

Information Technology and Productivity Stagnation

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The Logic of GDP Growth (1)

- Imagine the economy as a kitchen – we combine ingredients (materials) in various bowls and pots (infrastructure and technology), bake the mixture in an oven (more infrastructure and energy), hope that the chef has good skills (human capital) and a good recipe (technology) and end up with a meal (GDP).



There's an entire segment of the economy that produces and distributes ingredients (agriculture) as well as partially and fully assembled meals (restaurants and food retailers). Another segment produces and tries to improve pots and pans and ovens. Yet another segment teaches chefs how to cook (household instruction and educational institutions).

The Logic of GDP Growth (2)

- Now, while we may long for an old fashioned home-cooked meal, we're unlikely to get one unless we cheat and use modern high-yield agriculture to produce the ingredient, use kitchen pots and pans with some modern exotic materials (even heating, non-stick, easy cleaning, and light weight), use modern ovens and ranges (replacing older, energy hungry, large appliances or an open pit or fireplace!). And, while the resulting meal will be a good deal easier and faster to prepare, it still might not taste as good as you remember Grandmother's meals. But your doctor will thank you for avoiding the rich variety of delicious fats that Grandmom prepared in the old days and that along with the after dinner libations and smokes might help explain why your memories of Grandfather may be less vivid than your memories of Grandmother...

The Logic of GDP Growth (3)

- Let's not forget that if the meal seems less wonderful than Grandmother's meals, this is due in large part to the fact that Grandmom and later generations of care-givers have found better ways to spend their time. Grandmother's human capital can earn a higher return for herself and her family by using modern conveniences and by making other choices on how to spend her time.
- Now let's ask how the GDP produced in food preparation today is higher or lower than the GDP of the good old days. Since the inputs and outputs have all changed, we cannot deduce this from a direct comparison. But we can use dollar valuations and account for inflation to deduce that we all spend a much lower portion of our budgets on foods than our forebears did. We repeatedly show that we value our time savings more than the goodness of taking many slow steps in food preparation. And without a Grandmother to count on as an undercompensated home cook, we can no longer afford to depend on old-fashioned home-cooked meals.

The Logic of GDP Growth (4)

- I recommend taking this approach because, as simple as it is, it contains many of the problems of modern GDP accounting including valuing involuntary inputs, accounting for quality changes, and considering spillover effects such as health, nutrition, and pollution.
- What about growth? Using this example, we can see that many of the players had incentives to improve on food preparation techniques. The kitchen equipment manufacturers provided valuable changes in materials, convenience, and energy usage through continual competition and innovation. Agriculture and food refiners constantly innovated also. Grandmother found more rewarding ways to use her time. GDP accounting is bound to show large increases in GDP due to these changes. And we're likely to be left with a nostalgic awareness that the modern output may have a higher dollar value than the older output but that it does not strictly dominate the more time-consuming, more hands-on products of the past.

The Logic of GDP Growth (5)

