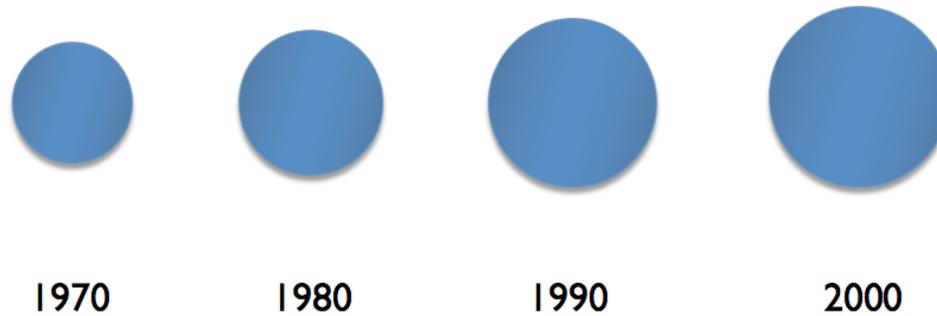


Oops! The world economy depends
on an energy-related debt bubble

Gail Tverberg, OurFiniteWorld.com, October 2015

We have been told a story about the economy

- ▶ The world economy can grow essentially forever
 - ▶ Growth rate won't decline over time
- ▶ Belief in endless growth is behind our financial system



- ▶ Belief in endless growth allows stock prices to grow
 - ▶ Allows bonds to be repaid with interest
 - ▶ Allows banks, insurance companies, and pension plans to exist

Clearly, growth story is not true indefinitely

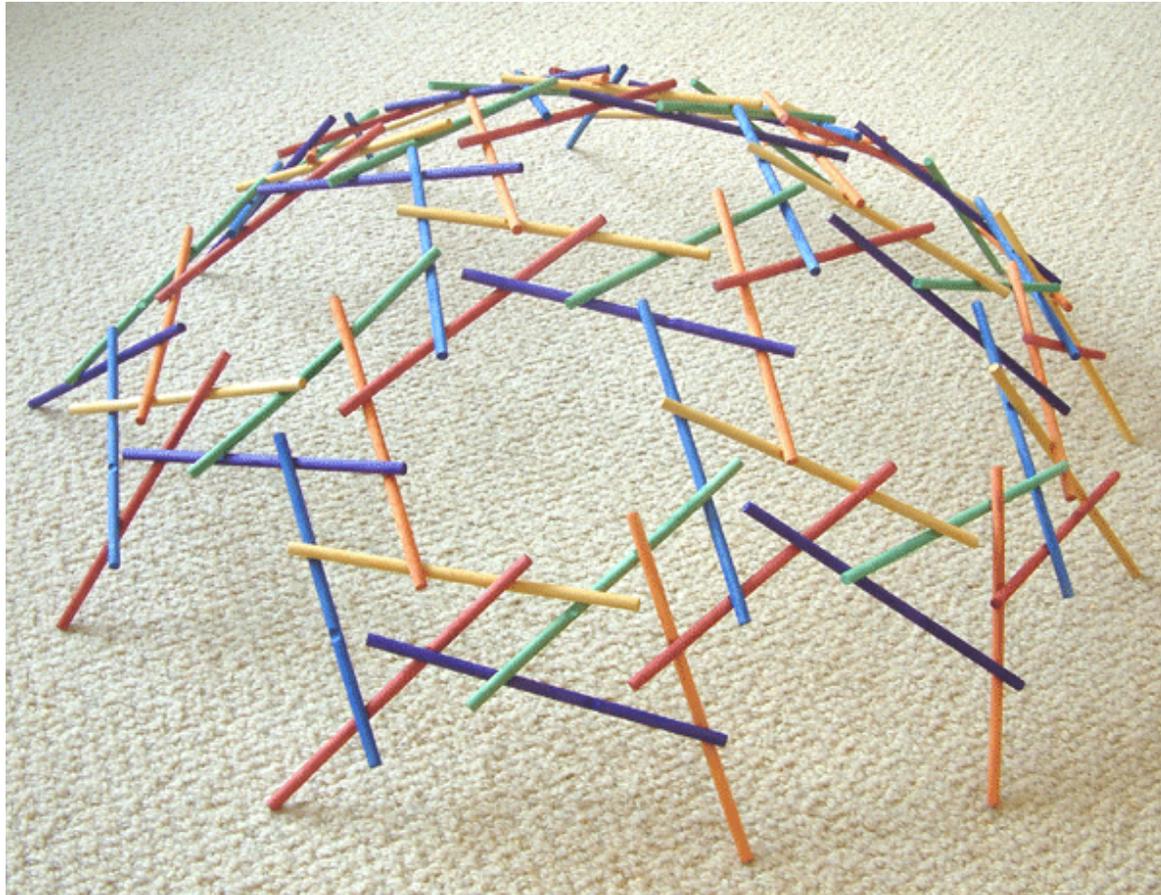
- ▶ We would “run out” of some necessary resource
 - ▶ Fresh water
 - ▶ Popular belief – “run out” of oil
 - ▶ Quality of metal ores would fall to too low
- ▶ Population would grow too dense
 - ▶ 1 person per square foot???
- ▶ Global warming would become too much of a problem

When does the endless economic growth story become untrue?

- ▶ 2100?
 - ▶ Or 2050?
 - ▶ Or now?
- ▶ We have been living in a debt bubble since WW2
 - ▶ Allows us to believe the endless growth story
 - ▶ The debt bubble is enabled by cheap-to-extract energy
 - ▶ Growing debt allows **price of energy = cost of extraction**
 - ▶ As the cost of extraction grows, ever-more debt is needed
 - ▶ Eventually debt/GDP ratios become overwhelming; bubble collapses
- ▶ Once the debt bubble collapses, we are in deep trouble
 - ▶ Low commodity prices suggest we are now near debt collapse

Our economy is a networked system of businesses, governments, and consumers

- ▶ Grows over time, as new are added, old leave



Leonardo Sticks <http://www.rinusroelofs.nl/structure/davinci-sticks/gallery/gallery-01.html>

Usual way growth occurs – Slide 1 of 3

- ▶ Business starts new enterprise
 - ▶ “Capital” comes from financial instruments
 - ▶ Sale of stock, sale of bonds, bank loans
 - ▶ Adding businesses tends to increase total amount of such loans/stock
- ▶ Enterprise uses a combination of
 - ▶ Human labor
 - ▶ Supplemental energy (electricity, oil, etc.)
 - ▶ Other resources (water, iron ore, copper, etc.)
 - ▶ Machines, trucks, and other prebuilt devices
 - ▶ Buildings
 - ▶ Land – Especially for farming, extracting minerals and fossil fuels
- ▶ Last three items tend to require financing
 - ▶ Can be from cash flow, if profits high enough

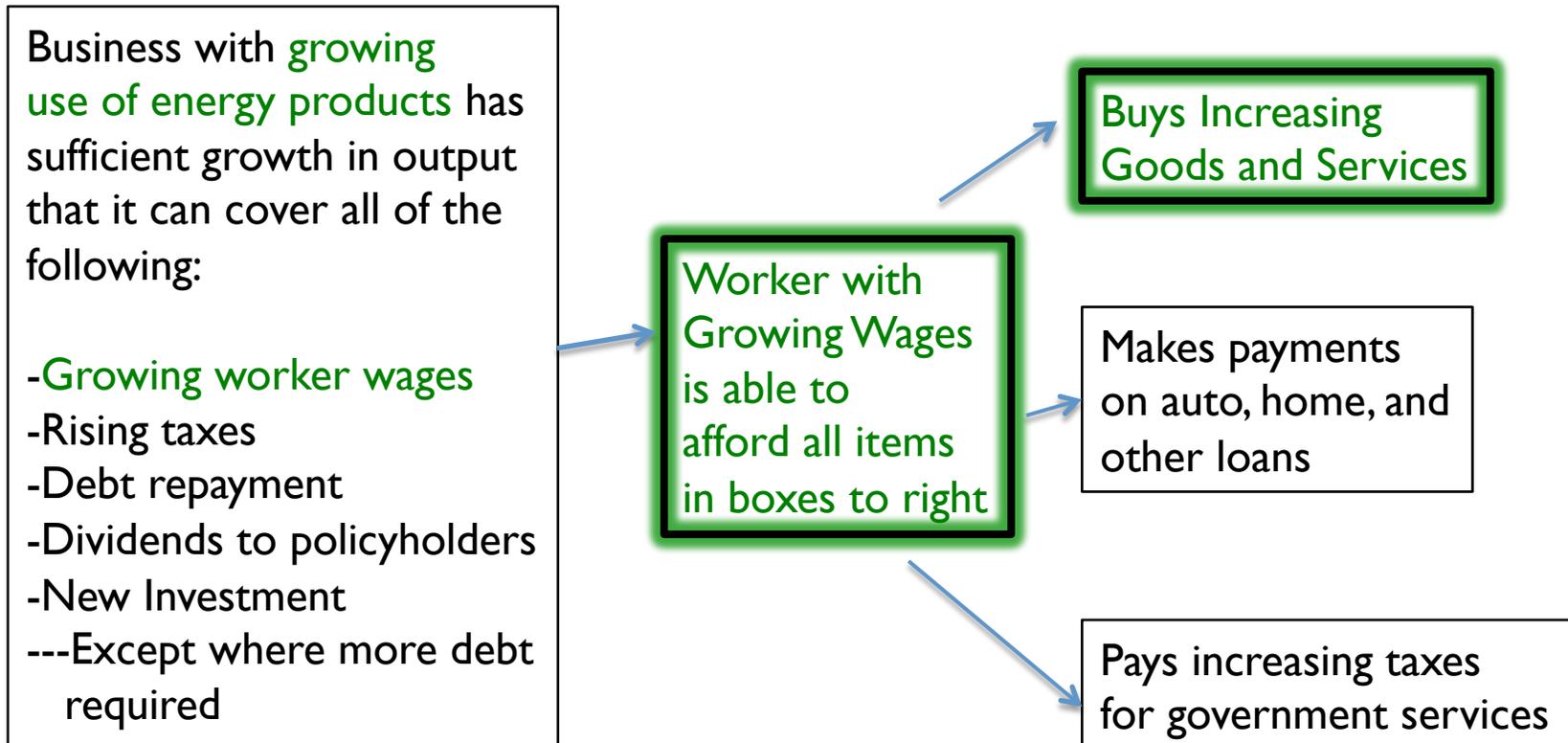
Usual way growth occurs – Slide 2 of 3

- ▶ Growth occurs if products can be made more cheaply than competition
 - ▶ Process that works: Leverage human labor with increasing amounts of cheap supplemental energy
- ▶ Result: Output per hour of human labor rises
 - ▶ Supplemental energy allows humans to become more productive
 - ▶ Humans' wages rise, to reflect higher productivity
- ▶ With higher wages, Workers can put on Consumer “hat”
 - ▶ Buy more goods and services
 - ▶ Pay more taxes
 - ▶ Whole system tends to grow

