Converging Crises

Gail Tverberg - Age of Limits – May 25, 2014
Many crises converging

1. Population Issues
2. Resource Depletion
3. Environmental Degradation
4. Debt; Viability of Financial System
5. Government Funding Issues
6. Jobs Availability
7. Electrical Grid Problems
8. Geopolitical: Fighting Over Resources Again
1. Population Issues

- Human population huge compared to our “relatives”

  Chimps < 300,000 today
  Max based on range, density < 3 million

How did our population get to be so large?

- All species have more offspring than needed to replace parents.

Humans have done better than others in keeping deaths down.

Reason #1 for Population Growth

- Control of fire > 1 million years ago
- Our bodies are now adapted to cooked food
- Range is greater with fire

Source: http://www.publicdomainpictures.net/view-image.php?image=1161&picture=fire
Reason #2 for Population Growth

- Agriculture ~ 10,000 Years Ago

Source: http://www.ars.usda.gov/is/graphics/photos/dec05/k5051-8.htm
Reason #3 for Population Growth

- Coal ~ 200 years ago

Source: US Census Bureau
Reason #4 for Population Growth

- Oil ~ 1945 on

Based on Agnus Maddison estimates [www.ggdc.net/MADDISON/oriindex.htm](http://www.ggdc.net/MADDISON/oriindex.htm)
Growing population – A problem!

- Less farmland per person

- Less wood per person (cooking, heating, making metals)

- Less readily accessible fresh water per person

- More resource extraction required

- Sixth mass extinction – other species
Can’t easily stop population growth

- Contraception expensive
- Who pays for all the elderly?

Population by Part of the World

Based on US Energy Information Administration data.
2. Resource Depletion

Problems in many areas:
- Fresh water
- Soil erosion
- Fish
- Pollinators
- Deforestation
- Minerals of many kinds
  - Gold, copper, platinum, phosphorous, etc.
- Oil
Amount of oil extracted has been flat recently

Based on BP 2013 Statistical Review of World Energy.
Shale oil

- Temporary growth in US oil
  - Little effect in world supply

- Estimates dropping
  - Monterey Shale estimate reduced by 96%!
  - Reduces total US resource amount by 60%

- Doubtful whether it is profitable
  “Shale Drillers Feast on Junk Debt to Stay on Treadmill” — Bloomberg, Apr 30, 2014
Need energy of the right kind for economic growth

Based on BP 2013 Statistical Review of World Energy and USDA compilation of World Real GDP.
Economy grows as oil supply grows
High oil prices lead to low wage growth

Source: Average wages are total US Wages from Bureau of Labor Statistics Table 2.1 adjusted to 2012 using CPI Urban, divided by total US population. Oil prices are from BP’s 2013 Statistical Review of World Energy.
Right now, oil prices don’t seem very high

Source: Based on US Energy Information Administration data.
Oil prices are **not high enough** for oil producers

- Need to borrow to pay dividends
- Some companies may hit credit limit
- Some companies cutting back on new drilling
  - Shell oil, most majors
- Concern: “Quit and go home”
If oil prices rise, they become too high for consumer

Recession follows
- Job layoffs

Economist James Hamilton has shown that oil price spikes associated with 10 out of 11 recent US recessions!
Danger of drop in oil production

- No oil price works
  - Low for producer
  - High for consumer
- Also debt connection – to be discussed later
- Combination likely to lead to steep drop off
  - Brings in all types of fuels simultaneously

Historical based on BP 2013 Statistical Review of World Energy, adjusted to IEA groupings.
Shape of curve roughly in line with past collapses

Based on *Secular Cycles* by Peter Turchin and Sergey Nefedov, Princeton University Press, 2009.
Hubbert curve based on a very different scenario

3. Environmental Degradation

- Air pollution
  - Burning wood, coal, animal dung, etc.
- Soil degradation – salinity, loss of minerals, loss of carbon
- Ocean acidification
- Harm from extraction
  - Fracking for oil and gas harm aquifer
  - Oil spill harm
- Fossil fuel use in medicine, pesticides => unintended harm
- Climate change
Rapid rise in coal use in China => Pollution

- Occurred after China joined World Trade Organization in 2001

- Now China cutting back because of pollution
  - Affects world economy

Source: Based on BP2013 Statistical Review of World Energy
Climate change models: OK or not?

1. Hard to include everything relevant
   - Should deforestation impact be modeled?
   - How about changes in the sun?

2. Hard to use reasonable values for everything modeled
   - High end of fossil fuel emission range seems impossible

3. Climate is always changing
   - Hoping for a perfectly stable climate is unreasonable
Forest coverage has been shrinking with current policies, at same time CO$_2$ rising.
Which is worse?

Burning Fossil Fuels

Deforestation
4. Financial System and Debt

- Financial system is like a computer operating system for the world
  - What gets made? What gets sold?