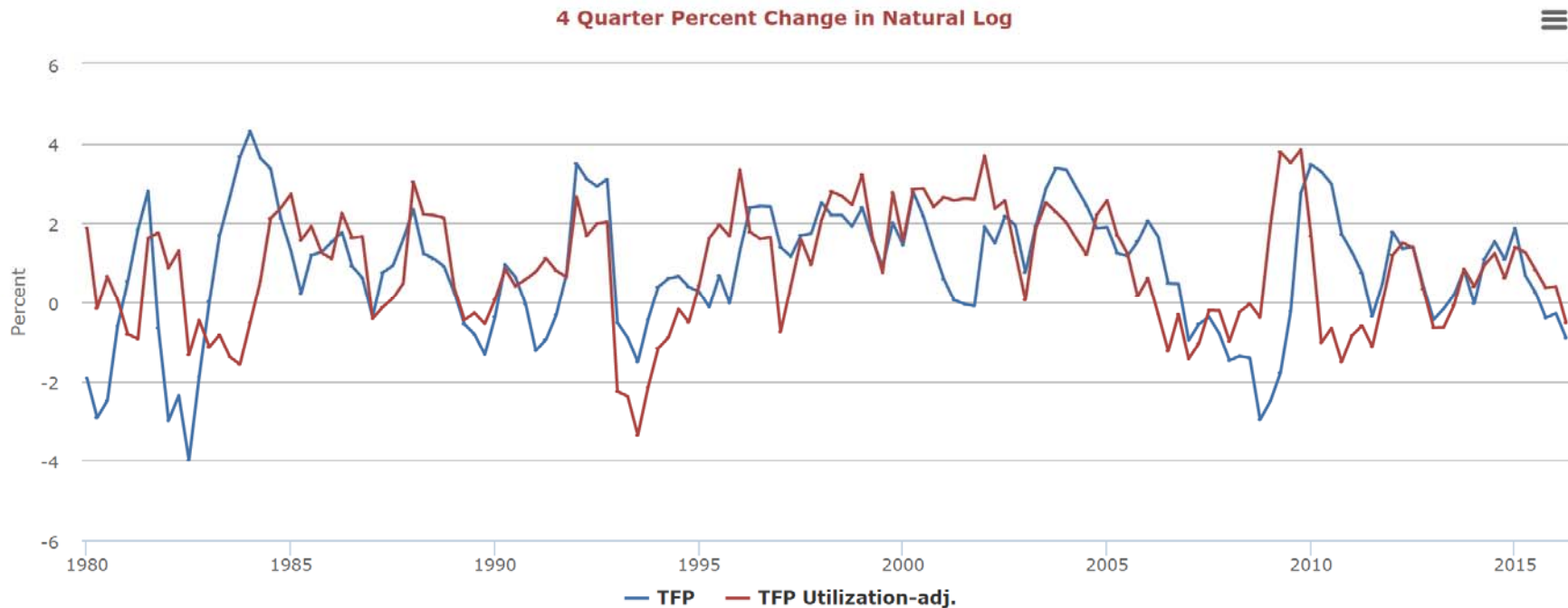
- Finally, suppose that we enter a period in which most of the innovations available are more aesthetic than practical. Different colored pots and pans with the same heating and cleaning properties may help organize the kitchen but suppose the appeal of the colors changes with fashion. Then we're likely to be faced with stagnating GDP growth. Meal preparation will no longer become easier relative to meal quality at the historic rate so appropriately, measures of productivity growth will slow. Companies will still be serving their customers who might be happier as a result but the GDP accounting is unlikely to show the old rate of increase.