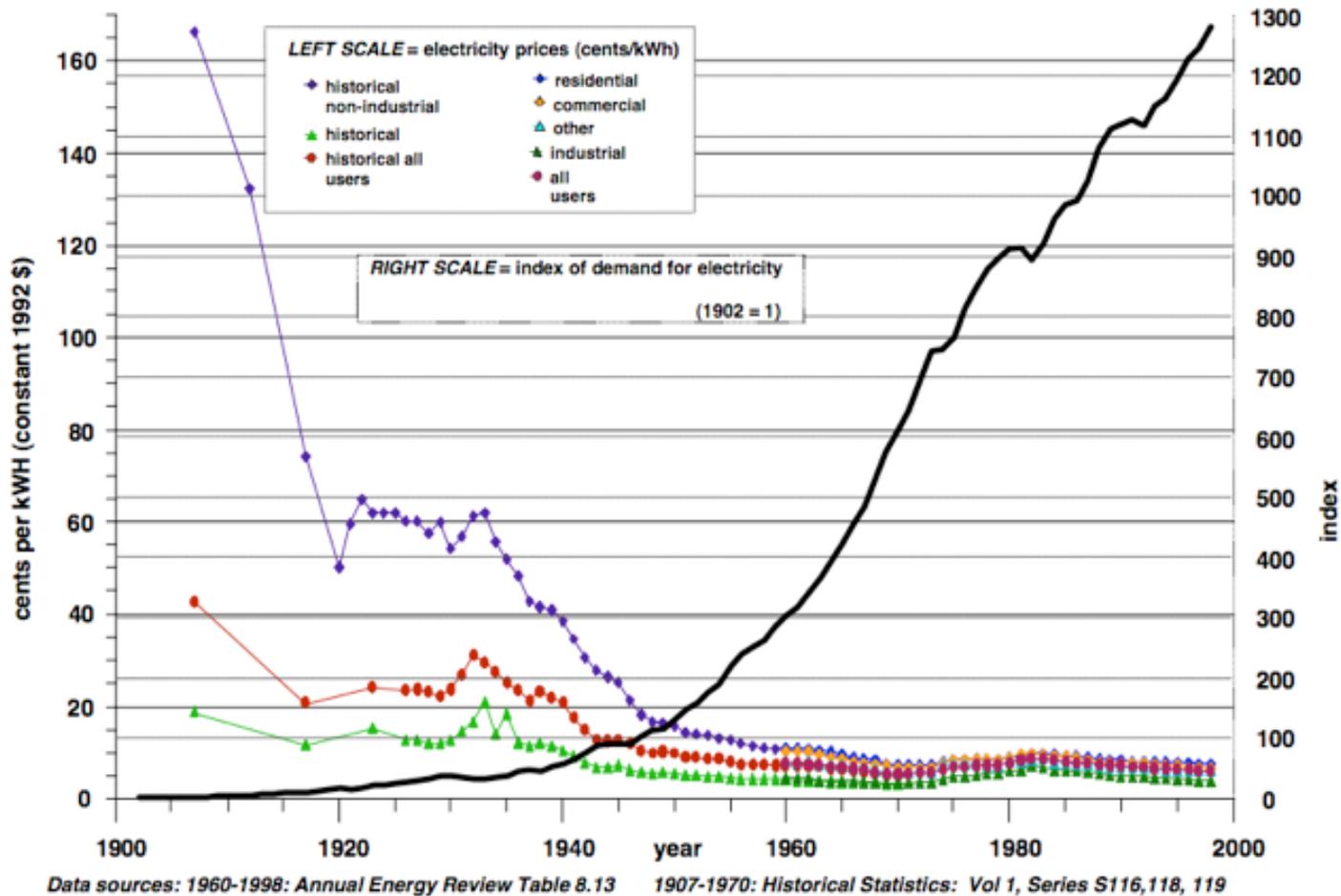
Usual Way Growth Occurs - Slide 3 of 3

- ▶ Business is able to repay debt
 - ▶ Price of company's stock tends to rise
- ▶ Key is rising use of cheap energy, to leverage human labor
- ▶ But rising debt is at least equally important
 - ▶ Without rising debt, system would come to a halt
 - ▶ Businesses couldn't finance their operations
 - ▶ Consumers couldn't afford output of system
 - ▶ Big ticket items especially—houses, cars, college education
 - ▶ Governments couldn't “stimulate economy” with debt
- ▶ Equity ownership ownership has similarities to debt
 - ▶ Both depend on financial health of company
 - ▶ Both result in ongoing obligations

The worker/consumer plays a key role in making the economy grow

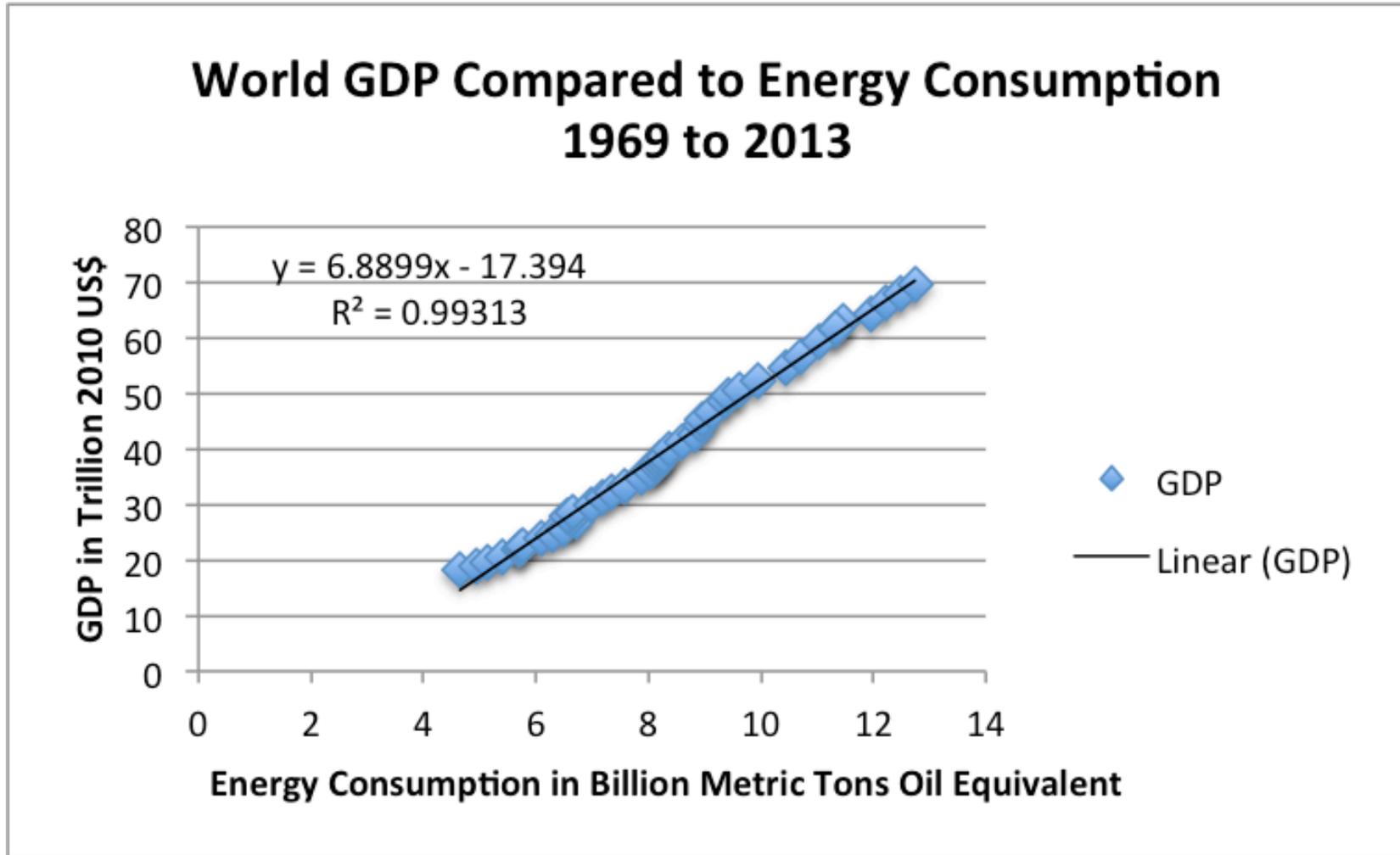


Growing efficiency of electricity production, 1900–1998, contributed to economic growth



