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The Case for Near Term Resource Limits

International Congress of Actuaries –N-12A – April 4, 2014
Gail Tverberg, FCAS, MAAA

Oil limits are financial limits

These financial limits seem to be hitting already.

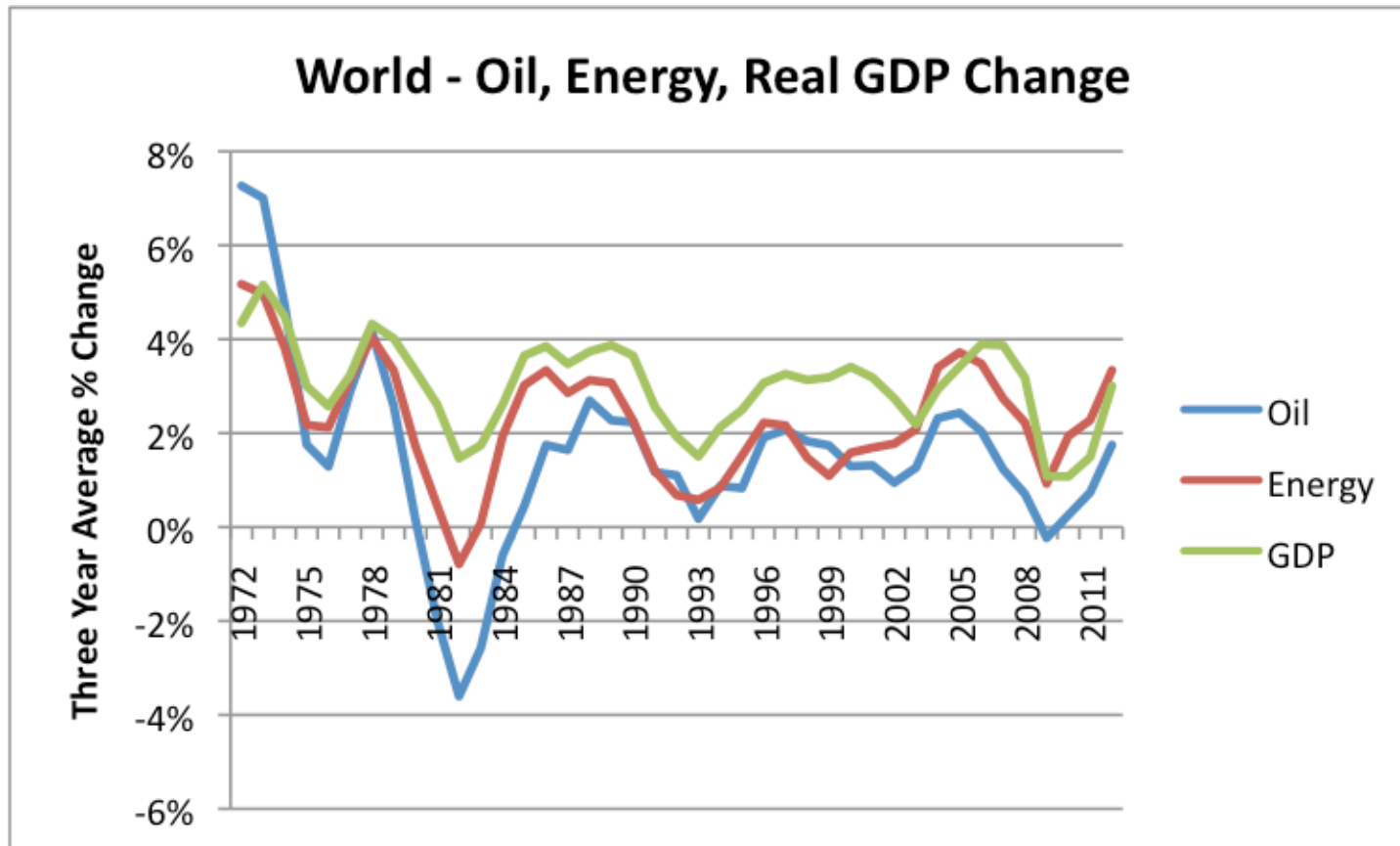
Why we have a problem:

- 1 Oil is an essential product.
- 2 The cost of oil production is rising much faster than our ability to pay for the oil.
- 3 Wages don't rise to compensate.
- 4 This can't end well.

