

September 20, 2016

Innovation Economics

Presentation to Technology Transfer Class

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Stephen Ezell

VP, Global Innovation Policy, Information Technology and Innovation Foundation (ITIF)

- Focus on science, technology, and innovation (STI) policy.
- Co-author of *Innovation Economics: The Race for Global Advantage* (Yale, September 2012).
- Co-founder of Peer Insight in 2003 to help develop the science of service innovation.
- Developed new service innovations at The NASDAQ Stock Market.
- Co-founder of Brivo Systems, a Web-based security systems provider.
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The Information Technology and Innovation Foundation is a non-partisan research and educational institute - a think tank - whose mission is to formulate and promote public policies to advance technological innovation and productivity internationally, in Washington and in the states.

Peer Insight **Peer Insight** partners with visionary leaders to inspire and architect breakthrough innovation that **matters**.



About ITIF

- Independent, nonpartisan research and education institute focusing on intersection of technological innovation and public policy, including:
 - Innovation and competitiveness
 - IT and data
 - Telecommunications
 - Trade and globalization
 - Life sciences, agricultural biotech, and energy
- Mission to formulate and promote policy solutions that accelerate innovation and boost productivity
- Ranked by University of Pennsylvania as top science and technology think tank in United States and number two in world

Publication Highlights



Today's Presentation

1

Is The Great Age of Innovation Over?

2

Neoclassical vs. Innovation Economics

3

Countries' Contributions to Innovation

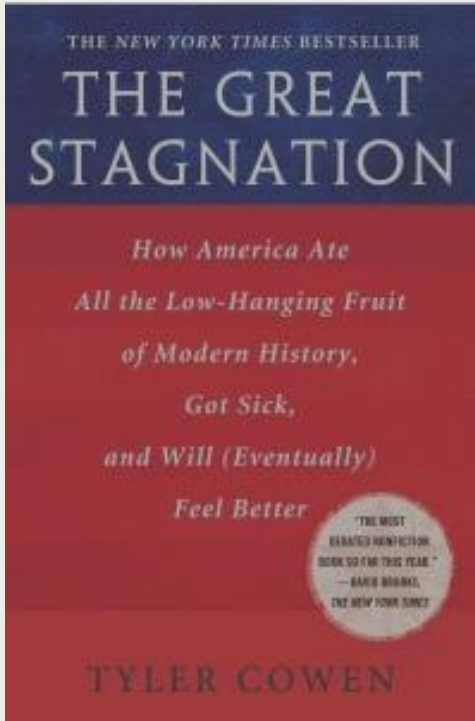
4

Life Sciences Case Study

5

Revitalizing American Innovation

■ The Great Stagnation?



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.

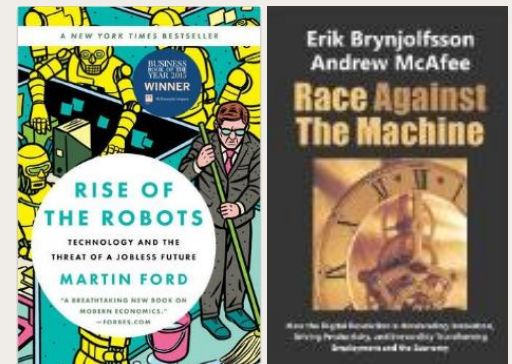
The primary cause of this growth slowdown is a set of four headwinds, all of them widely recognized and uncontroversial. Demographic shifts will reduce hours worked per capita, due not just to the retirement of the baby boom generation but also as a result of an exit from the labor force both of youth 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.



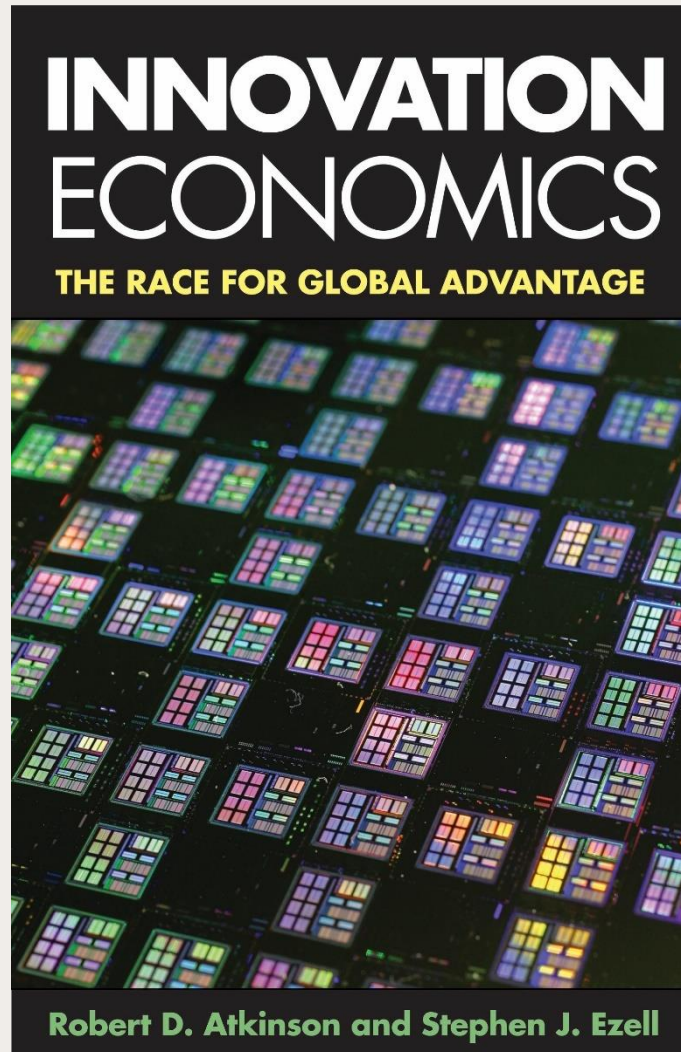


Charles H. Duell

*“Everything that can be
invented already has been.”*

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

■ Innovation Economics



Rob Atkinson



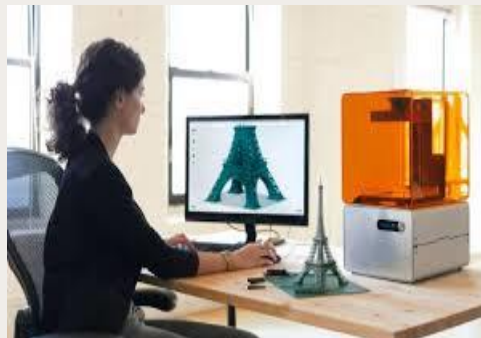
Stephen Ezell

**Yale University Press
September 2012**



■ Innovation Is Far From Over

- We're 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.
 - Gene repair; driverless cars; nuclear fusion; Internet of things; nanotechnology; clean energy innovation; etc.
- 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.”

Innovation Isn't Easy...Some Puzzles to Ponder...

Why didn't IBM keep the operating system?

Why didn't Western Union buy the telephone?

Why didn't Microsoft create the browser?

Why didn't Netscape create the search engine?

Why didn't AT&T create AOL?

Why didn't Sears create Wal-Mart?

Why didn't American Airlines create Southwest?

Why didn't Citibank create PayPal?



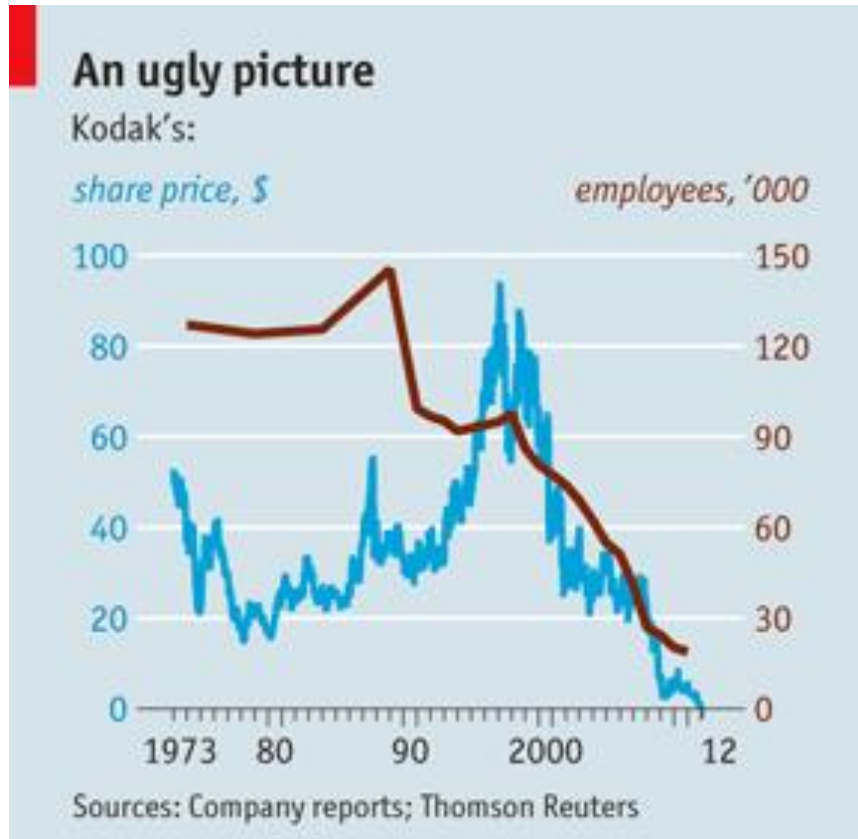
It takes effort to stand in the future and see new possibilities.

Just because you aren't willing to disrupt your own business, doesn't mean somebody isn't willing to do it for you.

Too many companies—and even countries—don't recognize the need to innovate until it's too late.

Beware the “Innovation Paradox”

The Fall of Kodak



When the recognition that you need to innovate comes too late.