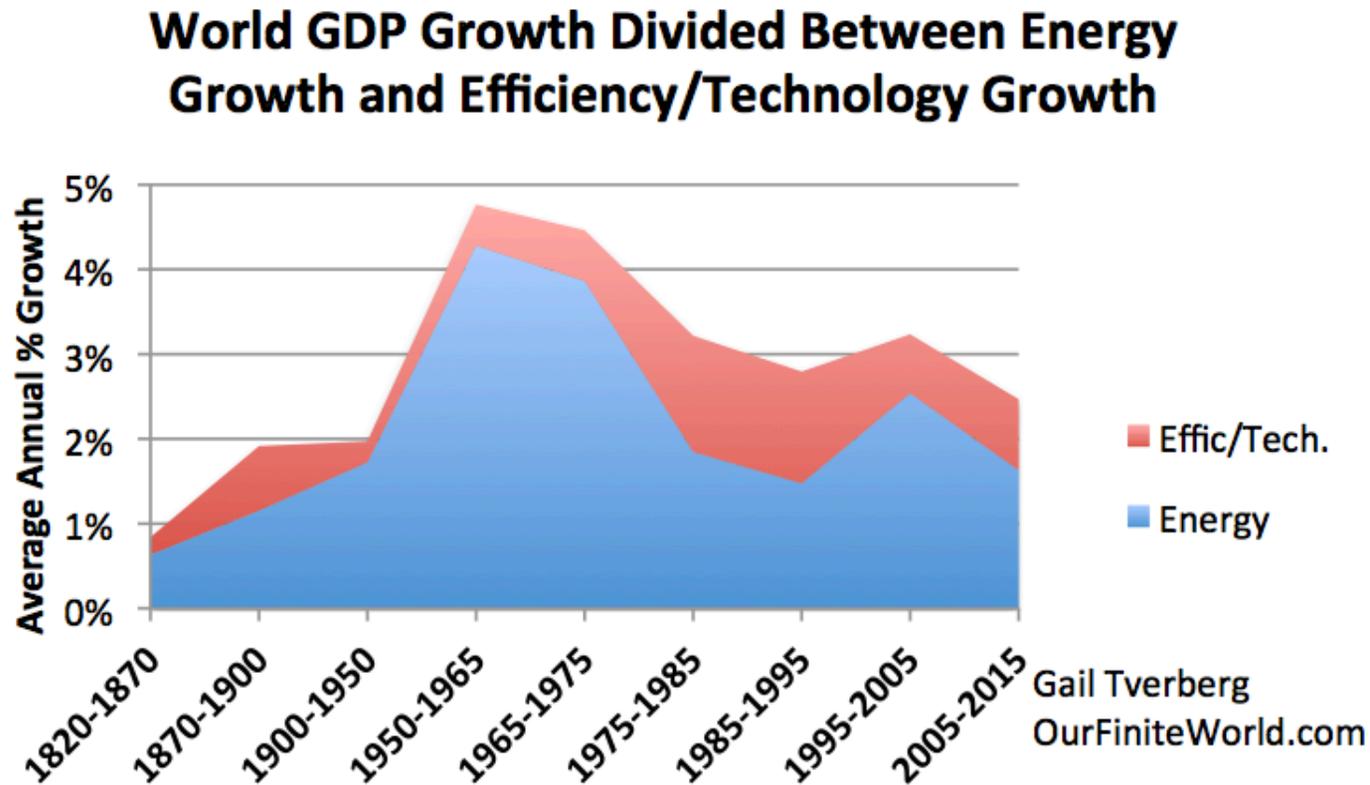
Source: R. Ayres and B. Warr, Accounting for growth: the role of physical work.

Over 99% correlation of energy consumption with GDP



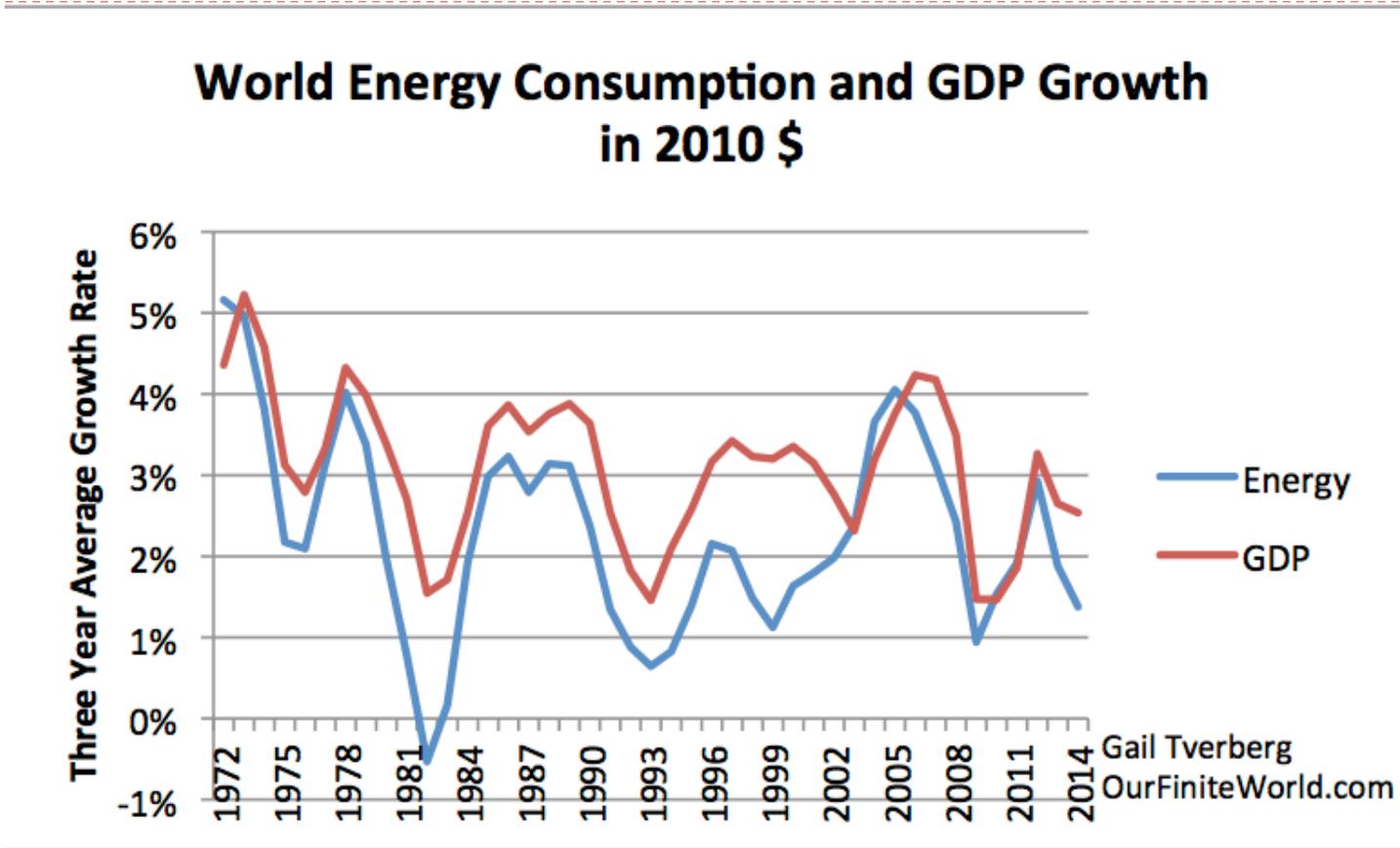
GDP is in 2010 US\$, as provided by USDA; energy use from BP.

The majority of long-term GDP growth seems to come from growth in energy use



- ▶ Note world economic growth peaked 1950-1965
 - ▶ Almost as high in 1965-1975, trending down since

Growth in GDP and growth in energy use correlate on shorter basis as well



- ▶ Energy growth tends to precede GDP growth
Suggests energy growth is a *cause* of GDP growth; new recession ahead

Why is debt needed?

- ▶ Nothing would happen without an initial investment
- ▶ Examples:
 - ▶ Invest time in hunting for animals for food
 - ▶ Invest time in planting seeds for a crop
 - ▶ Invest time in cutting down trees to create arable land
 - ▶ Invest time and resources getting coal out of ground
 - ▶ Invest time and resources in extracting oil
 - ▶ Invest time and resources in building automobiles
- ▶ Need some way to pay for initial and ongoing investment

End up with a web of promises

- ▶ Very early promises were not financial in nature
 - ▶ I will hunt; you will gather
 - ▶ We will share the proceeds
 - ▶ Tribe members who keep the best for themselves will be thrown out
- ▶ Later promises were financial in nature
 - ▶ Lend money to start business
 - ▶ Or sell shares in stock to start business
 - ▶ Hire employees, and promise to pay them for their work
- ▶ These promises have no value, unless the business actually succeeds

Government ends up in the web of promises as well

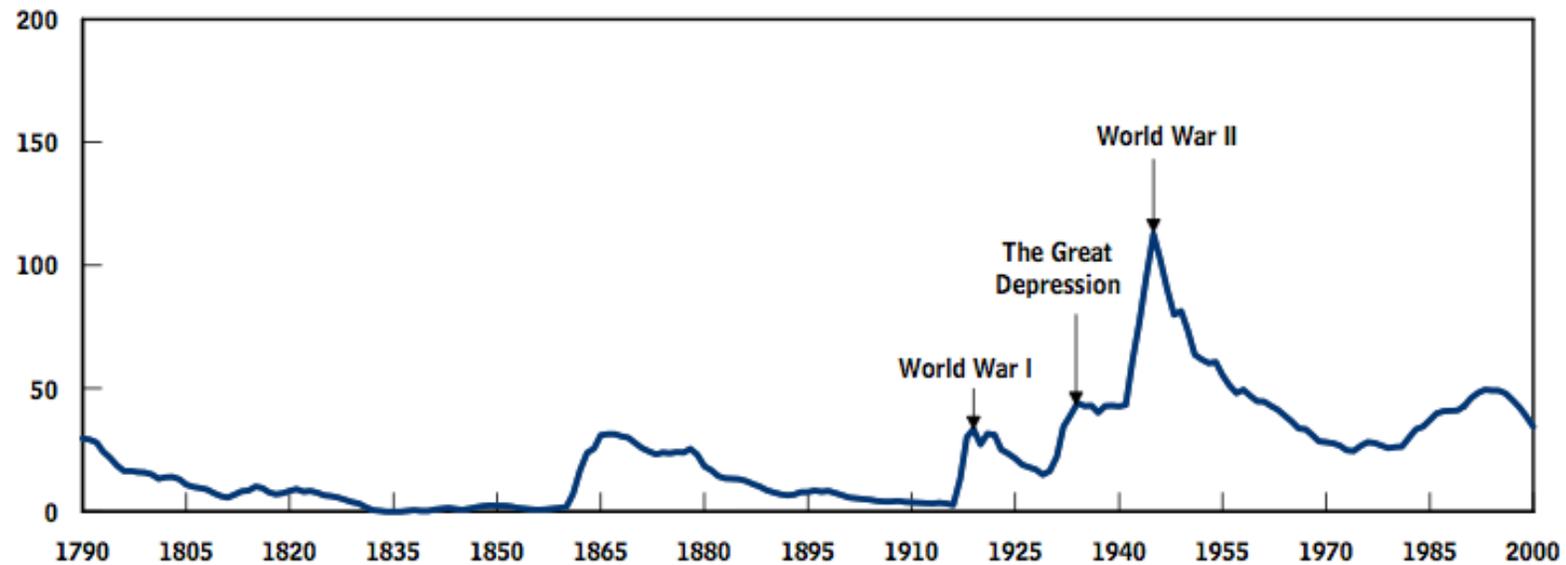
- ▶ Businesses need roads
- ▶ Businesses also need laws and a financial system to enable transactions
- ▶ Government becomes an important part of the economy
 - ▶ Taxes are used to support the government
 - ▶ Some taxes are on businesses; other are on individuals
- ▶ Businesses incur multiple obligations
 - ▶ Debt + interest
 - ▶ Dividends to policyholders, ideally growing over time
 - ▶ Taxes

