December 1, 2014

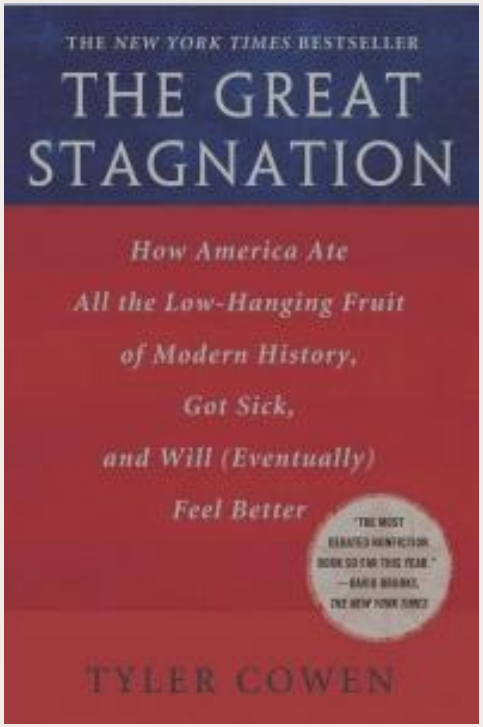
The State of Innovation in the States

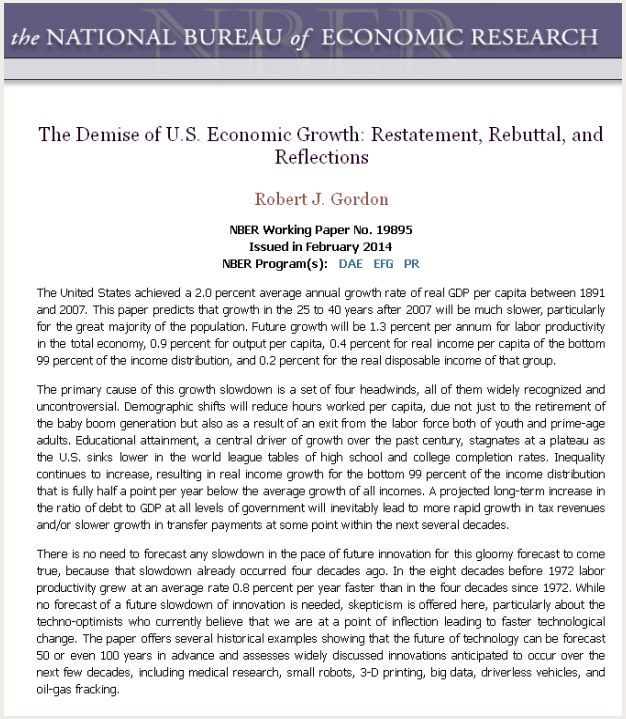
iKuben Delegation

Stephen Ezell, Senior Analyst

Information Technology and Innovation Foundation

The Great Stagnation?





the NATIONAL BUREAU of ECONOMIC RESEARCH

The Demise of U.S. Economic Growth: Restatement, Rebuttal, and Reflections

Robert J. Gordon

NBER Working Paper No. 19895
Issued in February 2014
NBER Program(s): DAE EFG PR

The United States achieved a 2.0 percent average annual growth rate of real GDP per capita between 1891 and 2007. This paper predicts that growth in the 25 to 40 years after 2007 will be much slower, particularly for the great majority of the population. Future growth will be 1.3 percent per annum for labor productivity in the total economy, 0.9 percent for output per capita, 0.4 percent for real income per capita of the bottom 99 percent of the income distribution, and 0.2 percent for the real disposable income of that group.

The primary cause of this growth slowdown is a set of four headwinds, all of them widely recognized and uncontroversial. Demographic shifts will reduce hours worked per capita, due not just to the retirement of the baby boom generation but also as a result of an exit from the labor force both of youth and prime-age adults. Educational attainment, a central driver of growth over the past century, stagnates at a plateau as the U.S. sinks lower in the world league tables of high school and college completion rates. Inequality continues to increase, resulting in real income growth for the bottom 99 percent of the income distribution that is fully half a point per year below the average growth of all incomes. A projected long-term increase in the ratio of debt to GDP at all levels of government will inevitably lead to more rapid growth in tax revenues and/or slower growth in transfer payments at some point within the next several decades.

There is no need to forecast any slowdown in the pace of future innovation for this gloomy forecast to come true, because that slowdown already occurred four decades ago. In the eight decades before 1972 labor productivity grew at an average rate 0.8 percent per year faster than in the four decades since 1972. While no forecast of a future slowdown of innovation is needed, skepticism is offered here, particularly about the techno-optimists who currently believe that we are at a point of inflection leading to faster technological change. The paper offers several historical examples showing that the future of technology can be forecast 50 or even 100 years in advance and assesses widely discussed innovations anticipated to occur over the next few decades, including medical research, small robots, 3-D printing, big data, driverless vehicles, and oil-gas fracking.

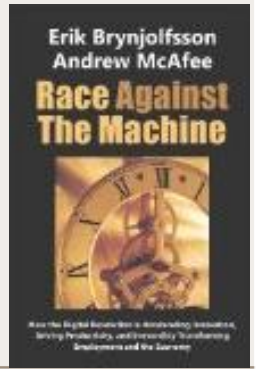
Is the Great Age of Innovation Over?

1. We're experiencing "long-term technological stasis"; the "low-hanging" innovation fruit is gone.

2. There were only a few truly fundamental innovations, and we've mostly made them.

3. We really haven't innovated anything all-that-impressive since the 1970s/1980s.

4. Technology destroys, not creates, jobs.

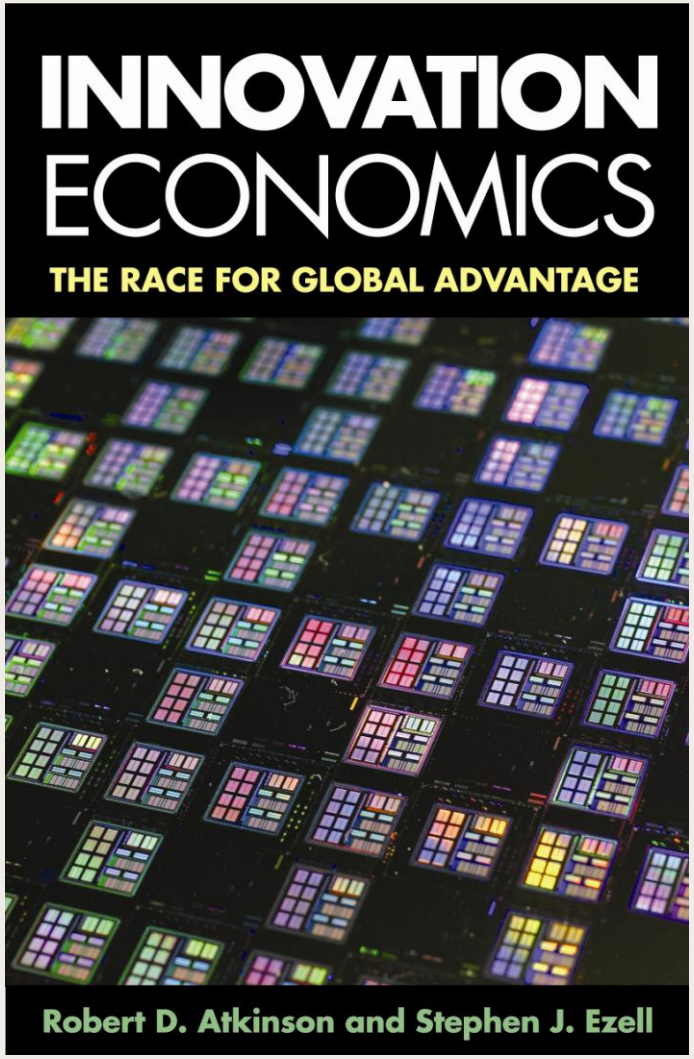


Charles H. Duell

“Everything that can be invented already has been.”

- Commissioner U.S. Patent & Trademark Office, 1900

Innovation Economics



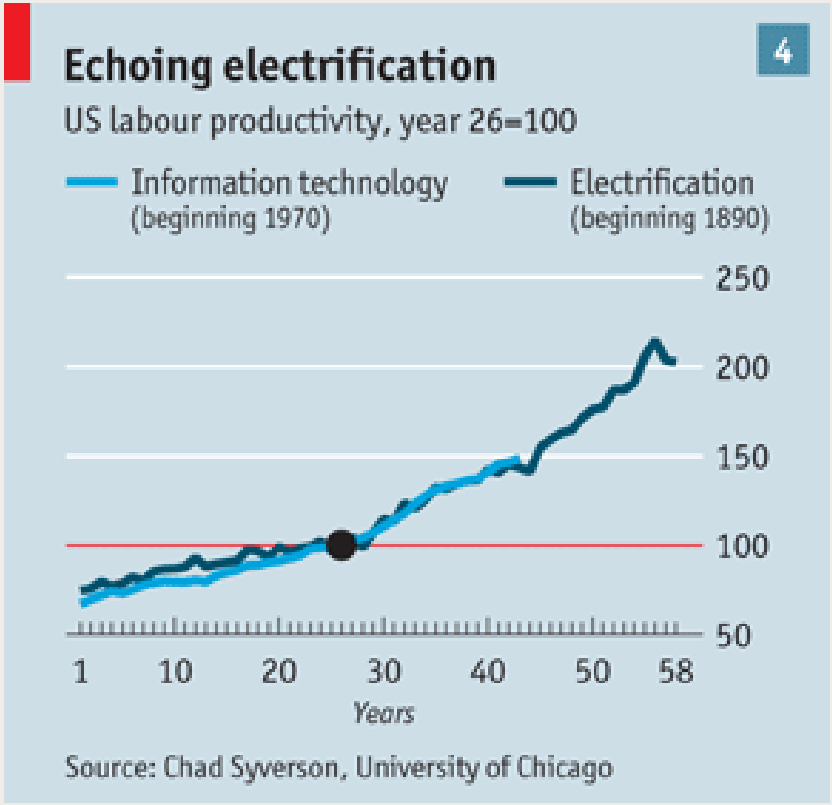
Rob Atkinson

Stephen Ezell

Yale University Press
September 2012

Benefits of ICT Innovation Far From Over

- The lag between investments in ICT and improvements in productivity is between 5-15 years.




2005
Luca Bruno / AP

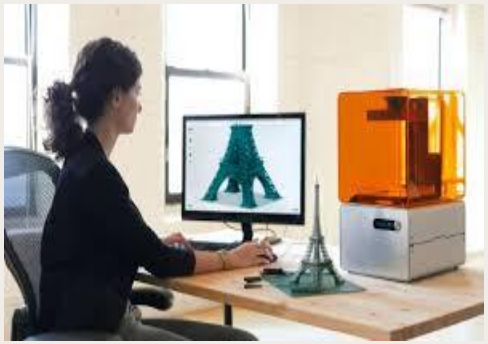

2013
NBC NEWS
Michael Sohn / AP

Innovation Is Far From Over

- On the cusp of breakthroughs in many sectors:

  We only mapped the human genome a decade ago; biologics/drugs take 12-14 years to develop.

- 92% of all scientists and engineers in world history live today.