**1999 Revenues: \$16B
2012 = Bankrupt**

Source: *The Economist*, “The Last Kodak Moment”

Evolution of the bookstore

1994

Courtesy, Eric Kiaer, Doblin



Evolution of the bookstore

2003

Courtesy, Eric Kiaer, Doblin



Evolution of the bookstore

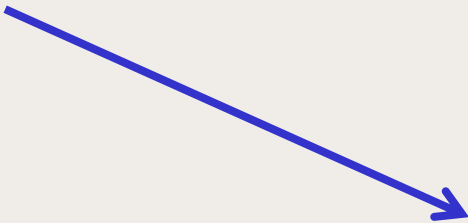
2007

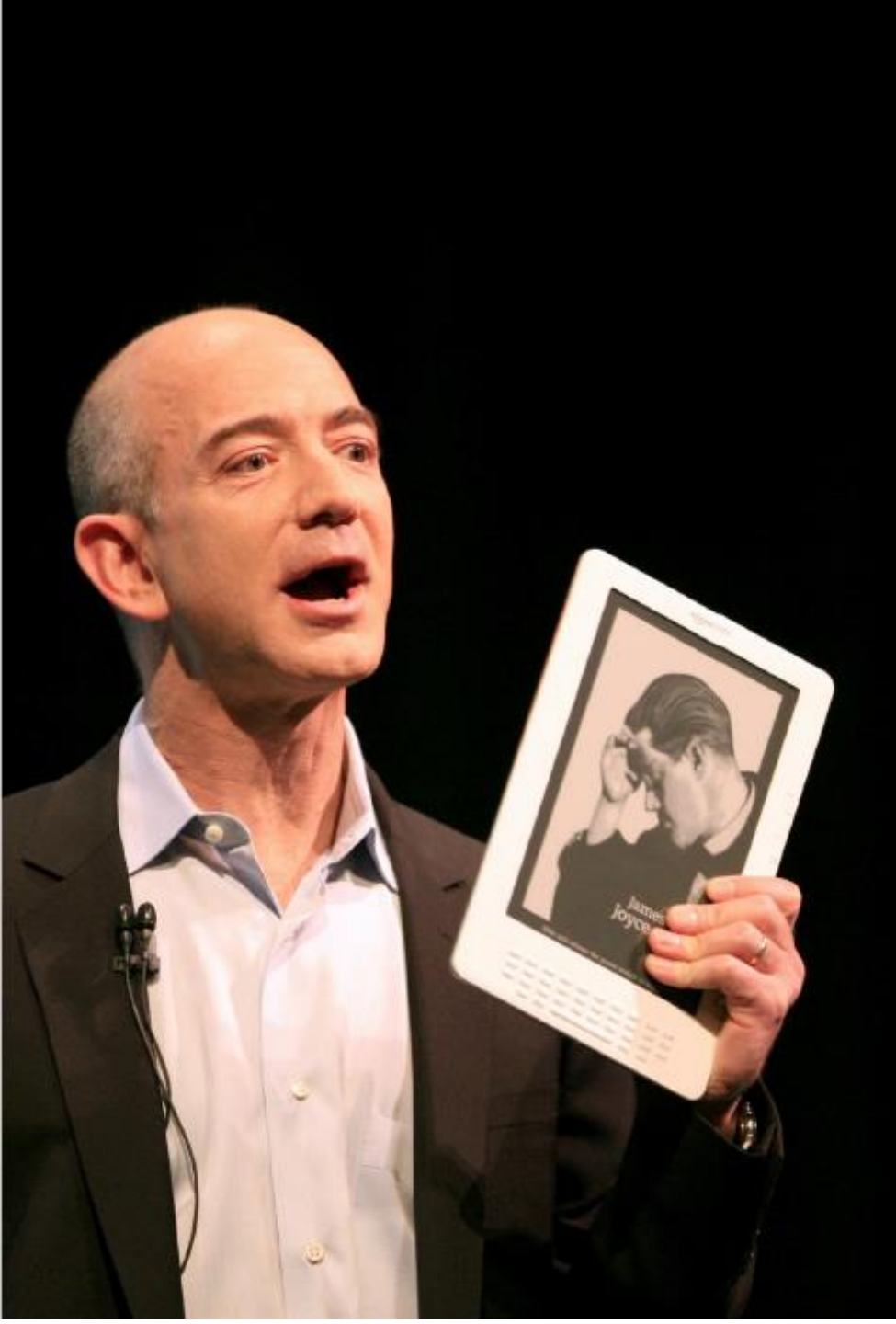
Courtesy, Eric Kiaer, Doblin



Evolution of the delivery of physical products

2016





Jeff Bezos, Founder and CEO

“Every new business we’ve ever engaged in has initially been seen as a distraction... They’ll say, ‘Why are you expanding outside of media products? Why are you entering the marketplace business with 3rd-party sellers?’

These are fair questions. But they all have at their heart one of the reasons that it’s so difficult for incumbent companies to pursue new initiatives.

It’s because even if they are wild successes, they usually have no measureable impact on the company’s economics for years.”

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■ Soul Searching for the Economics Profession

Economist.com

OPINION
LEADERS

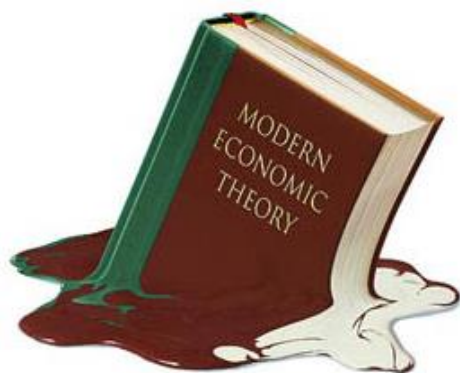
Economics

What went wrong with economics

Jul 16th 2009
From The Economist print edition

And how the discipline should change to avoid the mistakes of the past

Illustration by Jon Berkerly



The Economist, July 16, 2009

http://www.economist.com/opinion/displaystory.cfm?story_id=14031376

The New York Times

September 6, 2009

How Did Economists Get It So Wrong?

By [PAUL KRUGMAN](#)



Jason Lutes

The New York Times, September 6, 2009

<http://www.nytimes.com/2009/09/06/magazine/06Economic-t.html?scp=1&sq=What%20went%20wrong%20with%20economics?&st=cse>

■ The Indictment

1. Economists helped cause the crisis;
2. Economists failed to spot the crisis;
3. Economists have no idea how to fix it.

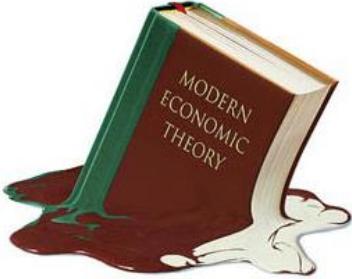
Economist.com OPINION **LEADERS**

Economics

What went wrong with economics
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Illustration by Jon Berkerly



■ What Actually is an Economy?



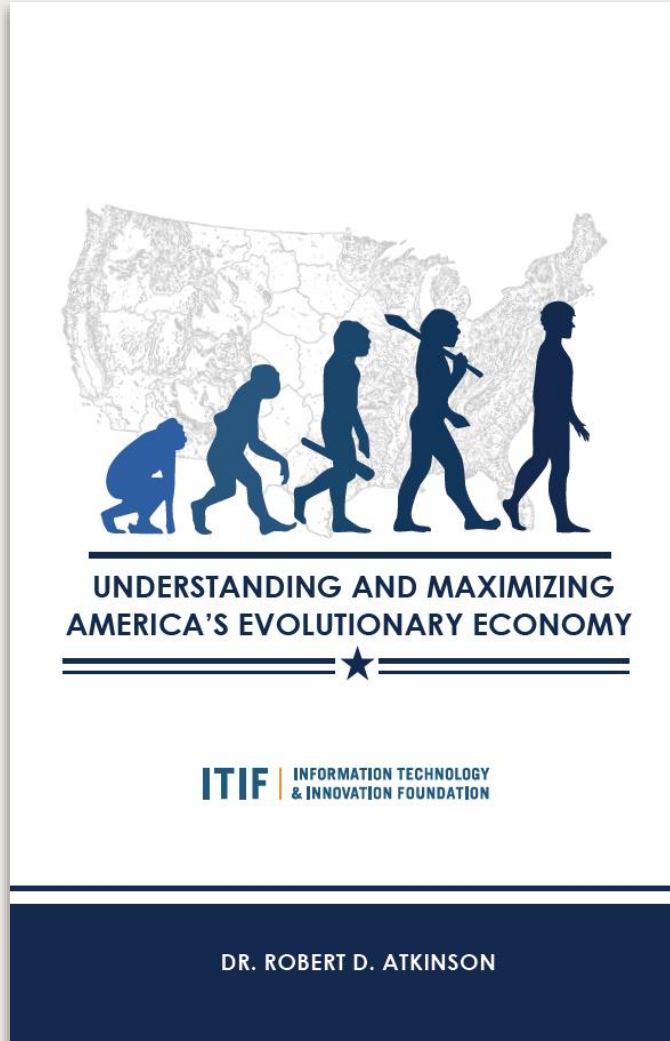
- A machine that heats up and cools down?

■ What Actually is an Economy?



- A vast agora for exchanges?

■ What Actually is an Economy?



- An Economy is an Evolutionary System

Today:

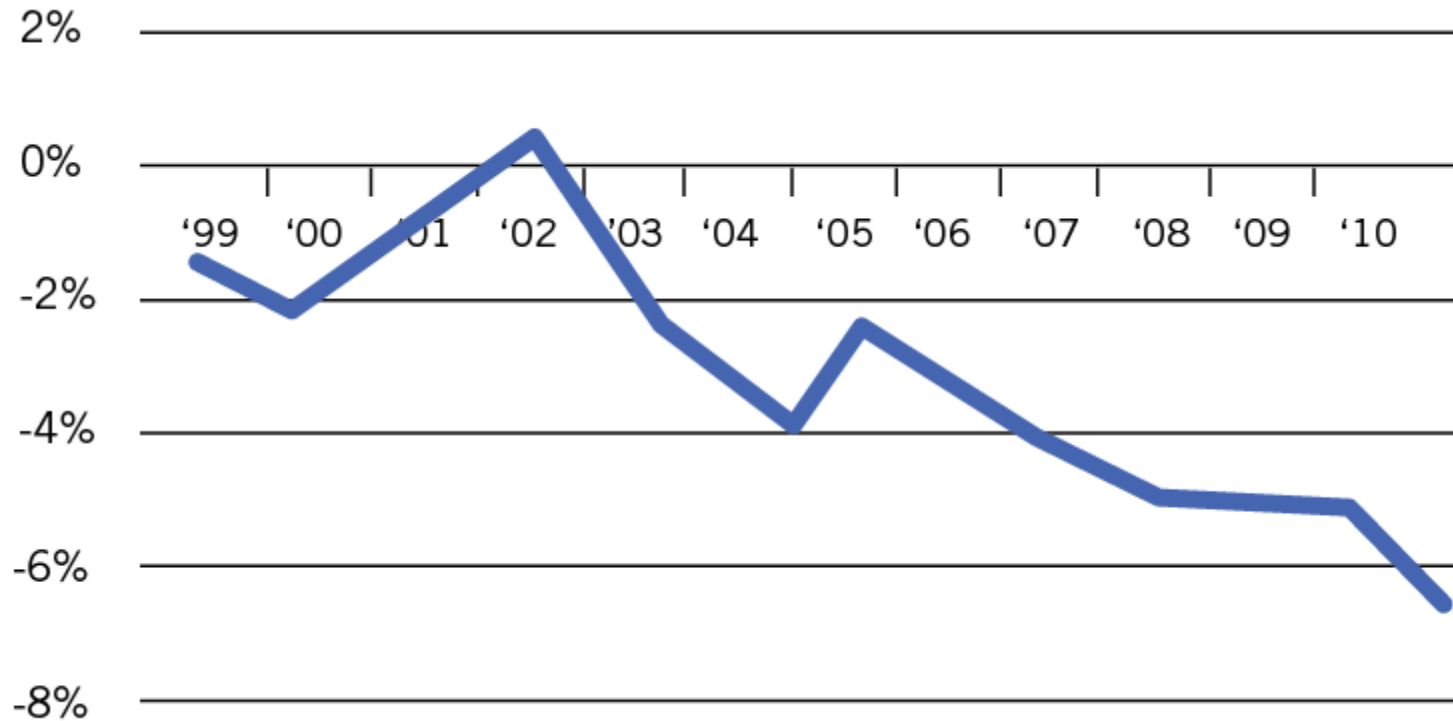
- 620 Patents Will be Issued
- 434 New Products Released
- 439 New Production Processes Adopted