Current growth bubble started with World War II

- ▶ Debt allowed hiring of many workers, including women
- ▶ Increased use of oil, coal allowed productivity to grow

Federal Debt Held by the Public, 1790 to 2000

(Percentage of gross domestic product)



Source: US Congressional Budget Office

Huge loss of jobs after WW2, if US didn't add non-governmental debt

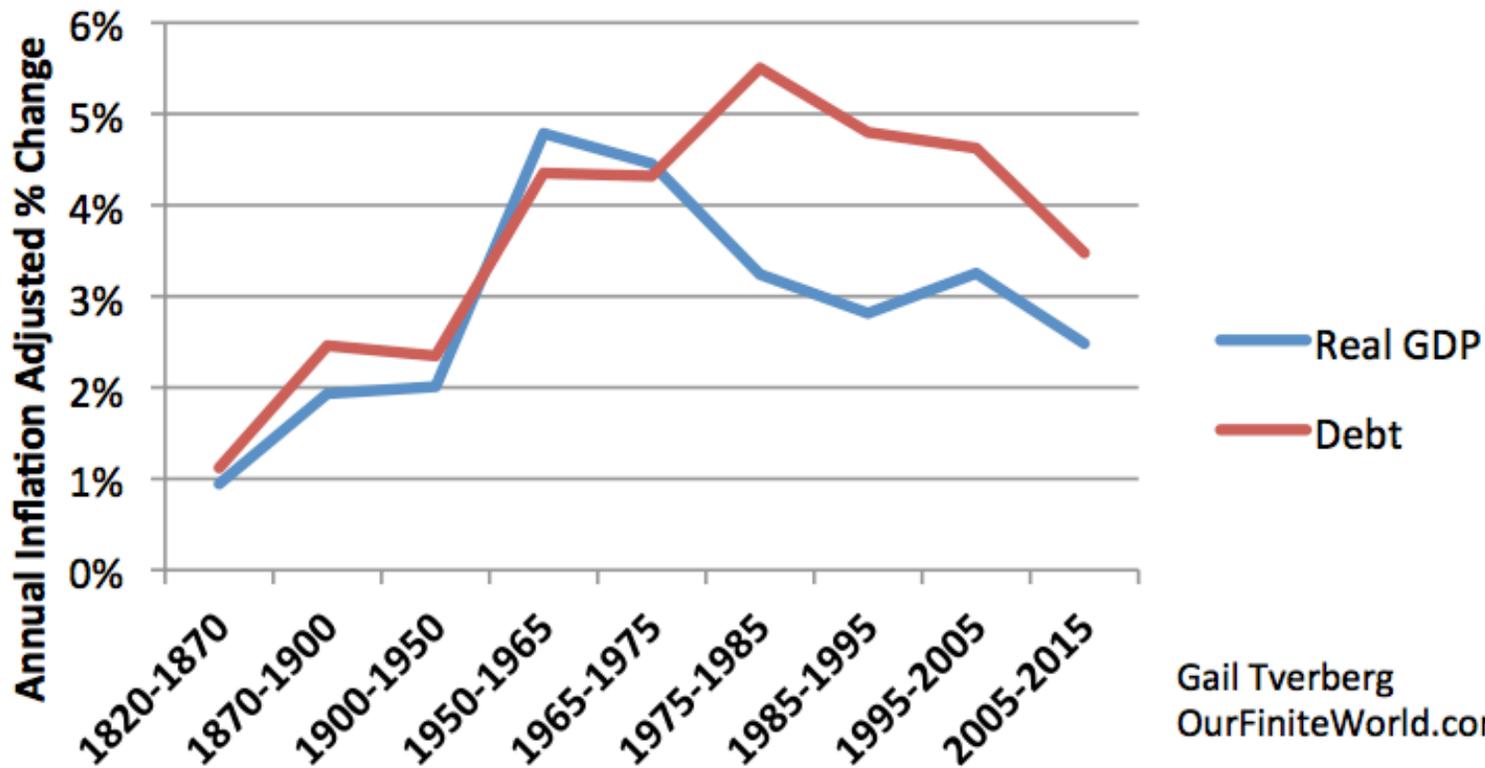
- ▶ We, in fact, added lots of debt after WW2



Chart prepared in 2011 for post, The United States 65-Year Debt Bubble

Debt rose at same rate as GDP prior to 1975; debt rose much faster than GDP later

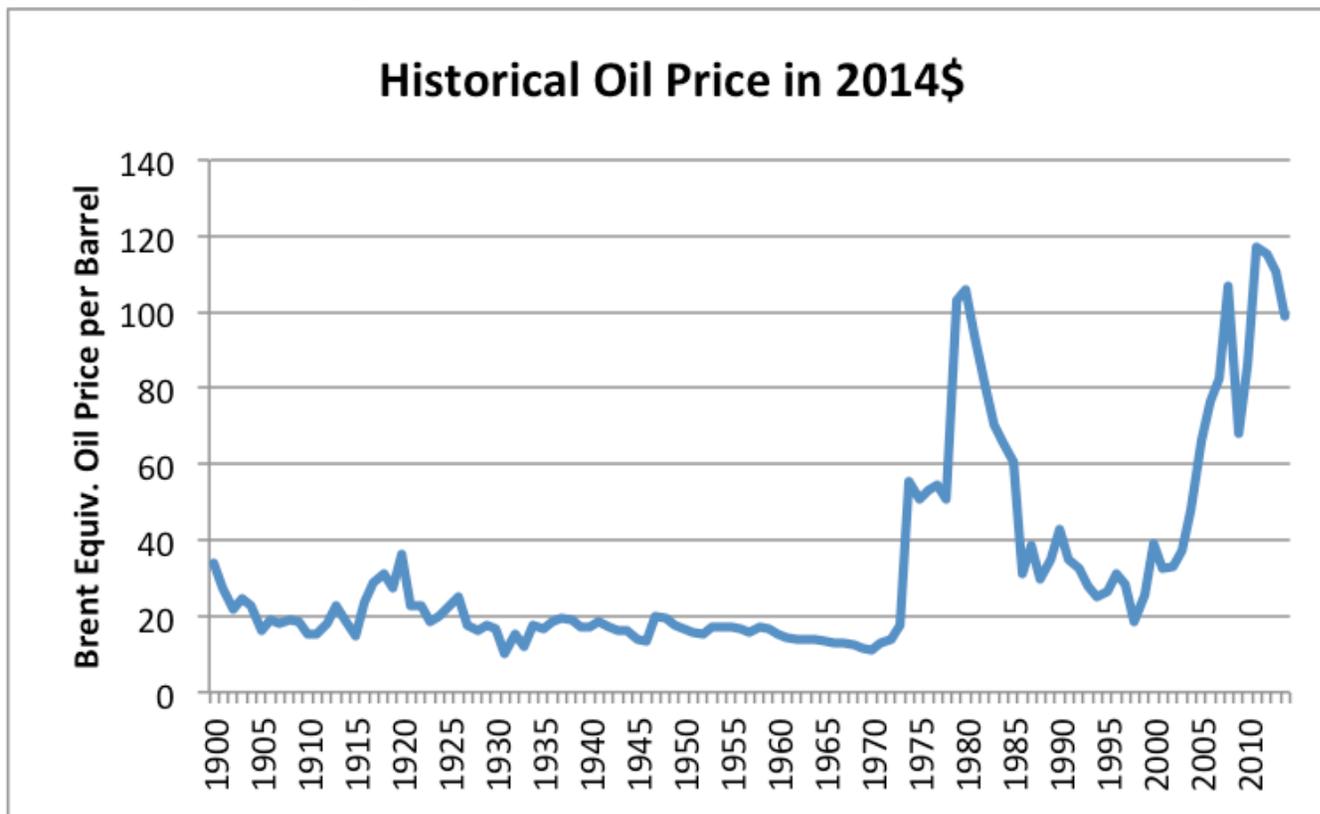
Growth in Inflation Adj. World Debt and GDP



Gail Tverberg
OurFiniteWorld.com

What went wrong after 1975? Why did debt rise much faster then?