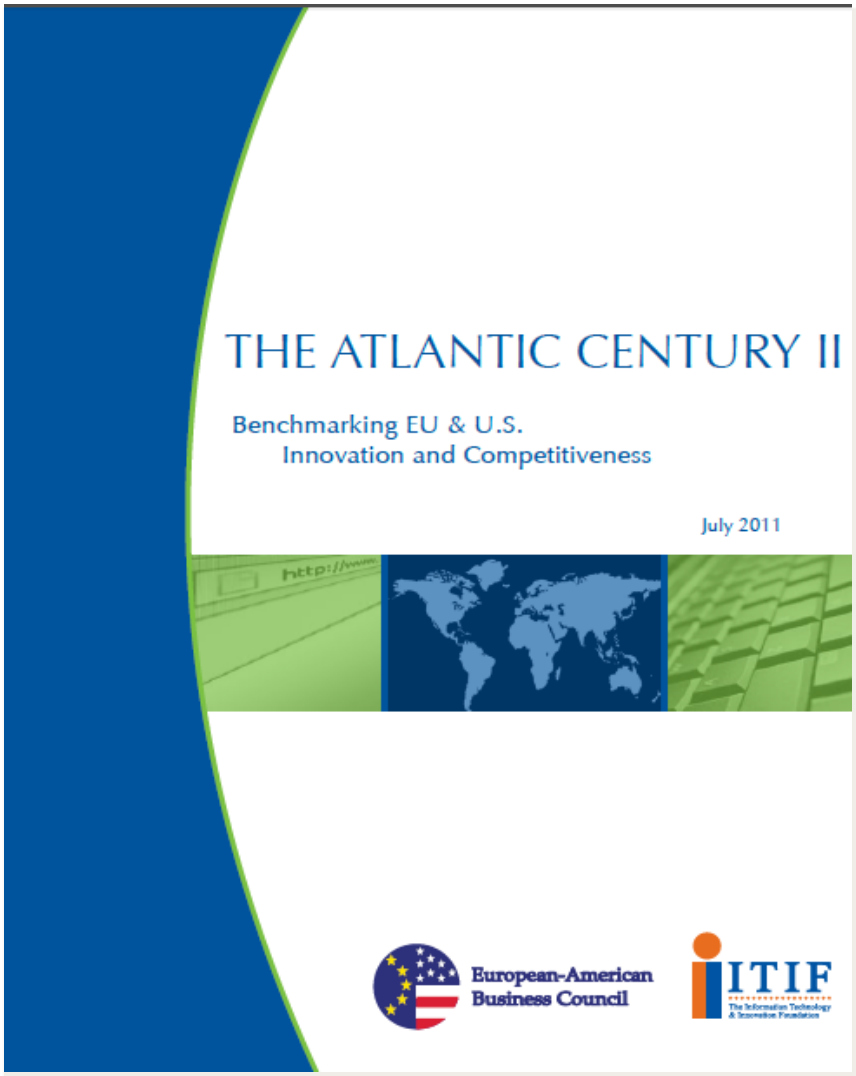


Innovation Is Far From Over

Joseph Schumpeter

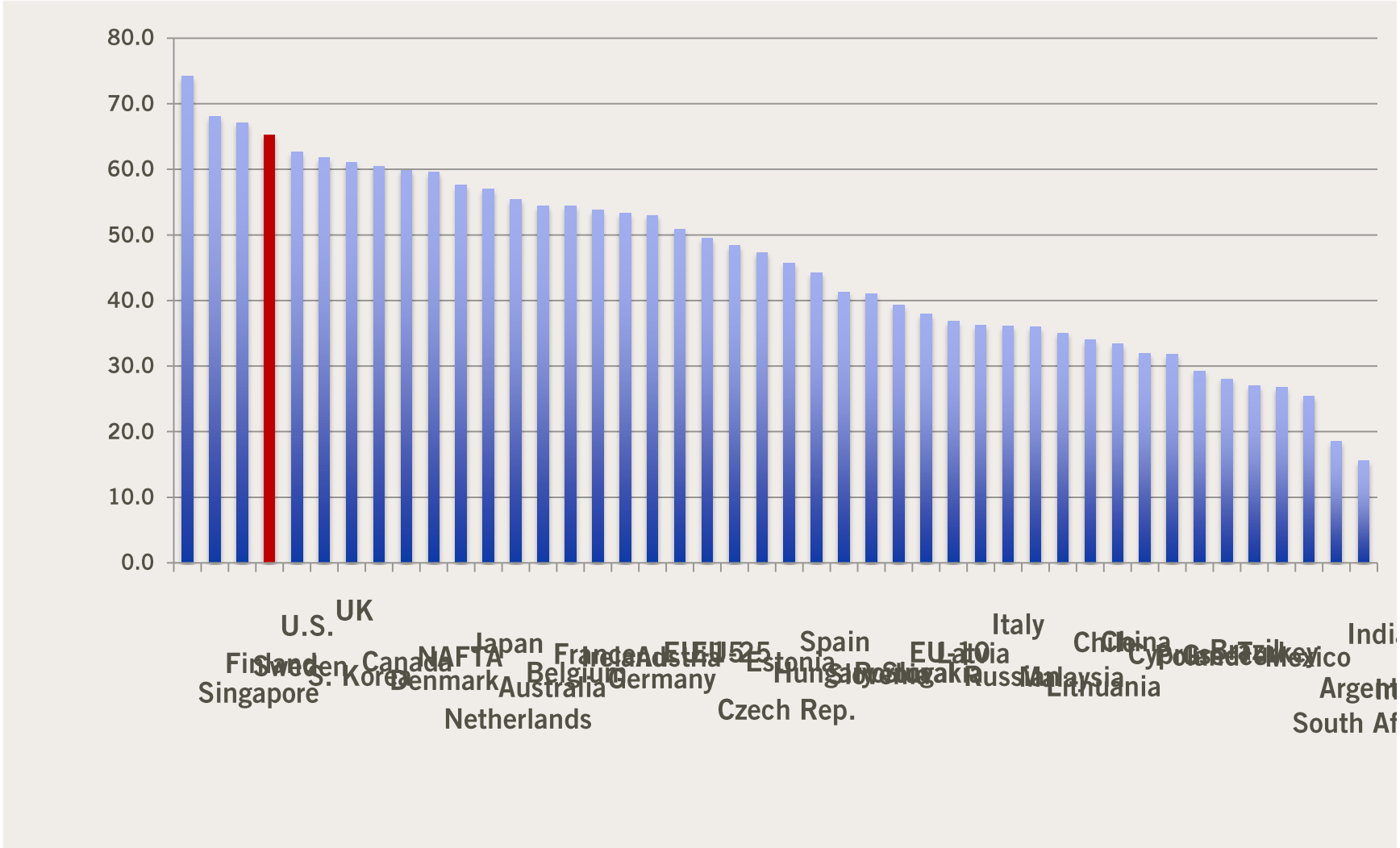
"There is no reason to expect the slackening of output through the exhaustion of technological possibilities."

The Atlantic Century II



- **The Study:** Compares innovation-based competeness of 44 nations and regions.
- **16 indicators:** Including corporate and government R&D, scientists and engineers, new firms, corp. tax, productivity growth and others.

Overall Score for Global Competitiveness and Innovation



- A Tale of Two Americas:

1. A Very Robust Silicon Valley/High-Tech Sector

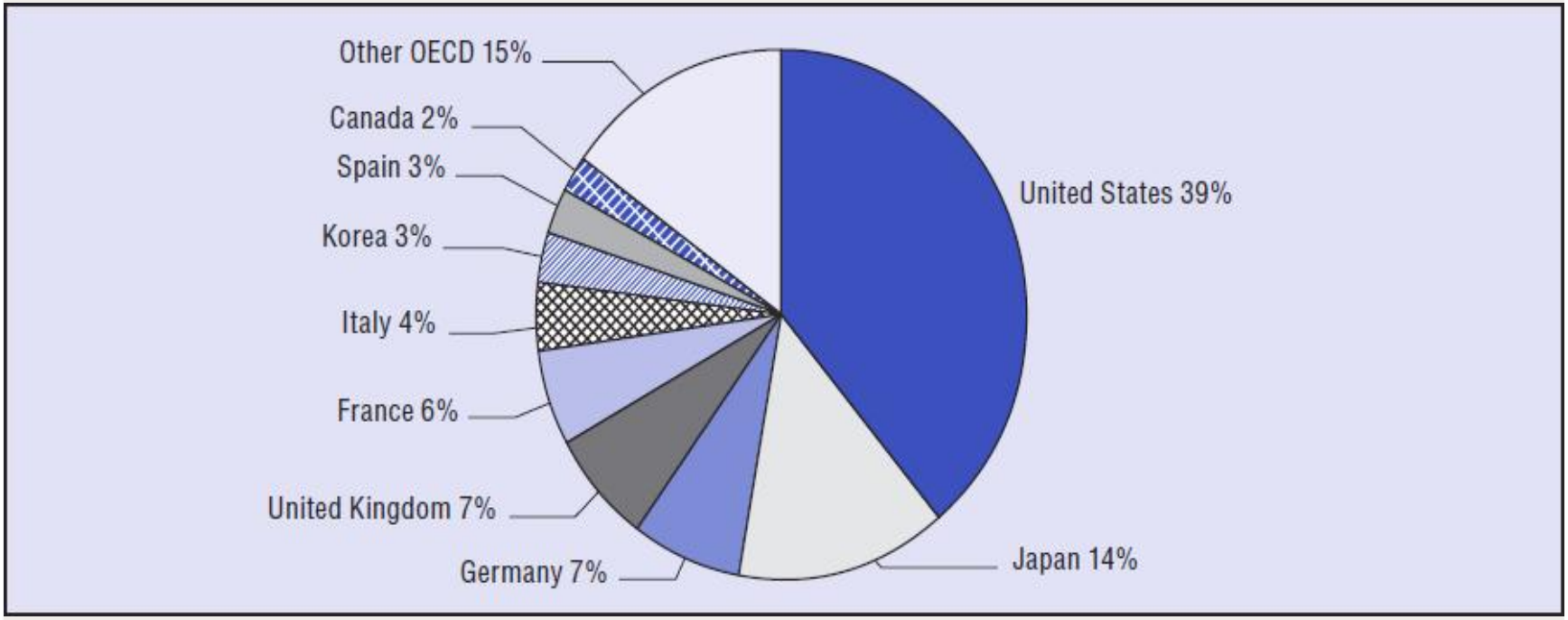
- Strong in ICTs; Apps; Aerospace; Biotechnology
- Still the Best Business Environment for Innovation

2. A Faltering Innovation Policy Environment

- Faltering Innovation Infrastructure
- Lacking Political Consensus to Support Innovation

