

3. Overview of a Networked Economy

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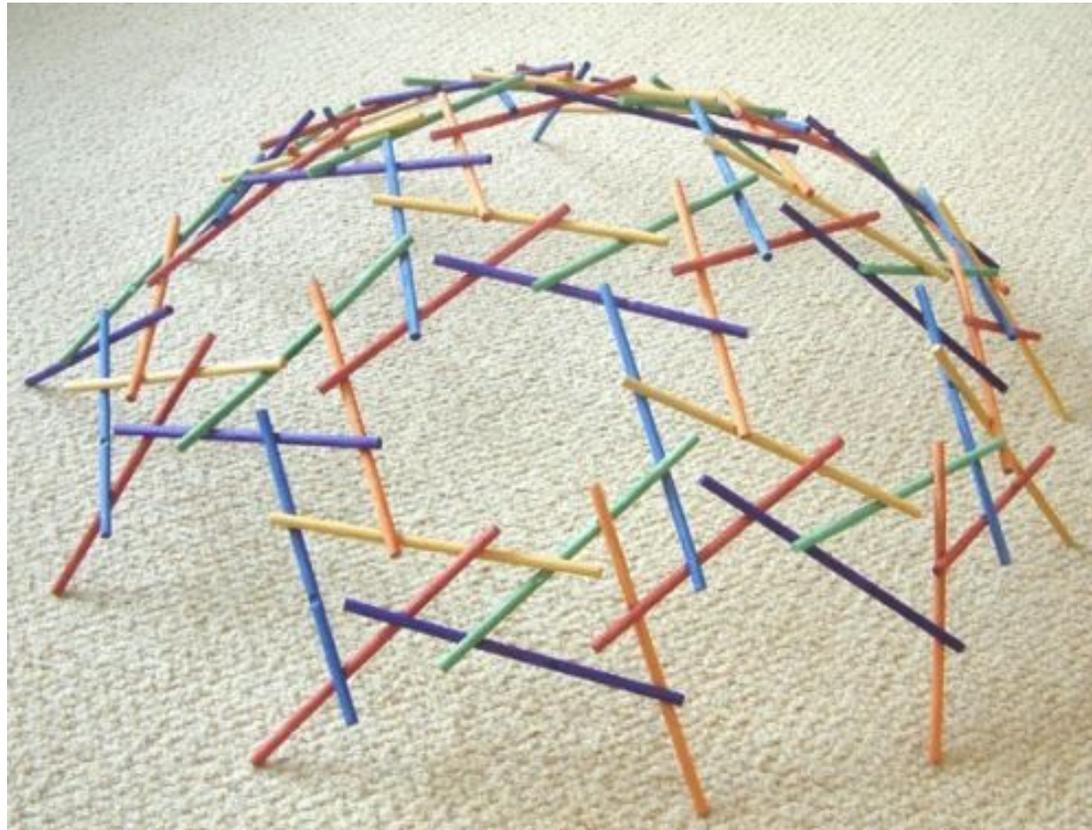
We are all familiar with how an economy works

- ▶ New businesses are added over time
 - ▶ Try to fill needs other businesses are not meeting
 - ▶ Look at government rules, customers available
 - ▶ Also availability of suppliers, workers
- ▶ People participate, both as workers and as consumers
 - ▶ Usually buy the low priced product
 - ▶ Can't buy more than they can afford
 - ▶ Want job that pays as much as possible
- ▶ Governments keep changing the rules
 - ▶ Also add roads, schools, trains
- ▶ Businesses and consumers adapt to changing situation
- ▶ A financial system ties things together

Does the previous slide agree with the way you think of an economy as working?

I imagine the economy as being like a child's toy – it gets built higher and higher

- ▶ Some sticks get taken out, and new ones added



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

What happens when the Three Gorges Dam was built over the Yangtze River?

- ▶ What changes were made?
- ▶ How does the new electric power change lives?
- ▶ How does the loss of farmland change lives?
- ▶ How do the new homes change lives?
- ▶ Is it possible to “go backwards”?

