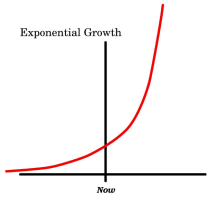
# Impact of Oil Limits on the Economy and Insurers

Gail E. Tverberg, CAS Annual Meeting, Nov. 2013

## Myth: Growth can continue indefinitely in a finite world




- This is clearly nonsense
- Most people don't know what what to look for, when limits are about to hit

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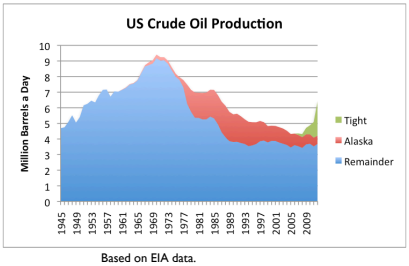
## We have been hearing an optimistic oil story in the media

- Based on short term blip in US oil production




Based on EIA data.

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## CEO Peter Voser says he regrets Shell's huge bet on US shale

Excerpts:

"Shell said it had put its acreage in the Eagle Ford shale up for sale as part of a strategic review."

"We had expected higher flow rates. . ."

--Financial Times
Oct. 6, 2013

http://www.ft.com/intl/cms/s/0/e964a8a6-2c38-11e3-8b20-00144feab7de.html?siteedition=intl#axzz2hFKpWWOh

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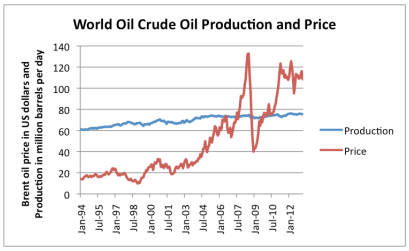
## World oil supply not fixed by high US output – World oil prices are not down




Source: Based on EIA data.

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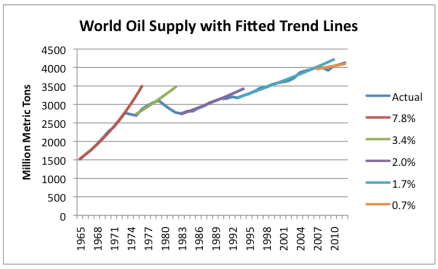
## Trend lines fitted to world oil supply growth show flattening




"Actual" amounts from BP 2013 Statistical Review of World Energy

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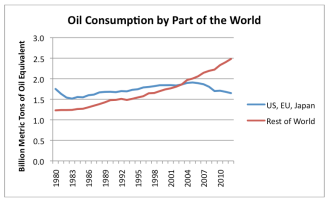
## Oil consumption in US, EU and Japan are declining

- Very little of this is due to efficiency
- More related to loss of manufacturing, slow job growth
- Reduced imports not necessarily good




Source: Data from BP's 2013 Statistical Review of World Energy.

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## Oil is very important

- Nearly all transport uses oil
- Important in growing, transporting food
- Raw material for medicines, asphalt, fabric, etc.
- We have no way of replacing oil with electricity
  - Even if we did, cost would be overwhelming
- 10 out of 11 recent US recessions were associated with oil price spikes – Economist James Hamilton, *"Historical Oil Shocks"*

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## High oil prices create multiple problems

1. Consumers have less disposable income
   1. Food, fuel for commuting costs more
   2. Results in falling home prices
   3. Results in debt defaults
2. Businesses need to raise prices, or profits will decrease
   1. Reason: oil used in making, transporting almost everything
   2. If raise prices, demand drops and layoffs occur
3. Businesses in countries with high oil usage become less competitive compared to countries using coal

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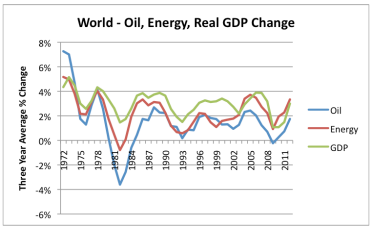
## Economic growth and energy consumption are closely tied

- Because oil is most expensive, its growth is slightly lower




Data from BP 2013 Statistical Review of World Energy and USDA compilation of World Real GDP.

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## High oil prices seem to be a major cause of the Great Recession

- Gail Tverberg, "Oil Supply Limits and the Continuing Financial Limits," *Energy*, Vol. 37, Issue 1, January 2012, Pages 27-37
- James Hamilton, Causes and Consequences of the Oil Shock of 2007-08, Brookings Papers on Economic Activity, Spring 2009, 215-259.