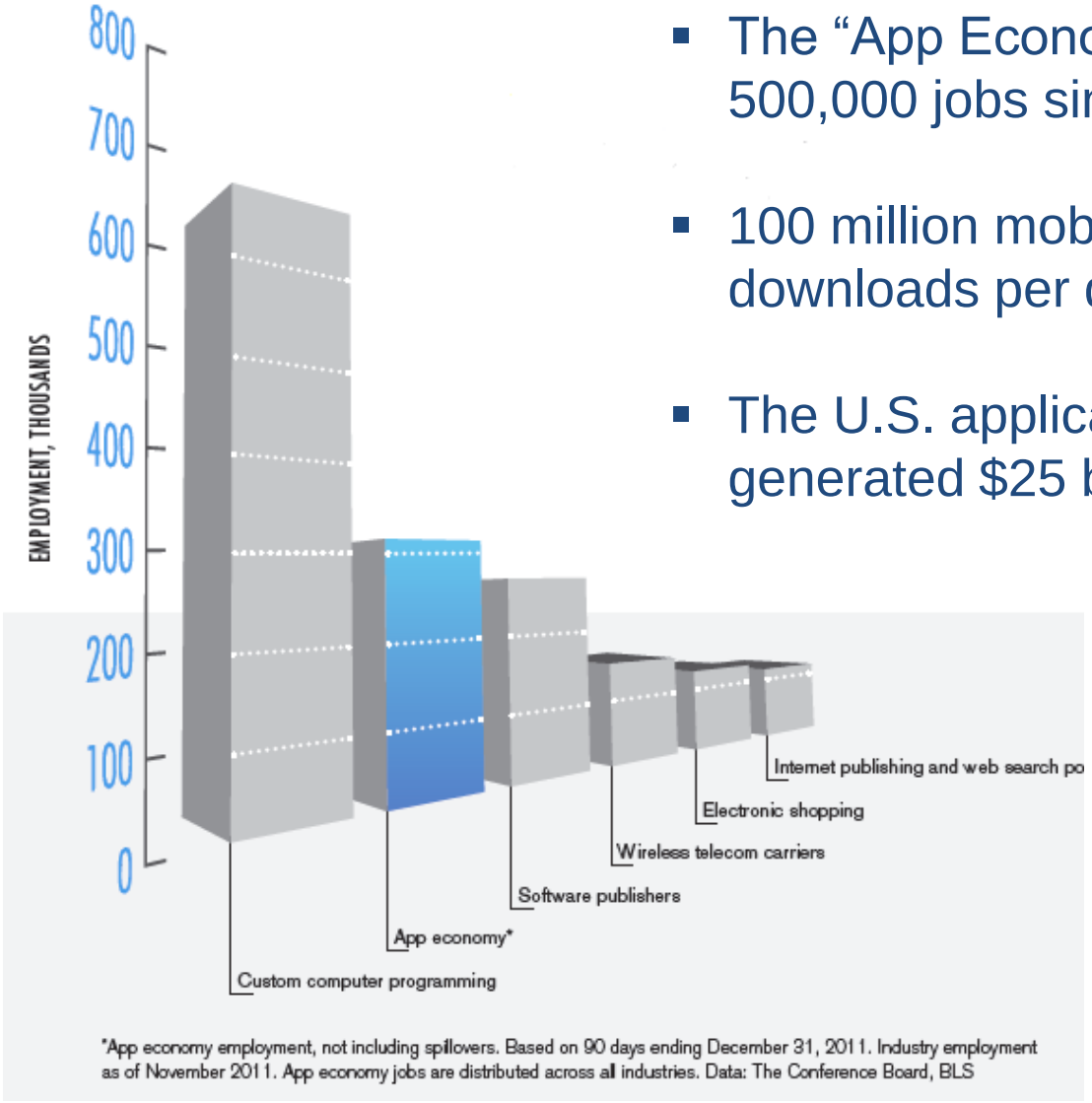
- U.S. Hotbed for ICT Innovation

Share of OECD ICT Sector Value-Added by Country



Source: ***OECD Information Technology Outlook, 2011***

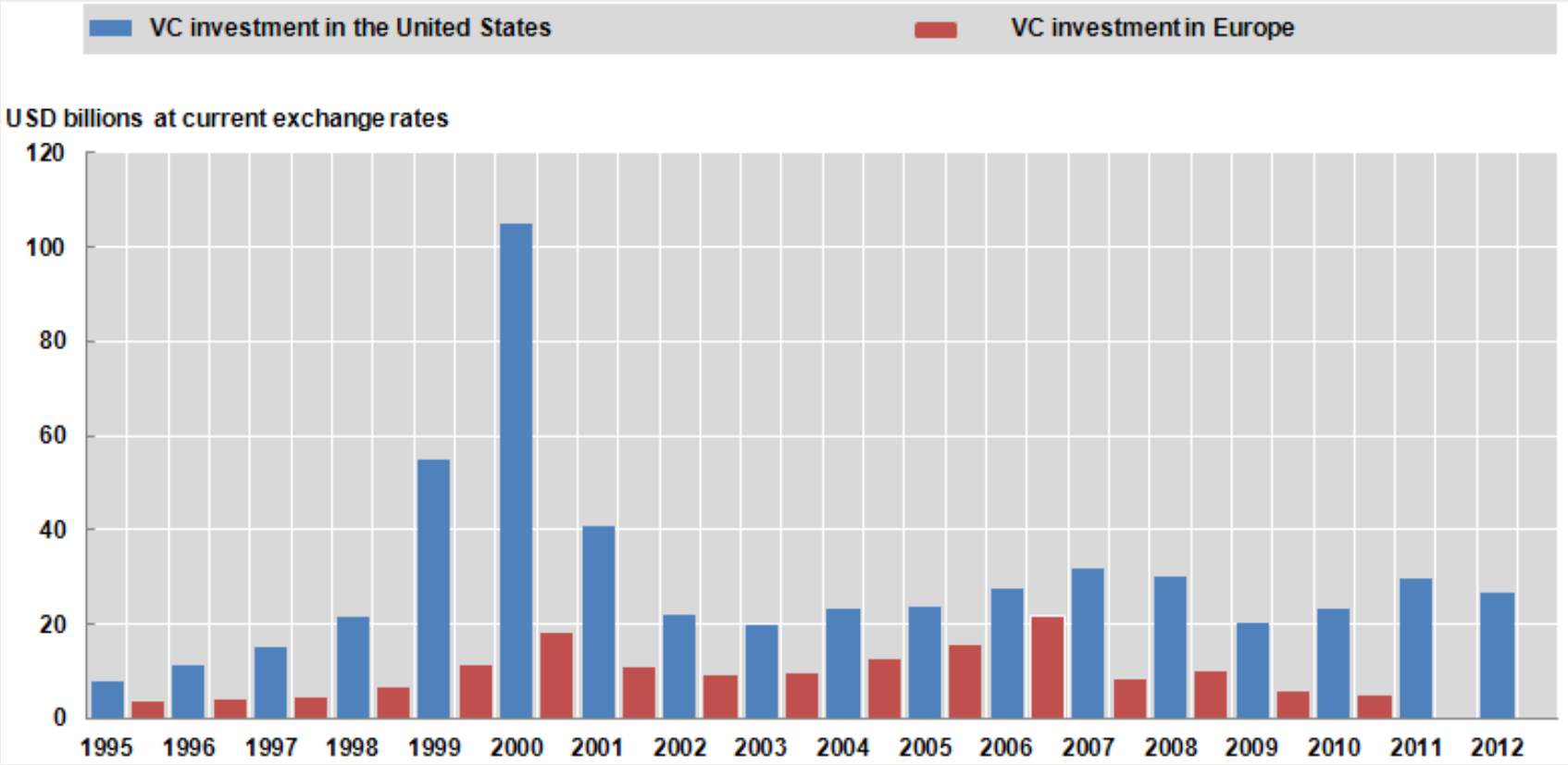
The "App Economy" Now Driving Innovation



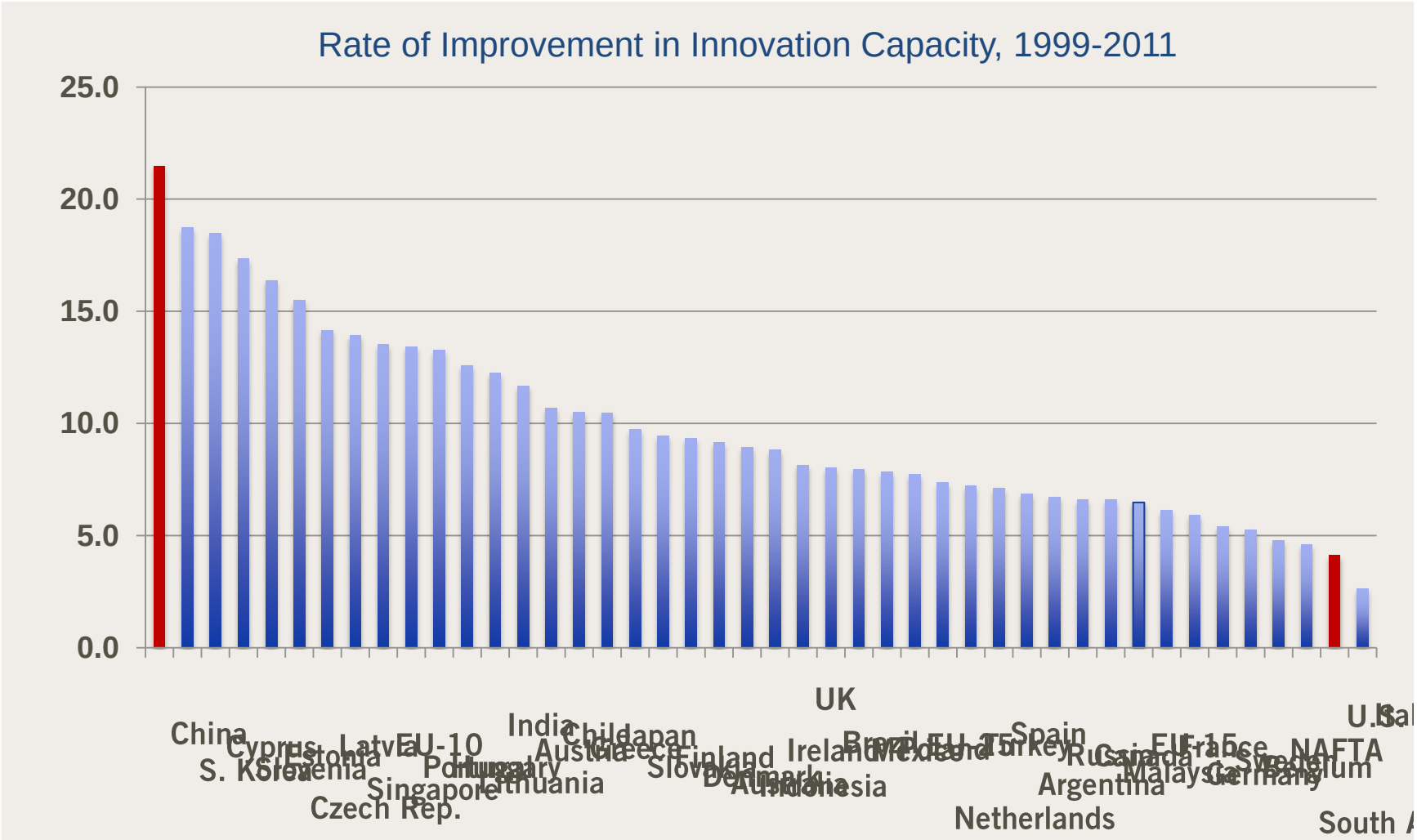
- The "App Economy" has created over 500,000 jobs since 2007.
- 100 million mobile applications downloads per day globally; 36B/year.
- The U.S. applications development generated $25 billion in revenue in 2013.

Source: Michael Mandel, *The App Economy*

U.S. Remains Global Leader in Venture Capital Investment



But All is Not Well With the U.S. Innovation Economy



Source: ITIF, *The Atlantic Century II*

But All is Not Well With the U.S. Innovation Economy

Innovation Environment

- Lagging R&D Investment
- Short-term Corporate Behavior
- Bad Policy Hurting Innovative U.S. Industries

Economic Environment

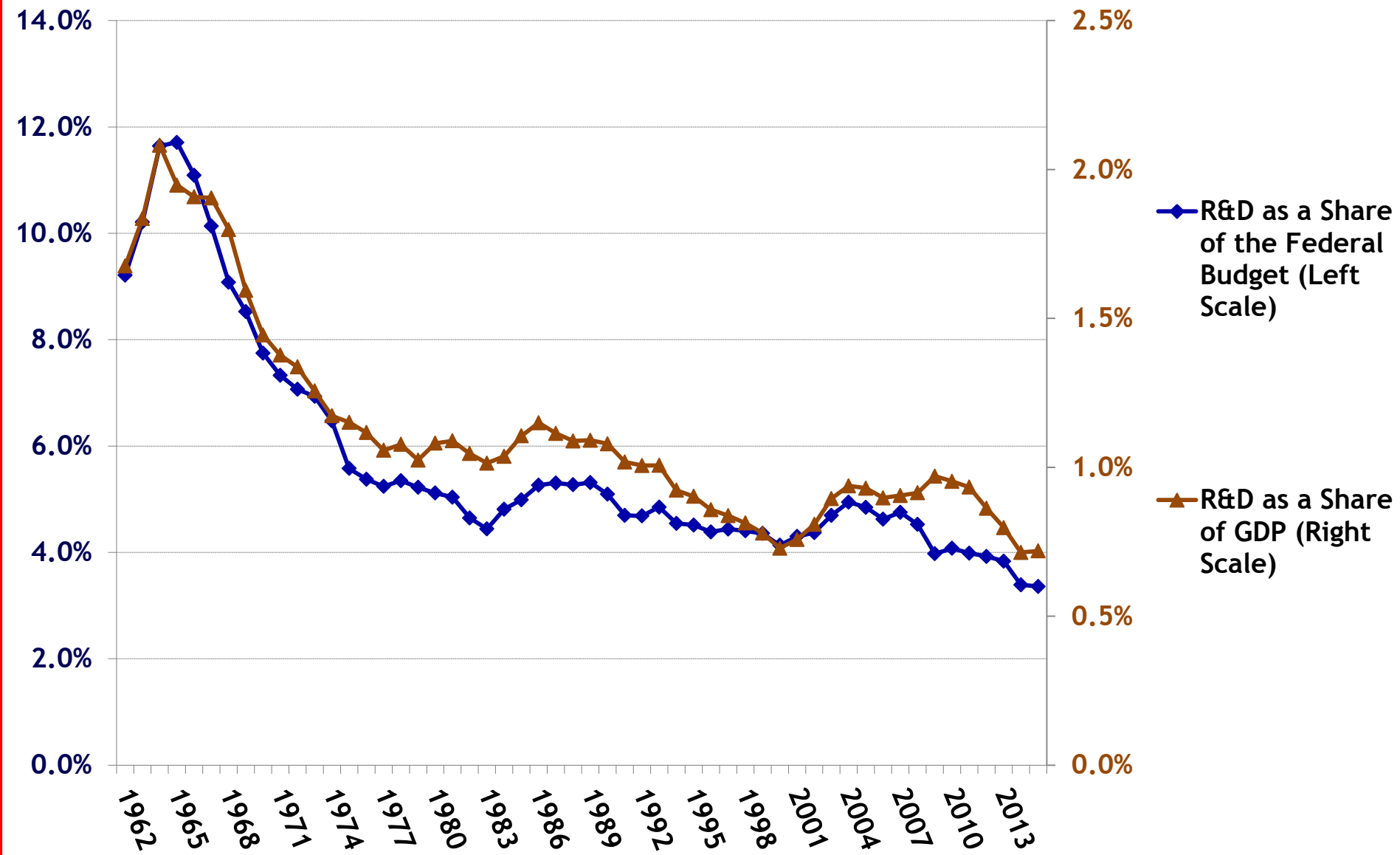
- U.S. Manufacturing Decimated
- Trade Deficit Enormous

Framework Environment

- Poor Tax Environment
- Education and Infrastructure Faltering
- Self-destructive Immigration Policies

Federal R&D in the Budget and the Economy

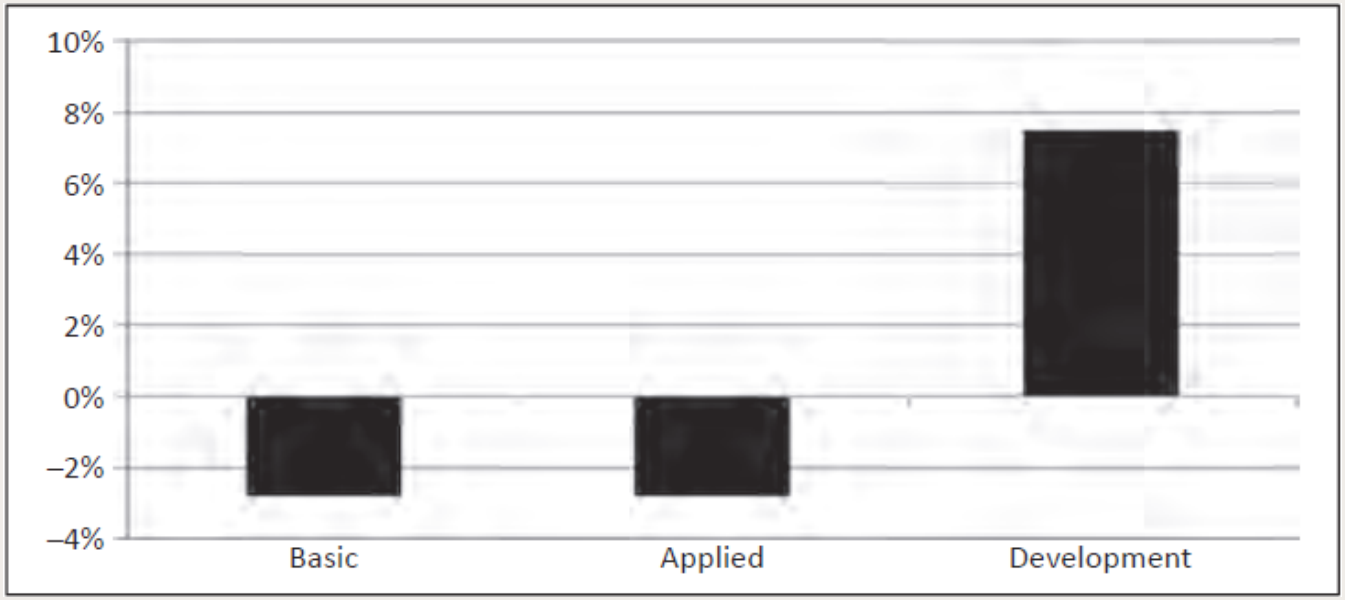
Outlays as share of total, 1962 - 2015



Source: *Budget of the United States Government, FY 2015.* FY 2015 is the President's request.