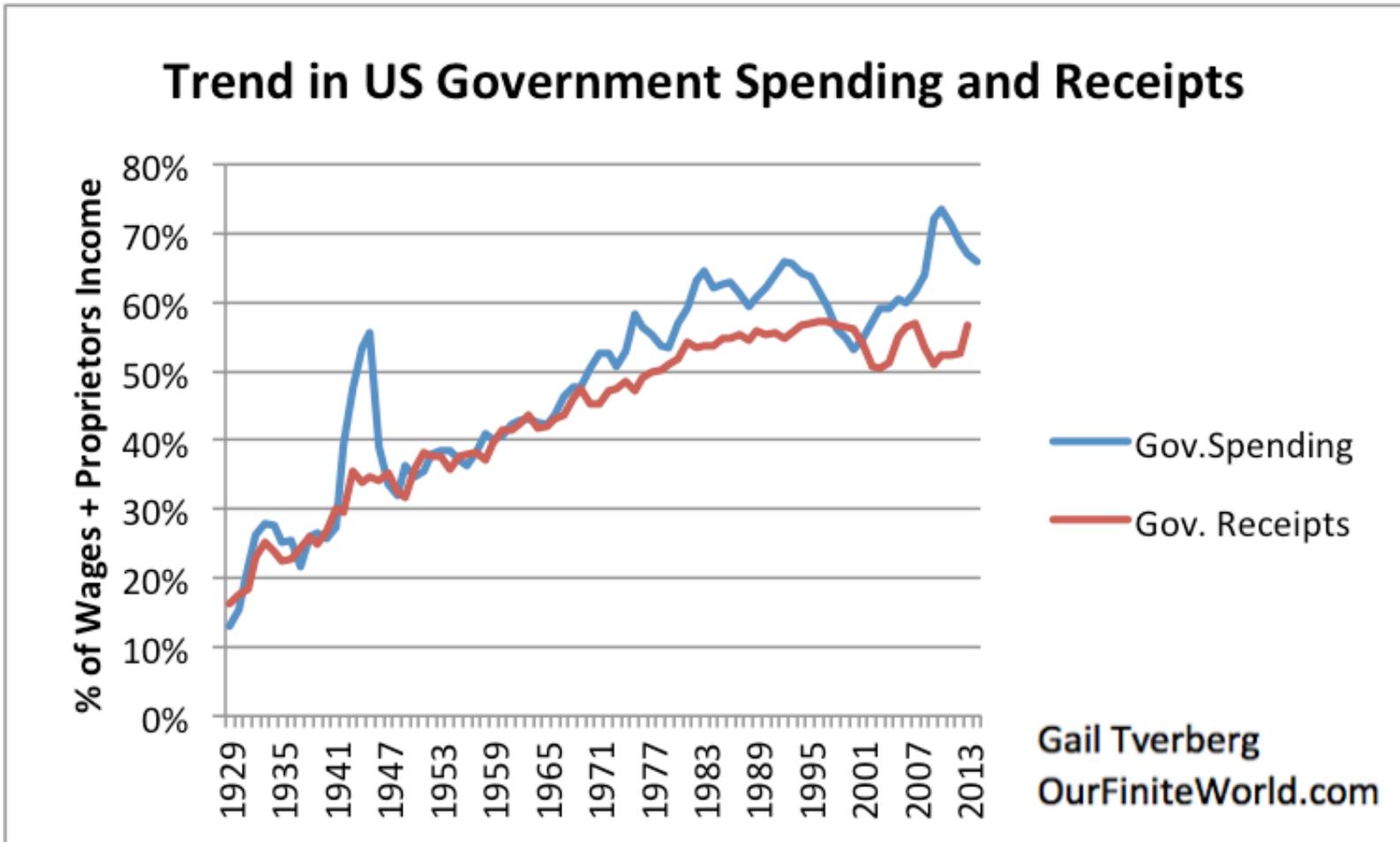
How about industrialization since 2001?

- ▶ How did it change lives?
- ▶ Does everyone know how to raise crops now?
- ▶ Are as many animals used in plowing available now as before?
- ▶ Could the system go backward, now, to a pre-industrialized state?

With the industrialization, what happens to the cost of government?

- ▶ Who pays for the new roads, bridges, train systems?
- ▶ Who pays for the food and housing of the elderly who now have their own apartments?
- ▶ How do schools change?
- ▶ How does healthcare change?
- ▶ How do tax levels change?
- ▶ Is it possible to go backward?

In the United States, government costs have risen sharply compared to wages



Based on data of the US Bureau of Economic Analysis.

Problem with accumulating promises, such as pensions

Year	Payment made in year					
Promise	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>
<u>Began</u>						
2010	100	100	100	100	100	100
2011		100	100	100	100	100
2012			100	100	100	100
2013				100	100	100
2014					100	100
2015						100
Total	100	200	300	400	500	600

Summary of a few characteristics of a networked economy

- ▶ Economy tends to grow over time, as energy is added
- ▶ Economy does not shrink back well
 - ▶ Model shows the economy as hollow for this reason
- ▶ Government tends to grow disproportionately to the economy as a whole

Such systems studied in recent years

- ▶ **By systems analysts – Complex Adaptive Systems**
 - ▶ System grows in complexity
 - ▶ Adapts to changing conditions