- ▶ Price of energy went up – needed an increasing amount of debt to compensate



Based on BP Review of World Energy 2015 data

Problem underlying higher oil prices was “diminishing returns”

- ▶ **Plenty of oil available**
 - ▶ But it cost more to extract
 - ▶ Deeper wells; less convenient locations; now “fracking”
 - ▶ Diminishing returns = opposite of growing efficiency

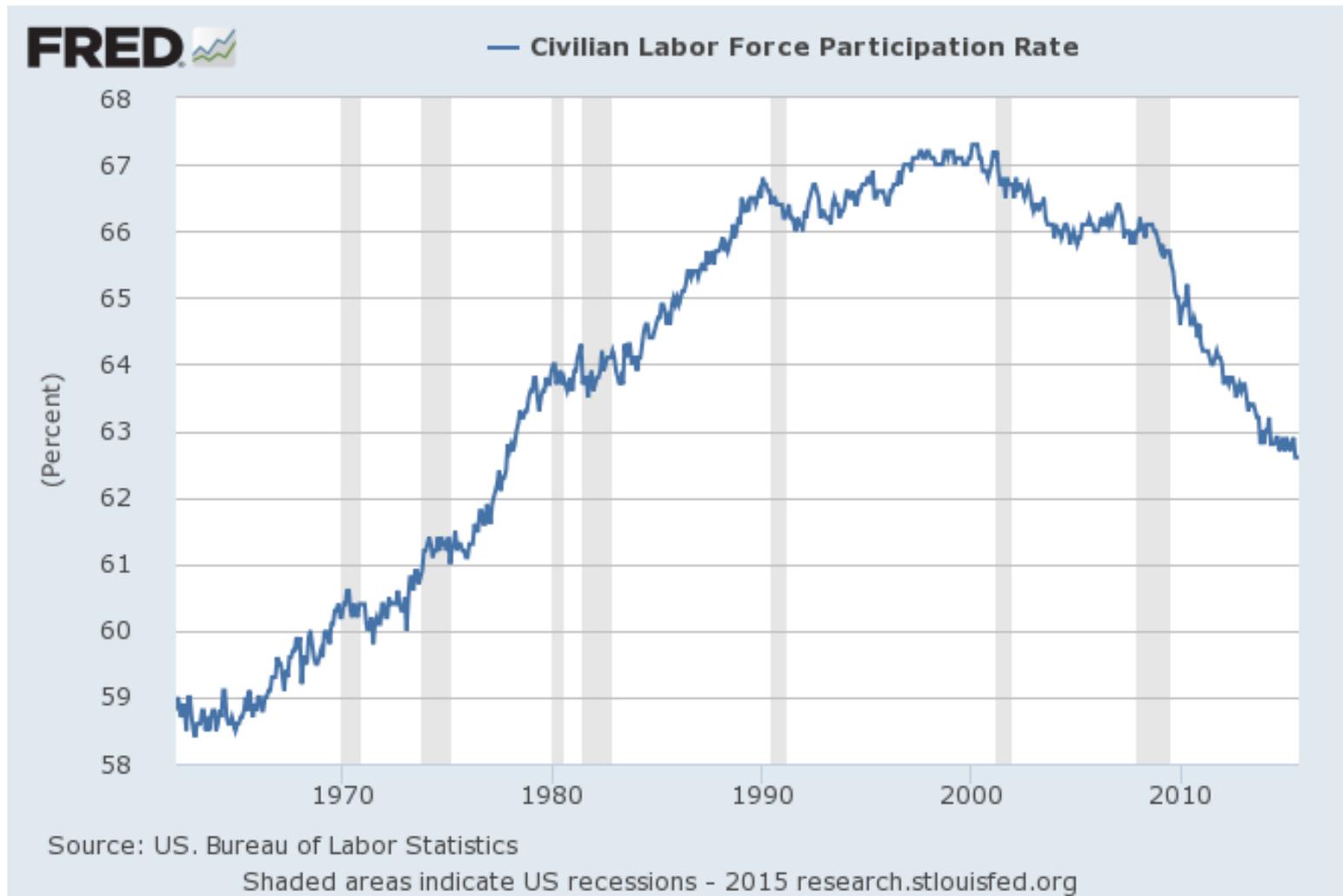
- ▶ **As we noted earlier**
 - ▶ Economic growth comes from growing efficiency

- ▶ **Diminishing returns for energy is a “headwind”**
 - ▶ Pollution control: another headwind
 - ▶ Rising population relative to arable land: another headwind
 - ▶ Increased debt helps overcome the headwinds

What happens as we reach limits of a finite world?

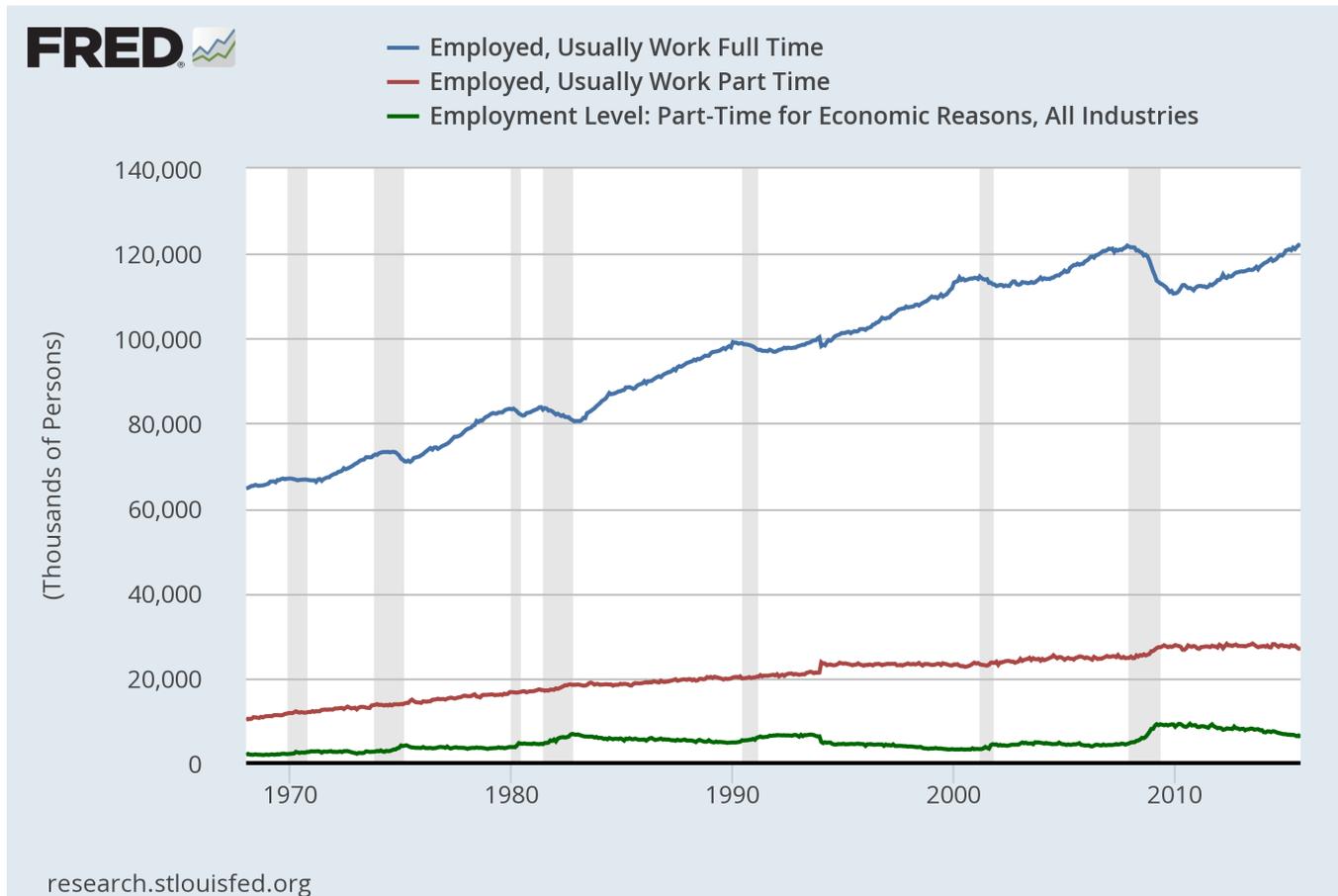
- ▶ Rising costs in many areas
 - ▶ Higher costs of producing energy products
 - ▶ Higher food costs
 - ▶ More pollution control costs
 - ▶ Higher resource costs (fresh water, metals)
 - ▶ All of these represent opposite of growing efficiency
- ▶ Rising debt relative to GDP
 - ▶ Way of compensating for all the higher costs
 - ▶ Need lower interest rates too, so debt is affordable
- ▶ Wages of workers are still critical for enabling growth
 - ▶ But too few with jobs; median wages not growing

Percentage of available US workers with jobs has been falling since 1998



Jobs that are available are increasingly part-time jobs

- ▶ Hard to afford transportation, child care with PT job



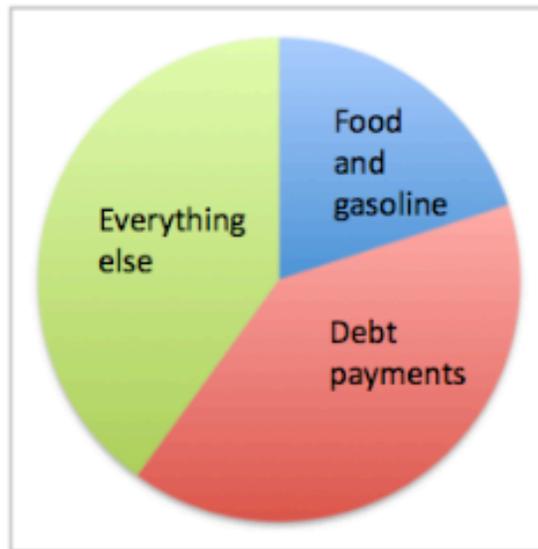
How does problem of increasingly high cost of energy products resolve?