U.S. Firms Investing Less in Long-term R&D

Change in Allocation of U.S. Corporate R&D, 1991– 2008



U.S. Firms Investing Less in Capital Goods

- Business investment in equipment, software and structures grew 5.2% from 1990 to 1999, but just 0.5% from 2000 to 2010.
- From 1999 to 2007, investments by U.S. business in workforce training declined by 45%.

ITIF
The Information Technology & Innovation Foundation

Restoring America's Lagging Investment in Capital Goods

BY LUKE A. STEWART AND ROBERT D. ATKINSON | OCTOBER 2013

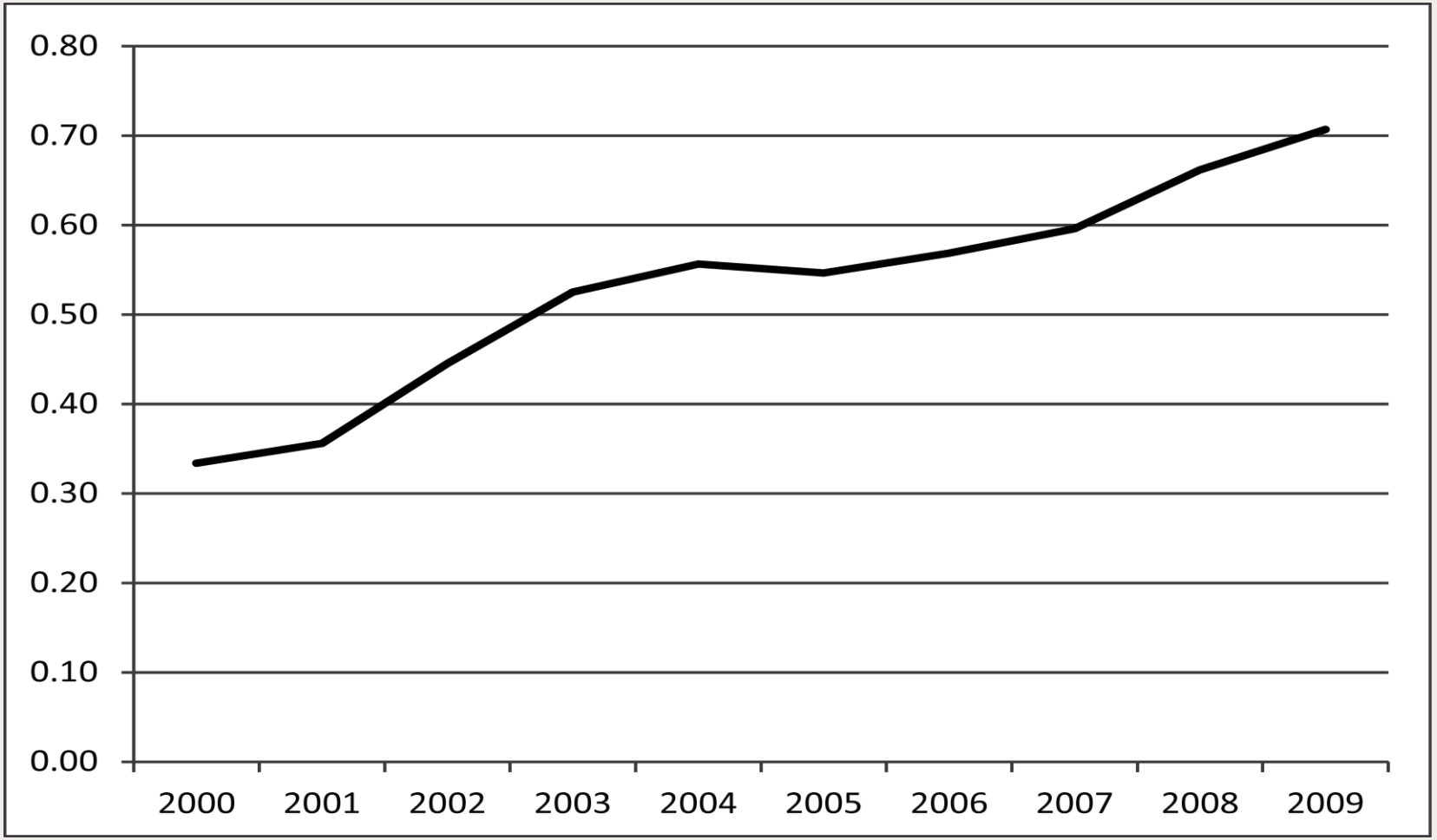
Not only has the business investment rate stagnated in the 2000s, but investment that was once broadly distributed across industries is now much more concentrated in a few select domestic-serving services industries.

Investment in new equipment and software is the primary means through which innovation—the key driver of economic growth—diffuses throughout the economy. Without new capital investment refreshing a nation's capital stock, innovation loses its power, productivity growth stagnates, and national economic competitiveness declines. It is troubling, then, that over the past decade, business investment rates in the United States have stagnated. Between 1980 and 1989, business investment in equipment, software and structures grew by 2.7 percent per year on average and 5.2 percent per year between 1990 and 1999. But between 2000 and 2011 it grew by just 0.5 percent per year—less than a fifth of that of the 1980s and less than one tenth that of the 1990s. Moreover, as a share of GDP, business investment has declined by more than three percentage points since 1980.

In this report, we examine the role of private nonresidential capital investment in economic growth and then analyze trends in that investment over the past three decades. We find that, not only has the overall business investment rate stagnated in the 2000s, but investment that was once broadly distributed across industries is now much more concentrated in a few select domestic-serving services industries, and industries that once powered U.S. investment growth and global competitiveness are now falling behind. Industries in which we are thought to be global leaders, such as computers and chemicals products, have experienced declines in capital investment. The report reviews possible reasons behind the investment decline, suggesting that the rise of "short-termism" on the part of corporate managers and declining U.S. economic competitiveness have played key roles. To turn these around, Congress should use the tax code to more strongly encourage

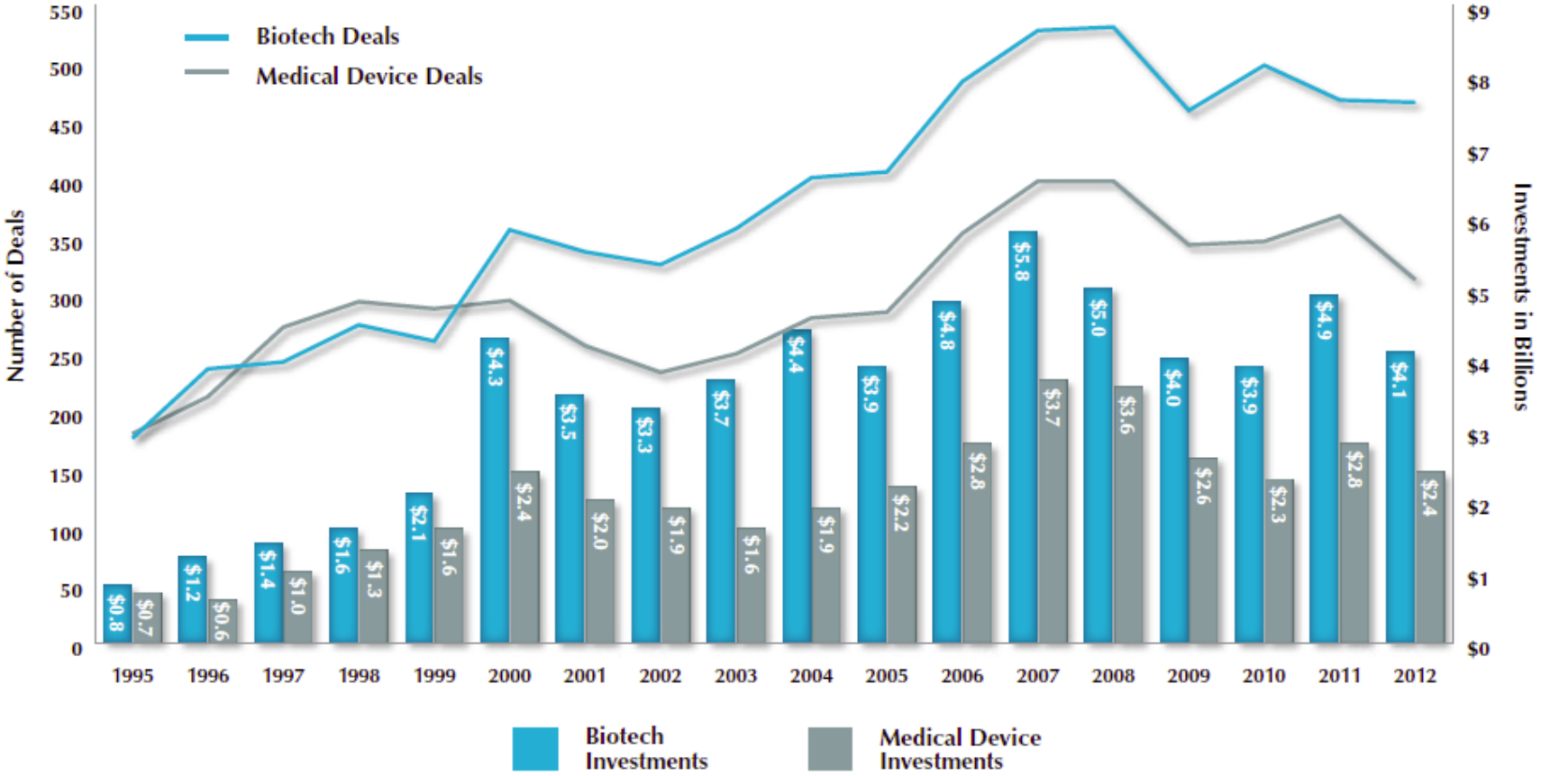
THE INFORMATION TECHNOLOGY & INNOVATION FOUNDATION | OCTOBER 2013 PAGE 1

Ratio of U.S.-Headquartered Manufacturing MNCs' Foreign to Domestic Capital Investment



