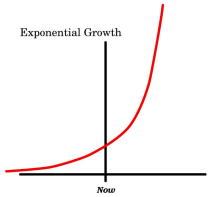
Oil supply limits may lead to severe recession

Gail E. Tverberg, CAS In Focus, Sept. 30, 2013

Myth: Growth can continue indefinitely in a finite world

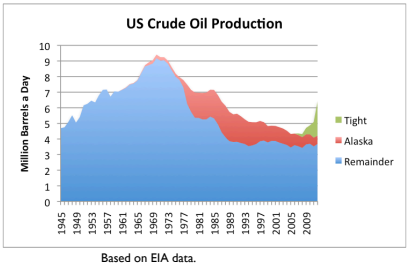


- This is clearly nonsense
- Most people don't know what what to look for, when limits are about to hit

2

We have been hearing an optimistic oil story in the media

- Based on short term blip in US oil production



Based on EIA data.

3

Shale Grab in U.S. Stalls as Falling Values Repel Buyers

Bloomberg - Oil companies are hitting the brakes on a U.S. shale land grab that produced an abundance of cheap natural gas -- and troubles for the industry. The spending slowdown by international companies including BHP Billiton Ltd. (BHP) and Royal Dutch Shell Plc (RSDA) comes amid a series of write-downs of oil and gas Shale assets, caused by plunging prices and disappointing wells. The companies are turning instead to developing current projects, unable to justify buying more property while fields bought during the 2009-2012 flurry remain below their purchase price, according to analysts.

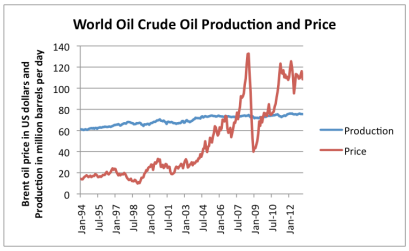
The spending slowdown by international companies including BHP Billiton Ltd. and Royal Dutch Shell Plc comes amid a series of write-downs of oil and gas shale assets, caused by plunging prices and disappointing wells.

The deal-making slump, which may last for years, threatens to slow oil and gas production growth as companies that built up debt during the rush for shale acreage can't depend on asset sales to fund drilling programs.

http://www.bloomberg.com/news/2013-08-18/shale-grab-in-u-s-stalls-as-falling-values-repel-buyers.html

4

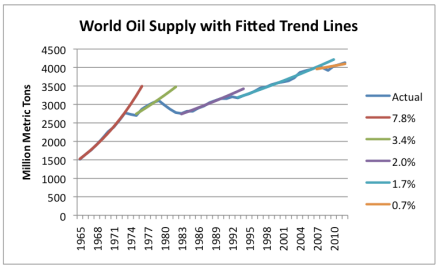
World oil supply not fixed by high US output – World oil prices are not down



Source: Based on EIA data.

5

Trend lines fitted to world oil supply growth show flattening

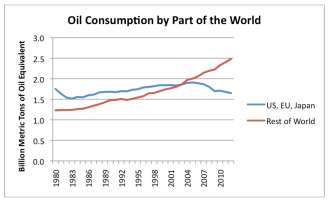


"Actual" amounts from BP 2013 Statistical Review of World Energy

6

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.

7

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"*

8

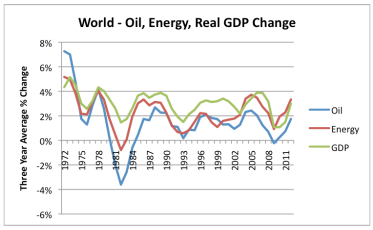
High oil prices create multiple problems

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

9

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.

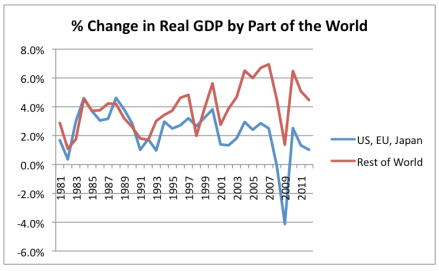
10

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.

11

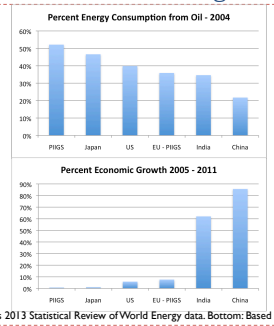
Economic growth of big oil importing countries is lower than other countries



Based on USDA Real GDP data.

12

In fact, 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.