Oil is very important

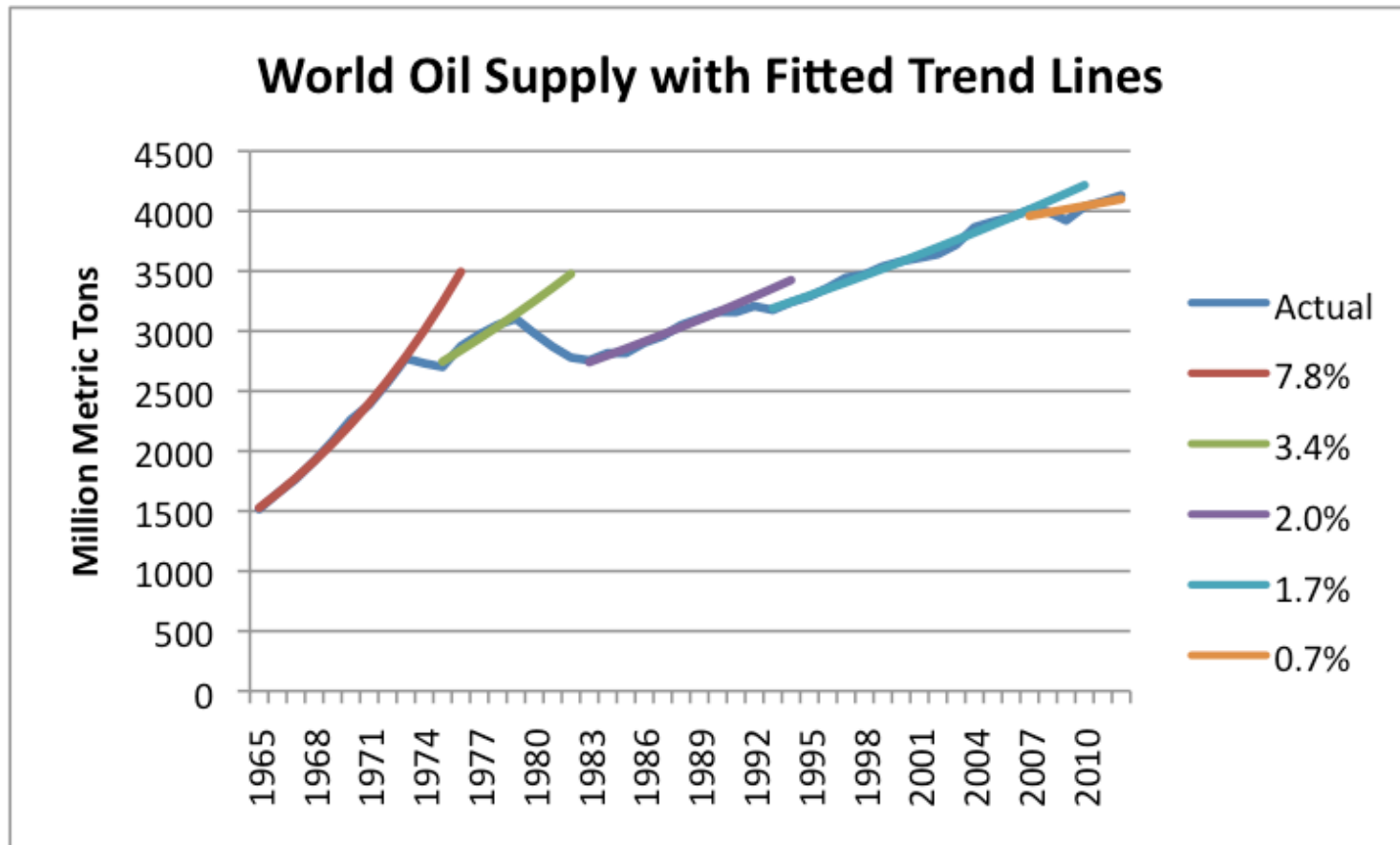
- ▶ Nearly all transport uses oil
- ▶ Important in growing, transporting food
- ▶ Raw material for medicines, asphalt, fabric, etc.
- ▶ We have no way of replacing oil with electricity
 - ▶ Even if we did, cost would be overwhelming
- ▶ 10 out of 11 recent US recessions were associated with oil price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

Economic growth and energy consumption are closely tied



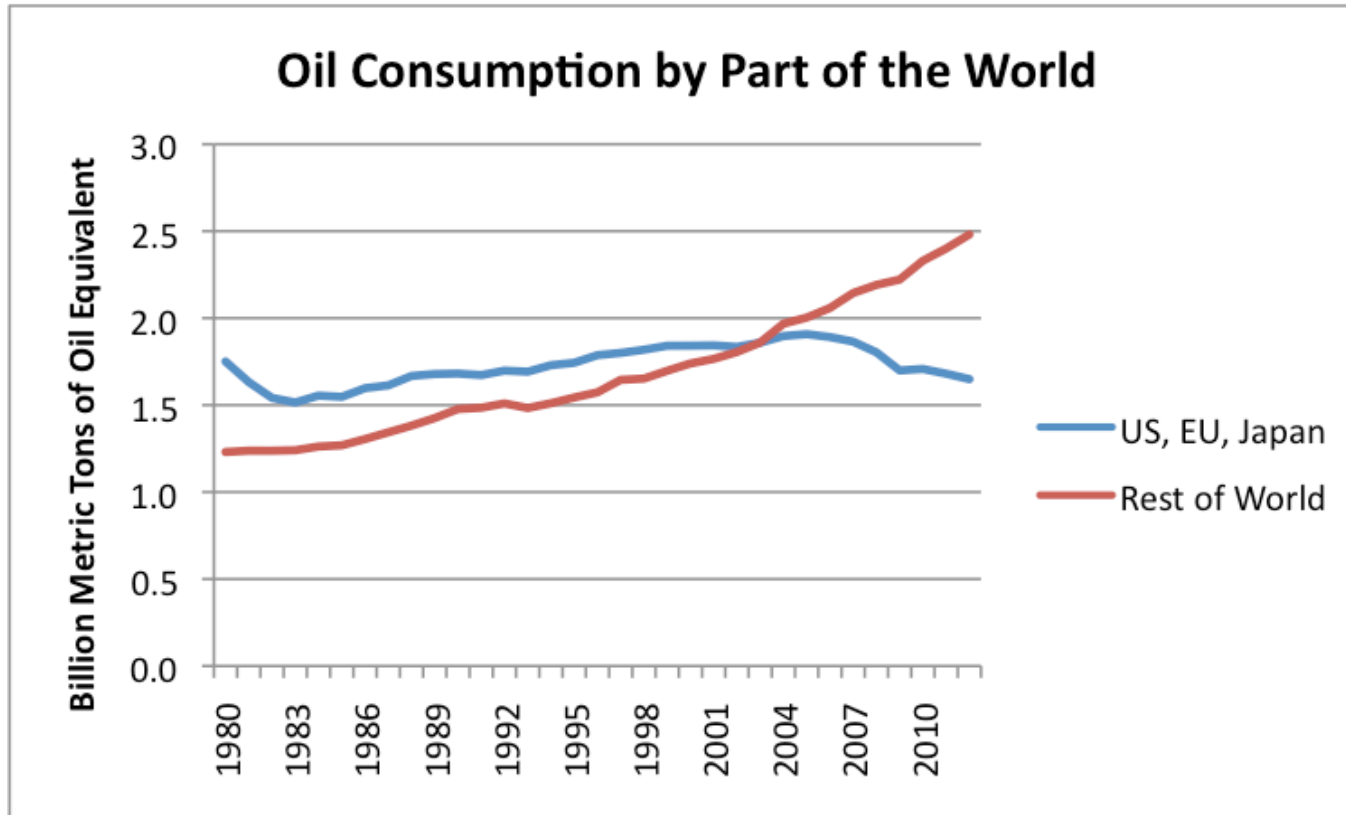
Data from BP 2013 Statistical Review of World Energy and [USDA compilation of World Real GDP](#).