Source: *Innovation Economics,* ITIF, 2012

VC Investment in Medical Devices Devastated



Source: ***Patient Capital 3.0,*** **National Venture Capital Association**

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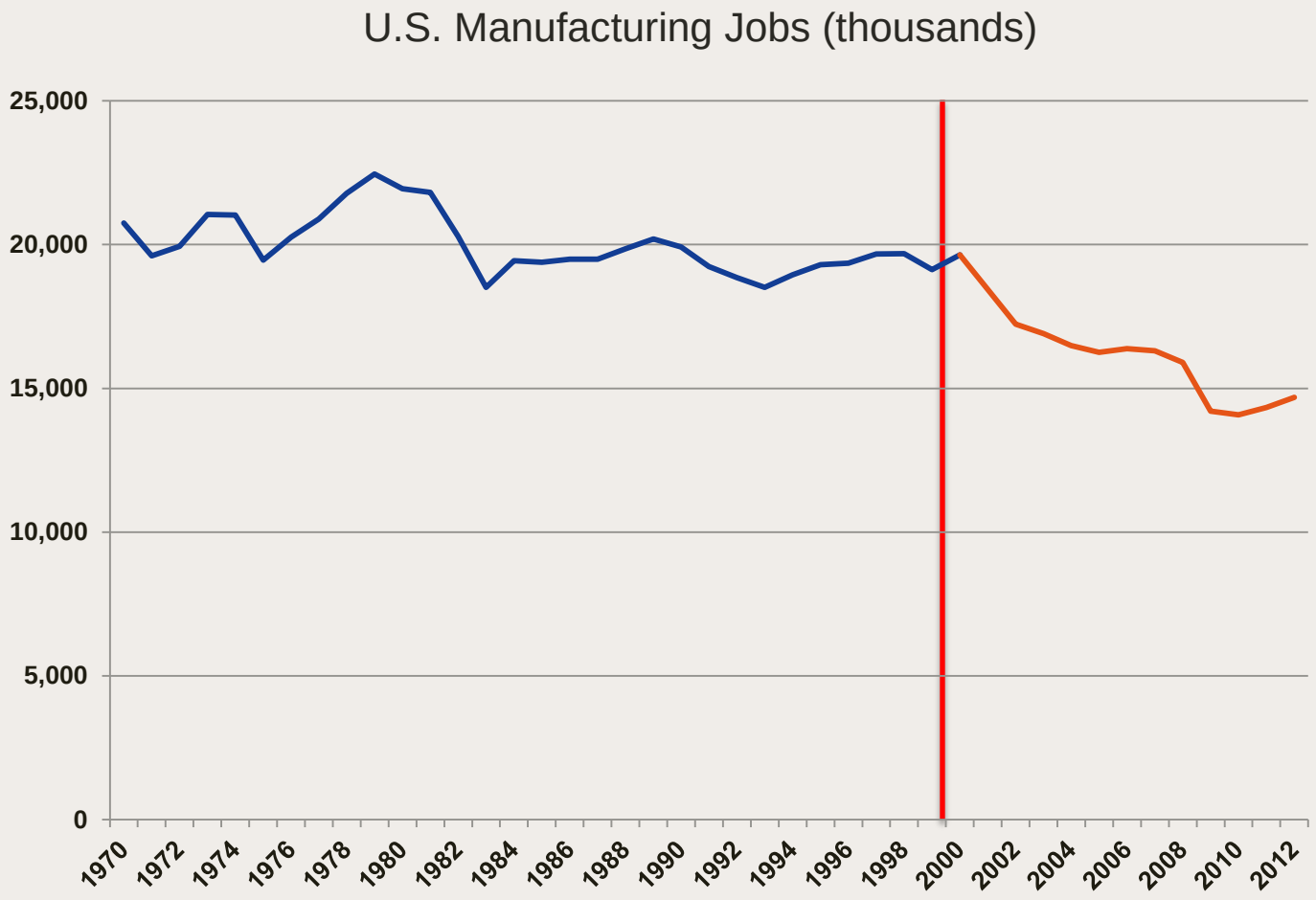
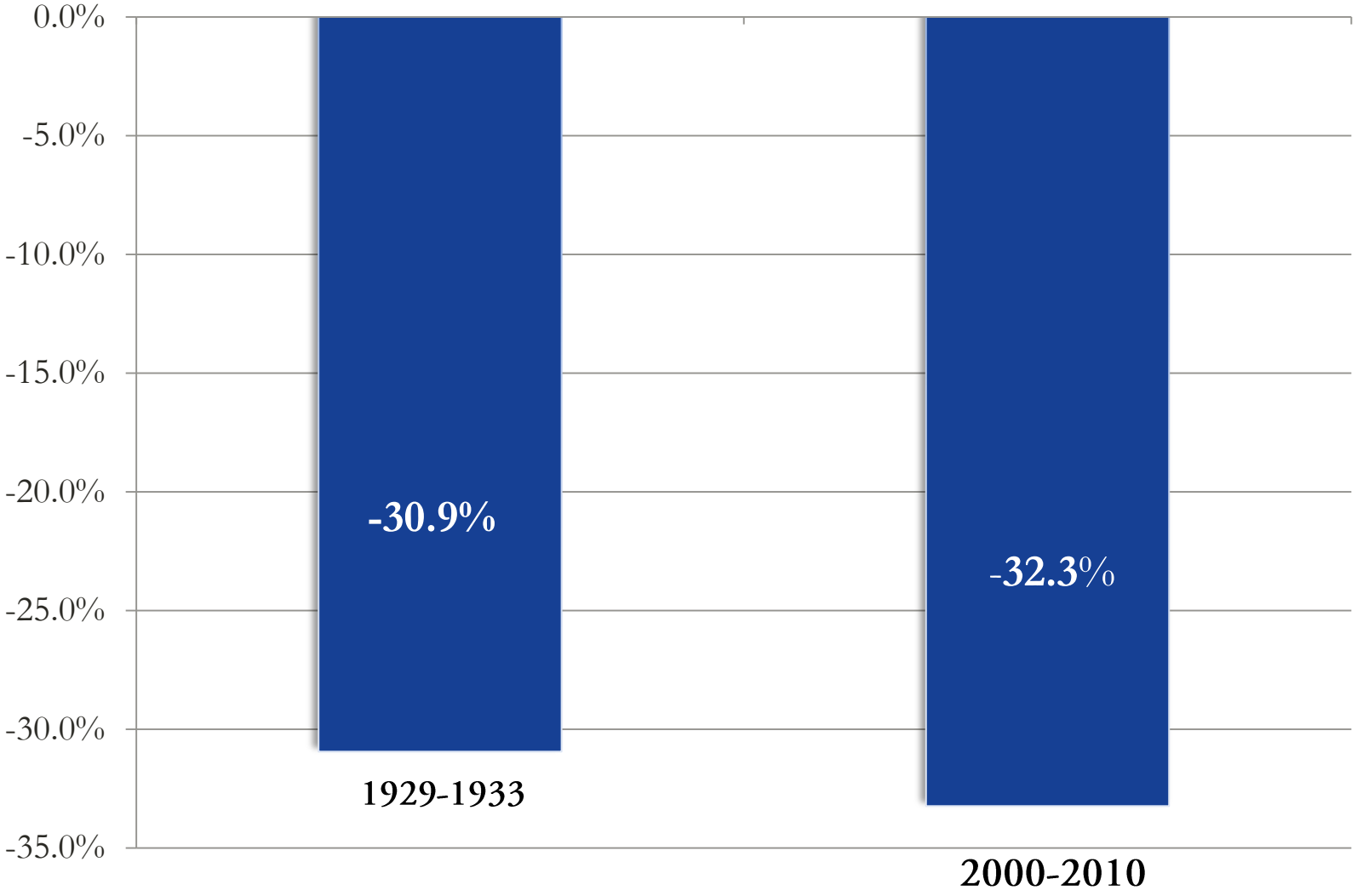
U.S. Manufacturing Jobs Have Fallen Precipitously Since 2000



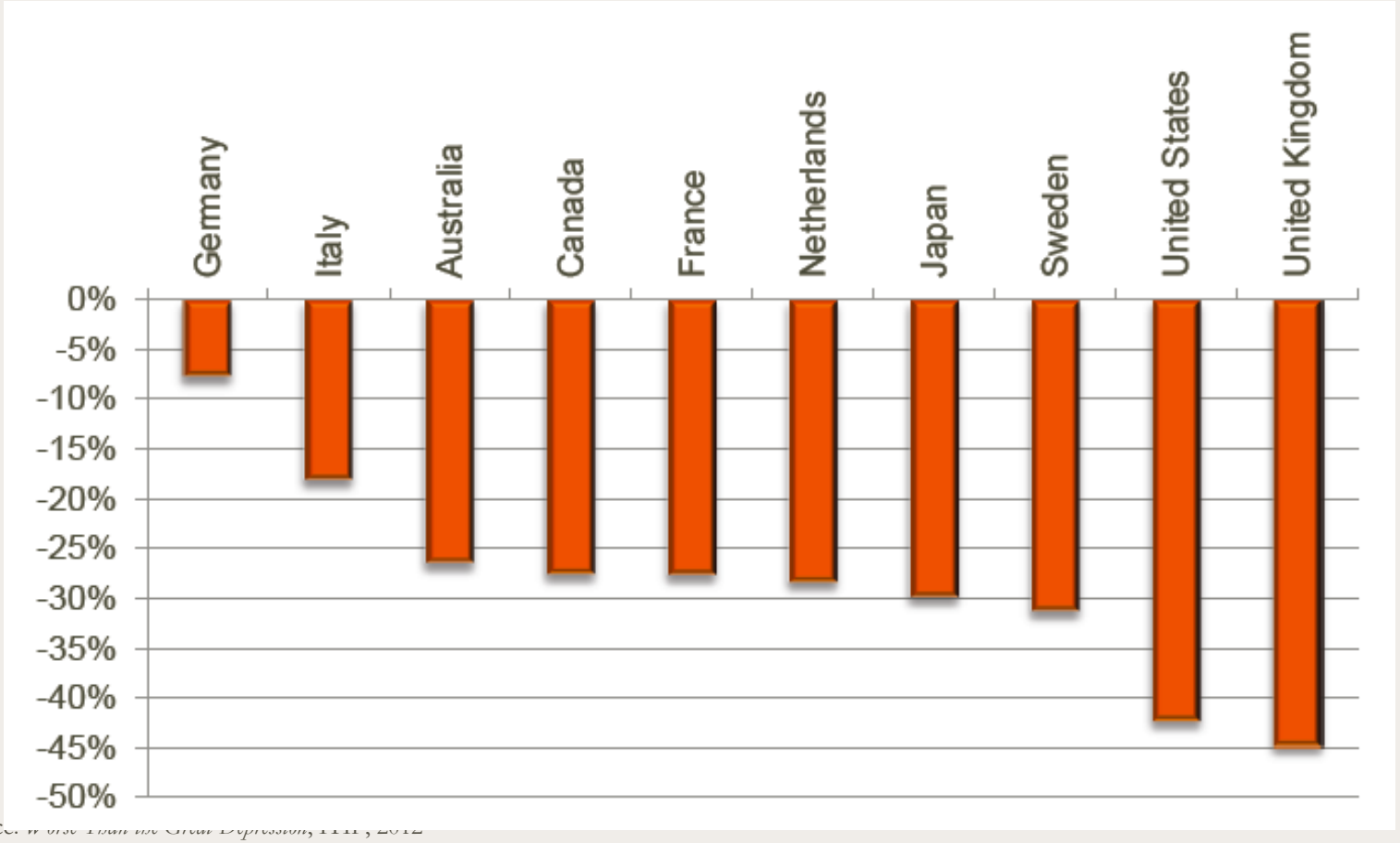
Source: ***U.S. Bureau of Labor Statistics***

Worse Manufacturing Job Loss than the Great Depression



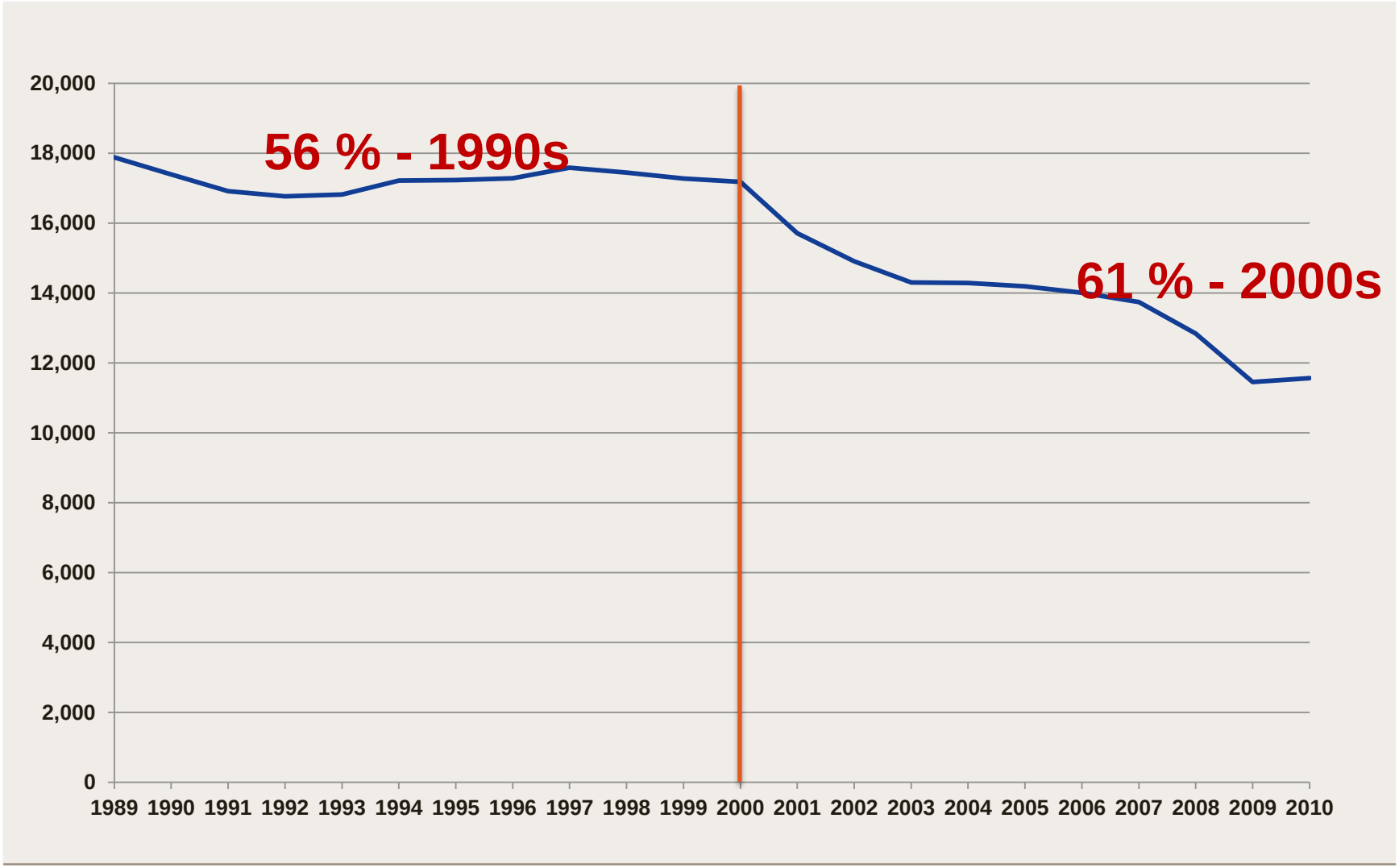
A Rate of Loss Far Worse Than Peer Countries

Percent Change in FTE Manufacturing Jobs in Select Countries, Adjusted for Population Growth, 1997-2010