- ▶ Common belief is that oil prices will rise endlessly
 - ▶ Prices keep up with rising cost of extraction
 - ▶ This doesn't really work
- ▶ Workers' wages don't rise
 - ▶ In fact, they tend to stagnate
- ▶ At some point, debt stops rising fast enough to keep prices rising
 - ▶ Prices for many commodities will fall below the cost of production

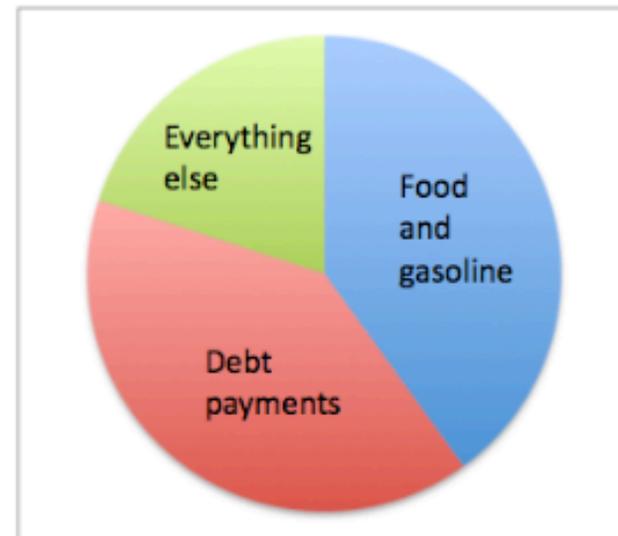
Rising energy prices and flat/falling wages lead to recession