The Logic of Productivity Increases

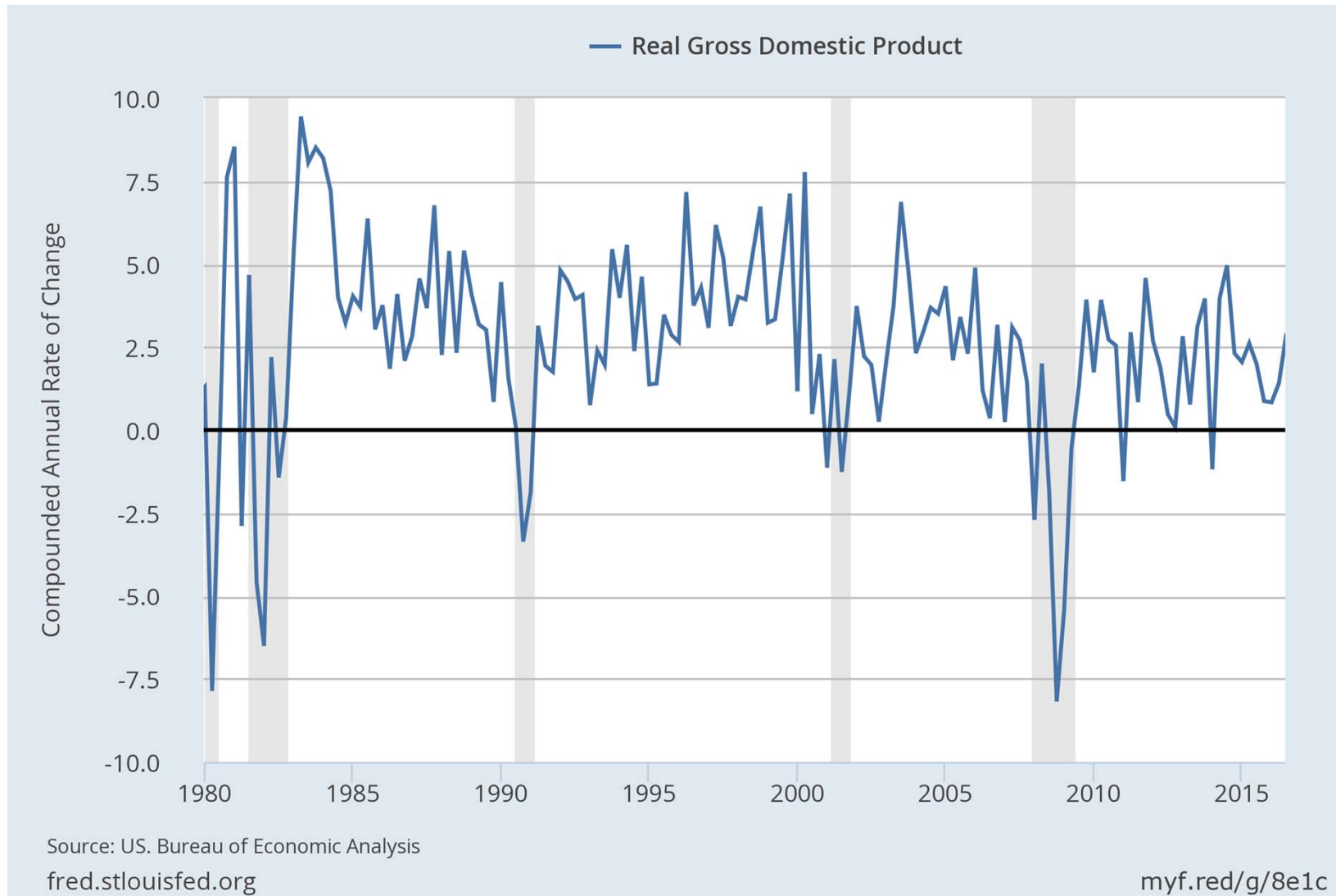
- One way to summarize the logic of GDP accounting is to ask what makes the rate of GDP growth ebb and flow. If we think of the kitchen example, we're looking for a simple equation to describe how GDP is formed. Inputs combine using currently available knowledge to produce a dollar valuation (after a fair amount of accounting). One very simple formulation shown just for example is:
 - $GDP = AL^{\alpha}K^{\beta}$
where L stands for Labor input, K stands for Capital input, and A captures increases (or decreases) in the effectiveness of known ways of combining and distributing the outputs. The exponents a and b are sometimes restricted to add up to 1, in which case doubling L and K will double GDP.
 - It turns out that this simple equation opens the door to talking about technology, productivity and both actual and measured GDP. The key is A, the multiplier that we expect in this modern age will keep growing and that would falter if we entered a kind of technological or economic dark age or simply a pursuit of aesthetics rather than the practical.
 - A is not written in stone. It varies with scientific research and serendipity, investments, property rights, taxes, and regulation as well as human capital. It increases with economic development and will falter if economies fall back.