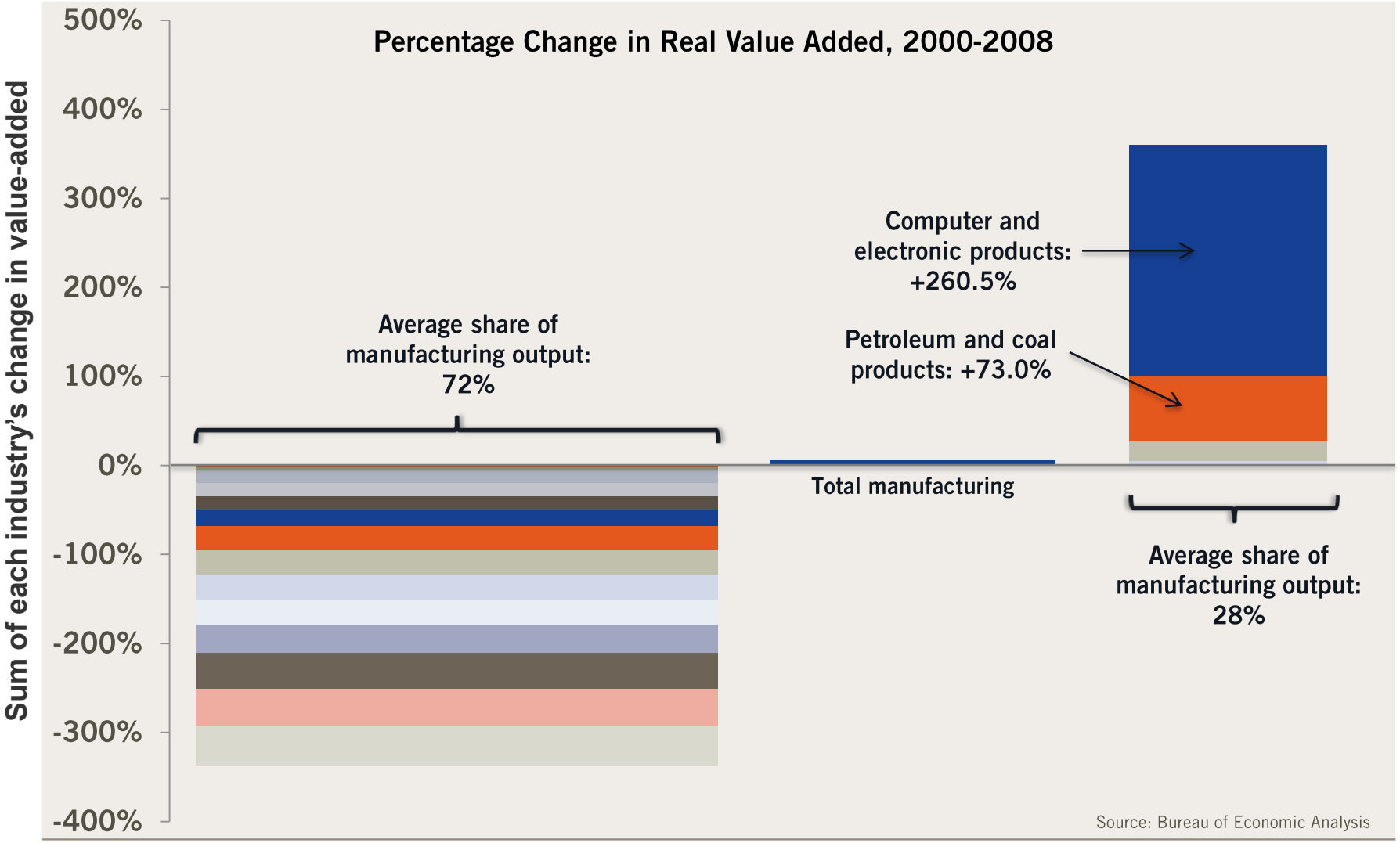


Source: *Worse Than the Great Depression*, ITIF, 2012

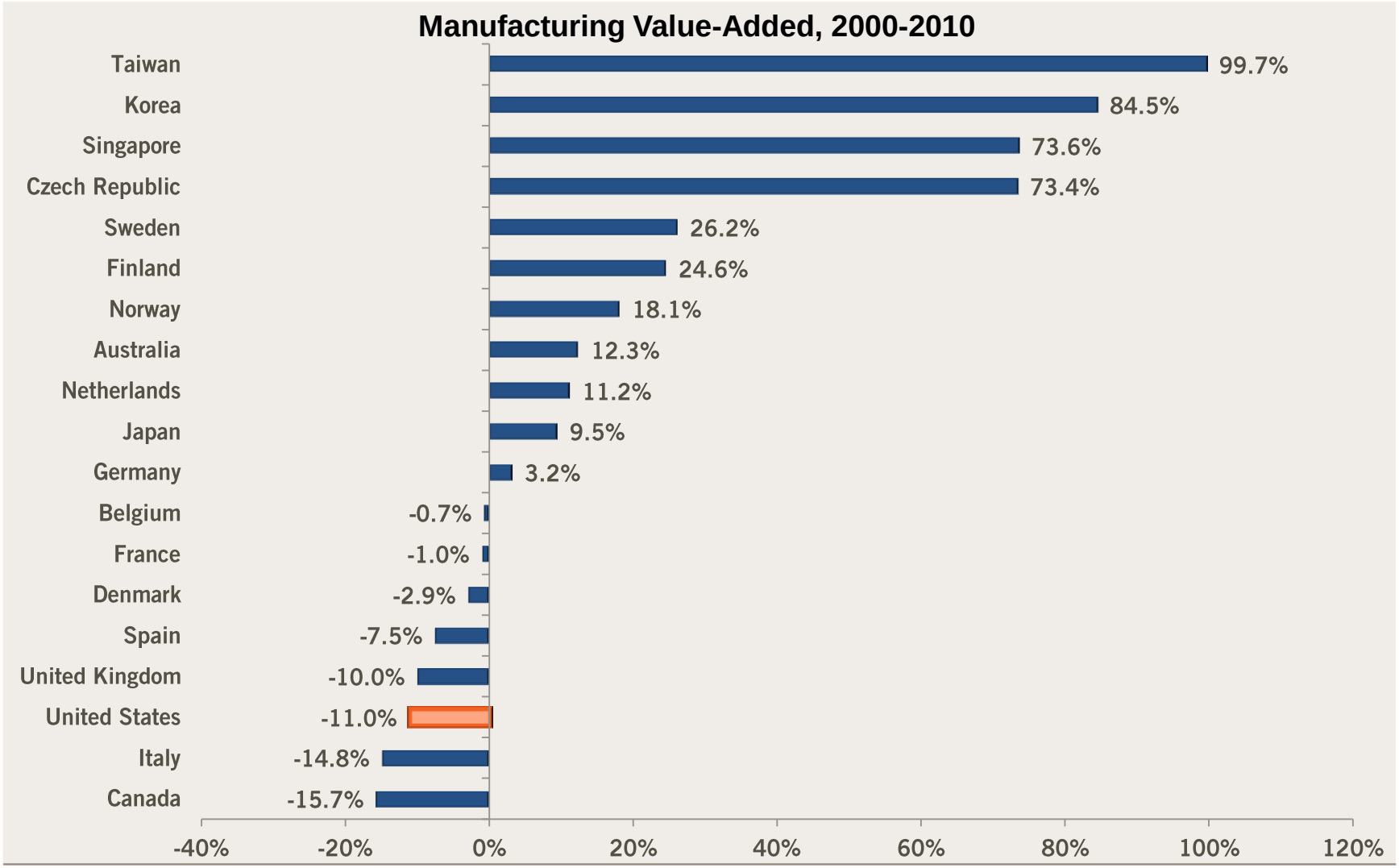
But Loss *Not* Principally Because of Productivity Gains



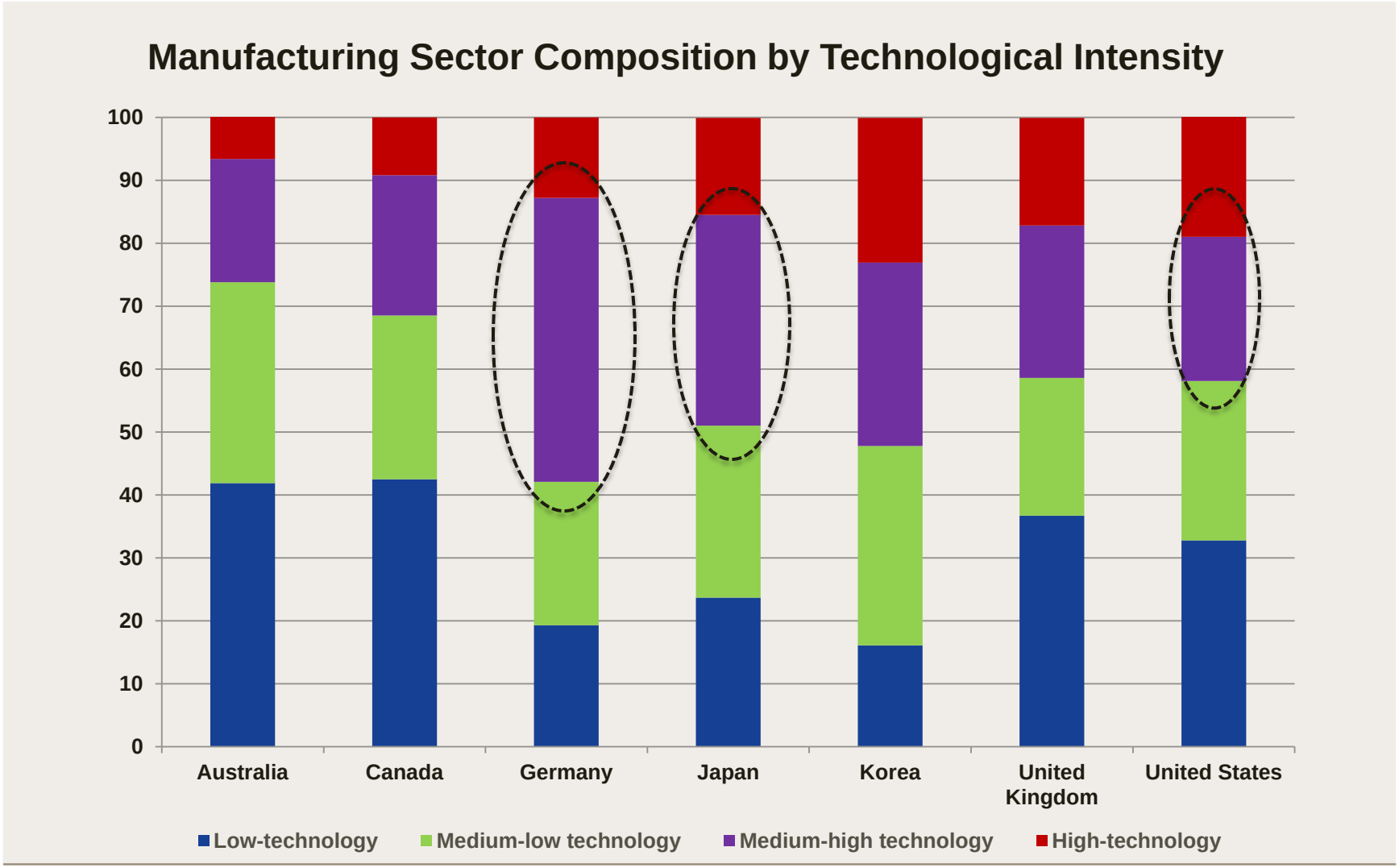
Only 4 of 19 U.S. Manufacturing Sectors Grew in the 2000s



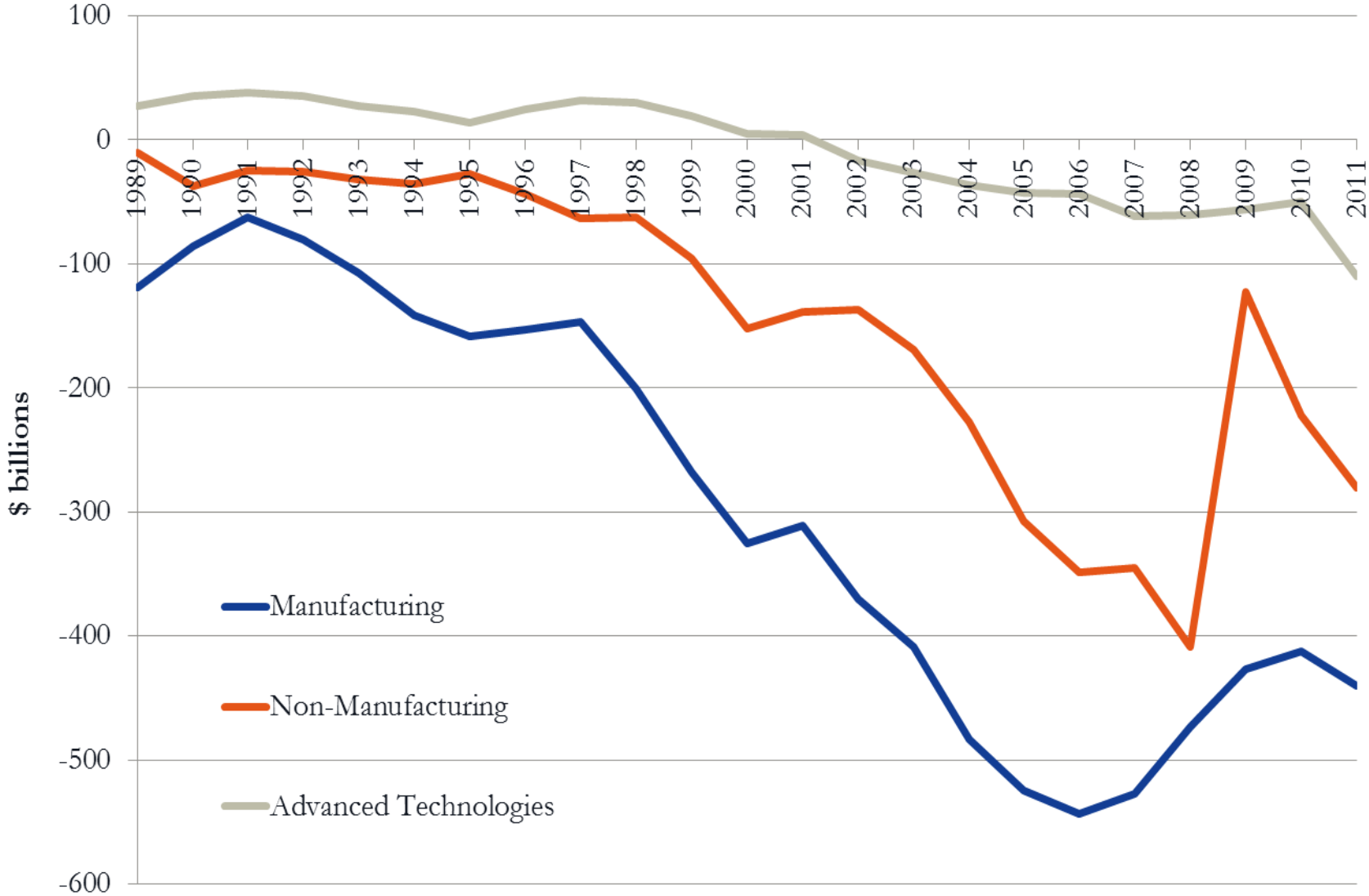
As U.S. Manufacturing Value-Added Significantly Fell



