last run-through would include:

1. Decline in exposures. If this occurs over the long term, it can be expected to put upward pressure on expense ratios.
2. Better auto insurance experience. If oil prices are higher, there is less discretionary driving, and claim experience improves.
3. Poor homeowners experience. More vacant homes, more homes that homeowners plan to give back to the bank shortly, declining property values.
4. Terrible loss experience on financial guarantee insurance, and very poor loss experience for mortgage guarantee insurance.
5. Very poor investment income.
6. Declining valuations of some investments, such as CDOs, and more bond defaults.
7. Poor workers compensation experience, through the period of layoffs and lower payrolls.

Pretty much all of the foregoing list can be tied to higher oil prices, higher debt defaults, the resulting credit contraction, and the ensuing recession. As debt defaults rose, credit availability was cut back, leading to a further reduction in spending, and more layoffs. With layoffs, more people defaulted on their mortgages, and prices on homes tended to drop. There was a flight to safety on investments, and government interest rates especially tended

[13] "Joint Operating Environment," *United States Joint Forces Command* 2010, http://www.jfcom.mil/newslink/storyarchive/2010/JOE_2010_o.pdf

to drop. Low interest rates were also encouraged by Federal Reserve policy, in an attempt to get the economy out of its slump.

We have recently had somewhat of a bounce back from the financial crisis, partly as a result of lower oil prices (resulting from lower demand caused by credit cutbacks and recession), stimulus spending, bailouts for banks, and the greater discretion that banks now have in valuing their difficult-to-value investments.

Going forward, this analysis indicates that there is a high probability of something very similar happening again, only this time getting significantly worse. It is possible that there will be a bounce back from the next recessionary drop, but if this happens, another further drop will happen within two or three years. Eventually, bond defaults and debt defaults of all kinds will get to be such a problem that many insurance companies will fail, at rates far above the level that guarantee funds are set up to handle. To explain a little why this is expected, I offer some information about a forecast I made that led to an invitation to give a presentation at 2009 Biophysical Economics Conference at SUNY-ESF, Syracuse, New York.

3. FORECASTS FROM EARLY 2008

Back in 2007 and early 2008, I was one of the people looking at oil shortages, and the likely impact of these shortages on the financial system. At the beginning of 2008, I published an article, which foretold many of the happenings of the 2008 financial crisis, and explained some of the reasons why. To quote from that article[14]:

> At this time of year, we read many financial forecasts for the year ahead. Nearly all of these are written with the "filter" assumption of infinite growth. "Oil production problems are a temporary issue; after a short dip, the economy is likely to continue growing rapidly again. We may have a short recession, but we will soon be back to business as usual." Etc.
>
> I think this filter is fundamentally in error, and leads to a mistaken impression with respect to where the world is headed. The world is changing in a very major way. Oil is in short supply, and this shortage is likely to get larger in the future. The pressure of short supply and rising prices adds a systematic bias that the financial community is not recognizing. This bias has as its basis the fact that it is becoming

[14] Tverberg, Gail, "Peak Oil and the Financial Markets: A Forecast for 2008," *The Oil Drum* 9 Jan. 2008, http://www.theoildrum.com/node/3382.

more and more difficult for both people and businesses to pay back loans, because of the rising costs of oil and food. This situation cannot be expected to go away. In fact, it is certain to get worse in years ahead, as oil supplies become tighter.

Besides the systematic bias, there is also a systemic risk, arising from the interconnectedness of all of the parts of the economy. This was well described in a post a few days ago called "The Failure of Networked Systems."[15] One of the issues in systemic risk relates to the financial system itself. If one party in the financial system fails, it increases the likelihood that other parties in the economic system will fail as well.

Another aspect of systemic risk is the close ties of the financial system to the rest of the economy. One example is the higher oil and food prices mentioned above that lead to a systematic bias toward higher defaults. Another is the fact that the lack of oil can be expected to impede economic growth, making the infinite growth model underlying the current economic system less sustainable, based on the economic model of Robert Ayres and Benjamin Warr[16]. Another linkage is that of oil with ethanol. Higher oil prices leads to increased pressure to produce more ethanol, which further raises food prices, as demonstrated by Stuart Staniford in "Fermenting the Food Supply."[17]

Later in the article, I explain further about the issue:

First, some definitions to go with the introduction.