How is the Variable A Changing? Annual Growth Rate of Total Factor Productivity



<http://www.frbsf.org/economic-research/indicators-data/total-factor-productivity-tfp/>

Why we care about Productivity: Disappointing US Economic Growth



Major Sector Productivity and Costs

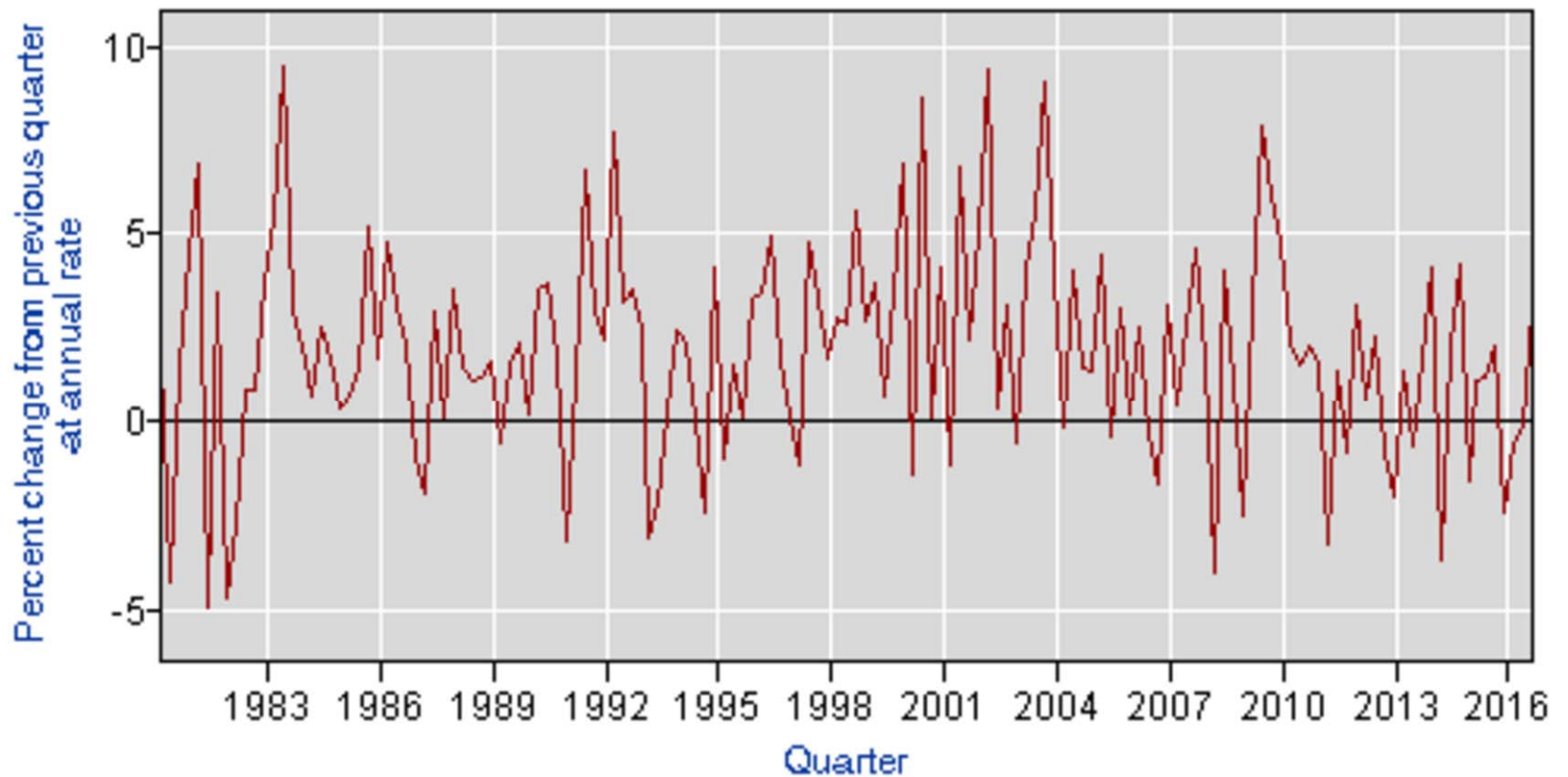
Series Id: PRS85006092

Sector: Nonfarm Business

Measure: Labor productivity (output per hour)