U.S. Manufacturing Lags in Technological Intensity

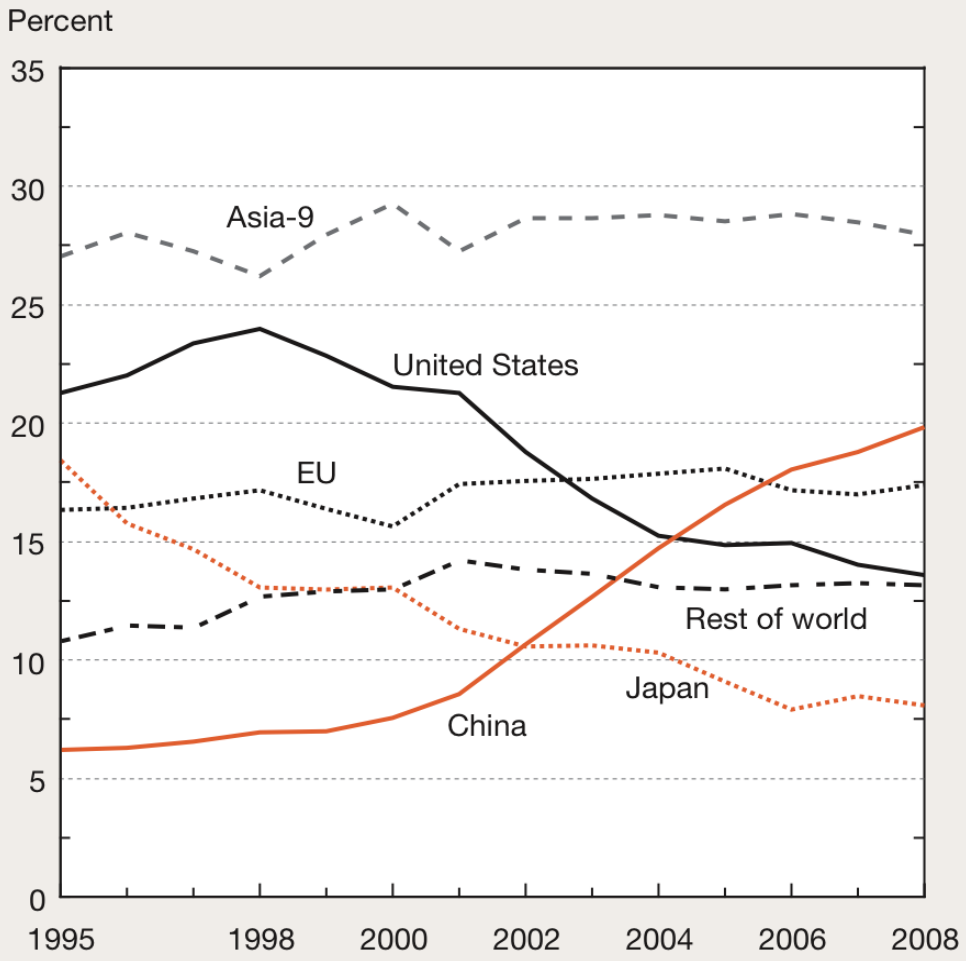


U.S. Trade Deficits Have Reached Astounding Levels



And U.S. Share of Global High-Tech Exports Fell

Share of global high-technology exports, by region/country: 1995–2008



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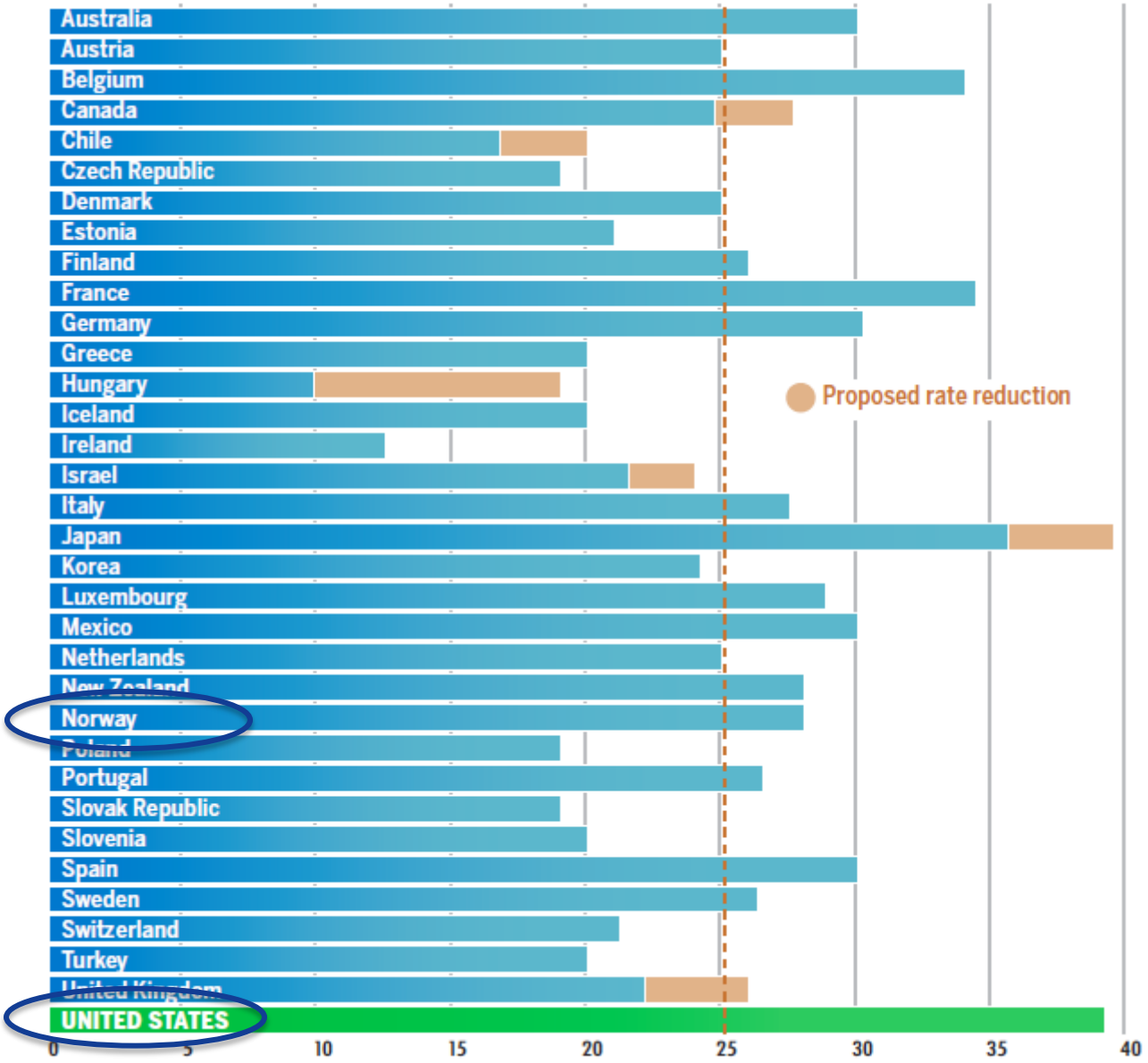
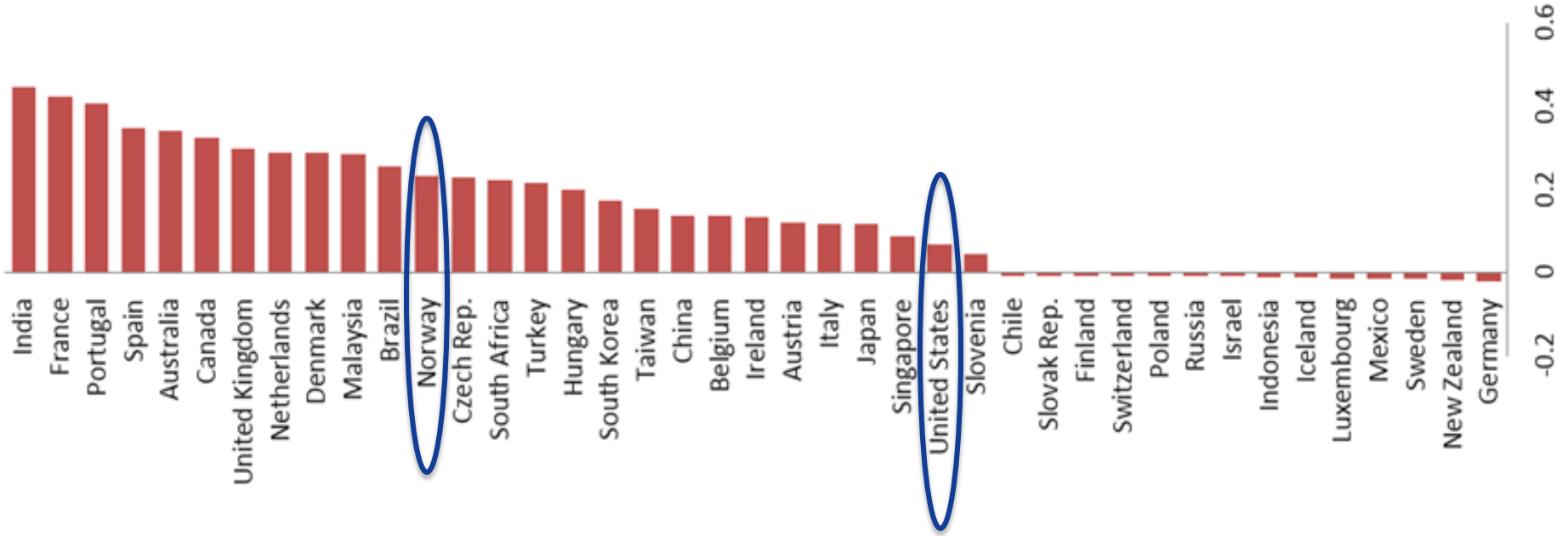
U.S. Has OECD's Highest Corporate Tax Rate

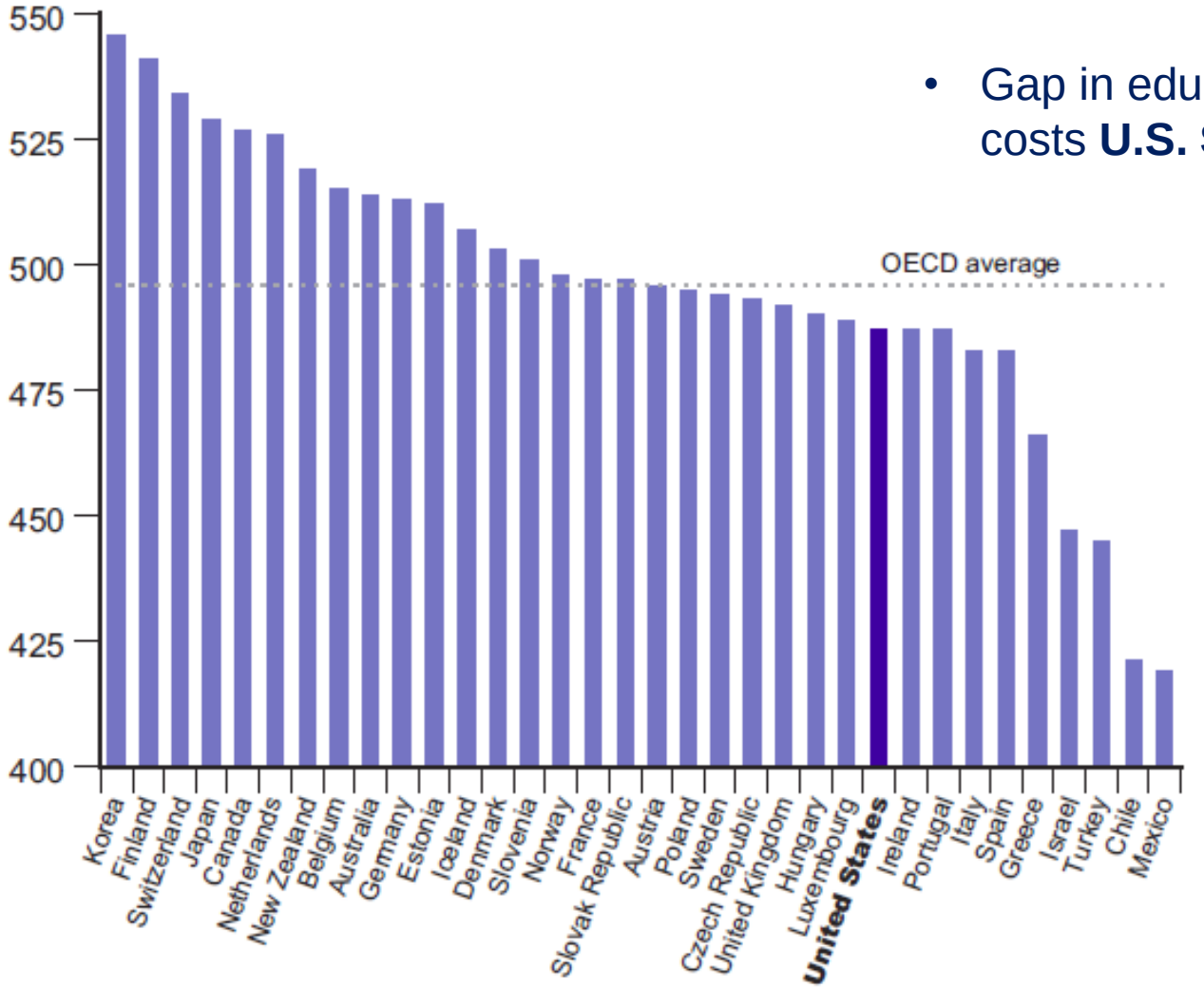


U.S. Is 26th in R&D Tax Credit Generosity



U.S. Education System Faltering

8th Grade PISA Math Scores



- U.S. 48th in quality of mathematics and science education.
- Gap in education achievement costs **U.S. $2.3 trillion** annually.