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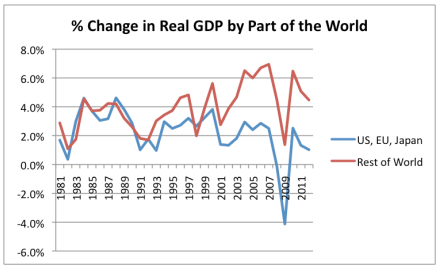
## Economic growth of big oil importing countries is lower than other countries




Based on USDA Real GDP data.

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## One current concern: Oil price required by exporters keeps rising


- We are temporarily in a Goldilocks price zone
  - May disappear if price required by exporters rises
  - Or the ability of the importers to pay drops

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## Prices required to balance budgets are near current prices

- Deutche Bank (Mark Lewis –ASPO USA-Dec. 2012)
  - Saudi Arabia – $78.30
  - Nigeria - $113.50
  - Russia - $115.90
- Arab Petroleum Investment House – Aug. 2013
  - Saudi Arabia - $98
  - Nigeria - $123
  - Iran - $144
  - Venezuela - $115
  - Libya - $114

http://www.apic.com/Research/Commentaries/2013/Commentary_V08_N08-09_2013.pdf

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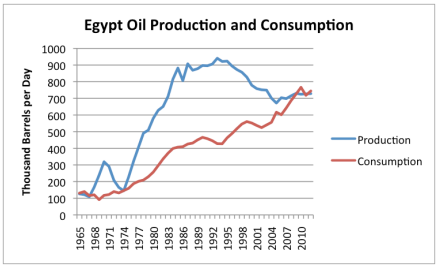
## Egypt: Former oil exporter who experienced decline, then financial problems




Based on BP 2013 Statistical Review of World Energy data.

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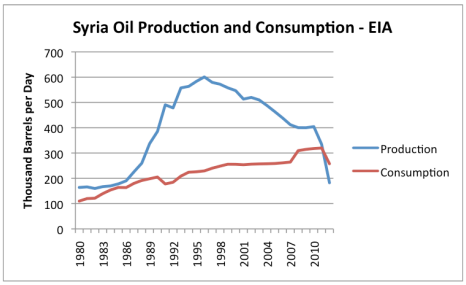
## Syria: Another former oil exporter who experienced decline, then civil disorder




Based on data of the US Energy Information Administration.

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## Resource Limits: What does history say about civilizations that hit limits?

- Many civilizations have grown, reached limits, and then collapsed
- Cliodynamics – New multidisciplinary area of mathematical modeling of historical dynamics
- *Secular Cycles* – Peter Turchin and Sergey Nefedov, Princeton University Press, 2009
  - Developed a theory, and tested it with data
  - Studied eight civilizations that ultimately collapsed
  - Time series of populations, prices, wages, rents, taxes
  - Period covered: 350 BCE to 1922

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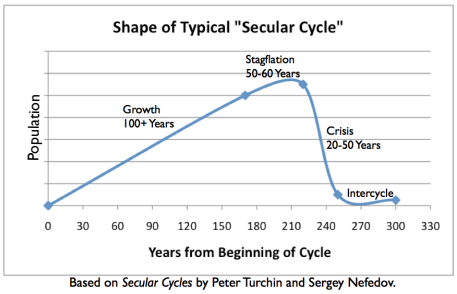
## Civilizations that collapsed seem to follow a similar pattern




Based on *Secular Cycles* by Peter Turchin and Sergey Nefedov.

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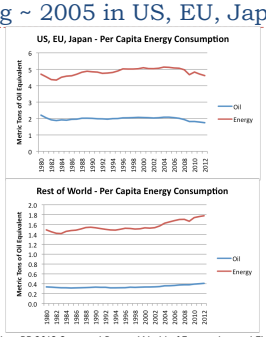
## Per capita oil/energy consumption began decreasing ~ 2005 in US, EU, Japan




Both charts based on BP 2013 Statistical Review World of Energy data and EIA population data.