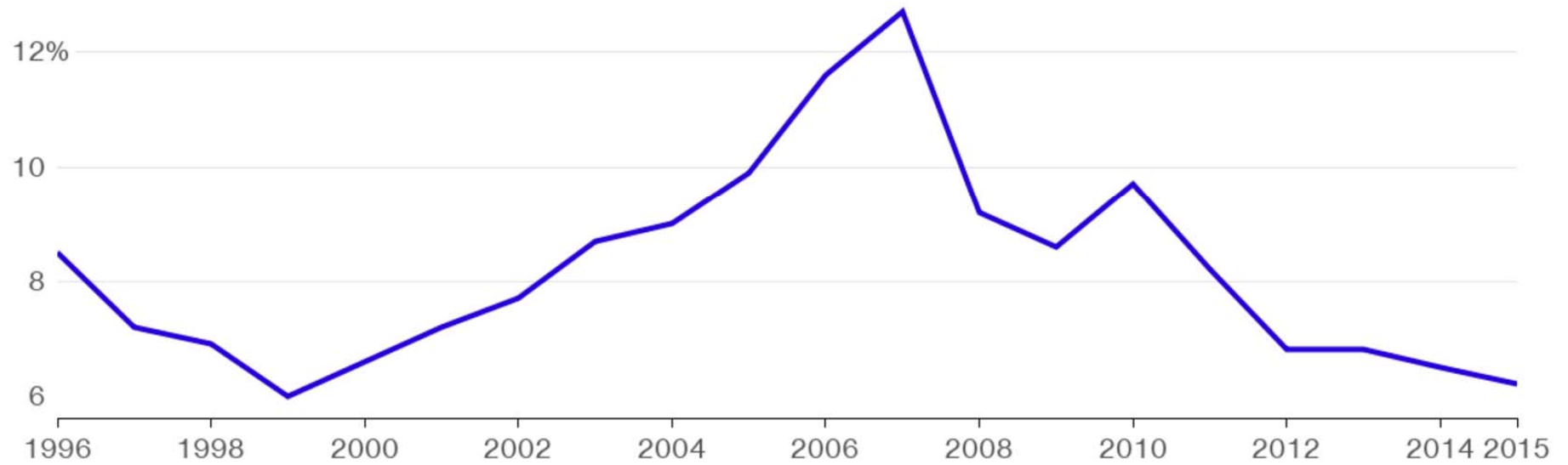
Duration: Percent change from previous quarter at annual rate

Base Year: -



China Productivity Growth at 16-Year Low

■ China labor productivity growth YoY



Sources: National Bureau of Statistics, International Labour Organization
Data based on 2005 constant price.