The Key Takeaway:

- Companies have moved from being price makers to price takers in global markets.

- *The U.S. has simply become a less attractive investment environment for globally mobile capital.*

So What Does America (Or Any Country) Need to Do?

1. Embrace “Innovation Economics”
2. Get the “Innovation Triangle” Right
3. Promote an Innovation-Maximizing Global Economic System
4. Recognize that an Innovator’s Job is Never Done

Embrace Innovation Economics

Paul Krugman

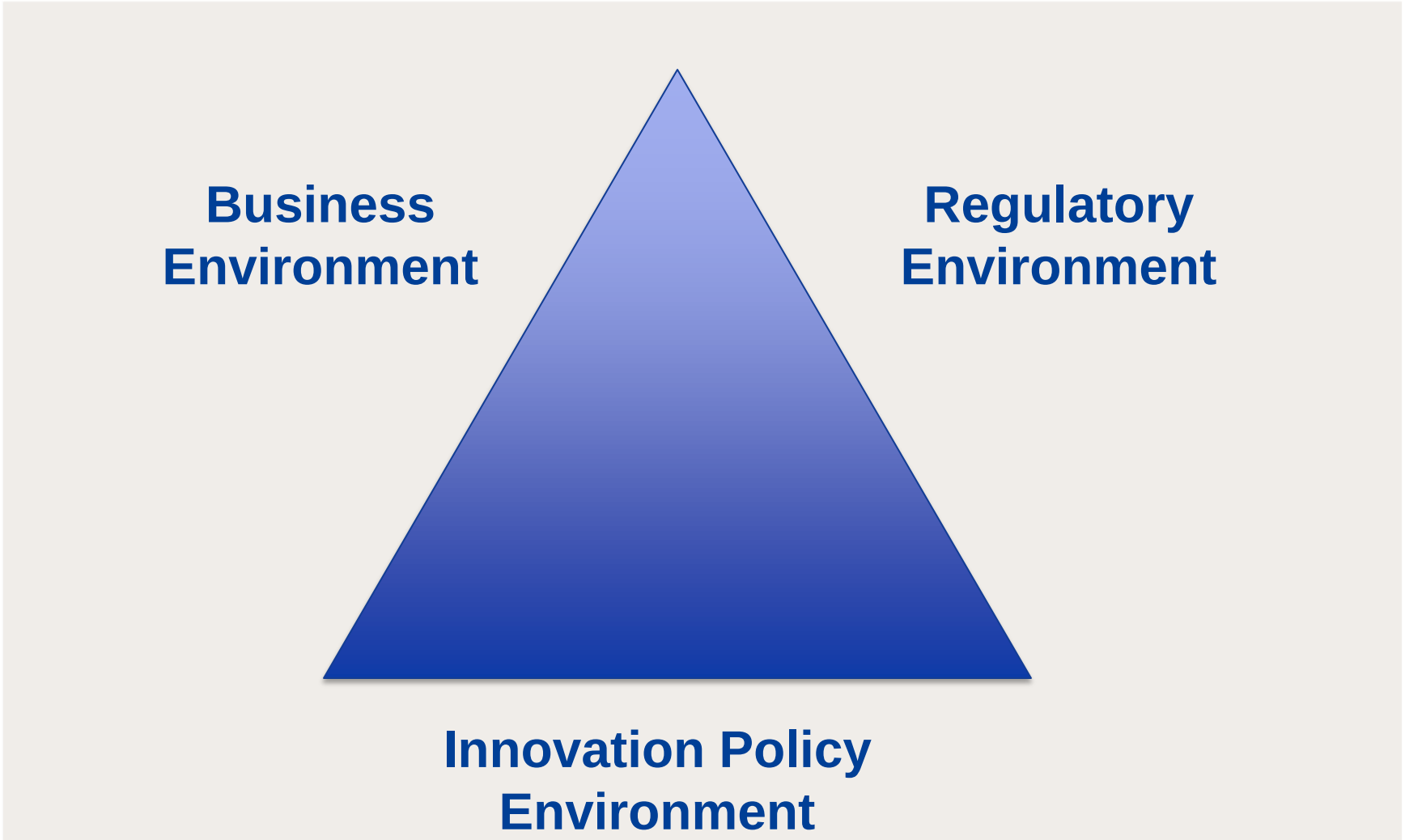
"Productivity growth is the single most important factor our economic well-being. *But it is not a policy issue, because we are not going to do anything about it."*

Joseph Schumpeter

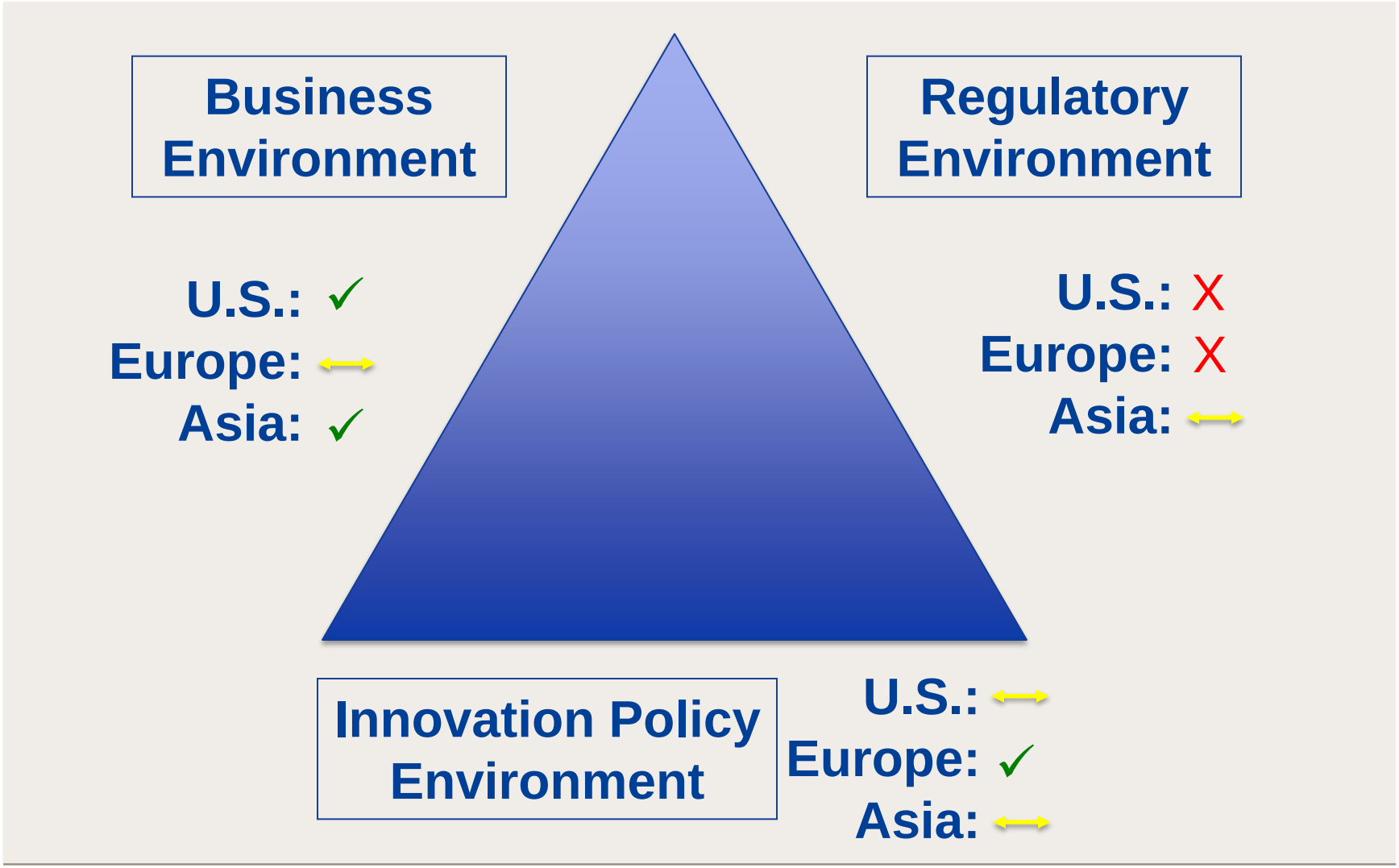
1. The central goal of economic policy should be to spur higher productivity and greater innovation.

2. Markets relying on price signals alone will not always be as effective as smart public-private partnerships in spurring higher productivity and greater innovation.

- Maximizing Innovation: Get the Innovation Triangle Right



Maximizing Innovation: Get the Innovation Triangle Right

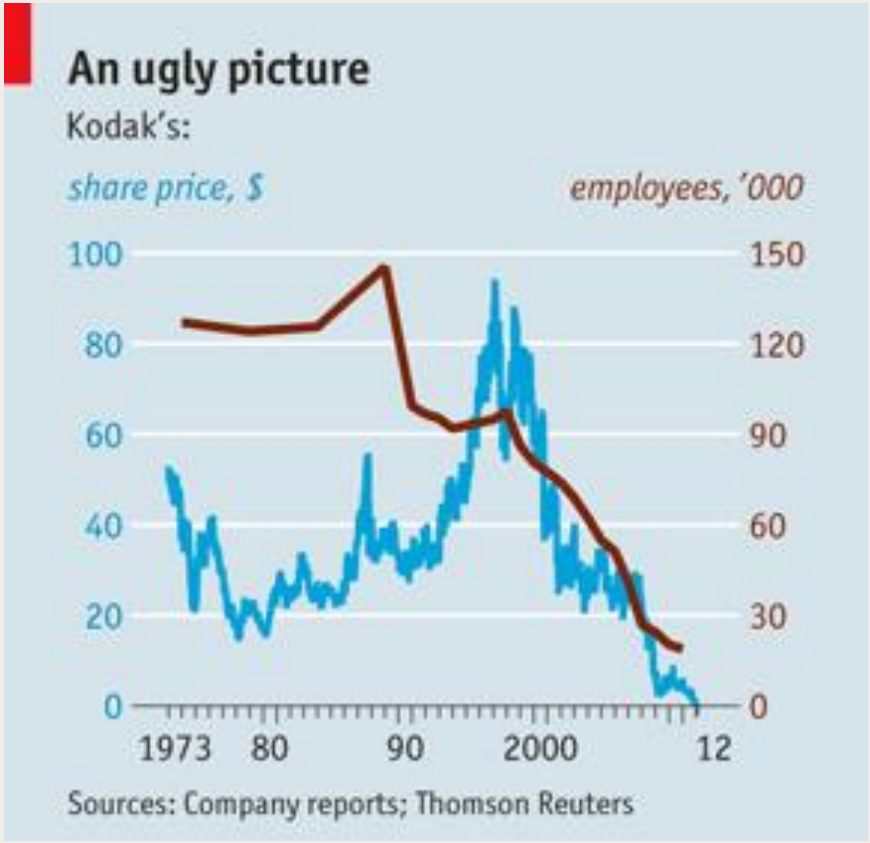


Architect an Innovation-Maximizing Global Economy

		World	
		Wins	**Loses**
Country	**Wins**	**"Good"** (e.g. R&D Support)	**"Ugly"** (e.g. IP Theft; Currency or Standards Manipulation)
	Loses	**"Self-destructive"** (e.g. Limiting High-Skill Immigration)	**"Bad"** (e.g. Import Substitution Industrialization)

Beware the Innovation Paradox

The Fall of Kodak



When you don't recognize the need to innovate until it's too late!

Kodak:
1999 Revenues: $16B
2012 = Bankrupt

Source: ***The Economist*****, "The Last Kodak Moment"**

Beware the Innovation Paradox

"Only the paranoid survive."
– Andy Grove, Intel

Weaknesses of U.S. Innovation System

1. Believe we'll always be #1 without having to do anything about it.
2. We lack a political consensus that technology and innovation drive economic growth.
3. Any kind of innovation strategy is demeaned as industrial policy.
4. We don't do a good enough job commercializing and producing our technological innovations.
5. Running out of money for R&D investment.

Strengths of U.S. Innovation System

1. Strong embrace of innovation/use of ICT by our private sector.
2. Majority of the world's best universities.
3. Fair amount of residual bench strength. (E.g. National Labs/DARPA).
4. Can still place a lot of bets across many emerging technology areas.
5. Entrepreneurs and innovators still want to come/be here.

So: Is Churchill still right?

Tusen Takk!

Stephen Ezell
sezell@itif.org

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