Theory says oil price can increase—
but our pocketbooks disagree

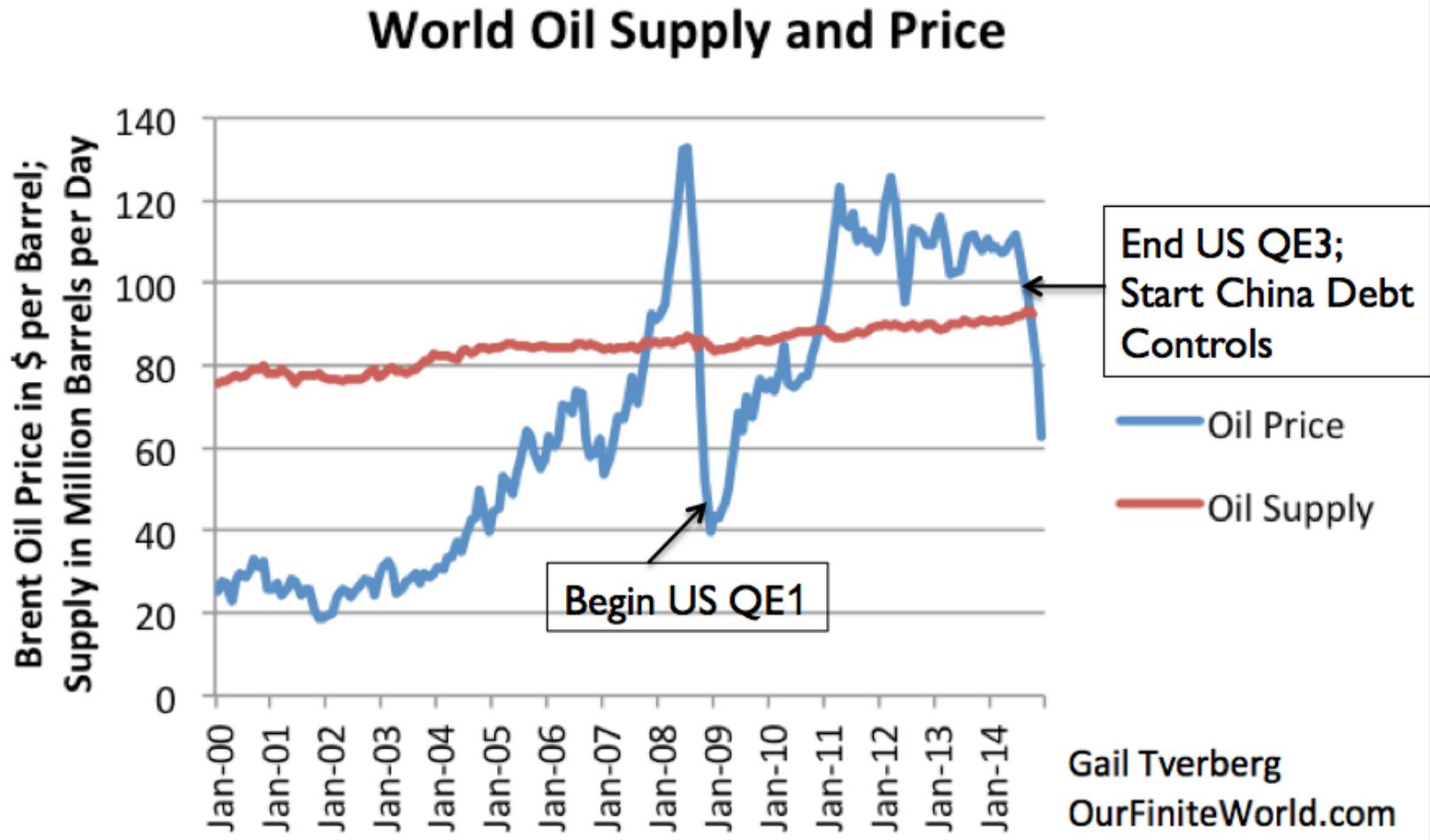
Low oil price budget



High oil price budget



Rise and fall of debt affected oil prices, 2008 - 2014



Cut back in non-governmental debt was the problem in 2008, when oil prices fell

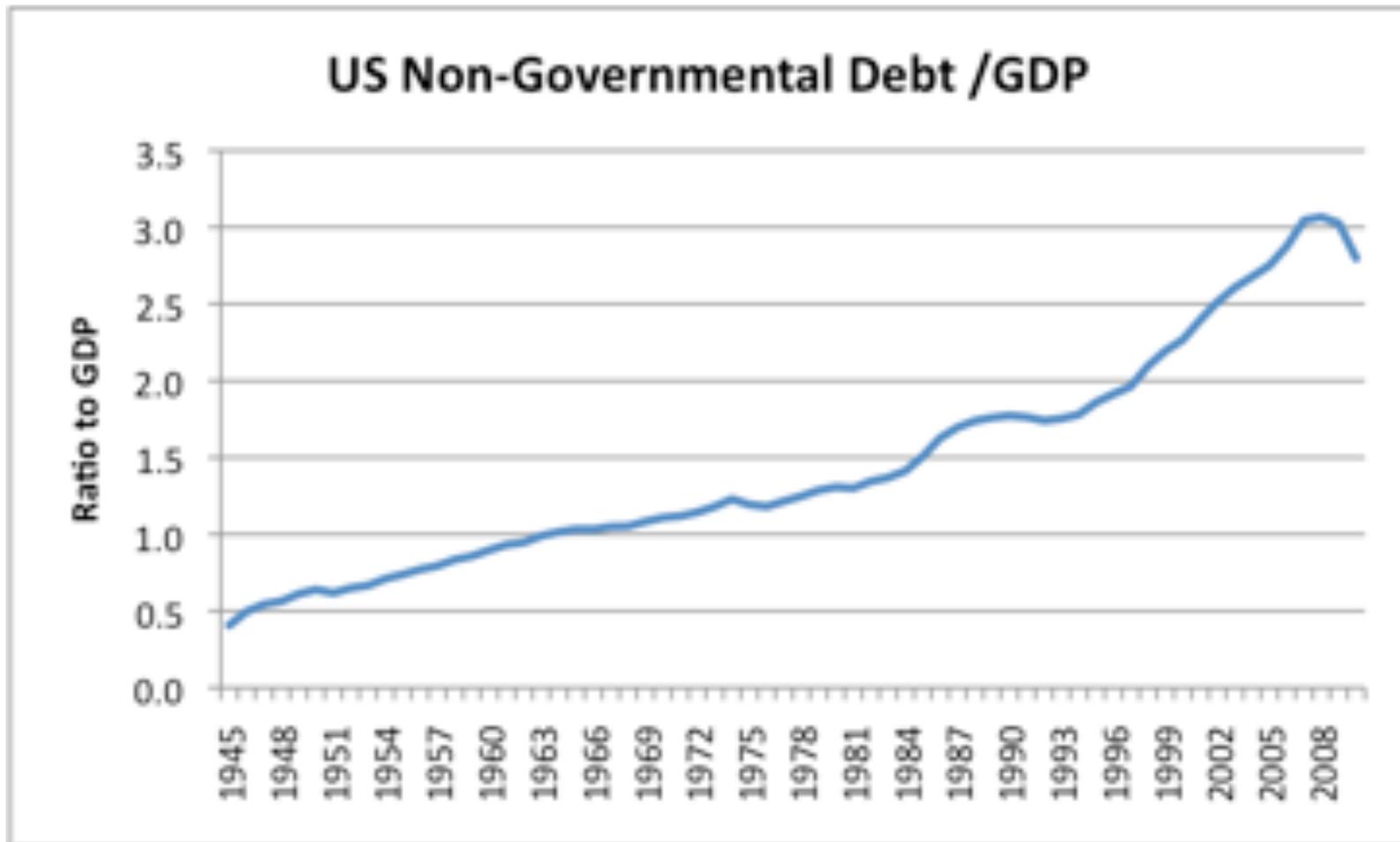
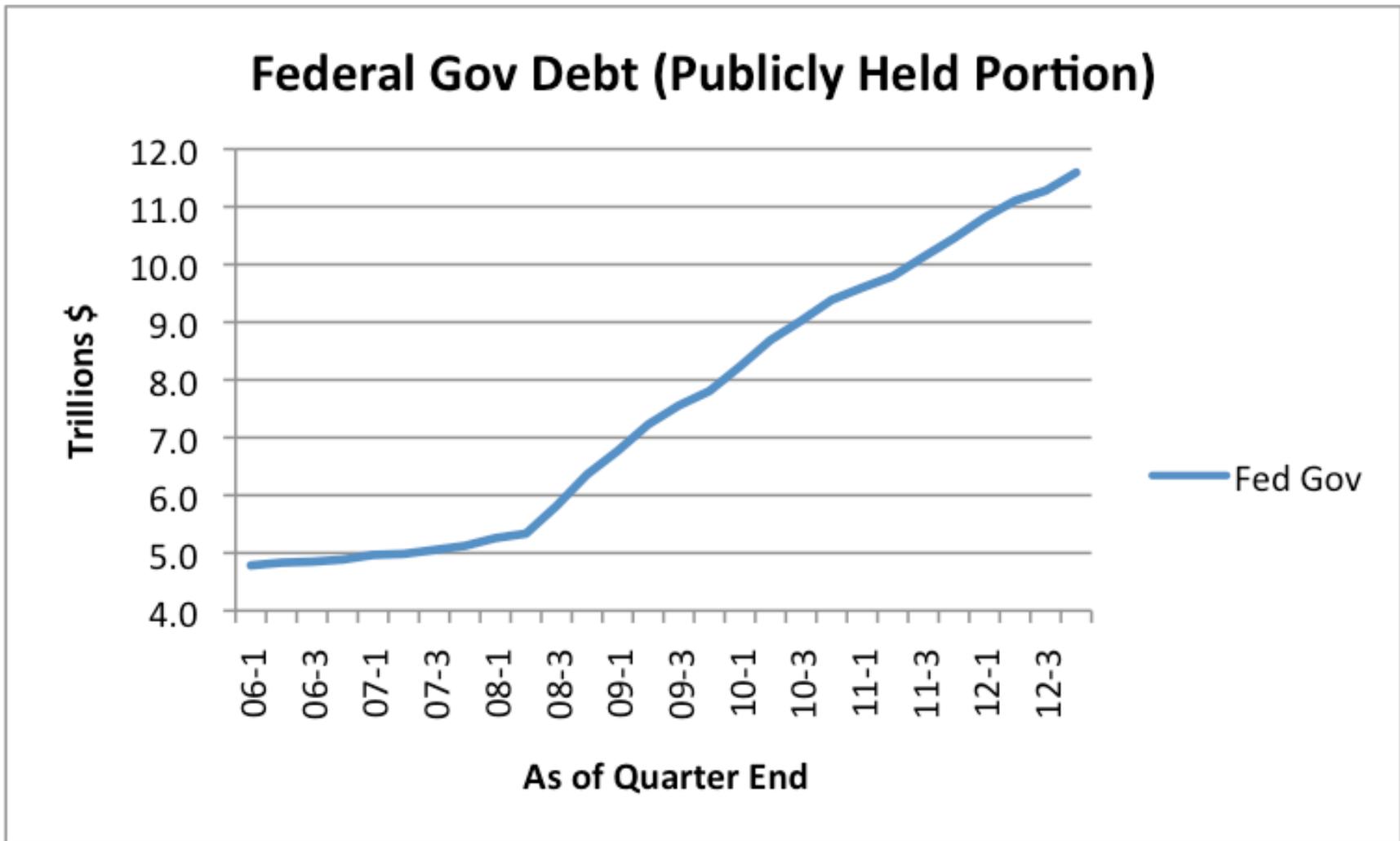
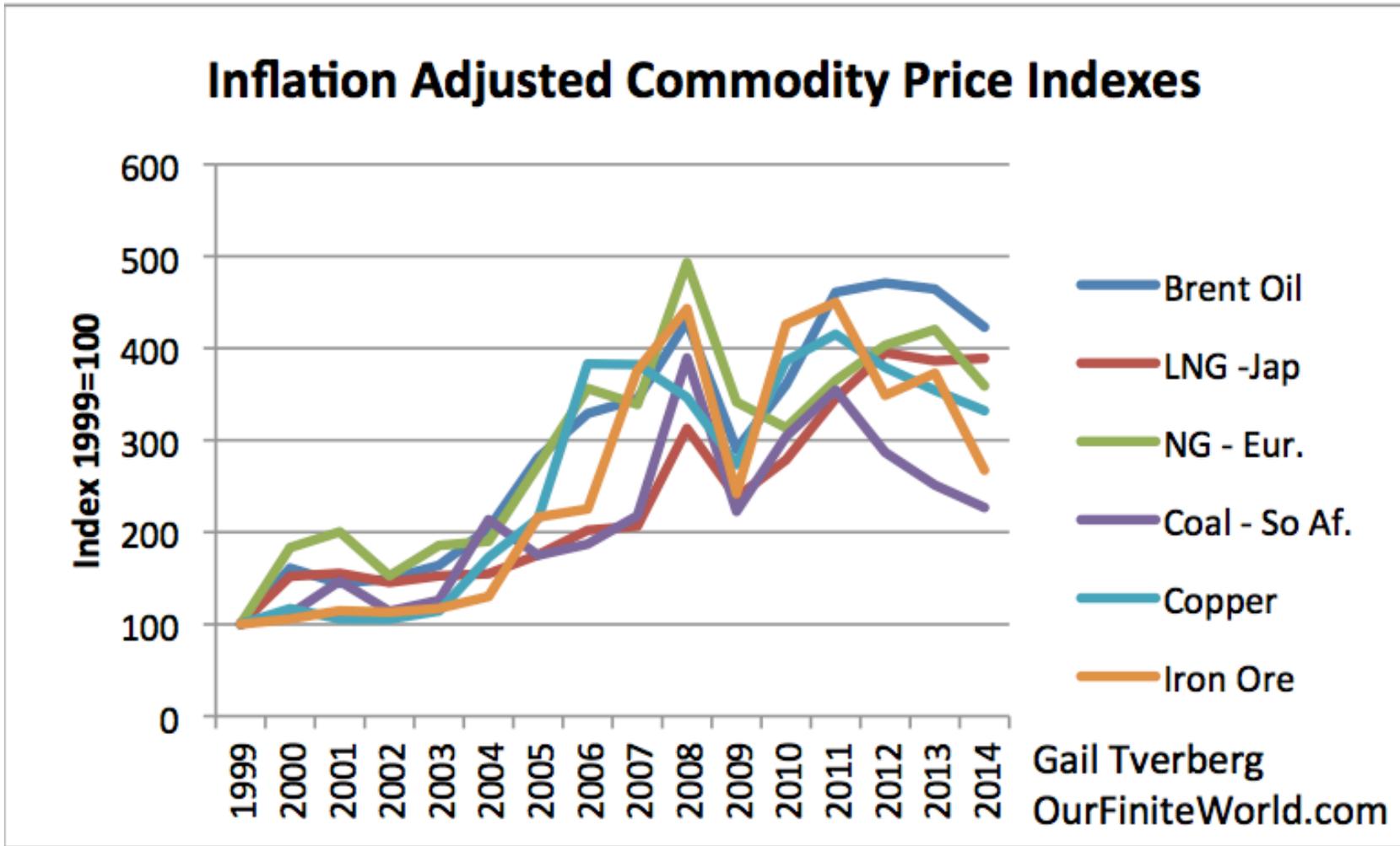


Chart prepared in 2011 for post, "The United States 65-Year Debt Bubble"

Rapid rise in US governmental debt was part of rescue plan in 2008



What we are seeing now is falling prices for all commodities

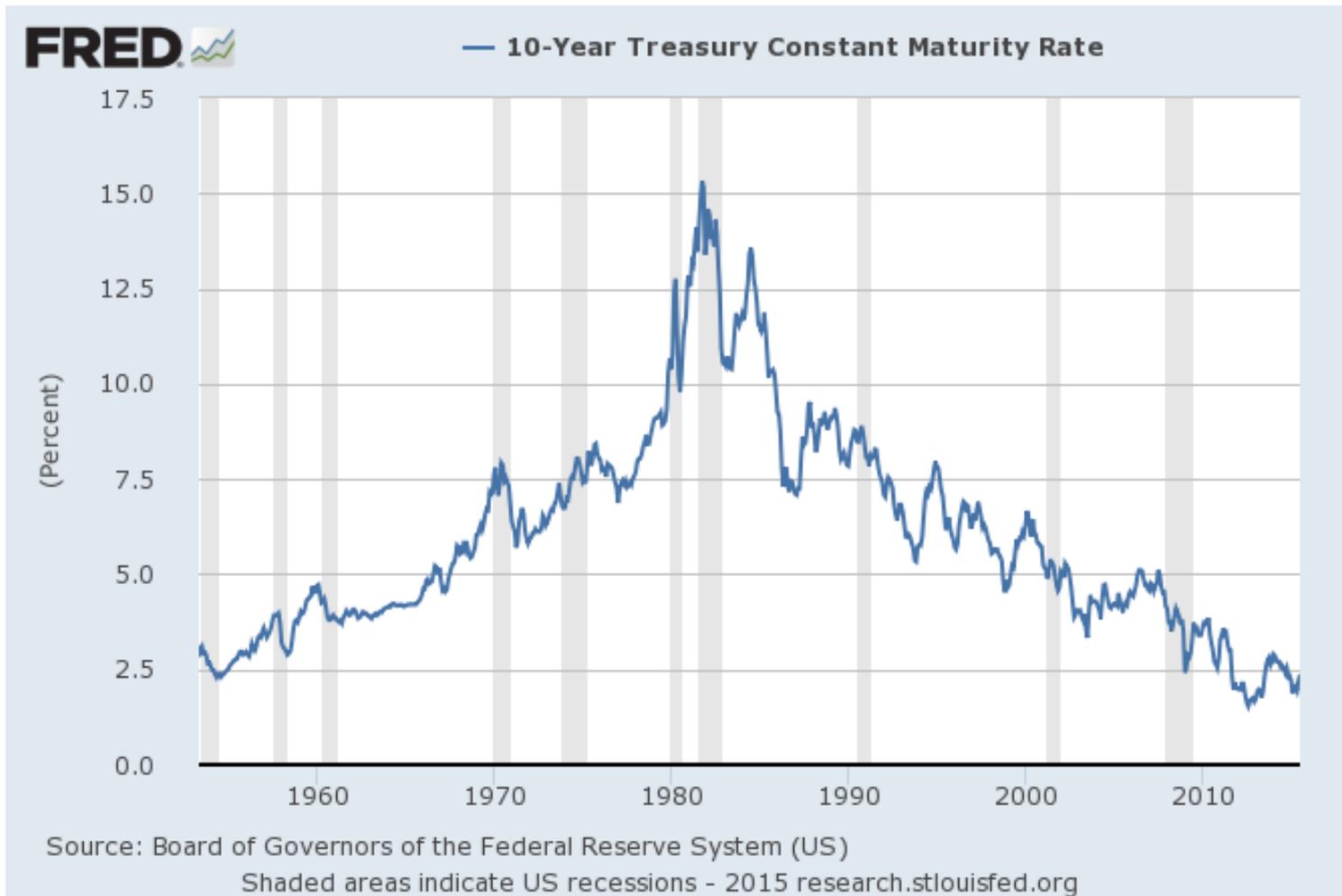


Based on IMF Pink Sheet data.