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## Economic growth seems to reflect a positive feedback loop

- Energy use is key
  - Can't make goods without energy
  - Even making services requires energy
  - Encourages rising population
- Cheap energy key to competitiveness and growth
  - Increasingly cheap energy makes salaries go farther, country more competitive

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## Current financial problems are mostly oil-limits problems

- Businesses generally aren't affected
  - Can keep profits high by laying off workers; making less product
  - Outsourcing work to low cost country also keeps profit high
- Wages of individuals decline
  - Lack of good paying jobs
- Increasing government debt
  - Low wages -> Less tax revenue
  - More unemployment; stimulus; early retirement
- Quantitative easing helps hide these problems

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## Paths Forward

- Scenario 1: Worst Case Scenario
  - End of quantitative easing [or default on US debt]
  - Interest rates rise
  - Many follow-on effects of rising interest rates
    1. Government cost of paying its debt rises: Need higher taxes
    2. Consumer cost of debt rises: Fewer cars purchased
    3. Mortgage interest rates rise: Fewer move-ups; home prices drop
    4. Business interest rates rise: Less investment in new facilities
    5. Bond prices drop
    6. Stock prices drop
    7. Farm prices drop
    8. Amount of new debt decreases
    9. Drilling for new oil and gas decreases

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## Paths Forward (cont.)

- Scenario 1: Worst Case Scenario (continued)
- The price of oil citizens can *afford* may drop
  - Consumers pressured by higher interest rates; higher taxes
  - May bring world price of oil below the cost of extraction
    - Could be catastrophic, if oil production starts to decline as a result
    - Could lead to feedback loop that gives increasing contraction, rather than expansion
- Ultimately, this could be path to Collapse mentioned in Turchin research
  - Or at least long term recession

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## Paths Forward (cont.)

- Scenario 2: United States holds on for another 20 years
- Perhaps Euro Zone and Japan collapse
  - United States with superior energy resources holds on
  - US economic growth still not very good
    - Rate of return on investments remains low
  - Economy skates along on the edge of recession
  - Federal reserve holds interest rates low (How??)
  - Economic growth around the world gradually declines

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## Paths Forward (cont.)

- Scenario 3: "Bounce"

- Scenario starts as in Scenario 1
- World price of oil decreases
- Lower price of oil stimulates economies around the world
- Severe contraction (worse than 2008-2009) in 2014-2015
  - But economy is able to recover for several years
  - Eventually drops again, perhaps with another bounce
  - Eventually heads downward again

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## Paths Forward (cont.)

- Scenario 4: Bounce, plus miraculous cheap new energy

- Similar to Scenario 3, but miraculous cheap new energy source developed soon enough to catch bounce
  - Immediately after 2014-2015 recession
  - Needs to be a liquid
  - Perhaps cheaper way of producing oil
  - Needs to be huge quantity—far more than today's tight oil
  - Needs to bring oil prices down to $40 barrel or less

- Then theoretically could be a much longer-term recovery

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## Implications for Actuaries

- Worrying times are ahead
- Great Recession may become the norm!
- Insurance companies will need to deal with whatever comes up
  - Best that actuaries at least understand underlying problems
  - Perhaps another actuary would come to different conclusions

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## If problem thought of as long term recession

- Expect outcomes similar to during Great Recession
  - Auto may do well
  - More layoffs, joblessness
  - Fewer policies sold
  - Financial results for insurers may be unfavorable
    - Financial guarantee products in particular do poorly
  - Interest rates stay low
    - Affect investment income
    - Debt defaults likely as well
    - Asset side of balance sheet a problem
  - Reserves may develop favorably
  - If interest rates rise, new insurers will have a pricing advantage

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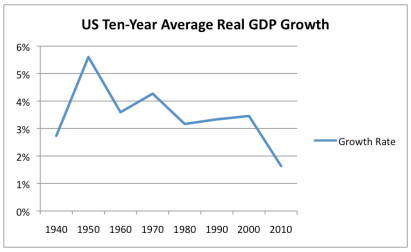
## Problem can also be thought of as the end of growth




Based on US Bureau of Economic Analysis data.

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## If thought of as the end to growth

- Financial models in general are wrong
  - Growth cannot be expected long term
  - Nearly all economic models are wrong
    - Pensions must be much smaller
    - Difficult to repay debt with interest
    - Stocks, bonds drop in real value
    - Not even clear capitalism works
- Failure of financial institutions is likely
  - Governments in danger of failing
  - Many previously "independent" events highly correlated
  - Whole field of risk management needs to be reconsidered

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## Contact Information


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- See my article "Oil Supply Limits and the Continuing Financial Limits," *Energy*, Vol. 37, Issue 1, January 2012, Pages 27-37. (Free version at http://ourfiniteworld.com/oil-supply-limits-and-the-continuing-financial-crisis/ )

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## Optional Additional Slides