- ▶ **By physicists – Dissipative Structures**
 - ▶ Ilya Prigogine – Nobel Prize in 1977
 - ▶ Earliest work on such systems
 - ▶ Francois Roddier –Economy as Dissipative Structure
 - ▶ Thermodynamique de l'evolution
 - ▶ Published in 2012 in France

Dissipative structures

- ▶ Tend to form in thermodynamically “open” systems
- ▶ Receive energy from an outside source
 - ▶ Allows growth for a temporary period
 - ▶ System “self-organizes”
 - ▶ Permanent growth not possible in a finite system
- ▶ For example, all plants and animals are dissipative structures
 - ▶ Grow, eventually die
 - ▶ Receive energy from the sun, food
- ▶ Hurricanes are also dissipative structures
 - ▶ Receive energy from hot sea water, sun

Economy as a dissipative structure

- ▶ Receives energy from many sources
 - ▶ Human energy
 - ▶ Animals used by humans
 - ▶ Burning wood and “biomass”
 - ▶ Fossil fuels
 - ▶ Nuclear electricity
 - ▶ Hydroelectricity
 - ▶ Other so-called “renewables”
- ▶ Grows and self-organizes, almost like a living being
- ▶ History shows that many economies have collapsed

Several scientists have studied economies that have failed

- ▶ *The Collapse of Complex Societies, 1988*
 - ▶ By Joseph Tainter, Archeologist
 - ▶ Emphasized the need for increasing complexity as society grew
 - ▶ Also the role of diminishing returns

- ▶ More notable: *Secular Cycles, 2009*
 - ▶ Lead author Peter Turchin, evolutionary biologist
 - ▶ New science of “Cliodynamics”
 - ▶ Studied details of eight agricultural civilizations that collapsed
 - ▶ Looked at precisely what happened
 - ▶ How growth occurred: wages, prices, debt, reason for downfall
 - ▶ Based on detailed original records
 - ▶ Goal: Determine why history takes place as it does

Findings of *Secular Cycles*

- ▶ Population typically found a new agricultural resource
 - ▶ Cleared land for farming
 - ▶ Or began using irrigation
 - ▶ Current situation: World began using fossil fuels about 1800
- ▶ **Stage I: Growth Stage** (often 100+ years)
- ▶ Population below the *carrying capacity* of the newly available resource
 - ▶ Plenty of room to add population
 - ▶ Population grew rapidly
 - ▶ Wages tended to rise
 - ▶ Plenty of resources for everyone

Findings of *Secular Cycles* (Continued)

- ▶ **Stage 2: Stagflation** (often 50 to 60 years)
- ▶ Population approaches the carrying capacity of the land with the new resource
 - ▶ Population growth slows
 - ▶ Wages start becoming a problem
 - ▶ Not enough resources for new workers to make a good wage
 - ▶ Nobles still receive high wage
 - ▶ Increasing economic inequality
 - ▶ Increasing prices of commodities
 - ▶ Increasing peasant indebtedness
 - ▶ Urbanization increasing
 - ▶ Tax burdens heavy