■ An Economy is an Evolutionary System

Today:

- 3,800 Firms Will Die
- 4,000 Will be Born

■ Book, Periodical and Music Stores



Source: Bureau of Labor Statistics

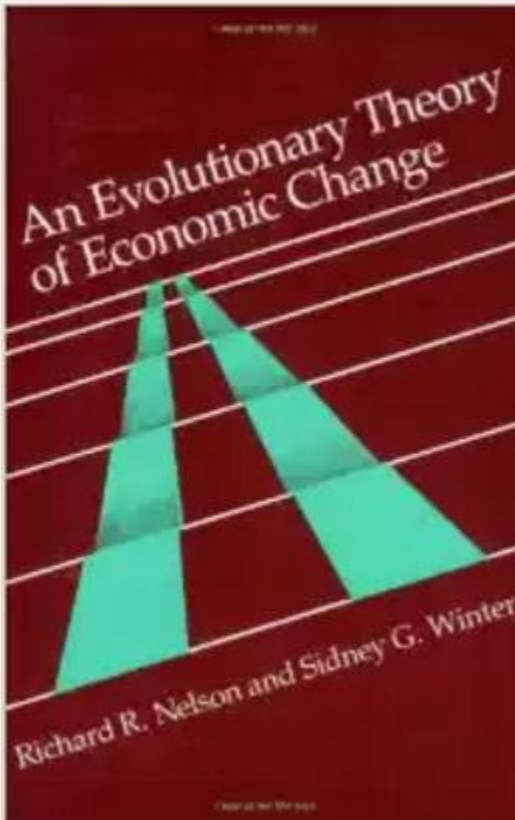
■ What is Evolutionary Economics?



“The essential point to grasp is that in dealing with capitalism we are dealing with an evolutionary process...the fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers’ goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates.”

**-Joseph Schumpeter,
*Capitalism, Socialism and
Democracy*, 82-3.**

■ What is Evolutionary Economics?



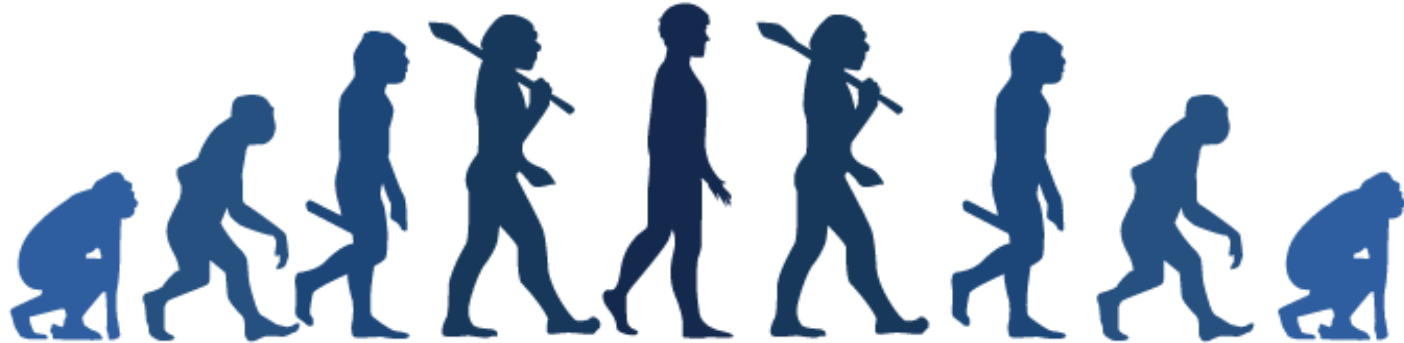
“The broader connotations of evolution include concern for processes of long-term and progressive change.”

-Richard Nelson and Sidney Winter
An Evolutionary Theory of Economic Change

■ What Drives This “Evolution”?

1. Improvements in productivity.
2. Development of new welfare-enhancing products, services, and business models.
3. Increases in global competitiveness.

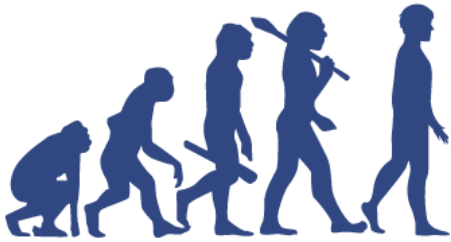
■ But Devolution Can Also Occur



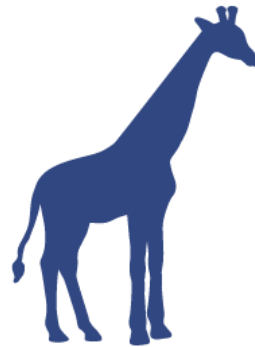
- Change that makes an economy less vibrant and adaptive.



■ Three Motive Forces for Economic Evolution



Darwinian



Lamarckism



Intelligent Design

■ Three Drivers of Economic Evolution

Geography

- Economies are entities that evolve over both time and space.
- The U.S. used to generate new industries to replace the ones it lost to low wage nations.
- Competition for leading-edge evolutionary “replacement species” is now much stiffer.

Industry	Decline
Plastics	17%
Fabricated Metals	20%
Furniture	26%
Paper	27%
Nonmetallic Minerals	30%
Primary Metals	36%
Apparel	40%

Real output loss, 2000 to 2010 for selected U.S. manufacturing industries

Source: Bureau of Economic Analysis

■ Three Drivers of Economic Evolution

Technology

- ICT, is enabling “genetic mutation” in virtually all industries...
- Prime examples are the transformations in sectors like media, news, travel services, retail, banking, taxis, hotels, and others.

Mainframe


Mini

PC

Mobile

Internet

<i>IBM</i>	<i>Digital</i>	<i>IBM</i>	<i>Apple</i>	<i>Google</i>
<i>Sperry</i>	<i>IBM</i>	<i>Apple</i>	<i>Google</i>	<i>Amazon</i>
<i>Burroughs</i>	<i>Data General</i>	<i>Intel</i>	<i>RIM</i>	<i>Facebook</i>
<i>Honeywell</i>	<i>Wang</i>	<i>Microsoft</i>	<i>Arm</i>	<i>Twitter</i>
<i>NCR</i>	<i>Prime</i>	<i>Dell</i>	<i>Samsung</i>	<i>eBay</i>
<i>CDC</i>	<i>HP</i>	<i>HP</i>	<i>HTC</i>	<i>Wikipedia</i>
<i>ICL</i>	<i>Sun</i>	<i>Compaq</i>	<i>Motorola</i>	<i>Netflix</i>
<i>Amdahl</i>	<i>Tandem</i>	<i>Seagate</i>	<i>Nokia</i>	<i>Pandora</i>
<i>Siemens</i>	<i>Oracle</i>	<i>Sony</i>	<i>Ericsson</i>	<i>Kickstarter</i>
<i>Fujitsu</i>	<i>Honeywell</i>	<i>Toshiba</i>	<i>Huawei</i>	<i>Lending Club</i>
<i>Hitachi</i>	<i>Olivetti</i>	<i>Amstrad</i>	<i>Sony</i>	<i>Airbnb</i>
<i>Cray</i>	<i>NEC</i>	<i>Lenovo</i>	<i>LG</i>	<i>Uber</i>

 HQ in Silicon Valley

Technology Disruptions

- Cloud, SaaS
- Mobility/Apps
- Social Media
- New Interfaces
- Big Data
- IoT, Wearables
- Open Source/DevOps



Industry Disruptions

- Mfg – 3DP, Robots, Food
- Health Care – Retailization
- Transport – Cars, Avionics
- Retail – Same Day Delivery
- Banks – Kickstarter, Bitcoin
- Education – MOOCs
- Insurance?

Dis-intermediation, Peer-to-Peer, Aggregation, Commoditization, Standardization, Re-invention ...

■ Three Drivers of Economic Evolution

Changes in Demand

- Changes in the types of goods and services demanded by consumers (whether these are businesses, governments or individuals) drive evolution.
- Various factors can alter the composition of demand, including demographics, culture, and government.



■ Three Drivers of Economic Evolution: Demand

Industry	NAICS Code	Real Gross Output Change 1998-2012
Growth Due to Societal Changes		
Military armored vehicle, tank, and tank component manufacturing	336992	294.9%
Tortilla manufacturing	311830	103.4%*
Wineries	312130	102.7%
Medical and diagnostic labs and outpatient and other ambulatory care services	6214-5, 6219	78.4%
Securities, commodity contracts, investments, and related activities	523A00	69.4%
Fitness and recreational sports centers	713940	62.8%*
Offices of physicians, dentists, and other health practitioners	6211-3	53.3%
Home health care services	621600	43.3%

Industry	NAICS Code	Real Gross Output Change 1998-2012
Decline Due to Societal Change		
Newspaper publishers	511110	-46.7%

Changes in real industrial output by industry and cause.