Trend lines fitted to world oil supply indicate flattening



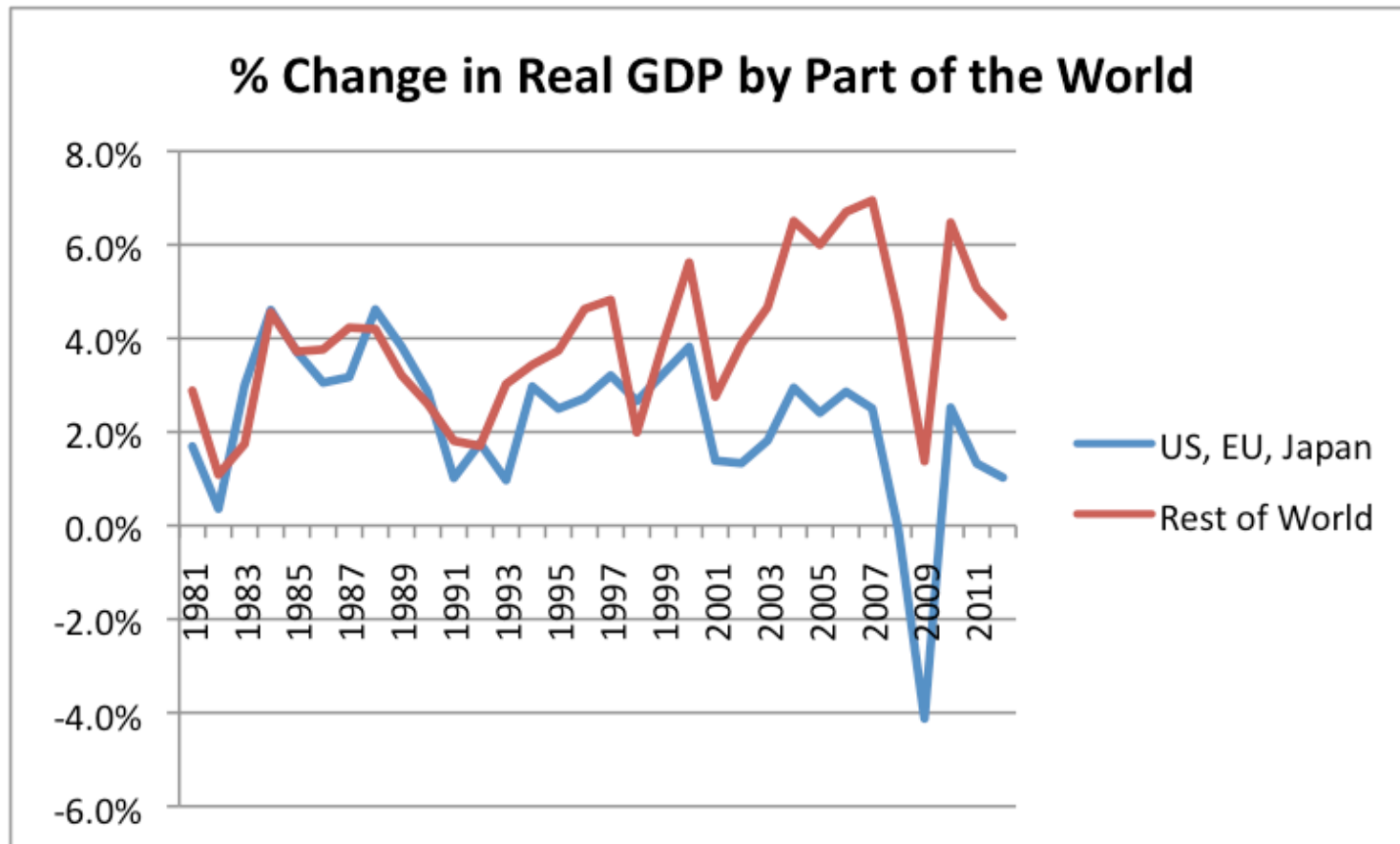
“Actual” amounts from BP 2013 Statistical Review of World Energy

Oil consumption in US, EU and Japan are declining



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

Big difference in economic growth rates



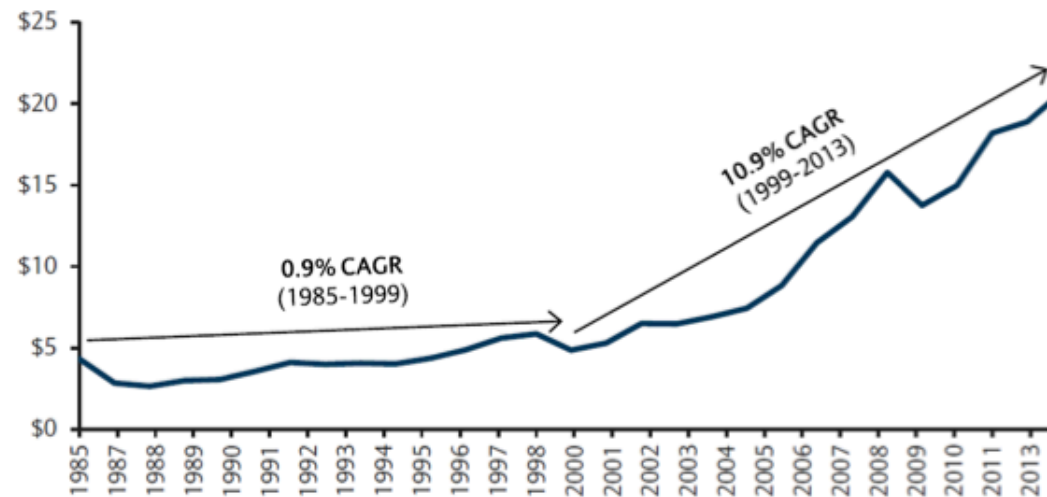
Based on USDA Real GDP data.