13

One current concern: Oil price required by exporters keeps rising

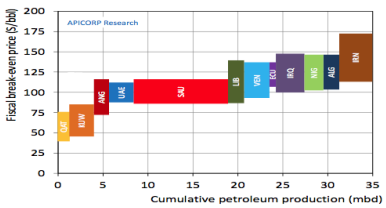
- We are temporarily in a Goldilocks price zone
  - May disappear if price required by exporters rises
  - Or the ability of the importers to pay drops

14

In fact, price oil exporters need to meet government budgets is near current oil price

Figure 3: OPEC Fiscal Cost Curve for 2013

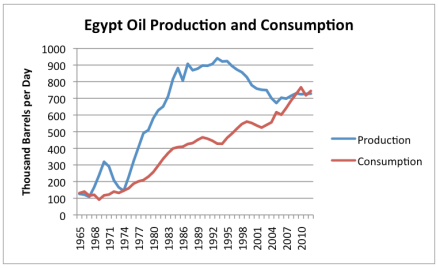
Bar width: country's production; bar heights: price estimate ranges



Source: http://www.apic.com/Research/Commentaries/2013/Commentary_V08_N08-09_2013.pdf
Arab Petroleum Investment House

15

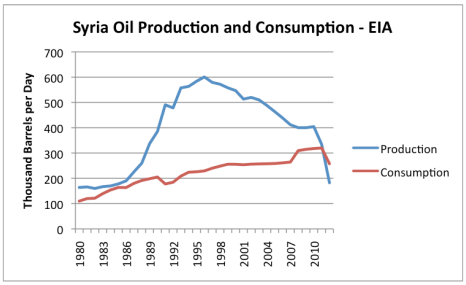
Another concern: Oil exporters whose production declines show severe instability



Based on BP 2013 Statistical Review of World Energy data.

16

Syria: Another example of an oil exporter with declining supply and severe instability



Based on data of the US Energy Information Administration.

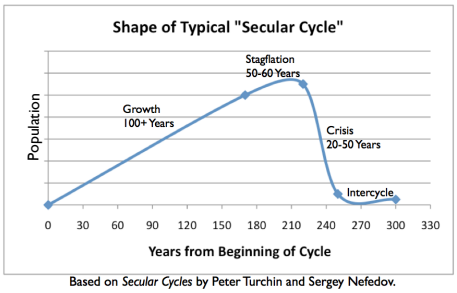
17

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

18

Civilizations that collapsed seem to follow a similar pattern



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

19

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

20

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

21

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

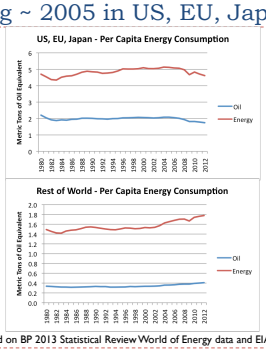
22

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

23

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.

24

Economic growth seems to reflect a positive feedback loop

- Energy use is key
  - Can't make goods without energy
  - Even making services requires energy
  - Rising energy use goes with more creation of goods
    - Some efficiency gains, but these are small on annual basis
- Rising energy use also encourages rising population
  - If have more jobs, this also contributes to growth, energy use
- Cheap energy key to competitiveness and growth
  - Increasingly cheap energy makes salaries go farther, country more competitive

25

Growing debt is closely tied to growth in energy consumption

- First tie:
  - More debt enables more oil/energy extraction
  - More debt enables more demand for goods using oil
- Second tie:
  - With more oil/energy use, economy grows faster
    - Makes it easier to repay debt with interest
    - Enables a higher interest rate
- Rising debt is therefore part of the positive feedback loop, enabling economic growth

26

Graphic representation regarding why growth is helpful to debt

Repaying loans is easy in a growing economy

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

27

Higher oil prices create barrier to growth; greater debt

- Higher oil prices make salary of workers go less far
  - Less money for debt repayment
  - Need ultra-low interest rates
- Higher cost of oil extraction means more resources diverted to oil extraction
  - Pulls resources out of the positive feedback loop
  - "Investment Sinkhole Problem"
- Need ultra-low interest rates to keep high oil price problem hidden