* 1998-2011 data

Source: Bureau of Economic Analysis

■ Implications of Evolutionary Economics

- Resistance to evolution is neither effective nor welfare enhancing.
- Support global integration of innovation-based industries.
- We need to move beyond the neoclassical and neo-Keynesian playbooks....
- *We need a new approach: **Innovation Economics.***

“Practical men, who believe themselves to be quite exempt from any intellectual influences whatsoever, are usually the slaves of some defunct economist.”

- John Maynard Keynes

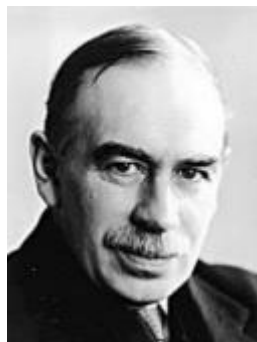
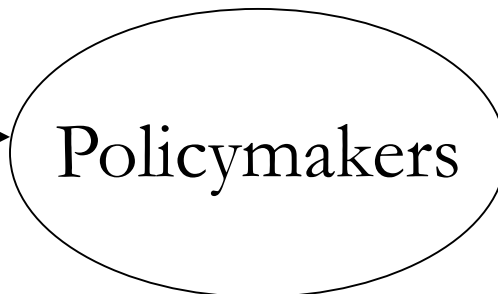
Three Dominant Economic Policy Doctrines



**Liberal
Neoclassicalists**
“Rubinomics”



**Conservative
Neoclassicalists**
“Supply-Side”
Economics



Neo-Keynesian Economics

Dominant Economic Policy Doctrines - Neoclassicalists



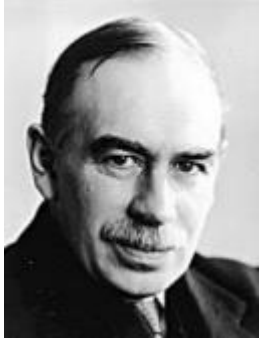
Liberal
Neoclassicalists
“Rubinomics”

- The accumulation of capital drives economic growth.
- Public policy should focus on ensuring high levels of savings, because savings create the capital pools that support investment...which in turn drives economic growth.
- ***But they diverge in the ways they seek to spur capital formation:***
 - **Supply-siders:** Advocate spurring capital formulation in the private sector by cutting taxes on income and wealth.
 - **Liberal neoclassicalists:** Spur capital formulation by having the federal government run budget surpluses, (or reduce deficits) and/or by helping low-income citizens save.



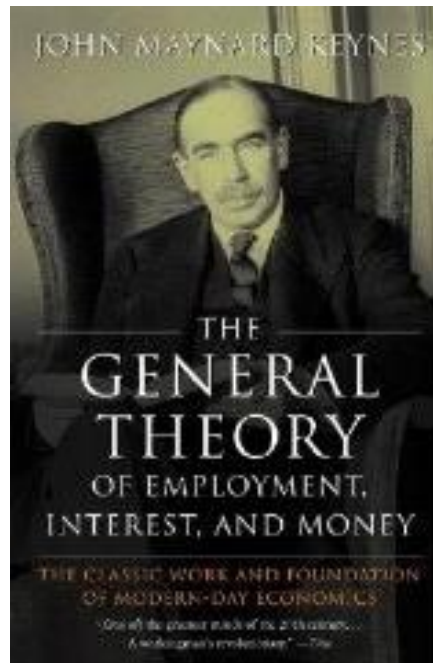
Conservative
Neoclassicalists
“Supply-Side”
Economics

Dominant Economic Policy Doctrines – Neo-Keynesians



- The federal government should ensure aggregate economic demand by increasing government spending.
- Ensure that the fruits of economic growth are fairly distributed.
- Manage the business cycle in the short term.

Neo-Keynesian Economics



Principles Guiding the Neoclassical Economics Doctrine

- 1. The accumulation of capital drives economic growth;**
- 2. Economic growth is achieved by maximizing allocative efficiency;**
- 3. The focus is on markets and prices;**
- 4. The economy tends to equilibrium;**
- 5. Individuals and firms are rational maximizers and respond to incentives.**

Principles Guiding the Neoclassical Economics Doctrine

1. The accumulation of capital drives economic growth.

- Need high levels of savings to create the capital pools that drive investment, which in turn drives economic growth.
- Technology is outside the model ... “Falls Like Manna from Heaven”

Principles Guiding the Neoclassical Economics Doctrine

1. The accumulation of capital drives economic growth.
2. **Economic growth is achieved by maximizing allocative efficiency.**
 - *Allocative efficiency:* The market condition whereby resources are allocated in a way that maximizes the net benefit attained through their use and the quantity produced is the most beneficial to society.
 - A cardinal sin to alter the “natural allocation” of factors (labor/capital/G&S); any policy that does causes ***deadweight loss***.
 - ***Holds that proactive policies to spur firms’ productivity or innovation are inappropriate because they distort the market.***

Principles Guiding the Neoclassical Economics Doctrine

1. The accumulation of capital drives economic growth.
2. Economic growth is achieved by maximizing allocative efficiency.
- 3. The focus is on markets and prices.**
 - All markets operate by the same principles globally.
 - Focus on interest rates, money supply, currency valuation, and inflation.



Larry Summers: *“Economics is a set of laws that applies in all times and all places.”*

Principles Guiding the Neoclassical Economics Doctrine

1. The accumulation of capital drives economic growth.
2. Economic growth is achieved by maximizing allocative efficiency.
3. The focus is on markets and prices.
- 4. Economies tend to equilibrium.**
 - Thus, the main task of economic policy is to reduce artificial barriers or impediments to market equilibrium (be sure prices are aligned with costs.)

Principles Guiding the Neoclassical Economics Doctrine

1. The accumulation of capital drives economic growth.
2. Economic growth is achieved by maximizing allocative efficiency.
3. The focus is on markets and prices.
4. Economies tend to equilibrium.
- 5. Individuals and firms are rational maximizers and respond to incentives.**
 - Adam Smith's Invisible Hand
 - Supply-siders: "One of the biggest incentives is taxes, so the recipe for boosting productivity is to cut tax rates for individuals."

Where Neoclassical Economics Is a Flawed Policy Guide

- 1. Innovation is actually a much larger driver of growth than capital;**
- 2. Productive and adaptive efficiency far more important than allocative efficiency;**
- 3. The economy increasingly doesn't tend to one equilibrium;**
- 4. Individuals and firms are not necessarily rational actors.**
- 5. What a country produces matters.**
- 6. Asserts that countries don't compete, only companies do.**
- 7. Effective public policies can make a difference in spurring innovation.**

Where Neoclassical Economics Is a Flawed Policy Guide

1. Innovation is a much larger driver of growth than capital;

- Focus on capital may have made sense in a factory-based economy and before global financial markets, but not now...
- If anything, we've had *too much capital* chasing *too few* good investment opportunities.
 - U.S. has confused capitalized consumption with future investment.
 - 2000-2005 Corporate investment increased by \$119B; 10%
 - 2000-2005 Housing investment increased by \$350B; 164%

Where Neoclassical Economics Is a Flawed Policy Guide

1. Innovation is a much larger driver of growth than capital;
2. **Productive and adaptive efficiency more important than allocative efficiency;**
 - *Productive efficiency*: The ability of organizations to produce in new ways that lead to the most amount of outputs with the fewest inputs (whether labor/capital.)
 - *Adaptive efficiency*: The ability of economies and institutions to change over time to respond to successive new situations, in part by developing and adopting technological innovations.



Where Neoclassical Economics Is a Flawed Policy Guide

1. Innovation is a much larger driver of growth than capital;
2. Productive and adaptive efficiency more important than allocative efficiency;
- 3. Economies increasingly don't tend to one equilibrium;**
 - Elvio Accinelli: Potential of multiple equilibrium...high-end innovation society, or trapped in a low-skill, low-wage economy.
 - Government policy can move an economy to a higher output equilibrium and spur growth.
 - ***Economies are in a constant state of disruption; rapid technological change means equilibrium is almost never achieved.***

Where Neoclassical Economics Is a Flawed Policy Guide

1. Innovation is a much larger driver of growth than capital;
2. Productive and adaptive efficiency more important than allocative efficiency;
3. Economies increasingly don't tend to one equilibrium;
- 4. Individuals and firms are not necessarily rational actors!**
 - Behavioral economics and complexity theory.
 - Peoples judgments/decisions are affected by a “host of problems”:
 - Framing biases;
 - Difficulties judging risk;
 - Excessive loss aversion;
 - Superstitious reasoning.

Individuals and Firms Aren't Necessarily Rational Actors!

The Harvard MBA dilemma:

- A. Earn \$150k per annum – your classmates earn \$175k
[OR]
- B. Earn \$125k per annum – your classmates earn \$100k

80% of Harvard MBAs in a recent study elected to earn less in absolute terms, so long as they earned comparatively more than their classmates...they cared more about outperforming their peers.

Their reference point was *social*, not *individual*.

Individuals and Firms Aren't Necessarily Rational Actors!

The ultimatum dilemma

- You get a windfall of \$100 (in front of another player)
- You must offer part of it to the other player
- If other player accepts offer, you both keep the \$
- If other player rejects offer, you both lose the \$
- How much will you offer?

The ultimatum game has been played across generations and countries worldwide. Amazingly – across almost every culture – the average amount to be offered to the other player is about \$40.

The only statistical group significantly outlying the average?

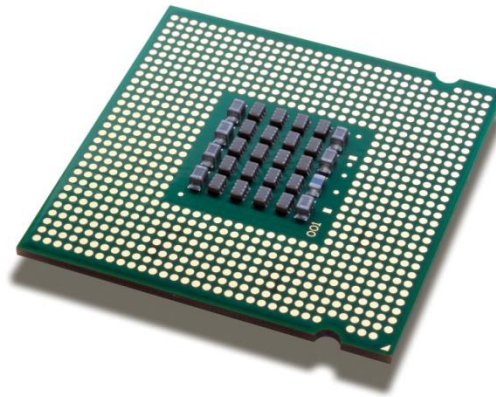
Economists. They are the only social group to consistently offer less than 10%, the breakpoint at which the offer is usually rejected by the second player.