Cost of Oil Extraction is Rising Rapidly

- ▶ Diminishing returns issue

Douglas –
Westwood

Costs are Rising Fast

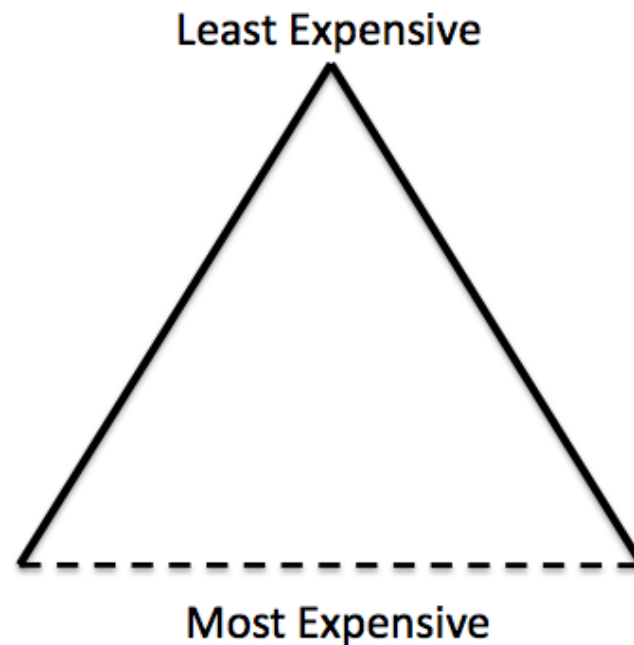


Source: IEA, Barclays Research

Amounts shown are Exploration and Production Costs from “Global Oil Market Forecasting” by Steven Kopits of Douglas Westwood at Columbia University, February 11, 2014

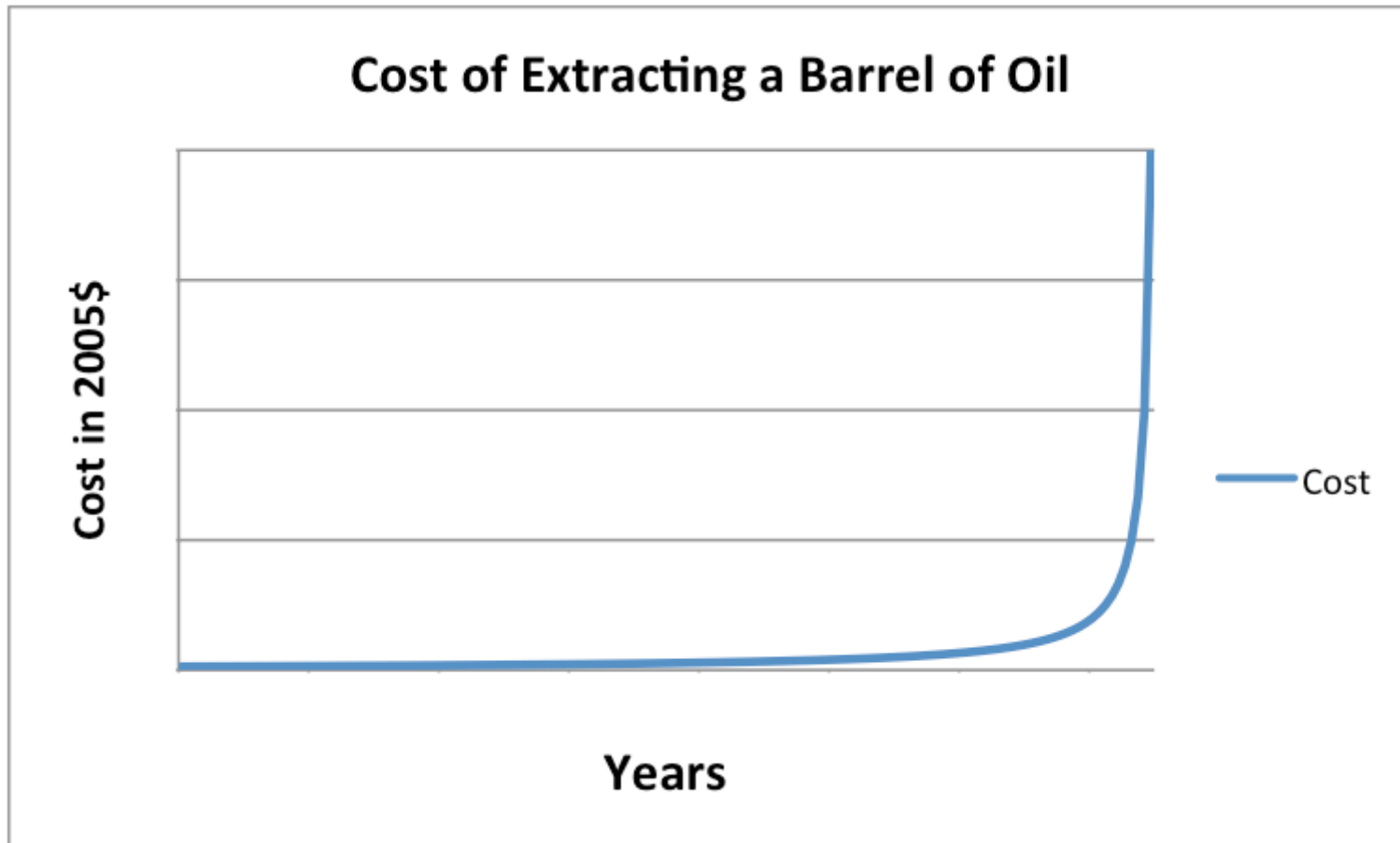
The supply of a resource is like a triangle

- ▶ Start extracting the least expensive (top)–work down
- ▶ Reserves keep growing–can always see more “ahead”