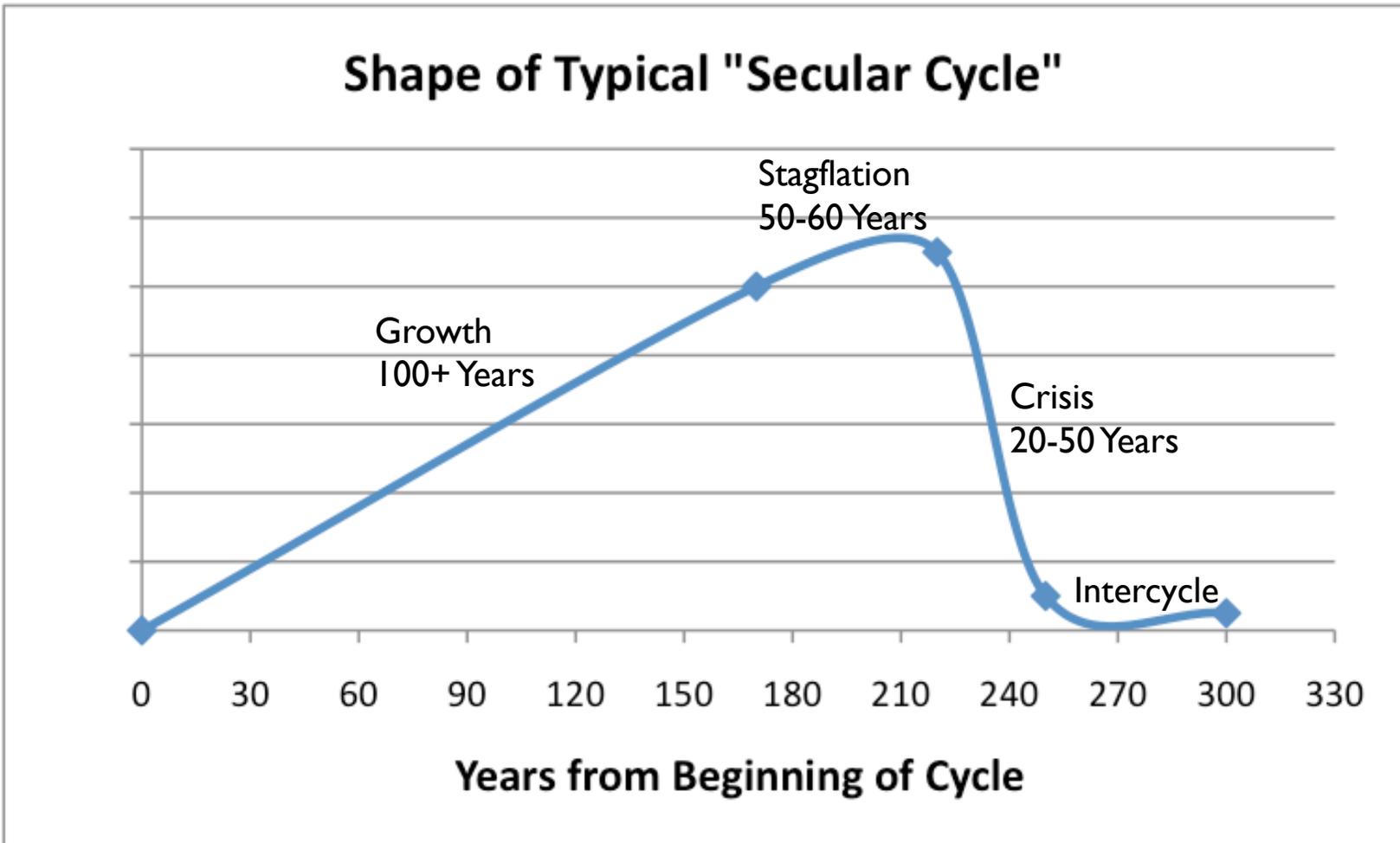
Findings of *Secular Cycles* (Continued)

- ▶ **Stage 3: Crisis Phase** (up to 50 years)
- ▶ Commodity prices high, very variable
- ▶ Sociopolitical instability
 - ▶ Tax system in a state of crisis
 - ▶ Can't collect enough taxes from impoverished peasants
 - ▶ May be civil war
- ▶ High concentration of land in hands of a few large owners
 - ▶ High economic inequality
- ▶ Impoverished common workers subject to epidemics
 - ▶ Not getting enough good food
- ▶ Population declines
- ▶ Popular movements for abolition of debts, land reform

Findings of *Secular Cycles* (Continued)

- ▶ **Stage 4: Intercycle** (can be very long)
- ▶ Population is low
- ▶ Government in state of disintegration or collapse
 - ▶ Periodic attempts to restore
- ▶ Abundant free land
 - ▶ By may not be secure enough to farm
 - ▶ Lack of government to protect against intruders
- ▶ Trade mostly local
 - ▶ Long distance networks interrupted
- ▶ Susceptible to invasions
- ▶ Handicrafts, artisanship declining

General Shape of Collapse in Non-Industrial Economies



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

What Peter Turchin is saying:

- ▶ Wages of common worker needs to be rising fast enough to withstand growing tax burden
 - ▶ Otherwise, government can't collect enough tax dollars
 - ▶ Government are likely to fail
 - ▶ Financial system fails with government
- ▶ If after-tax wages of common worker are falling, there are likely to be problems.
 - ▶ May not eat enough good food; die in epidemics
 - ▶ Government can't collect enough tax dollars
 - ▶ Collapse may occur

Why does increasing wealth disparity occur, as resources get scarce?

- ▶ (1) It takes resources to create jobs
- ▶ (2) High level officials already have jobs; they tend to keep their high paying jobs even as new workers are added at low wages
- ▶ (3) There are only so many resources to divide up
 - ▶ Low wages of common workers reflect the fact that the total amount of resources is low.
 - ▶ Even if the rich were taxed, it wouldn't affect the overall problem.

Agricultural societies were different from our civilization today

- ▶ Agricultural societies didn't use coal, oil or electricity
- ▶ Most workers in agricultural societies were workers
 - ▶ If their government disappeared, they could move elsewhere, and continue to do the same work
 - ▶ Not true with today's high-tech jobs
- ▶ Agricultural societies covered small areas
 - ▶ Today we have a networked international civilization

If a collapse did occur today, how would it be different from earlier ones

- ▶ Faster or slower?
- ▶ Easier or harder to start over?