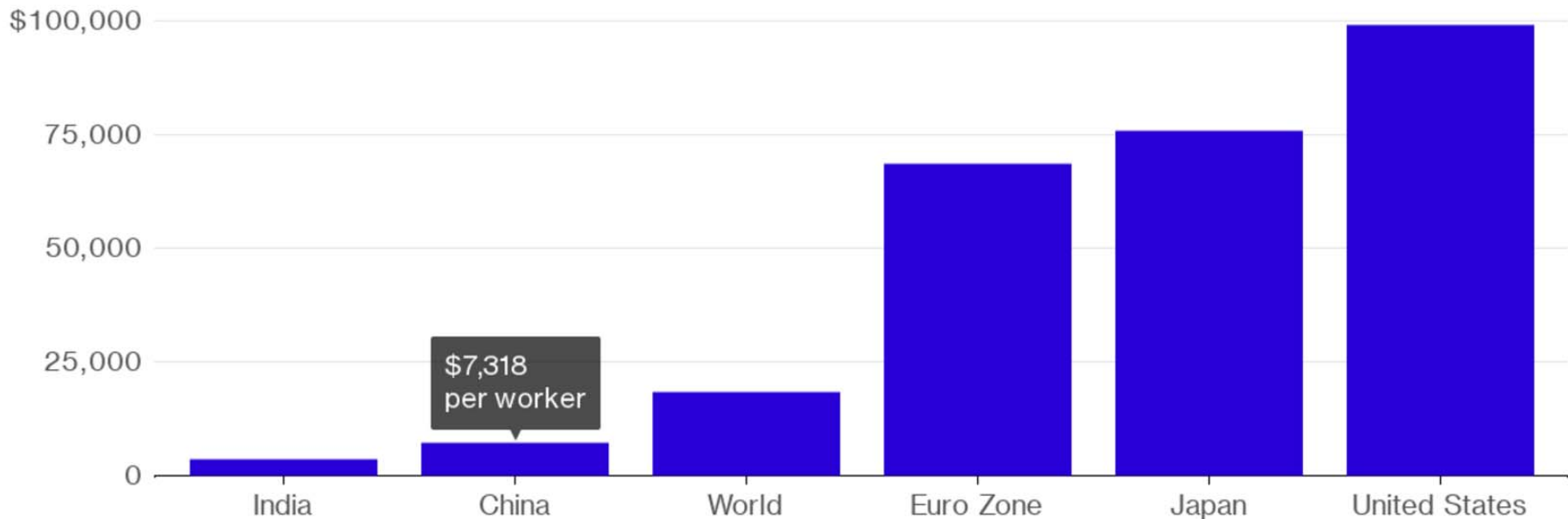
Bloomberg 

<http://www.bloomberg.com/news/articles/2016-09-05/china-s-productivity-growth-is-the-worst-since-the-asia-crisis>

China's Labor is Less Productive

Rates are less than a tenth of European, Japanese and U.S. levels

■ Annual labor productivity in 2015



Sources: International Labour Organization, National Bureau of Statistics of China
Data are in constant price of 2005

Bloomberg

<http://www.bloomberg.com/news/articles/2016-09-05/china-s-productivity-growth-is-the-worst-since-the-asia-crisis>

Back to the Future

... what everyone feels to have been a technological revolution, a drastic change in our productive lives, has been accompanied everywhere, including Japan, by a slowing down of productivity growth, not by a step up. You can see the computer age everywhere but in the productivity statistics.

Robert Solow, "We'd better watch out", New York Times Book Review, July 12, 1987, page 36.

Robert Solow
Economist



Robert Merton Solow is an American economist, particularly known for his work on the theory of economic growth that culminated in the exogenous growth model named after him. [Wikipedia](#)

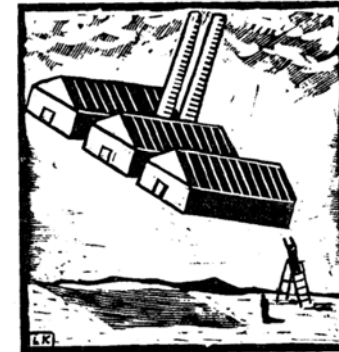
Born: August 23, 1924 (age 92), Brooklyn, New York City, NY
Education: Harvard University
Field: Macroeconomics
Awards: Nobel Memorial Prize in Economic Sciences, More
Influenced by: Paul Samuelson, John Maynard Keynes, Joseph Schumpeter, Wassily Leontief, William Phillips, Alvin Hansen

We'd Better Watch Out

MANUFACTURING MATTERS
The Myth of the Post-Industrial Economy.
By Stephen S. Cohen and John Zysman.
Tables and Charts. 297 pp. New York:
A Council on Foreign Relations Book/
Basic Books. \$19.95.

By Robert M. Solow

THERE is a lot of loose talk about the "deindustrialization" of the United States economy. We are losing our manufacturing industry to foreigners and becoming a "service economy" (if you like the idea) or a "nation of hamburger stands and insurance companies" (if you don't like the idea). Stephen S. Cohen and John Zysman begin their book, "Manufacturing Matters: The Myth of the Post-Industrial Economy," by insisting, quite correctly, that no such thing can happen. The orders of magnitude are such that the United States could not hope to pay for its manufacturing imports by selling services abroad. We

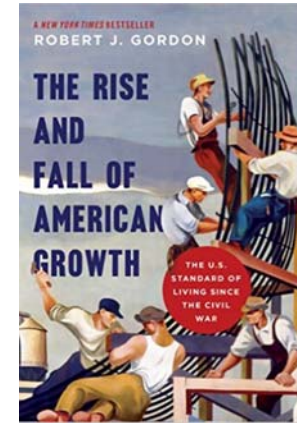


national falling in alizing at what is a generaliz tent with discussal of those. for flexit ing requi market v site of 1 America trouble is actly wh United St few good I do 1 beliefs is turing, it that Am That ma need to s

Why isn't ICT raising productivity?