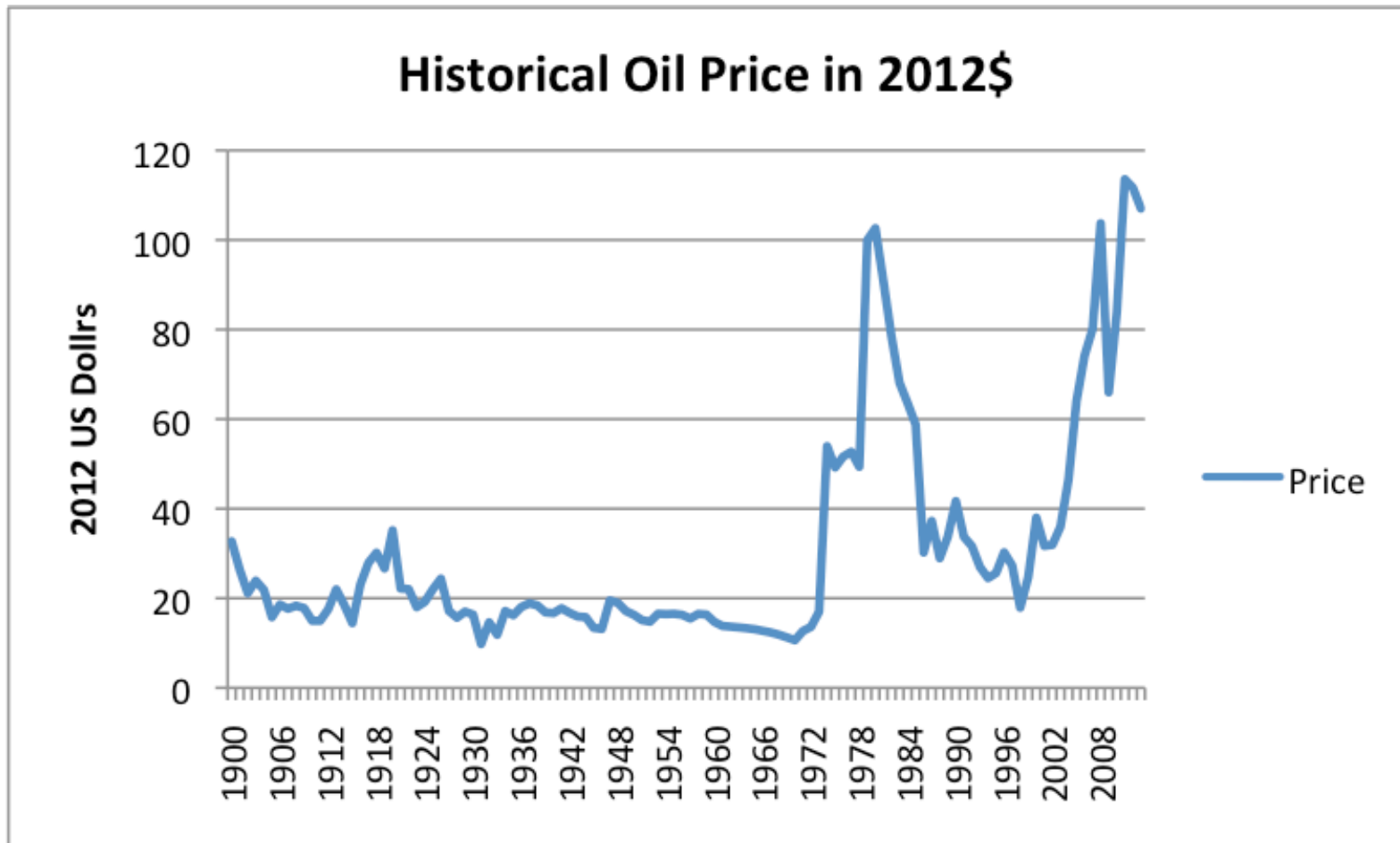


- ▶ The cut-off is a dotted line – can't tell when price limits will hit

Extraction costs increase dramatically as we approach the limit

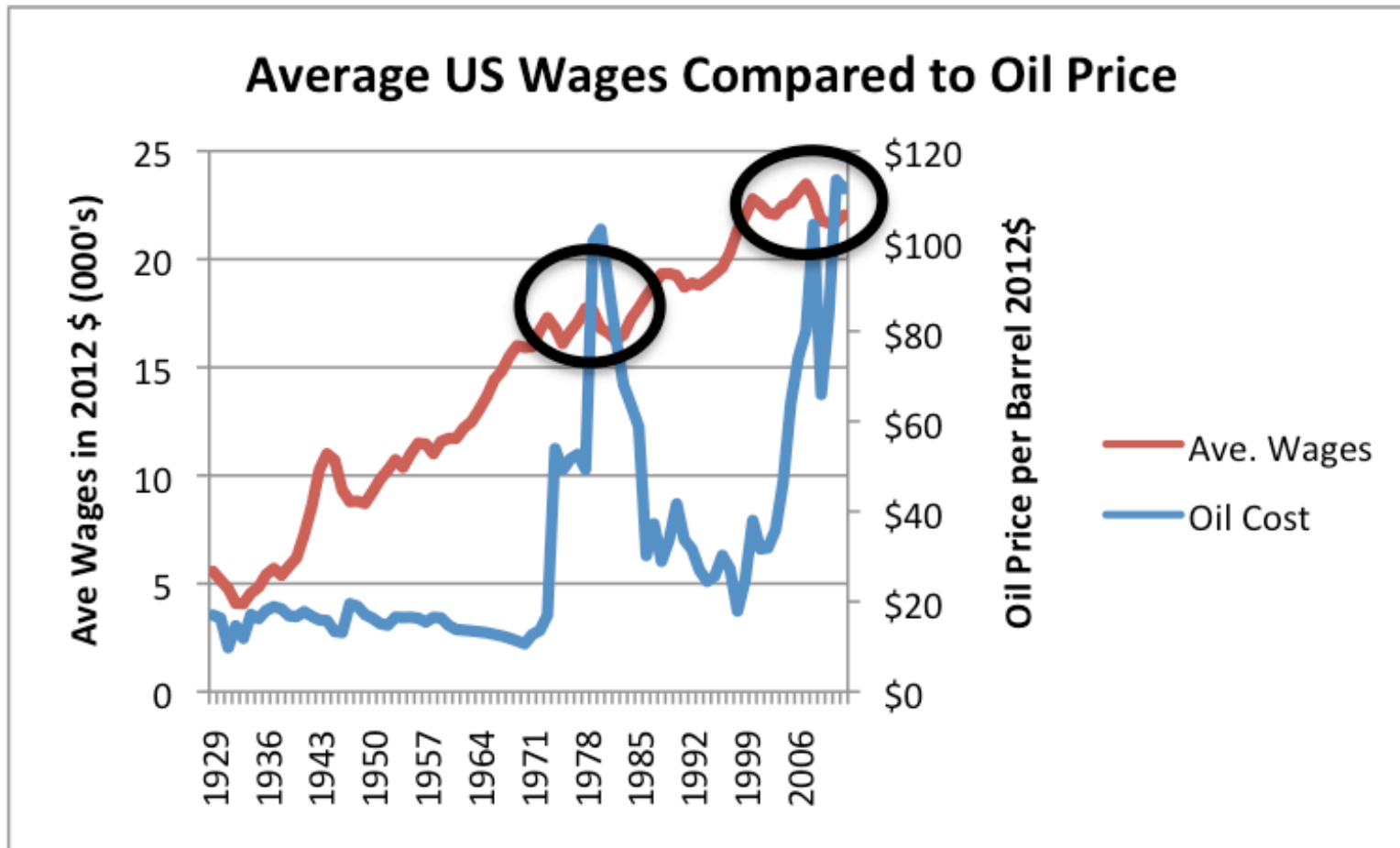


Recent price history suggests we are reaching oil limit



Source: BP Statistical Review of World Energy, 2013.