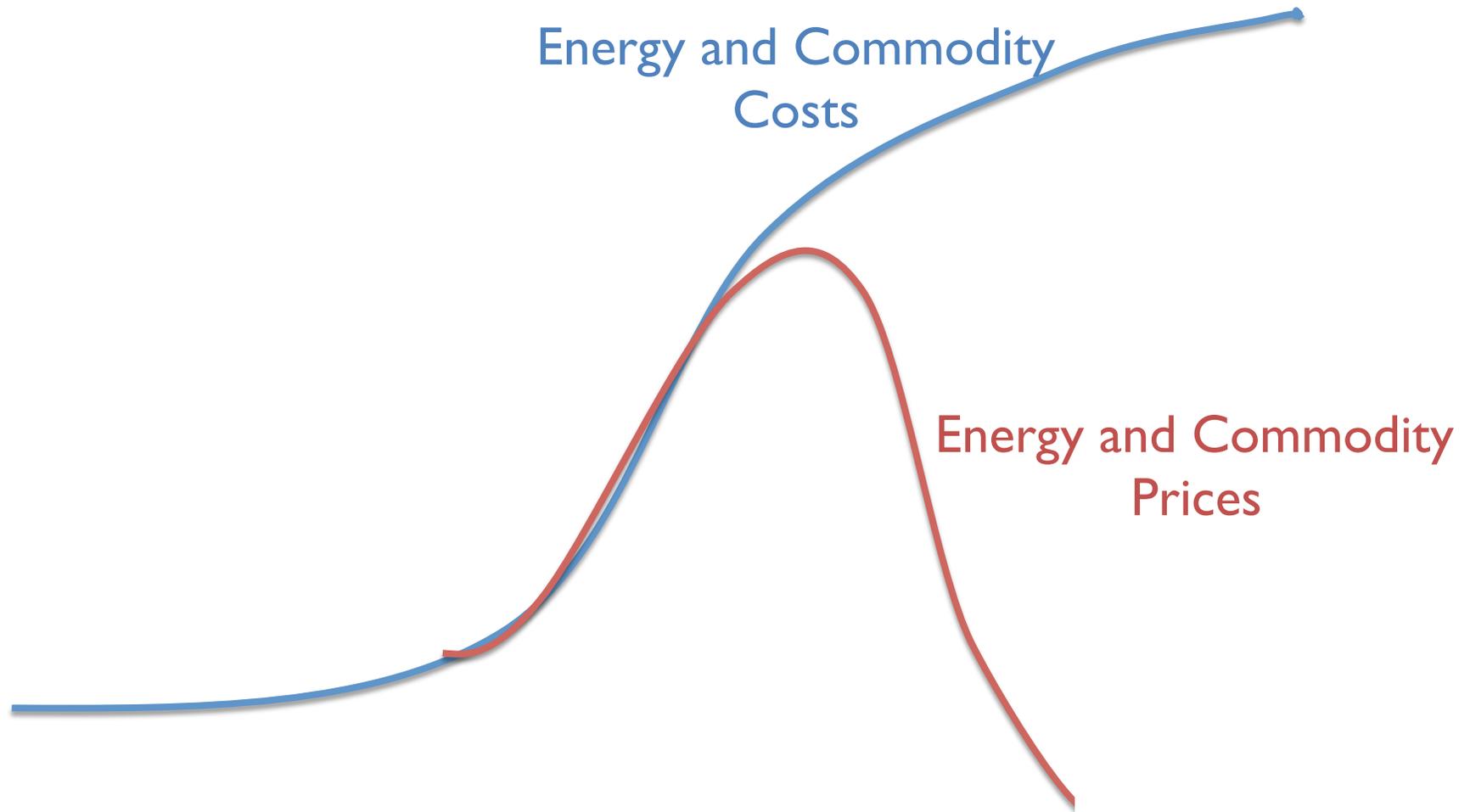
Our debt bubble is no longer growing fast enough

- ▶ Hard to keep the illusion of growth occurring
- ▶ Too many headwinds
 - ▶ Rising costs of energy production
 - ▶ Rising overhead of governmental costs
 - ▶ Rising pollution costs
 - ▶ Rising costs of water, metals
- ▶ Wages not providing the needed “upward lift”
- ▶ Huge growth in debt needed to offset these headwinds
 - ▶ Not happening
 - ▶ Debt to GDP ratios already too high

Governments have nearly exhausted their ability to lower interest rates further



End up with *energy and commodity costs* continuing to rise, but *prices* falling behind



Prices falling behind costs is a *disaster*

- ▶ Can't get the oil out if prices fall too low
- ▶ Can't grow food commercially if prices are too low
- ▶ **Asset prices fall**
 - ▶ Cost of land, value of oil in the ground falls
 - ▶ Debt secured by these assets tends to default
 - ▶ Businesses fail; share prices go to zero
- ▶ **Financial institutions fail**
 - ▶ Governments find it increasingly difficult to bail them out

What really lies behind all of this debt?

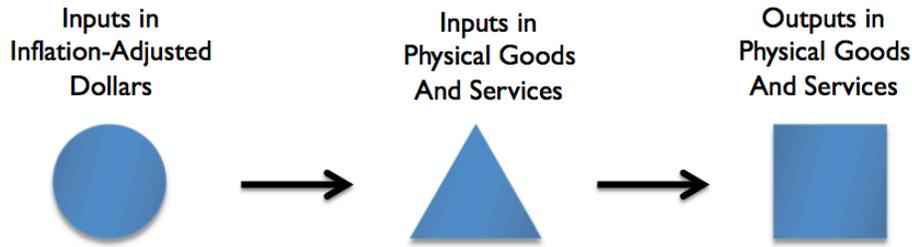
- ▶ Promise that current system will continue
- ▶ Promise that growth will continue indefinitely, so that debt can be repaid with interest
- ▶ Hope that wages will rise endlessly, so that workers can buy more goods and services
- ▶ If current system fails, none of these promises holds
 - ▶ We have faith that a temporary debt bubble will last forever

Many sources of confusion

- ▶ **Belief we don't really need energy**
 - ▶ We do, and it is a *growing quantity* that is important
 - ▶ Cannot afford a growing quantity if price is too high
 - ▶ Focus is often on % of GDP, not % growth in quantity
- ▶ **Belief economic growth can continue forever**
 - ▶ Growth slows, and it must be supported by ever-more debt
- ▶ **Belief we pay each other's wages**
 - ▶ What is really important is growing efficiency
 - ▶ Diminishing returns is growing inefficiency (next slide)
 - ▶ Need ever more debt to counter diminishing returns

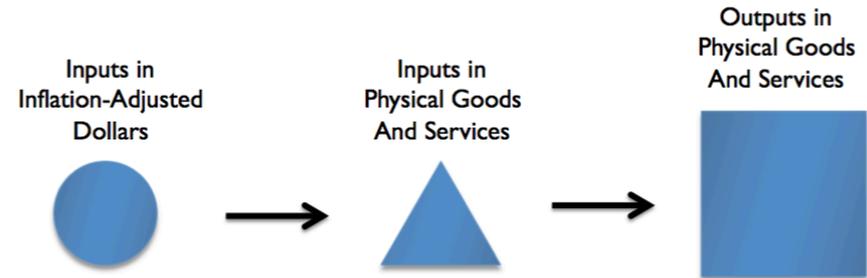
Increased efficiency => economic growth; Growing inefficiency => economic contraction

Base Case



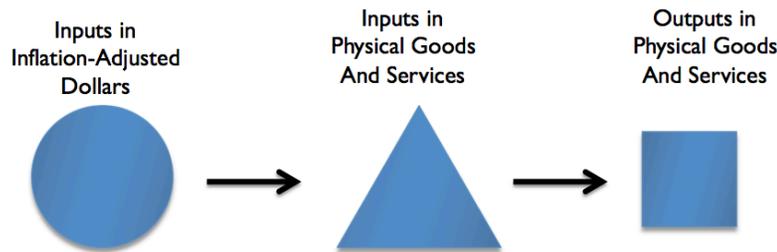
Gail Tverberg OurFiniteWorld.com

Increased Efficiency



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Growing Inefficiency



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Many causes of confusion (continued)

- ▶ Failure to recognize that we are dealing with an interconnected system
 - ▶ Doesn't act in an intuitive way
 - ▶ Always depends on growing debt
 - ▶ System clearly hasn't been sustainable since mid-1970s
 - ▶ Time when oil price passed \$20 barrel in 2015 dollars
- ▶ Failure to recognize that we need very cheap, non-polluting substitutes for today's energy products
 - ▶ Needed in very large quantities
 - ▶ Needed now
 - ▶ Needed without huge amounts of debt-based investment

What we should expect (Slide 1 of 2)

- ▶ Rerun of 2008 financial crisis, only worse
 - ▶ Governments less able to resolve
 - ▶ May shift problems to depositors, rather than bailing out banks
- ▶ Timing – not very far away
 - ▶ World seems to be heading into recession now
- ▶ Commodity prices don't rise very high for very long
 - ▶ Trend in prices is down, not up
 - ▶ Problem is related to demand (affordability)
 - ▶ Leads to bankruptcy of some suppliers

What we should expect (Slide 2 of 2)

- ▶ Quantity of commodities produced will fall
 - ▶ Result - lower overall production of goods
 - ▶ Economic contraction
- ▶ Gradual, or not so gradual, loss of systems we depend on
 - ▶ Financial system
 - ▶ International trade
 - ▶ Many governments
 - ▶ Major businesses
- ▶ Decline in food and water availability
 - ▶ Falling population

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