Where Neoclassical Economics Is a Flawed Policy Guide

1. Innovation is a much larger driver of growth than capital;
2. Productive and adaptive efficiency more important than allocative efficiency;
3. Economies increasingly don't tend to one equilibrium;
4. Individuals and firms are not necessarily rational actors
- 5. What a country produces matters.**



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Where Neoclassical Economics Is a Flawed Policy Guide

Even Today: *Manufacturing Doesn't Matter*



Where Neoclassical Economics Is a Flawed Policy Guide

- **Why Some Industries Matter More than Others**

1. Some industries experience very rapid growth, spur the development of entirely new industries, and drive productivity increases in other industries.
2. Require a higher skill level and thus pays more.
3. If you lose the computer chip industry to foreign competition, that value similarly disappears...can't assume new domestic industries will replace old ones.
 - Vacuum tubes → semiconductors
 - Inversion of offshoring process

Where Neoclassical Economics Is a Flawed Policy Guide

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2. Productive and adaptive efficiency more important than allocative efficiency;
3. Economies increasingly don't tend to one equilibrium;
4. Individuals and firms are not necessarily rational actors
5. What a country produces matters.
- 6. Countries do compete.**



- Paul Krugman: **“The notion that nations compete is incorrect... countries are not to any important degree in competition with one another.”**

Where Neoclassical Economics Is a Flawed Policy Guide

1. Innovation is a much larger driver of growth than capital;
2. Productive and adaptive efficiency more important than allocative efficiency;
3. Economies increasingly don't tend to one equilibrium;
4. Individuals and firms are not necessarily rational actors
5. What a country produces matters.
6. Countries do compete.
- 7. Effective innovation policies can make a difference.**



Alan Blinder: **“Nothing—repeat, nothing—that economists know about growth gives us a recipe for adding a percentage point or more to the nation’s growth on a sustained basis.”**

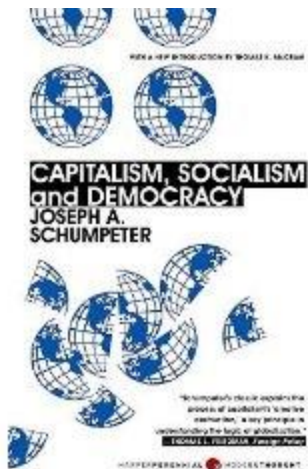


Paul Krugman: “Productivity growth is the single most important factor our economic well-being. ***But it is not a policy issue, because we are not going to do anything about it.***”

The New Kid on the Block - Innovation Economics



- A new theory and narrative of economic growth.
- Reformulates the traditional model by placing knowledge, technology, entrepreneurship, and innovation at the center.
- Holds two fundamental tenets:
 1. The central goal of economic policy should be to spur higher productivity and greater innovation.
 2. The most important job for economic policy as creating an institutional environment that supports technological change, within an environment of competitive markets.



Principles Guiding the Innovation Economics Doctrine

1. Innovation drives economic growth.

- Up to 90 percent of per-capita income growth stems from innovation.
- Use of capital 5x more important than the amount of capital.

2. The major drivers of growth are productive and adaptive efficiency.

- Views economics not as how “societies allocate scarce resources” but as how societies create new forms of production, products, and business models.”

3. Creative Destruction: The new knowledge-based economy tends towards change; not equilibrium.

- *In fact, market disequilibrium is responsible **not for economic inefficiency**, but for growth and progress.*

Principles Guiding the Innovation Economics Doctrine

- 4. Spurring evolving and learning institutions are the keys to growth.**
 - Recognizes innovation and productivity take place within the context of institutions; are the consequence of actions by economic actors.

- 5. Smart public-private partnerships are the best way to implement policy.**
 - “The true choice in innovation is not between government and no government, but about the right type of government involvement in support of innovation.”

Today's Presentation

1

Is The Great Age of Innovation Over?

2

Neoclassical vs. Innovation Economics

3

Countries' Contributions to Innovation

4

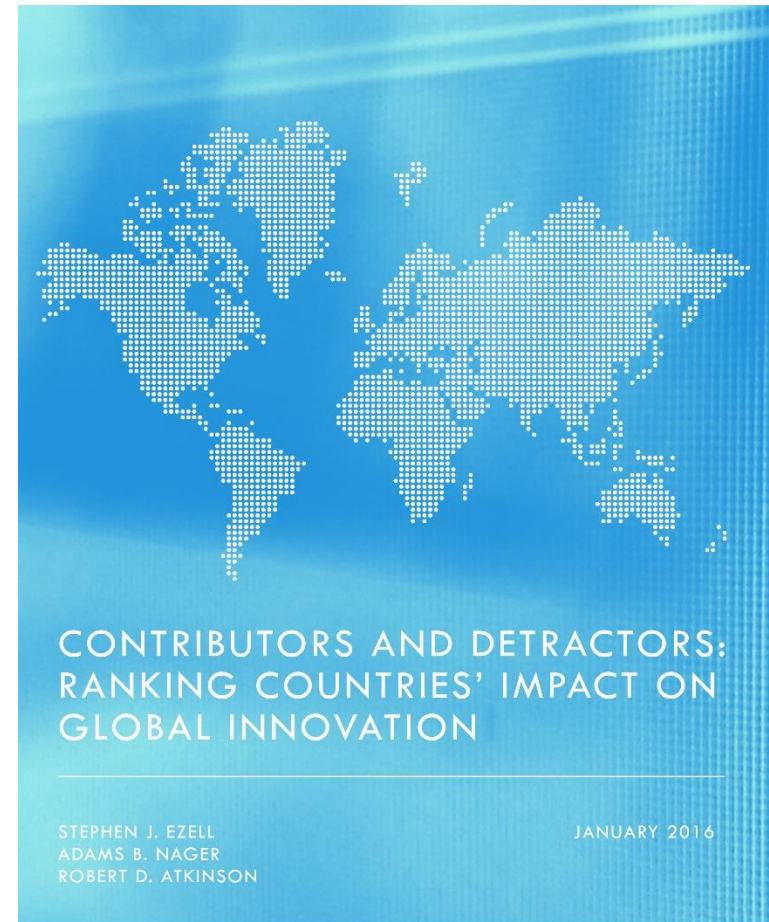
Life Sciences Case Study

5

Revitalizing American Innovation

The Report

- Assesses 56 countries on 27 indicators, grouped into “Contributions” and “Detractions.”
- Measures the extent to which, on a per-capita basis, countries’ economic and trade policies contribute to, and detract from, global innovation.



ITIF | INFORMATION TECHNOLOGY
& INNOVATION FOUNDATION

Why Write this Report?

1. The world is not producing as much innovation as is possible—or as is needed.
2. Innovation policy is still largely conceived in terms of how it impacts national economic growth.
3. Studies have ranked countries on innovation capabilities and outcomes, but none on how countries' policies impact global innovation.
4. Policies have significant positive and negative geographic spillovers.

National Policies Impact Global Innovation



Results: Country Ranks

Top 5

Overall

1. Finland
2. Sweden
3. United Kingdom
4. Singapore
5. The Netherlands
- 10. United States**

Contributions

1. Singapore
2. Korea
3. Finland
4. Sweden
5. United Kingdom
- 17. United States**

Detractions

1. Finland
 2. The Netherlands
 3. Belgium
 4. Ireland
 5. Sweden
 - 6. United States**
-

Bottom 5

Overall

52. Ukraine
53. Thailand
54. India
55. Indonesia
56. Argentina

Contributions

52. Colombia
53. Argentina
54. Indonesia
55. Mexico
56. Costa Rica

Detractions

52. Russia
 53. Argentina
 54. India
 55. China
 56. Thailand
-

Relative Country Positions and Typologies



Typologies

- Schumpeterian
- Adam Smithian
- Advanced Asian Tiger
- Innovation Mercantilist
- EU Continentalist
- EU Up and Comer
- Innovation Follower
- Traditional Mercantilist

What U.S. Would Have to Do to Be #1



Five changes could make the U.S. the top performer for both contributions and overall:

1. Reduce its effective corporate tax rate from 27.7% to 18.2%;
2. Increase its R&D tax credit from 14% to 24%;
3. Implement an innovation box;
4. Increase government funding of university R&D by \$68 billion per year; and
5. Increase number of tertiary graduates in STEM fields by 20%.

■ 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 haven't done 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 IT by our private sector.
2. Best university system in the world.
3. Can place a lot of bets across a range of emerging technology areas.
4. Fair amount of residual bench strength. (E.g. National Labs/DARPA).
5. Entrepreneurs and innovators still want to come here.
6. Is Churchill still right?



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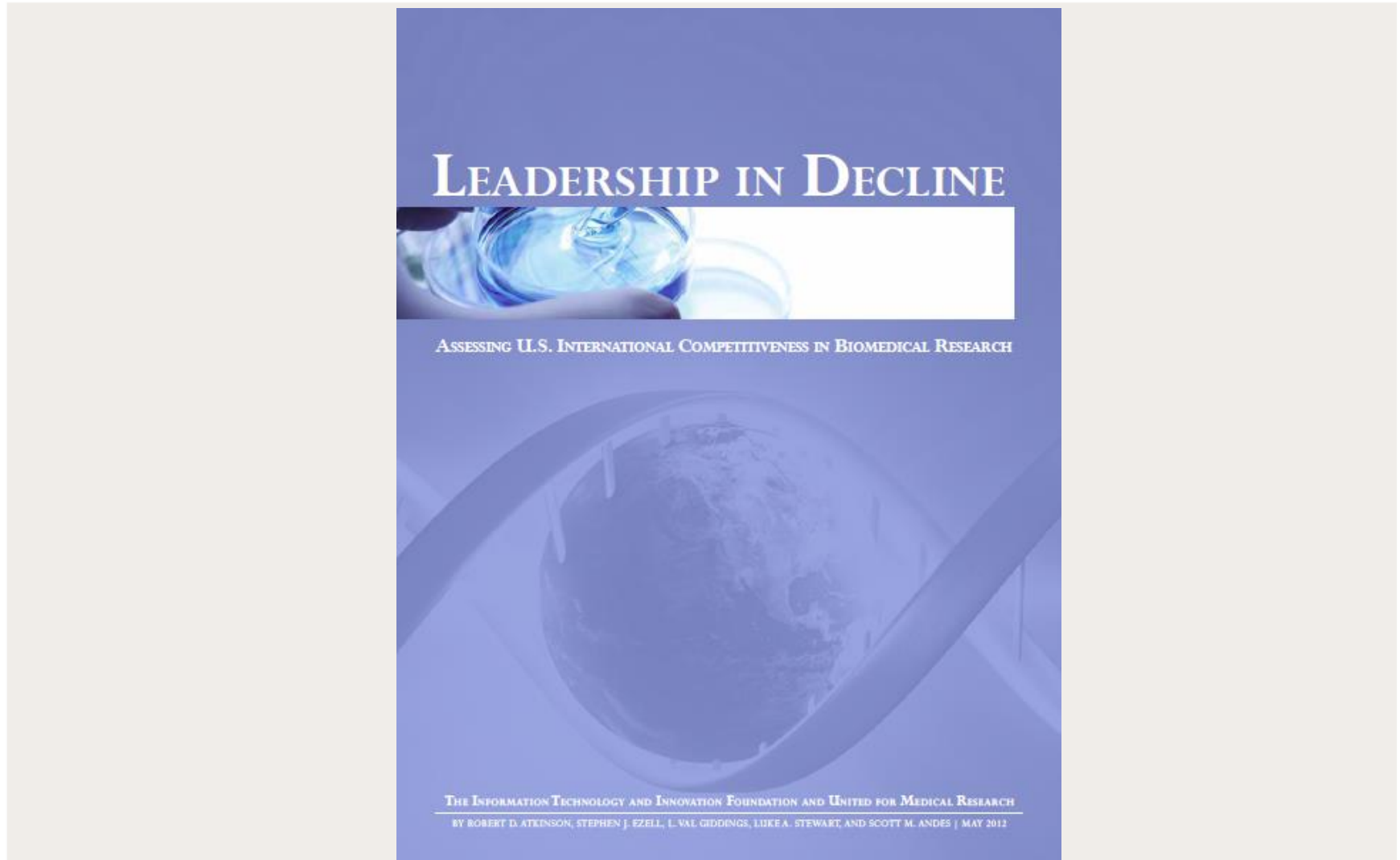
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Revitalizing American Innovation