Wages don't rise as oil prices rise.
In fact, flattening occurs.

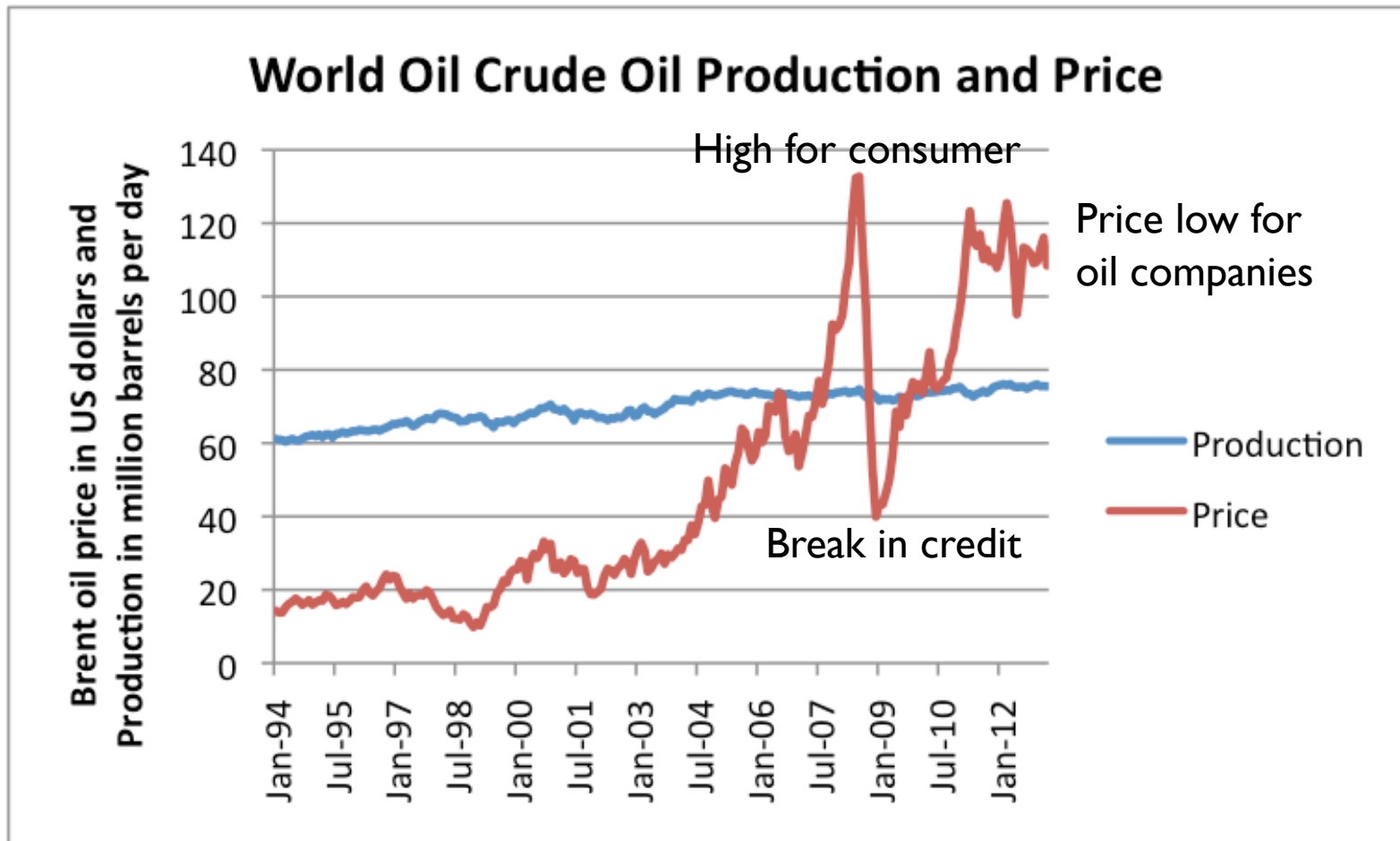


Wages are from Bureau of Labor Statistics Table 2.1, adjusted to 2012 using CPI-Urban inflation. Oil prices are Brent equivalent in 2012\$, from BP 2013 Statistical Review of World Energy.

Three ways this can end

- 1 Oil prices too high for consumer
- 2 Oil prices too low for the oil companies
- 3 Break in credit system