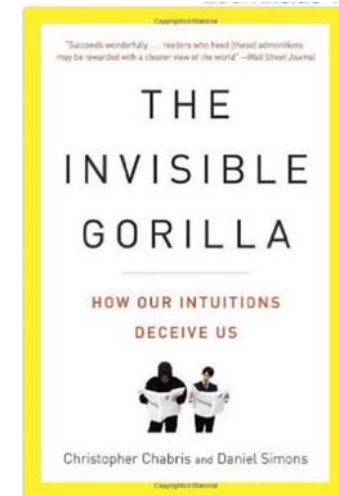
- Theories:

- The easy innovations have already occurred. See Robert Gordon.
- We're mismeasuring productivity and economic growth. We're happier than we know! See Hal Varian.
- We're not that rational – we are resistant to evidence that our priors are wrong. See Chabris and Simons.
- The Internet is deep and constantly changing. It's easy to drown in it. See Paul Thomas.



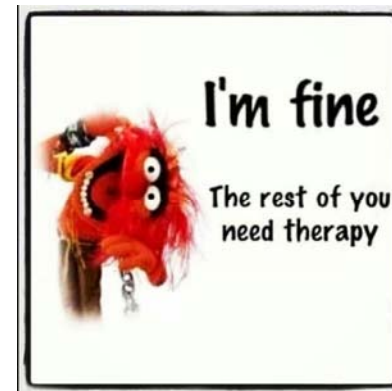
Hal Varian, chief economist of Google, says that the productivity puzzle is a sign that we are approaching the limits of what people can do. There's a lack of appreciation for what's happening in Silicon Valley, he says, because we don't have a good way to measure it. Photo credit: iStock for Alamy (2013) (2013).

- Computing and telecommunications without connectivity no longer useful to most of us. We communicate, socialize, consume, and work on the Internet.
- Fill in your own horror story. Mine is called “How I spent Thursday afternoon deducing and changing passwords, following links that lead to dead or extraneous URLs just to find out my latest dental insurance coverage! Worse, yet, I know for sure that this will happen again since I’m left with partial password updates to dead and extraneous URLs.



Being Curmudgeonly or There Be Monsters There?

- How can we tell whether the Internet is holding back rather than forwarding productivity?
 - We need micro studies at the level of individuals and households, employees and firms.
 - Won't this be addressed by markets? Or is the Internet, by its very nature, one enormous externality creating mechanism in which markets might fail?
 - Conduct your own self-examination. What drives you crazy in the Internet – what quirk interferes with your productivity when you're on a PC, tablet, or smart phone? Is it getting better or worse?
 - What companies (hardware, software, or Internet site or service provider) are addressing your frustrations?
 - Who might profit by making the Internet more efficient and less frustrating? So far, we're suffering from a tragedy of the commons.



What comes next?

- Private Internets (within company and communities) could address this issue but insistence on Net Neutrality may not be compatible with this approach.
- Websites specifically intended to provide a life raft in the Internet sea could flourish. For instance, Triplt will read your mail from airlines, hotels, and car rental companies and organize your itinerary for you. While this may raise privacy worries, the alternative might be going on several websites, finding changeable passwords, and working longer with your IT than you used to work with pencil and paper.
- Putting pressure on companies to add Internet trash collection to list of social responsibilities.
- Strong suspicion: this problem can be addressed. When it is, productivity and economic growth rates should increase decidedly.
- Or the Internet could drive us mad.