■ Assessing U.S. Competitiveness in Biomedical Research

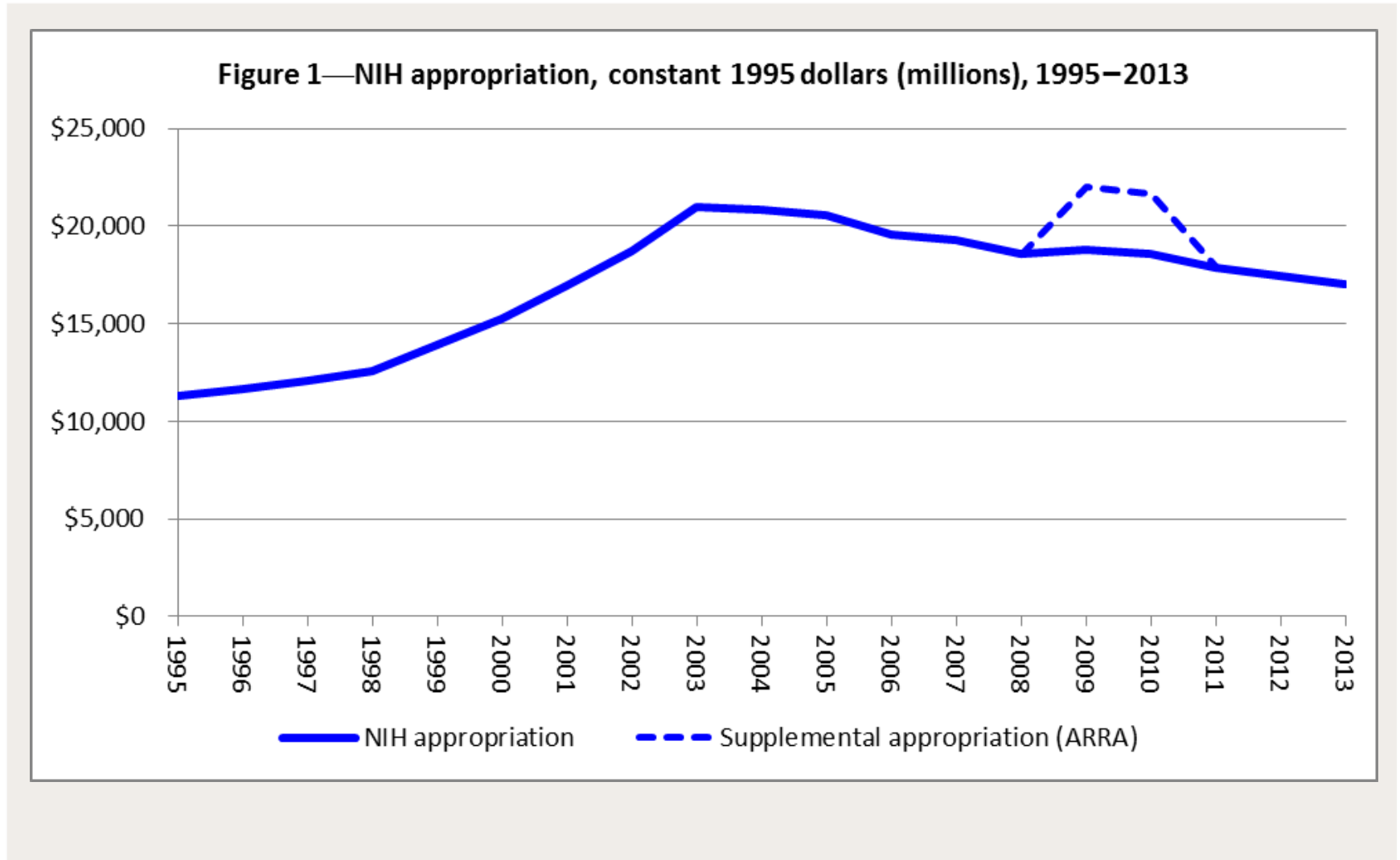


■ U.S. Leadership Today is Under Threat

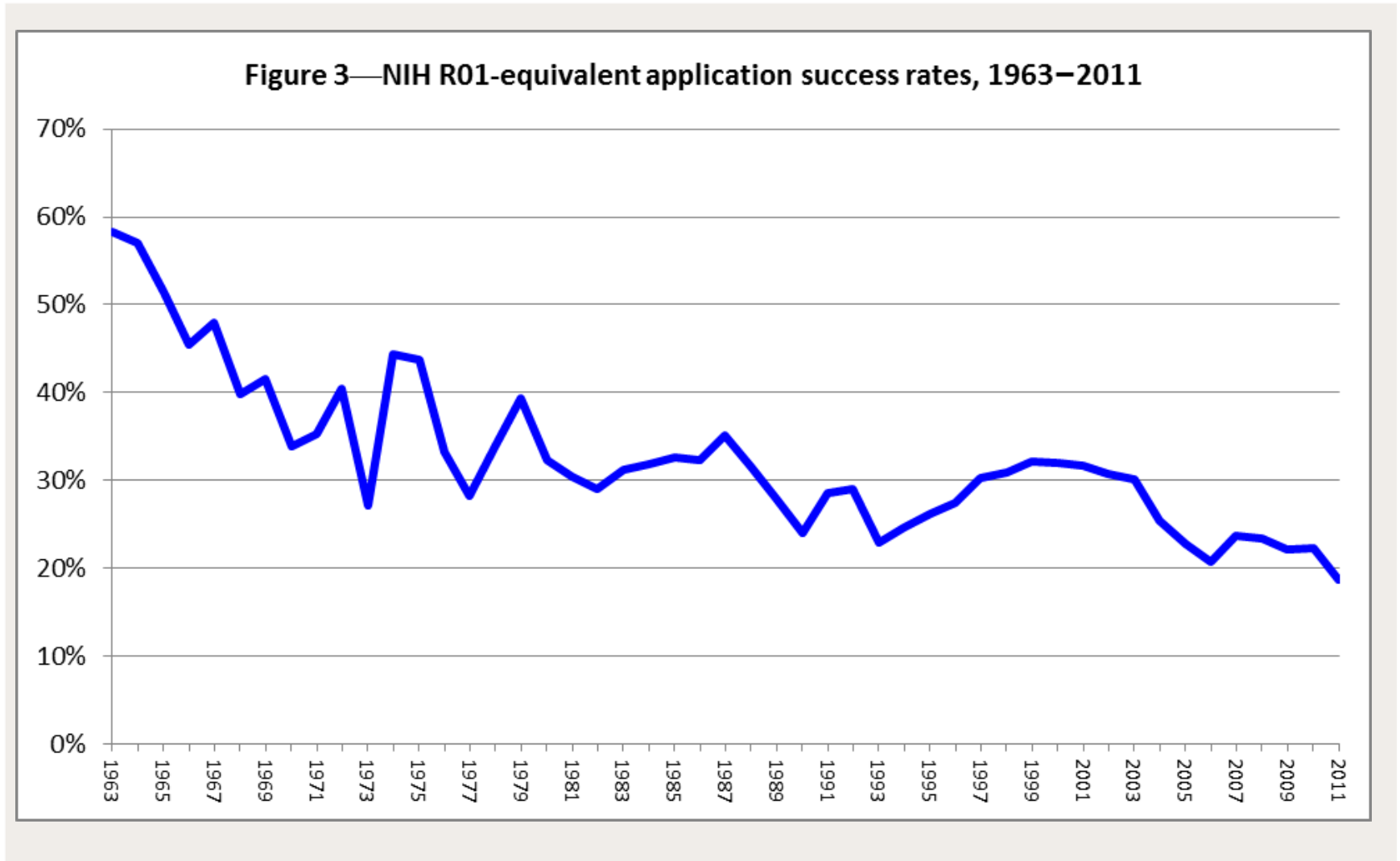
Competitors ramping up efforts with intent to stake their own claims on global leadership:

- China spending \$308B over next 5y (4x U.S. as share GDP); now leads world in DNA sequencing capacity.
- Korea's government provides 7 times more funding for pharmaceutical industry-performed research than does the United States as a share of GDP.