28

We get back to the issue mentioned before

- We are temporarily in a Goldilocks price zone

29

Myth: There is plenty of oil available

- Myth: Amount available is at least equal to
  - (Reserves / Amount extracted per year)
  - (2,057 / 31.5) = 65 years at current extraction rates
  - More available, if prices are higher
  - New technology helps too
- Reality: Cost is a problem; we can't get it out at desired rate
  - Cost is already too high for oil importers
    - Problem is an affordability issue
  - Cost is becoming too low for oil exporters; oil producers
  - Most oil will stay in the ground
    - Side issue: Climate models use way too much fossil fuels
  - Fact that world oil supply is still slightly increasing is irrelevant

30

Current financial problems are mostly oil-limits problems

- Businesses generally aren't affected
  - Can fix their problems with high oil prices by laying off workers; making less product
  - Outsourcing work to low cost country also keeps profit high
- One big impact is on individuals
  - Lack of good paying jobs
  - Related to oil related business layoffs
- Another big impact is on government
  - Not enough income; too much outgo
- Quantitative easing helps hide these problems

31

Paths Forward

- Scenario 1: Worst Case Scenario
  - End of quantitative easing
  - 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

32

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

33

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
    - Price of oil does not fall below cost of extraction
  - US economic growth still not very good
    - Increasingly high oil prices a drag on spending
    - 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

34

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

35

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

36

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

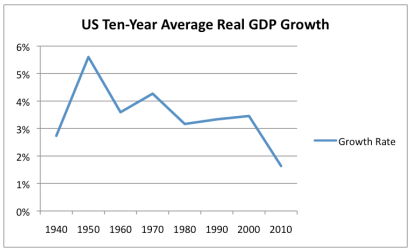
37

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

38

Problem can also be thought of as the end of growth



Based on US Bureau of Economic Analysis data.

39

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

40

Contact Information

- Gail E. Tverberg
- GailTverberg@comcast.net
- OurFiniteWorld.com
- Twitter: @gailtheactuary
- (407) 443-0505

- 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/)

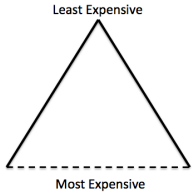
41

Optional Additional Slides

42

High oil prices allow more oil production

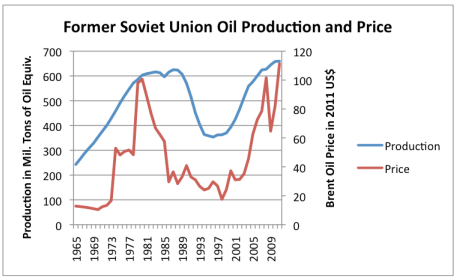
- For any resource, quantity is distributed as follows:



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

43

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

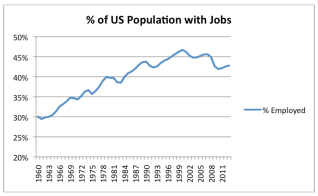


Based on BP's 2012 Statistical Review of World Energy data.

44

Workers are affected by continuing high oil prices

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

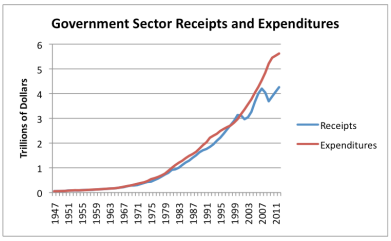


Based on data of US Bureau of Labor Statistics.

45

Government revenue is also 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.

46

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.

47

Recent letter to WSJ

Low-Priced Oil Is Really a Mirage

It is an illusion to think oil production will rise enough, long term, to lower prices.

Daniel Yergin's "China's Big Commodity Chill" (op-ed, Aug. 9) may well be another example of a contrary investment indicator. In a 2005 Washington Post article, with oil at $60 a barrel, Mr. Yergin told readers not to worry, as capacity would expand significantly. Since 2005, oil production has only grown 0.7% annually (BP Statistical Review) after growing at 2.1% annually from 1999 to 2005.

Exploration for oil isn't migrating to expensive deep offshore, arctic and "tight" oil formations because there is an abundance of cheap conventional oil still to be found. If countries such as Saudi Arabia had significant excess capacity, they could easily drive prices down to stop new high-cost exploration. The fact that they aren't says volumes about the tightness of global oil capacity.

The world is walking a tightrope between the need for additional oil supplies and the reality of limited future supply increases. As an example, tight oil production experiences rapid depletion compared with traditional oil fields. Current optimism about tight oil production increases is like the crew of the Titanic bragging about how fast the ship was pumping water out. The global economy, due to growth in the emerging economies, is experiencing an unprecedented expansion of the middle class. Higher oil and other commodity prices are in our future.

John R. Hummel President, AIS Futures Management LLC Wilton, Conn.

48