Systematic bias occurs in a system when a process favors a particular outcome. Instead of errors being random, they are consistent and repeatable. One example might be a thermometer that consistently reads high. In the economy, systematic bias occurs when loans experience a greater and greater tendency toward defaults, because of changes in the system (rising oil prices) since the time when the probability of default was originally estimated. As another example, rising oil prices can also cause profits of individual companies to grow more slowly than expected (relative to base period experience) because of a contraction in general economic growth.

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15 Aeldric, "The Failure of Networked Systems," *The Oil Drum* 6 Jan. 2008, http://anz.theoildrum.com/node/3377#more.

16 Ayres, Robert A. and Benjamin Warr, "Accounting for Growth: The Role of Physical Work," *International Energy Agency,* http://www.iea.org/work/2004/eewp/Ayres-paper1.pdf.

17 Staniford, Stuart, "Fermenting the Food Supply," *The Oil Drum* 7 Jan. 2008, http://www.theoildrum.com/node/2431#more.

Systemic risk is risk relating to the interconnectedness of the system. A push on one part of the system will lead to a pull on another part of the system, leading to unanticipated failures. As an example, the failure of one bank may lead to other banks failing, because of counter party risk. There is significant reason to believe that the interconnectedness of the system is increasing over time, as food becomes used as a fuel, and as financial products become more complex. See "The Failure of Networked Systems."[18]

The financial community has designed many models. Some of these are used by "quants" in pricing the newer sliced and diced financial products. Others are used by insurance companies in pricing the risk of defaults on bonds and on mortgages.

The assumption that is made in these models is that historic experience can be used, with only minor adjustments, as a guide for pricing current products. This approach fails to recognize the greater risk now entering the system, due to systematic bias because of rising oil prices, and due to greater systemic risk, because of greater interconnectedness.

One way of describing these models is to say that they assume that defaults are "independent events"—that is, there is no systemwide bias that would cause more and more defaults. This assumption of independence keeps insurance prices low, and makes the slicing and dicing of packaged securities work. Clearly, with the systematic bias and systemic risk that is now infecting the financial system, these assumptions are no longer valid.

Closely related to the assumption that events are independent is the assumption that distributions are "normal"—that is that they follow the Gaussian distribution. Benoit Mandelbrot has shown in *The (Mis)Behavior of Markets* that the actual tails of distributions are much "fatter" than implied by the Gaussian distribution. The bias introduced by the oil situation makes the normal distribution even less appropriate. For example, with higher oil prices, the number of defaults on bonds will be much greater than would be predicted, if one simply assumes that a normal distribution applied to past experience will be predictive of future experience.

If one looks at financial theories like the "Capital Asset Pricing Model"[19] and the

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[18] Aeldric, "The Failure of Networked Systems," *The Oil Drum* 6 Jan. 2008, http://anz.theoildrum.com/node/3377#more.

[19] "Capital Asset Pricing Model," *RiskGlossary.com,* http://www.riskglossary.com/link/capital_asset_pricing_model.htm

"Black and Scholes Option Pricing Model,"[20] one discovers that they assume normal distributions and statistical independence. These models were not quite right before, because the underlying distributions are not really normal, as shown by Mandelbrot. Now that systematic bias and systemic risk are playing greater roles, the predictive value they had previously can be expected to further decline.

My predictions for the economy, and the effect on the insurance and banking industries turned out to be quite accurate—certainly more than those of most other financial analysts.

4. *DELUSIONS OF FINANCE* PRESENTATION AT 2009 BIOPHYSICAL ECONOMICS CONFERENCE[21]

Professor Charles A. Hall of SUNY-ESF, Syracuse, New York was in charge of the program for the 2009 Biophysical Economics Conference in New York. He had heard of my work, and had seen how accurate my forecasts had proven to be. Even though I am not trained as a biophysical economist (although I am doing very similar work), he asked me to give a presentation at the 2009 Biophysical Economics Conference, explaining what mainstream economists had gotten wrong, and what this implies for the path ahead. He suggested a title of "Delusions of Finance." [22]

Let me quote a little some from this presentation:

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[20] Rubash, Kevin, "The Black and Scholes Model," *A Study of Option Pricing Models,* http://bradley.bradley.edu/~arr/bsm/pg04.html

[21] *Biophysical Economics Conference,* http://web.mac.com/biophysicalecon/iWeb/Site/BPE%20Conference.html.

