Oil supply limits, the economy, and insurance

Gail E. Tverberg, Zurich American, August 21, 2013
We have been hearing one oil story in the media

- Based on short term blip in US oil production

Based on EIA state oil production data.
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.

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

Source: Based on EIA data.
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.
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*”
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.
High oil prices seem to be a major cause of the Great Recession


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

% Change in Real GDP by Part of the World

Based on USDA Real GDP data.
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.
Oil price required by exporters keeps rising

- We are temporarily in a Goldilocks price zone
  - May disappear if price required by exporters rises
In fact, price oil exporters need to meet government budgets is near current oil price

Arab Petroleum Investment House
Resource Limits: What does history say about civilizations that hit limits?

- Many civilizations have grown 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
Civilizations that collapsed seem to follow a similar pattern

Shape of Typical "Secular Cycle"

- **Growth**: 100+ Years
- **Stagflation**: 50-60 Years
- **Crisis**: 20-50 Years
- **Intercycle**

Years from Beginning of Cycle

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

This is what “Malthusian limit” has looked like in the past
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
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.
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
Why oil price has such 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.
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
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
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
Big oil users are already reaching an affordability limits

- **Nature of limit:**
  - Using high-priced oil leads to low GDP growth
  - \((\text{Value of oil to society}) - (\text{Cost of oil})\) shrinks as oil prices rise

- **Globalization makes problem worse**
  - Businesses have need to “fix” profits, when oil prices rise
  - One way is to outsource production to low wage countries

- Expect more recession if oil prices rise further

- China, India will be affected too, eventually
Myth: There is plenty of oil available

- Myth: Amount available is at least equal to
  - \( \frac{\text{Reserves}}{\text{Amount extracted per year}} \)
  - \( \frac{2,057}{31.5} = 65 \) years at current extraction rates
  - More available, if prices are higher
  - New technology helps too

- Reality: Cost 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
Potential problem is financial collapse

- Financial collapse brings about decrease in oil production
  - Drop in oil production is likely to take place over a few years
- Financial collapse is related to
  - Mismatch between price oil producers require, and buyers can afford
  - Declining per capita energy consumption ("Malthusian problem")
  - Financial problems related to continuing high oil prices
  - Globalization impact on high wage countries
- Quantitative easing is hiding these problems
  - Leads to a potential "Oops!" when interest rates rise
Paths Forward

- Scenario 1: Worst Case Scenario
  - End of quantitative easing
  - Interest rates rise
  - Many follow-on effects of interest rates rising
    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
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
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
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
  - But economy is able to recover for several years
  - Eventually drops again, perhaps with another bounce
  - Eventually heads toward collapse
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
- Need to bring oil prices down to $40 barrel or less

Then theoretically could be a longer-term recovery
Implications for Actuaries

- Worrying times are ahead
- Great Recession may become the norm!

- Are the indications too bad to even consider?
  - Problems won’t just magically disappear
  - Insurance companies will need to deal with whatever comes up
  - Best that actuaries at least understand underlying problems
  - Perhaps another actuary would come to somewhat different conclusions
Implications for Actuaries (cont.)

- May reenter recession in the next few months, especially if interest rates rise
  - At best, tepid growth likely
  - Job growth is likely to continue to be depressed
  - New recession could be worse than 2008-2009

- Interest rates seem to be a real challenge
  - We have a can’t-win situation
  - Raising current low interest rates unleashes a whole range of other problems
  - If interest rates remain low, problem for some policies
    - Examples: Long term care, whole life, medical malpractice
Implications for Actuaries (cont.)

- Debt defaults likely to be a very large problem
  - Detroit just the beginning
  - Other types of debt likely to see more defaults
  - Asset values of insurers likely to be impacted
    - Stock and other asset values likely to fall
    - Defaults on bonds also likely
  - Banks likely to fail

- Pricing of any kind of financial guarantee is likely wrong, if economy turns down
  - Financial guarantee
  - Mortgage guarantee
  - Derivative pricing
Implications for Actuaries (cont.)

- Insurers can look to 2008-2009, and more recent experience, for indications as to how coverages are affected
  - **Homeowners** – More people at home, without jobs
    - More attempts to defraud insurer?
    - Perhaps more lack of maintenance issues
  - **Private Passenger Auto**
    - Few good jobs for young people
      - Keeps young from buying cars – holds down accidents
    - Older drivers may take fewer vacations – drive less
  - **Workers Compensation**
    - Fewer inexperienced workers – should help experience
    - Medical cost may be reduced as well
Implications for Actuaries (cont.)

- Reserves may develop more favorably
  - Less demand for medical services, so price may fall

- Insurers likely to sell fewer policies
  - Consumers do not have income to buy optional policies
    - Life insurance, renters coverage
  - Fewer young people driving cars
  - Homes increasingly owned by corporate owners

- If interest rates do rise, new insurance companies will have an advantage
  - New insurers can use higher interest rate assumptions
  - This is what happened with malpractice companies in 1974
Implications for Actuaries (cont.)

- New substitutes for oil likely to gradually change product mix
  - More coverage relating to solar PV, electric cars
  - Also, commercial policies relating to solar, wind turbines

- Climate change models assume way too much CO$_2$
  - May not matter from actuarial perspective
  - Actuaries are primarily concerned with next five years
  - But leads to bad government policy
    - Carbon taxes shift manufacturing to coal-using countries
    - Need tax on imports as well, to be helpful
    - But carbon decreasing regardless, if collapse occurs
Contact Information

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

Optional Additional Slides
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.*
Myth: Growth can continue indefinitely in a finite world

- This is clearly nonsense
- Most people don’t know what to look for, when limits are about to hit
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
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.
US economic growth seems to be headed downward

Based on US Bureau of Economic Analysis data.
Workers are one group affected by continuing high oil prices

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

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.
Oil prices have risen greatly in recent years

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