■ NIH Funding Trajectory – Constant dollars

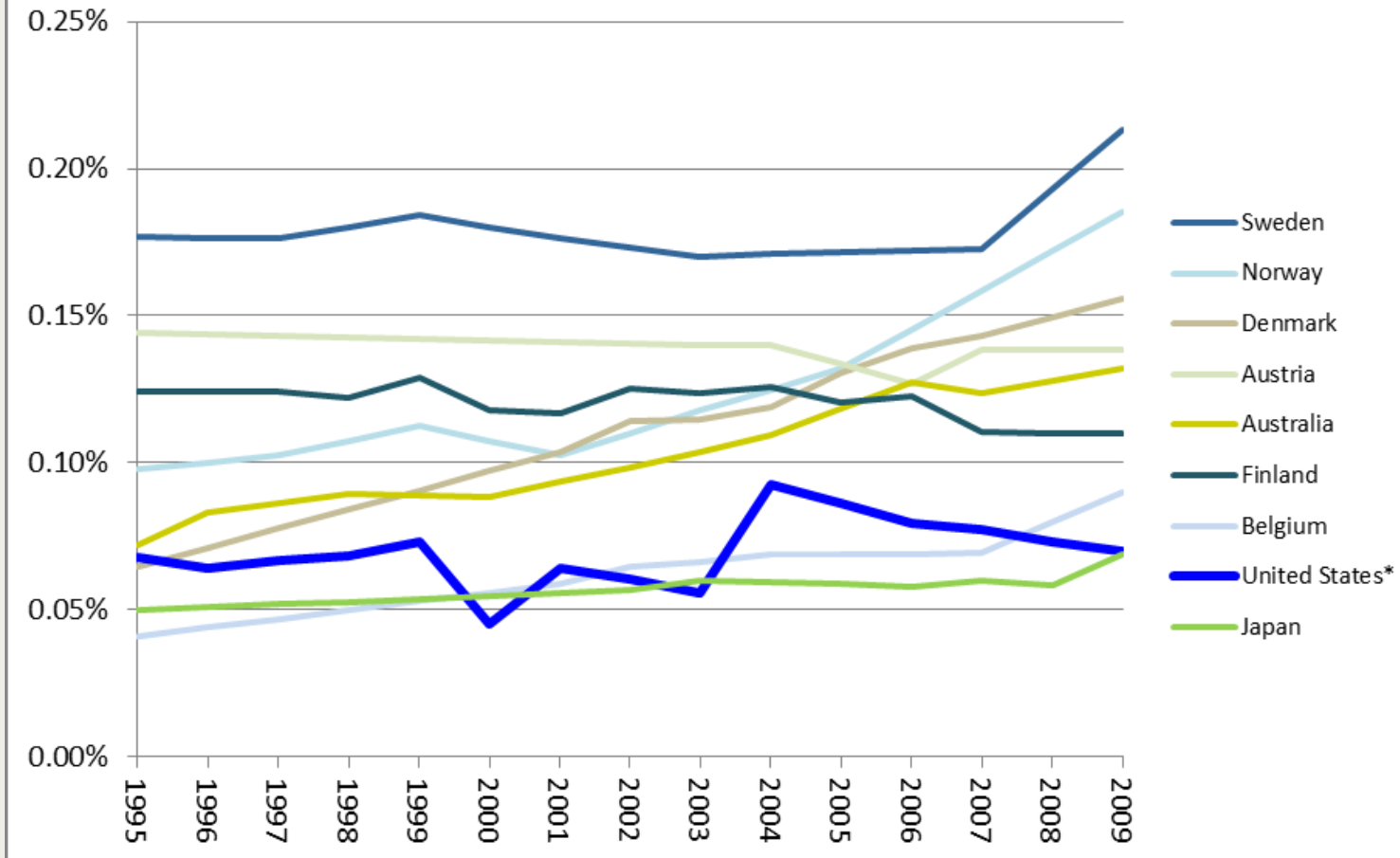


■ NIH Grant Applicant Success Rates

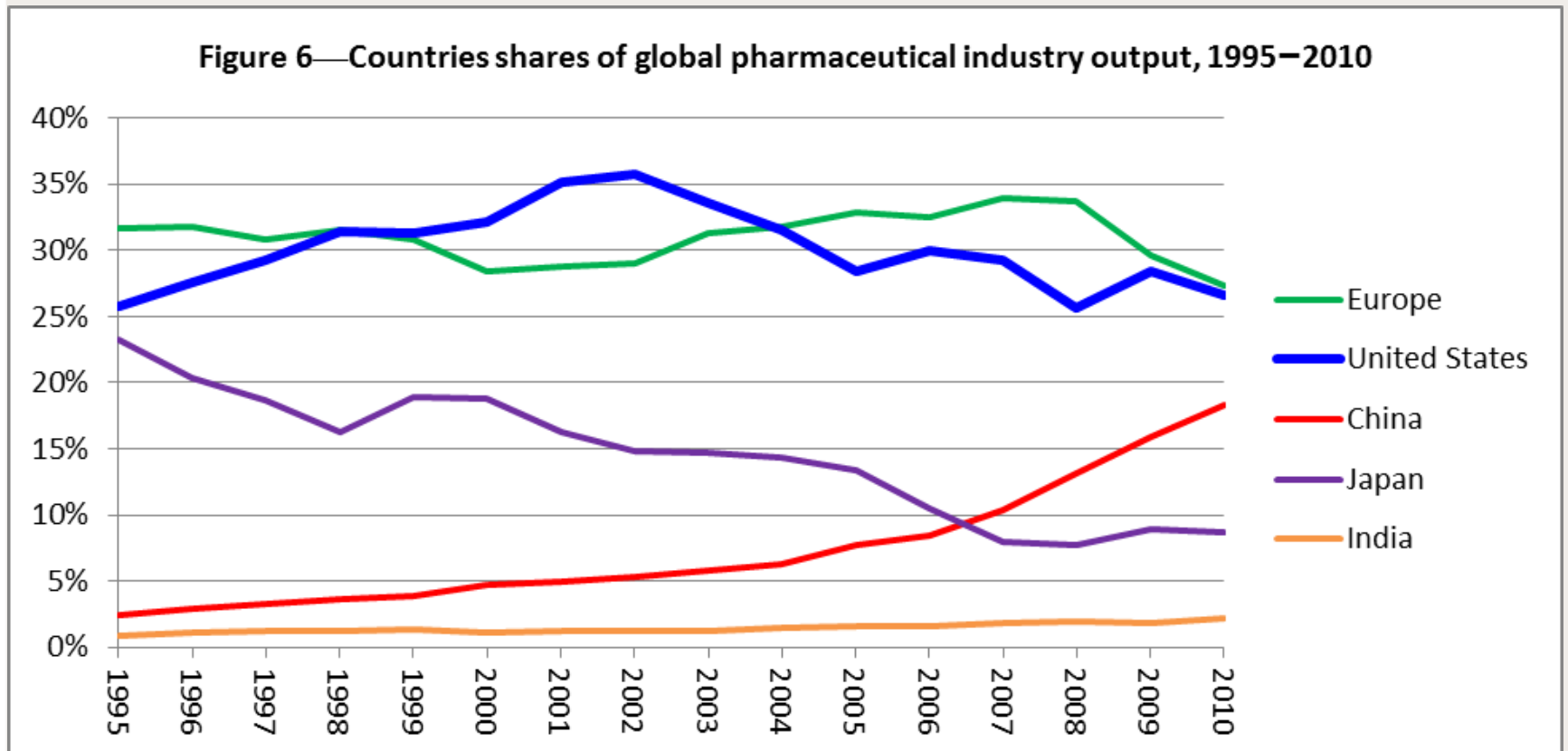


■ Government Funded R&D for Medical Science

Figure 4—Government-funded R&D for medical science performed by the academic and non-profit sectors (as shares of GDP), 1995–2009



■ Country Shares of Global Pharmaceutical Output



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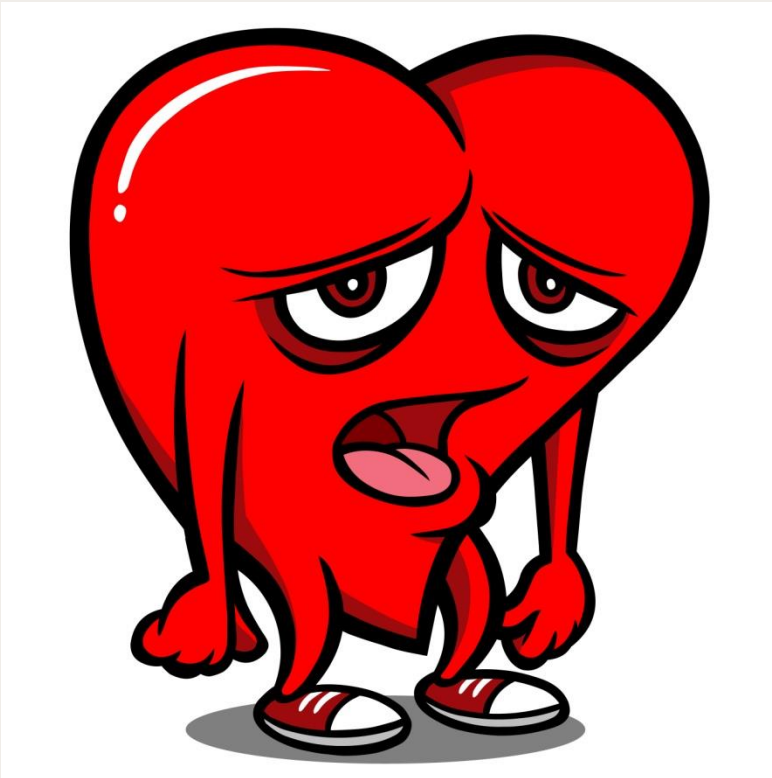
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Revitalizing American Innovation

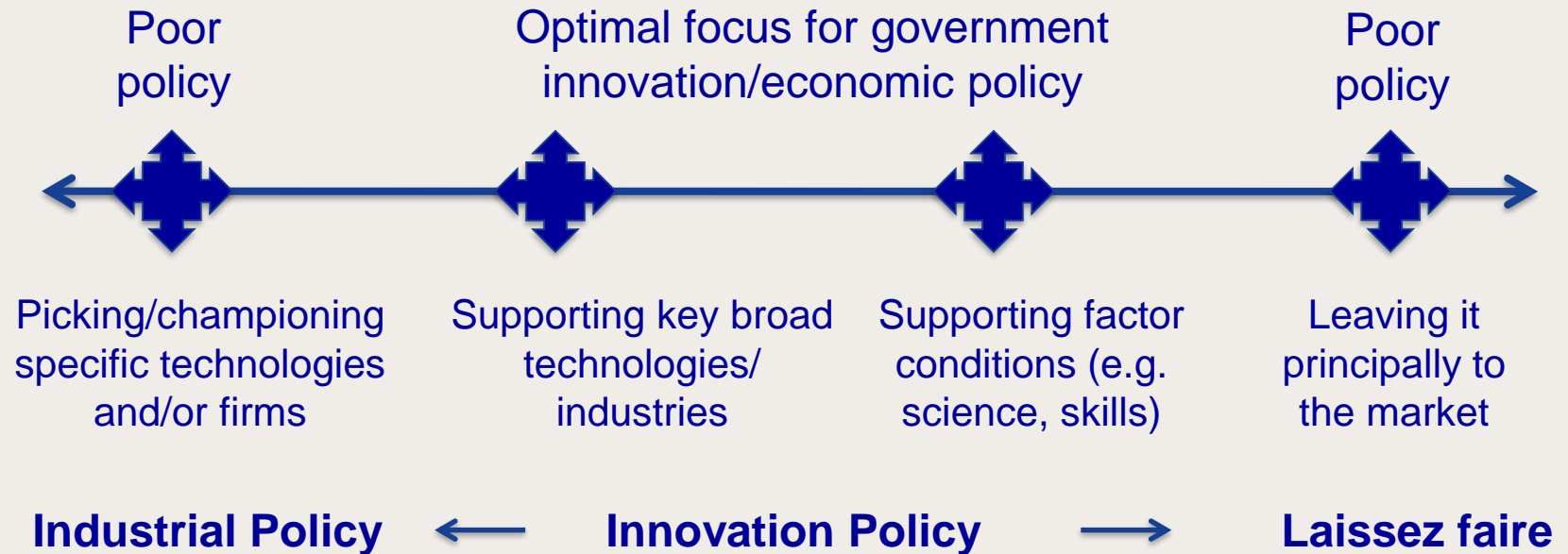
■ Boosting National Innovation Competitiveness