[22] Tverberg, Gail E., "Delusions of Finance: Implications for Where We are Headed," 2nd Biophysical Economics Conference 16 Oct. 2009, http://web.mac.com/biophysicalecon/iWeb/Site/BPE%20Conference_files/Download%20Tverberg.pdf

Slide 3:

Forecast in January 2008

- Higher loan defaults
- Bond insurer downgrades; insolvencies
- Loans will become less available
- Large bank failures
- Fannie Mae, Freddie Mac need assistance
- Recession in 2008, getting worse during year
- Sudden discontinuity may make thing worse

Slide 4:

What did others miss?

- Oil shortages -> economic decline
- Economic decline -> ***lots*** of debt defaults
- ***Lots*** of debt defaults -> troubled financial system
- Insurance programs set up protect financial system missed ***systemic risk***
- Major debt unwind is still ahead

Slide 5:

Oil Shortages -> Economic Decline

- Oil price rose, so food, gasoline prices rose
- Less money left for
  - Discretionary purchases; contributions
  - New house purchases
  - New car purchases
- Led to reduced sales; layoffs
- Dave Murphy: $80 oil (retail 5.5% of GDP; wholesale 4.0% of GDP) leads to recession

Slide 6:

Economic decline -> *Lots* of Debt Defaults

Repaying loans is easy in a growing economy

Repaying loans is much more difficult in a shrinking – or flat - economy

Slide 7:

Economic Decline -> *Lots* of Defaults

Growth	Decline

• Rising property values
  • Pull equity out, use it too!
	• Declining property values
	  • Why not walk away?

• Layoffs rare	• Layoffs common

• Business margins better
  • Easy to pay off debt
	• Business margins down
	  • Debt hard to pay back

• Government revenue up
  • Easy to pay off debt
	• Government revenue down
	  • Hard to pay back debt

If a person stops think about the situation, there a quite a few differences in the way the economy functions in a period of economic growth and in a period of economic decline. The assumption of continued economic growth by traditional economists (who don't consider resources and their limits) has been so strong that most have not even considered what the economy would look like in a period of long-term decline.

Slide 8:

Lots of Defaults -> *All* Financial Institutions in Trouble

- Financial system was not set up for lots of defaults
- Defaults erode the equity of banks, insurance companies, pension plans, etc.
- Government can "paper over" this problem, but it will keep coming back
  - Many more defaults ahead
  - Eventually governments likely to have troubles, too

Many have observed that there would have been defaults, even without peak oil, because of the reckless lending that had been done. I would contend that at least part of the reason the lending had been done was to give the illusion of growth, when there really wasn't much apart from that generated from very loose lending standards. Furthermore, even if loose lending standards were part of the problem, the problems related to peak oil made it worse (and can be expected to cause more problems in the future).

Slide 9:

Financial system insurance programs missed *systemic risk*

- Insurance programs for banks, pension plans, insurance companies all assume debt defaults are "***independent***"
  - Defaults unlikely to be a problem for several institutions as once
- Funding way too low to handle systemic risk
  - Problem for FDIC, Pension Benefit Guarantee Corp, insurance company guarantee plans, Fannie Mae and Freddie Mac equity requirements

When there isn't a problem like a limitation on the amount of oil available (or limits to growth in general), debt defaults are, in fact, pretty much independent. That is why the system for determining insurance charges to be included in the interest rates charged for loans worked pretty well until peak oil came along. In the absence of peak oil, a homeowner or businessman defaults because of some particular problems he or she has. Past history is likely to be predictive of the future, because while there are different individuals defaulting, the average number of defaults will tend to be pretty stable from year to year.