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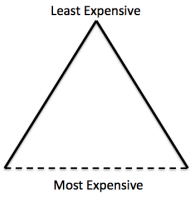
## High oil prices allow more oil production

- For any resource, quantity is distributed as follows:




- Always looks like there is more
- Cut off is uncertain—it is an affordability limit

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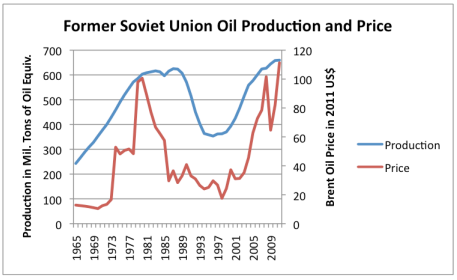
## Collapse of Former Soviet Union is example of what can happen if price is too low




Based on BP's 2012 Statistical Review of World Energy data.

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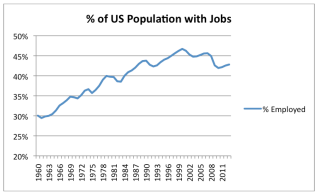
## Workers are affected by continuing high oil prices

- High oil prices reduce discretionary income
- Employment stays low
  - Outsourcing to lower-cost countries




Based on data of US Bureau of Labor Statistics.

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## Secular Cycles seem to Follow a Similar Pattern

- Start cycle by learning to increase food or fuel
  - Example – clearing forest for agriculture
  - Example – adding irrigation
  - Example – finding uses for fossil fuels, about 1800
- First 100+ years – Growth phase
  - Population grows
  - Wages high
  - Little urbanization
  - Government cost relatively low
  - Lots of resources per capita

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## Secular Cycles seem to Follow a Similar Pattern (cont.)

- Next 50-60 years: Stagflation
  - Population has expanded to equal carrying capacity
    - Much effort is required to further increase carrying capacity
  - Debt rises
  - Cost of government rises
  - Real wages of common workers stagnate or decline
  - Wages of common workers and elite increasingly diverge
  - More move to cities as artisans
    - Adding more farmers adds little output
- 1970s in the US – beginning of Stagflation?
  - US oil production began to drop

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## Secular Cycles seem to Follow a Similar Pattern (cont.)

- Next 20 to 50 Years – Crisis Period
  - Government costs become so high that it becomes impossible to collect enough taxes from the common worker
  - Debt repayment becomes a problem
  - More wars, with deaths
    - Resource wars
    - Civil wars
  - Common workers weakened by low pay, high taxes
    - Susceptible to epidemics
  - Government often collapses, or loses war to another country

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## Secular Cycles seem to Follow a Similar Pattern (cont.)

- Intercycle Period (Depression) - Up to 100 years
  - Stragglers find another group to fit in with
  - Require new political system to start over
    - Security becomes a major issue
    - Many areas unoccupied, because of low security
- First two phases (Growth, Stagflation) seem uncomfortably close to today
- Crisis period reflects way low resources per capita may play out
  - Malthusian limit

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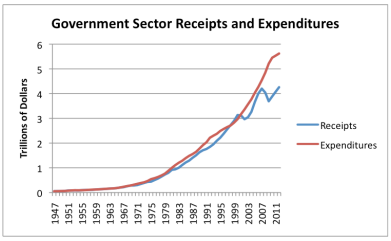
## Government revenue is affected by high oil prices / low employment

- Less taxes from workers
- More benefits




Current receipts and expenditures for all levels of government combined, from BEA.

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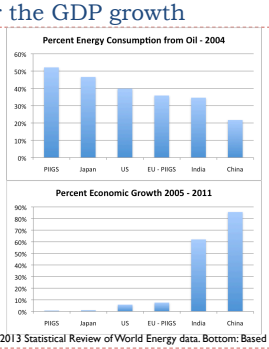
## The higher the proportion of energy from oil, the lower the GDP growth




Top: Based on BP's 2013 Statistical Review of World Energy data. Bottom: Based on USDA Real GDP data.

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## Why oil price has a profound effect on the economy

*Quote from one Our Finite World commenter:*

. . . we have traditionally had two parameters: economic activity and the price of oil, with one variable: the flow rate of oil. That is the economic paradigm that most of us grew up with. Economic activity increases, the price of oil increases correspondingly so more oil is produced thereby allowing the price of oil to go down again.

However, the flow rate of oil is now a parameter due to geological constraints.

Hence economic activity and oil price vary with respect to one another.

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