Can see these three outcomes on price chart



Source: US Energy Information Administration

Prices too high for consumer=> Recession

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

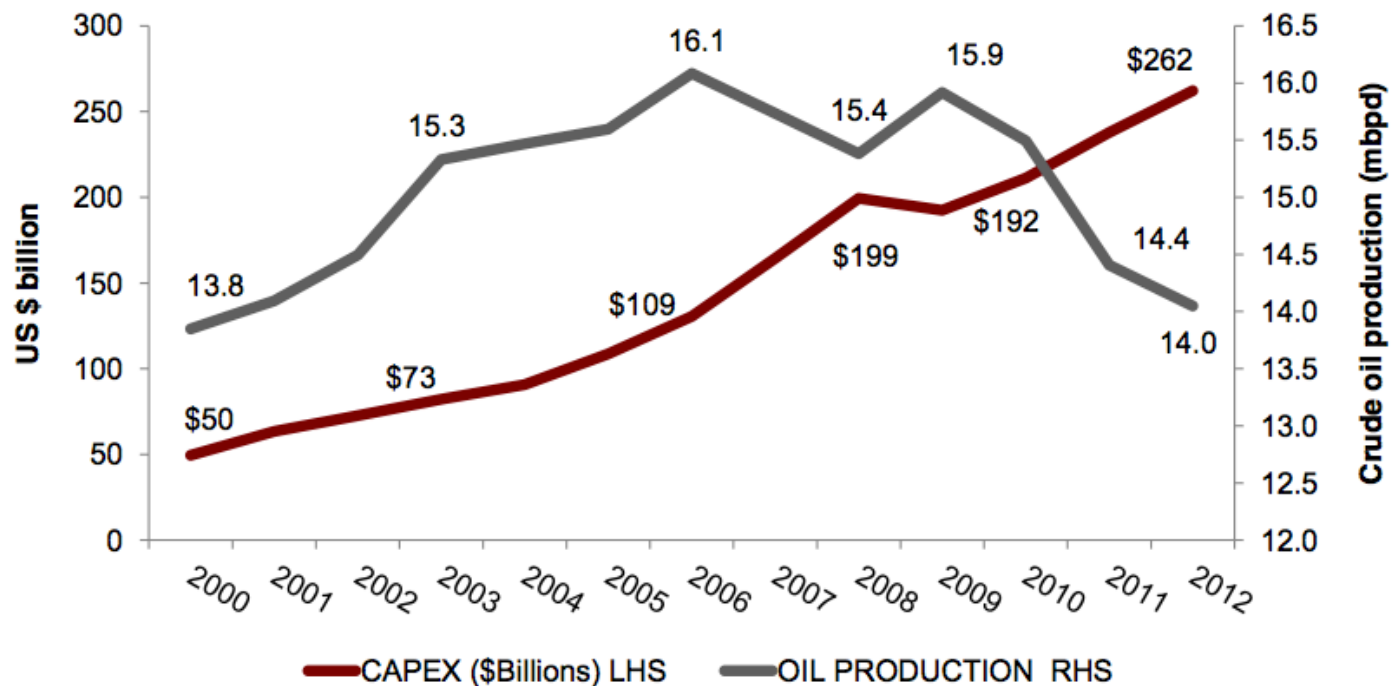
High oil prices seem to be a major cause of the Great Recession

- ▶ 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.

2nd outcome of high cost + flat wages: Prices too low for the producer

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Westwood

Listed Oil Majors: Capex and Crude Oil Production



Crude Oil Production and Capex

Combined data for BG, BP, COP, CVX, ENI, OXY, PBR, RDS, STO, TOT, XOM
Source: Bloomberg via Phibro Trading LLC

Source: “Global Oil Market Forecasting,” by Steven Kopits at Columbia University, February 11, 2014

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. . .”

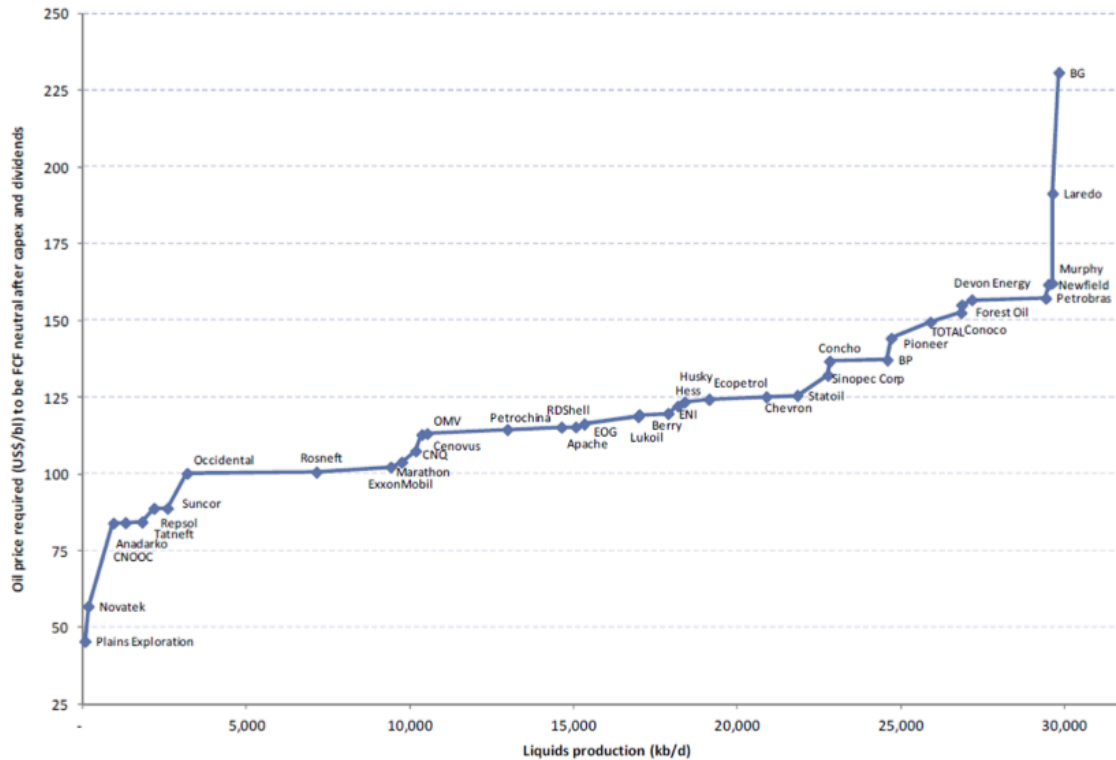
--Financial Times
Oct. 6, 2013

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

Big oil companies are running into cash flow problems; selling off assets to pay dividends

Douglas – Westwood

The Industry Needs \$100+ Oil Prices



Oil Price Required by Oil Companies to be Free Cash Flow Neutral After Capex and Dividends

Source: Goldman Sachs

Source: “Global Oil Market Forecasting,” by Steven Kopits at Columbia University, February 11, 2014

3rd Outcome: Break in Credit System

- ▶ Break in credit system brought down oil prices in 2008
 - ▶ Started with unwind in home, credit card credit
 - ▶ Accelerated to more areas, bringing oil price down
- ▶ Quantitative Easing started in November 2008
 - ▶ Prices stopped dropping and started rising in Dec. 2008
- ▶ Can QE be unwound without
 - ▶ Interest rates rising?
 - ▶ Oil prices falling, cutting off production?