Slide 10:

Debt problem is essentially *unfixable* in a declining economy

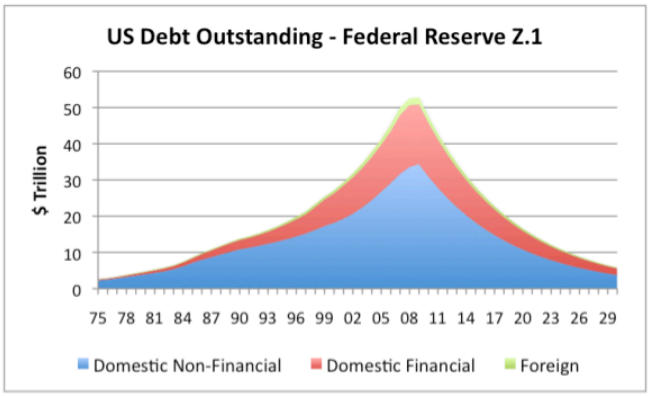
- Loan defaults will always be very high, if economy declining
- High "insurance charge" needed in interest rate
- Resulting high interest rate makes loans unaffordable for most
- Exceptions:
  - Very short term loans
  - Occasional very profitable businesses

It is possible that there will be some loans in a declining economy, but their use will be much less widespread than we see today. Their cost will also tend to be higher.

Slide 11:

Major debt unwind is *still ahead*

- One possible scenario:



When lending is increasing, businesses have more money to invest in new plants and

equipment, and homeowners find it easy to get loans for new homes and for home improvement. When lending is decreasing, the reverse is true.

Slide 12:

Major unwind is still ahead

- Defaults have only begun to occur
  - Likely to get worse in years ahead
  - Will include international defaults
- Bank equity will continue to drop, as more defaults occur
- Interest rates will be higher for those who can get loans

Slide 13:

Major unwind is still ahead

- Effect of unwind likely to be huge
- Adding debt in past allowed us to "borrow from the future"
  - Expanded funds available for investment, major purchases
  - Allowed us to keep up oil drilling, natural gas drilling, coal production, buy cars, buy houses
- Reducing debt will have opposite effect

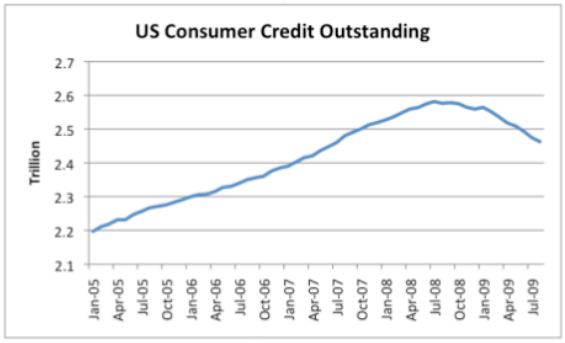
As countries cut back on their stimulus funds, the decline in credit available may be

especially severe.

Slide 14:

Debt unwind has already started

- US consumer credit peaked in July '08
  - Same month as when oil prices peaked



In the US, homeowners used their homes as a piggy-banks when home values were rising. They could refinance their homes, remove the built-up equity, and buy new cars, furniture, and other things. When there are fewer homebuyers (because of less loan availability), and continually declining values, the effect is reversed.

Slide 15:

Debt unwind likely to reduce availability of ***all*** fossil fuels

- Debt unwind means people less able to buy cars, houses, etc.
- Result is less manufacturing, leading to lower ***demand*** for oil, gas, and coal
- Lower demand -> lower prices
- Lower prices -> lower profit margin
- Lower profit margin (and less debt) means less funds for reinvestment -> less fossil fuels

Credit problems are really what are likely to spread the lack of oil to a much broader reduction in fuel use, essentially through growing recession. This recession may affect OECD to a greater extent than non-OECD, but there are such great links between the two that I expect eventually all will be affected. This reduction in fuel use is likely to be described in the press as "reduced demand"--which it is, but because of recession induced by credit contraction (ultimately going back to lack of growth in oil supply).

Slide 16:

Debt unwind also likely to impact nuclear, wind, and solar

- Lower fossil fuel prices make these products less competitive
- Funds available for investment much lower
  - Lack of debt availability
  - Profits available for reinvestment
- Result: All energy products in drastic decline
  - Perhaps low EROI is now being recognized
  - Economy may go into nosedive

Slide 17:

Debt unwind may also lead to *globalization unwind*

- Less oil -> travel more difficult
- Multiple defaults in loans -> less trust of international banking
- Can international banking system be fixed?
  - Everywhere, huge defaults
  - No easy fix: Debt based system no longer works
  - May lead to more bilateral trade (like barter)
  - Amount of international trade drastically reduced

5. IMPLICATIONS FOR THE PROPERTY/CASUALTY INSURANCE INDUSTRY

What does the foregoing analysis suggest as implications for the property casualty insurance industry?