- Another analogy: Financial system is like the electric grid
  - Without it, everything stops

- International system is the issue
  - Problem is keeping everyone trusting each other
  - Debt is a big part of the system
Adding debt makes the economic system “run faster”

- Consumer: Has $$ he never earned to spend
- Business: Can build new facilities, before profits are earned
- Governments: Spend money not yet collected in taxes

- Works if the economy is growing
Repaying loans is easy in a growing economy
Repaying loans is much more difficult in a shrinking – or flat - economy
Loans are essential to the system

- Loans are promises
  - Hire a worker – use promise of pay
  - Buy something bigger than you can conveniently save up for
    - House
    - Factory
    - New car
  - International trade – promise payment will be “good” when merchandise ordered is shipped

- Danger is *loss of trust*
  - Too little chance of repayment
Loans have downsides

- Too much interest goes to “bank” (or “rentier”)
  - => Growing income inequality

- If economy starts shrinking
  - Too many defaults

- Loss of loans => lower demand => low commodity prices
  - Can be huge problem
  - Oil companies stop extracting oil, if price too low
Big drop in oil prices was credit-related

Source: Based on US Energy Information Administration data.
Amount of US mortgage loans outstanding dropped at same time

Source: Federal Reserve Z.1 Data
Amount of US consumer credit outstanding dropped

Based on Federal Reserve. (Student loan data estimated prior to Dec 08).
US Government debt suddenly soared

Source: Federal Reserve Z.1 Data.
Even with Federal Government debt, total debt growth flattened.
Debt System is in Serious Trouble

- Economy is not growing enough
  - Related to oil supply

- Reaching the point where it is impossible to keep non-government debt growing
  - Wages are too low
  - Young people can’t afford expensive new homes, cars

- Have to keep interest rates low
  - Quantitative easing
Quantitative Easing has sort of worked

Overlay of oil prices on chart showing interest rates and central bank assets by Rune Likvern.
How long can current shenanigans last?

- Low interest rates create problem for pension plans

- US currently discontinuing Quantitative Easing
  - But strange happenings in Belgium

- Rising interest rates will sink the economy
  - Oil prices will drop

- Concern is debt defaults
  - Also follow-on loss of confidence
Impact of “Loss of Trust” on loans

- First affected
  - Countries in trouble: Greece, Cyprus
  - Consumers with low credit scores
  - Marginal businesses
    - Like shale oil/gas drillers
    - Or small companies in oil drilling “chain”

- Eventually
  - Long-term loans in general
  - Countries without good trading record
  - All but the most local, shortest-term loans
5. Government funding issues

- Government is funded by the *surpluses* of an economy

- Empires find it harder to maintain their armies
  - Can’t afford the army; collapse back to smaller size
  - Example: Collapse of Former Soviet Union

- Poor societies can only afford kings, dictators
  - Few programs to benefit the poor; elderly

- Rich societies can afford democracy
  - Also programs to take care of the poor, elderly
Turchin and Nefedov: Government funding was often a factor in collapse

- **Diminishing returns**: Needed higher taxes; wages low

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*Based on *Secular Cycles* by Peter Turchin and Sergey Nefedov, Princeton University Press, 2009.*
6. Jobs Availability

- Energy transforms raw materials into finished goods

- Too little energy => disappearing jobs
- Still can dig in dirt with a stick
  - Example of job not requiring energy
7. Electrical Grid Problems

- Myth: Electricity will save us if oil is a problem

- Reality (1): Electricity costs poised to rise
  - Add to our oil-based problems

- Reality (2): Electric grid likely to outlast oil by at most a few years
  - Too closely networked with rest of system
Why Electrical Grid Can’t Last

- Electricity infrastructure – mostly very old
  - No company has economic incentive to upgrade it

- Oil is necessary to maintain electric grid

- Cutbacks on coal, nuclear likely to affect electric grid

- Natural gas is not ready for the role many would like
  - The US is still a natural gas importer
Electrical grid mix changes slowly

Source: US Energy Information Administration.
Electrical Grid Problems

- Adding intermittent renewables adds grid problems
  - Load balancing
  - Higher cost
  - Utilities in financial distress (Germany)

- Corollary: If you want electricity long-term,
  - Do it yourself
  - Do it off grid
  - Stockpile batteries; inverters
8. Geopolitical: Fighting over resources again

- Globalization
  - Works well as long as there is “enough”

- Doesn’t work so well when there isn’t enough
  - Fight for own benefit

- Examples:
  - Russia – Ukraine
  - China – Viet Nam
Russia – Ukraine Background

- Ukraine can’t afford Russian natural gas
  - Russia can’t afford customers who can’t pay
  - Cutting off Ukraine is a necessity

- Russia has great power over Europe
  - Source of 30% of EU natural gas imports
  - No good source elsewhere

- Crimea has oil and gas reserves that would be helpful to Russia
Russia – Ukraine Recent

- Russia signed $400 billion gas deal with China
  - Undercuts US$ reserve currency
  - Less for Europe in long run

- US has an import advantage with the US dollar as reserve currency
  - If Russia (or Russia – China – Iran) can dislodge US as reserve currency, it will mean more oil for rest of the world

- Alliances may change
  - Germany may stick more closely with Russia
  - Bad for rest of EU-27
Solutions to Converging Crises

1. Limit family size

2. Look after the needs of your own family
   - Join forces with others with similar ideas
   - Can’t solve the problems of the whole world

3. We need help from a Higher Power
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