We have other contributing limits

Pollinators
(Bees)

Soil
Erosion

Soil
Quality

CO2
Levels

Fresh
Water

Air
Pollution
(China)

Petroleum
Price,
Quantity

Metals
Such as
Copper

Fish in
Ocean

Natural
Gas

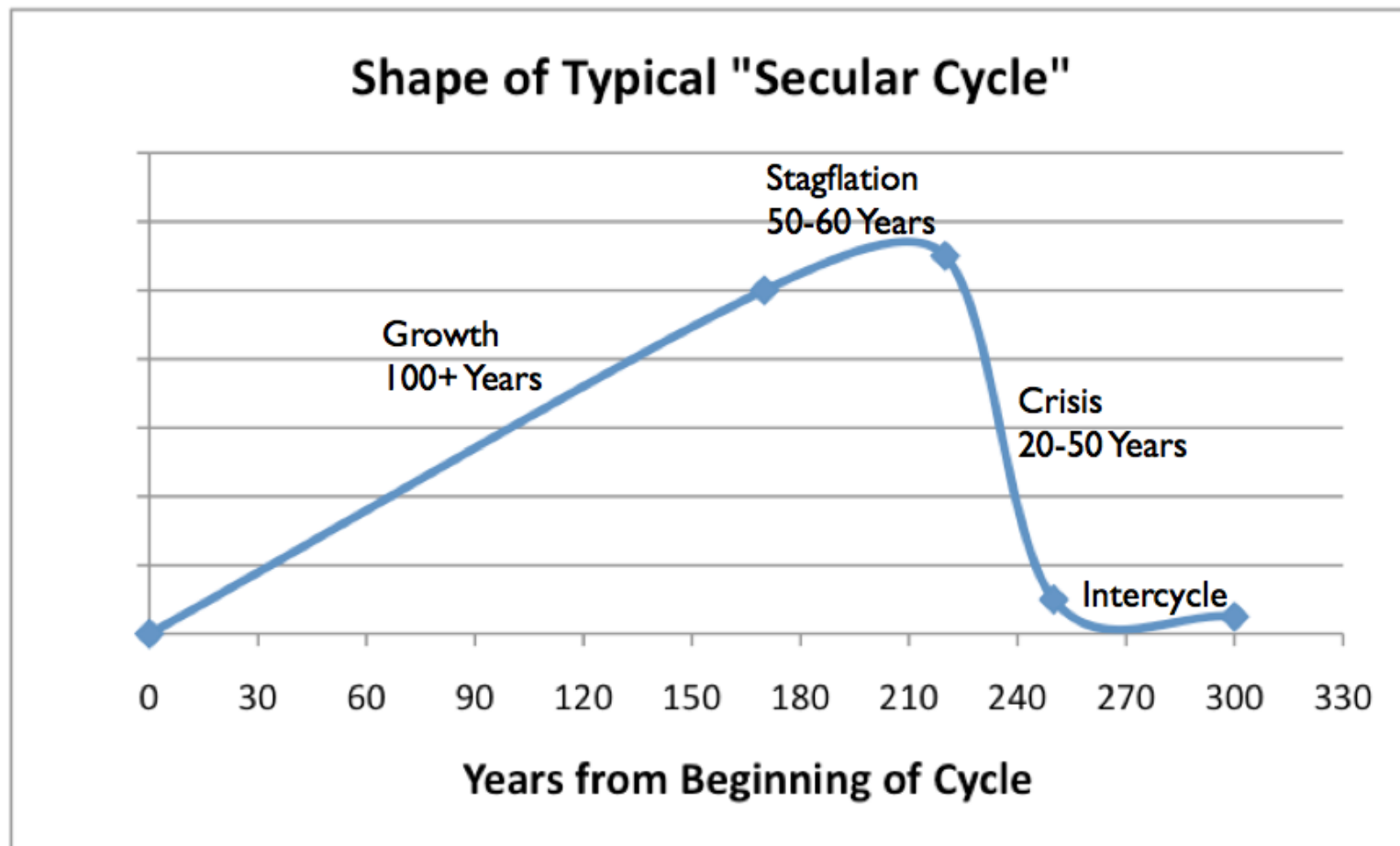
Drug
Resistant
Bacteria

Ocean
Acidifi-
cation

Many interconnections among limits

- ▶ Fixing one often makes another worse
 - ▶ Soil erosion – Solution “no till” farming – Kills bees
 - ▶ Water shortage – Digging deeper wells – Uses oil
 - ▶ Lack of oil – Corn ethanol – Less farmland, more erosion
- ▶ Shortage in one area makes shortage in another
 - ▶ Need water for most electric power plants
 - ▶ High priced oil makes metals high priced
- ▶ Common denominator to fixing problems:
 - ▶ More money: More government programs, costs

Academic studies show the pattern of past resource-related collapses



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

US government is doing its best to “fix” the problem

- ▶ Deficit spending since 2008
- ▶ Quantitative Easing
 - ▶ Ultra low interest rates
- ▶ But can this go on forever?
- ▶ If interest rates rise
 - ▶ Government spending on its own debt rises
 - ▶ Needed tax rates rise
 - ▶ Homes, cars less affordable
 - ▶ Prices of bonds fall
 - ▶ Prices of stocks likely fall as well – recent rise artifact of QE

We are likely headed back into recession

- ▶ Likely in next three years
- ▶ Similar to 2007-2009 recession, only worse
- ▶ Choice of ways to get to recession
 - ▶ Prices too high for consumer => Recession
 - ▶ Prices too low for producers, so cut back oil drilling => Recession
 - ▶ Cutback on credit availability => Recession
- ▶ Economic growth lower or negative; debt defaults

Insurance company impacts

▶ General Impact

- ▶ Similar to 2007-2009 recession
- ▶ Only worse – more debt defaults, falling equities

▶ Line of Insurance Impacts

- ▶ More unemployment
- ▶ Fewer policies sold
- ▶ Worse health, more deaths
- ▶ Drive less
- ▶ More theft; attempts to get unplanned coverage
- ▶ More defaults: surety, mortgage insurance, bond insurance

Insurance Company Impacts (cont.)

- ▶ Balance sheet impacts
 - ▶ Defaults reduce equity
 - ▶ Unrealized capital losses if interest rates rise
 - ▶ Partly balanced by higher interest rates on new money
- ▶ Greece, Spain, Cyprus, Egypt provide examples
 - ▶ Already beginning collapse
- ▶ Climate change issues lessened
 - ▶ Near term used in rates not affected
- ▶ Actuaries will need to deal with the problems that arise

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/>)