One implication is that the **assumption of independence** used in financial models of all kinds needs to be looked at much more closely than the past. If there is truly systemic risk in the system, caused by limitation on resources that prevents long-term economic growth, this could quite easily spill over into assumptions underlying all kinds of financial models. Clearly pricing of mortgage guarantee insurance and financial guarantee insurance would be affected. Pricing of homeowners insurance might also be affected, if systemic risk results in declining property values relative to replacement values, and thus tends to too low prices for many sub-coverages.

Another implication is that we are likely now in the time-period between two financial crises, and furthermore, that the second financial crisis is likely to be worse than the first. In the first financial crisis, life insurance companies tended to far worse than property casualty companies, for a variety of reasons, including longer term insurance products, riskier investments, and greater leveraging. This analysis suggests that there is a significant chance the property casualty insurance industry will be hit much harder in the next financial crisis than it was in the 2008-2009 crisis.

Based on my analysis, the big issue ahead for property-casualty insurance companies is that default rates on bonds are likely to be very high for many kinds of bonds. For example, municipal bonds are likely to have high default rates, as property values continue to drop, and municipalities find it increasingly difficult to collect enough taxes to meet all of their obligations.

Many of these municipal bonds are insured under financial guarantee insurance contracts; it is very doubtful that the insurance companies writing this coverage can withstand defaults by more than a small percentage of municipalities for which the coverage was provided. At some point, the financial guarantee insurers writing the coverage will become insolvent, and the property-casualty insurance industry may be on its own, in trying to deal with the issue.

There is of course some possibility of a bailout by Washington DC, but with increased federal borrowing, and debt problems around the world (Greece, Portugal, Spain, for example), even such a bailout may become impossible. An alternative bailout would be of all the municipalities with problems, but this would present the same issue of scale.

If the property-casualty insurance industry faces major defaults on bonds on its balance sheet—even those that are currently highly rated—this would likely lead to very significant erosion of insurer equity. Companies are likely to find themselves too highly leveraged,

based on AM Best solvency ratios, and may find it necessary to cut back on amount of insurance sold to meet regulatory requirements. Ultimately, many property–casualty insurers may fail.

Property-casualty post-insolvency assessment funds are not set up to deal with multiple failures of large insurance companies, so here again, the US government may want to step in. But again, there is likely to be an issue of ability to step in, if banks and life insurers are also having financial problems, and US borrowing is already stretched beyond reasonable limits.

If the crisis isn't as bad as to cause major debt defaults, this analysis would suggest it may play out somewhat like the 2008-2009 crisis, with some of the same issues involved. Workers compensation insurers may find themselves with reduced premium volume, but rising claim volume, related to employee layoffs. Insurers of all types are likely to find that exposure volumes are decreasing, rather than increasing, leading to pressure on expense margins. This issue may especially affect brokerage firms.

In the 2008-2009 crisis, reduced investment income was an issue. As default rates rise, one would expect interest rates start rising, reflecting the greater real risk involved in holding bonds. This may be a temporary respite for property-casualty insurance companies. Ultimately, however, rising interest rates can be expected to lead to defaults by more and more borrowers, as they find it impossible to repay debt plus the higher interest rates, in a declining economy.

Over the very long-term, if the economy is in permanent decline, this analysis would suggest that the only coverages that will really be feasible for property-casualty insurance companies are the very short-tail coverages—fire, auto physical damage, marine, etc. To the extent insurance is provided, one would exptect that it reflect a pooling of risk, with little time-shifting, because bonds held on the balance sheet can no longer be counted on for repayment several years later.

Long-term, this analysis would suggest that the financial services industry in general will shrink greatly in the years ahead. Without continued economic growth, pushed by rising energy supplies, debt products that are of more than very short duration can be expected to mostly disappear. Because of this, the whole world of financial services can be expected to greatly contract, including property-casualty insurance.