1. Strengthen the Heart of our Economy



■ Boosting National Innovation Competitiveness

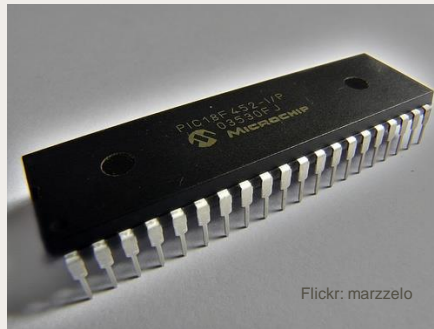
2. Find an Appropriate Role for Government in Supporting Innovation



■ Boosting National Innovation Competitiveness

3. Get the “4 Ts” Right

Tech



Tax



Talent



Trade



Extol Technology Transfer and Commercialization's

■ Central Importance to the Innovation Economy

It's what *tangibly* makes the world a better place, improves standards of living, and grows national economies.

Today, the best university TTOs in the world recognize:

Universities' technology commercialization programs are a *critical differentiator* in attracting students and faculty talent.

Incentives and leadership are vital to changing cultures.

It's about *impact* and *outcomes*; not about licensing *income*.

■ Policies to Bolster Tech Transfer/Commercialization

- ✓ Expand NSF's Innovation Corps (iCorps) Program to reach other federal agencies
- ✓ Create a High-Level Office of Innovation and Technology Partnerships (coordinate federal tech transfer activities/agencies)
- ✓ Congress should pass the TRANSFER Act (to provide \$ to pilot innovative approaches to technology transfer)
- ✓ Increase importance of technology transfer in national labs PEMP's scorecard
- ✓ Have all PI grant awards include page on commercialization potential of research.

■ University Policies to Drive Innovation

- ✓ Allocate R&D funding, in part, based on performance and ability to attract industry investment (Finland, Sweden).
- ✓ Increase *permeability*: Take faculty members' commercial experiences into account in tenure decisions; allow faculty to suspend tenure to pursue commercialization opportunities.
- ✓ Develop university entrepreneurship rankings
- ✓ Create new institutions (e.g. Olin College in Massachusetts)
- ✓ Develop common industry-university technology licensing agreements
- ✓ Make university-funded research available to companies and don't license/charge unless they can profit from the technology.

■ Tax Policies to Drive Innovation

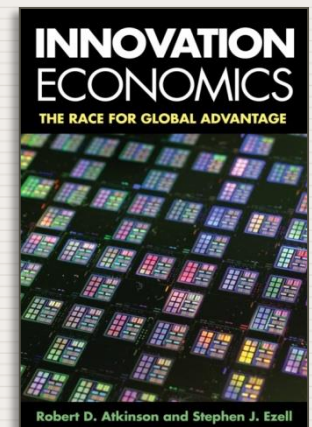
- ✓ More generous R&D tax credits (U.S. 26th; Sweden 39th of 41)
- ✓ Collaborative R&D tax credits (Canada, Chile, France, Korea)
- ✓ Patent boxes (Belgium, China, Netherlands, UK)

Thank You!

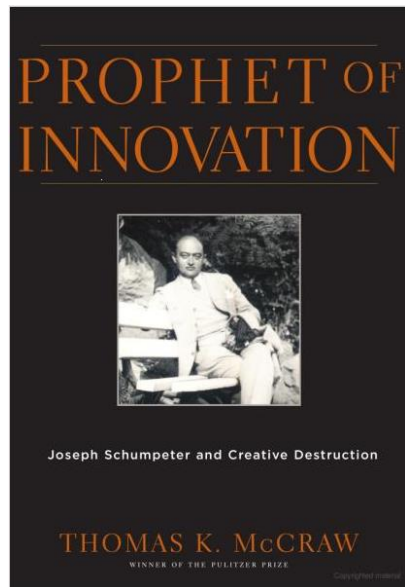
Stephen Ezell
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www.globalinnovationrace.com

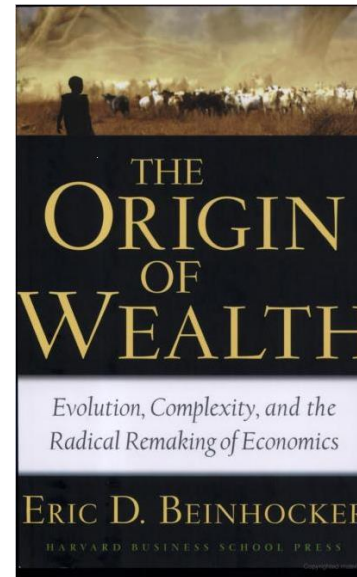
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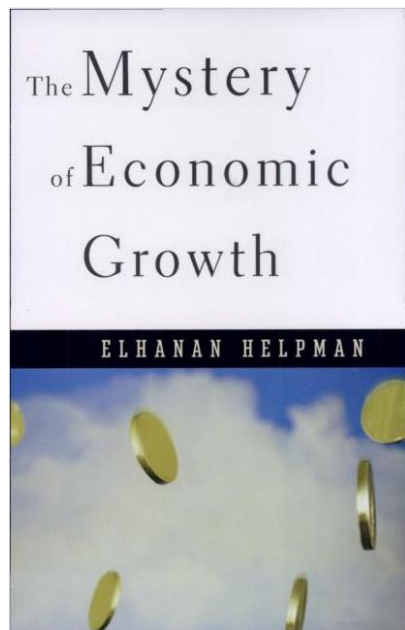
Interested in Further Reading on Innovation Economics?



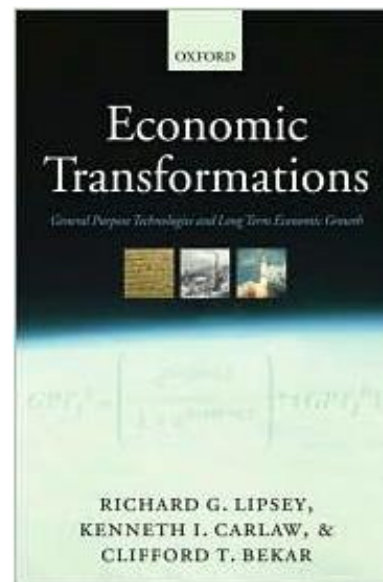
Excellent biography of Joseph Schumpeter's life. Details turmoil in personal life that and how they contributed to theories of creative destructions and innovation. Traces origins of famous works like *Capitalism, Socialism, and Democracy*.



Rejects traditional economic theory as based on a physics model of closed systems; argues for an emerging economic paradigm shift to "Complexity Economics." An open, adaptive system with interlocking networks that change organically, reflecting interaction of physical and social technologies.

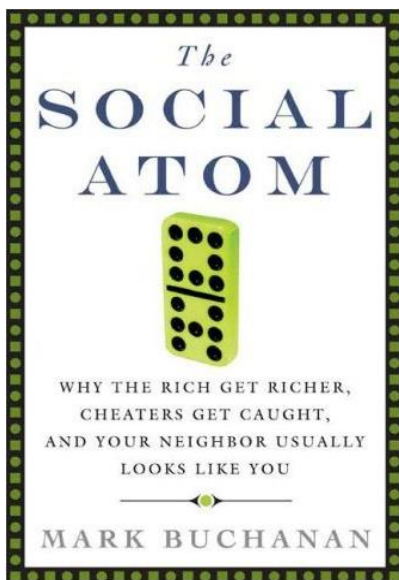


One of the leading researchers on economic growth, Harvard Professor Elhanan Helpman points to institutions-including property rights protection, legal systems, customs, and political systems-as the keys to the mystery of economic growth.



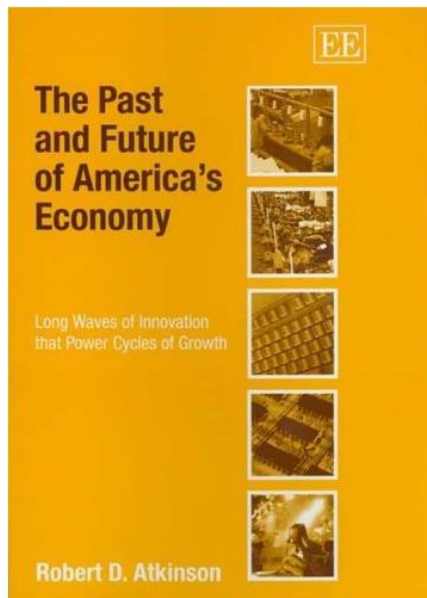
Economic growth is driven by technological revolutions that have periodically transformed the West's economic, social, and political landscape over the last 10,000 years. Argues that long term-growth is driven by pervasive general purpose technologies (GPTs).

Interested in Further Reading on Innovation Economics?



Shows how physics can explain – even predict – many human **social network** interactions ... explains many of the network effects seen in social technologies.

Eviscerates neo-classical economic models for thoroughly failing to account for how people actually make decisions.



Explains how long waves of innovation power cycles of growth. Argues that the U.S. economy has moved from being based on Mercantile/Craft, to Factory-Based Industrial, to Corporate/Mass-Production, to an Entrepreneurial, Knowledge Based Economy.