

# **The End of U. S. Economic Growth Has Already Happened**

**Robert J. Gordon**

**Northwestern University**

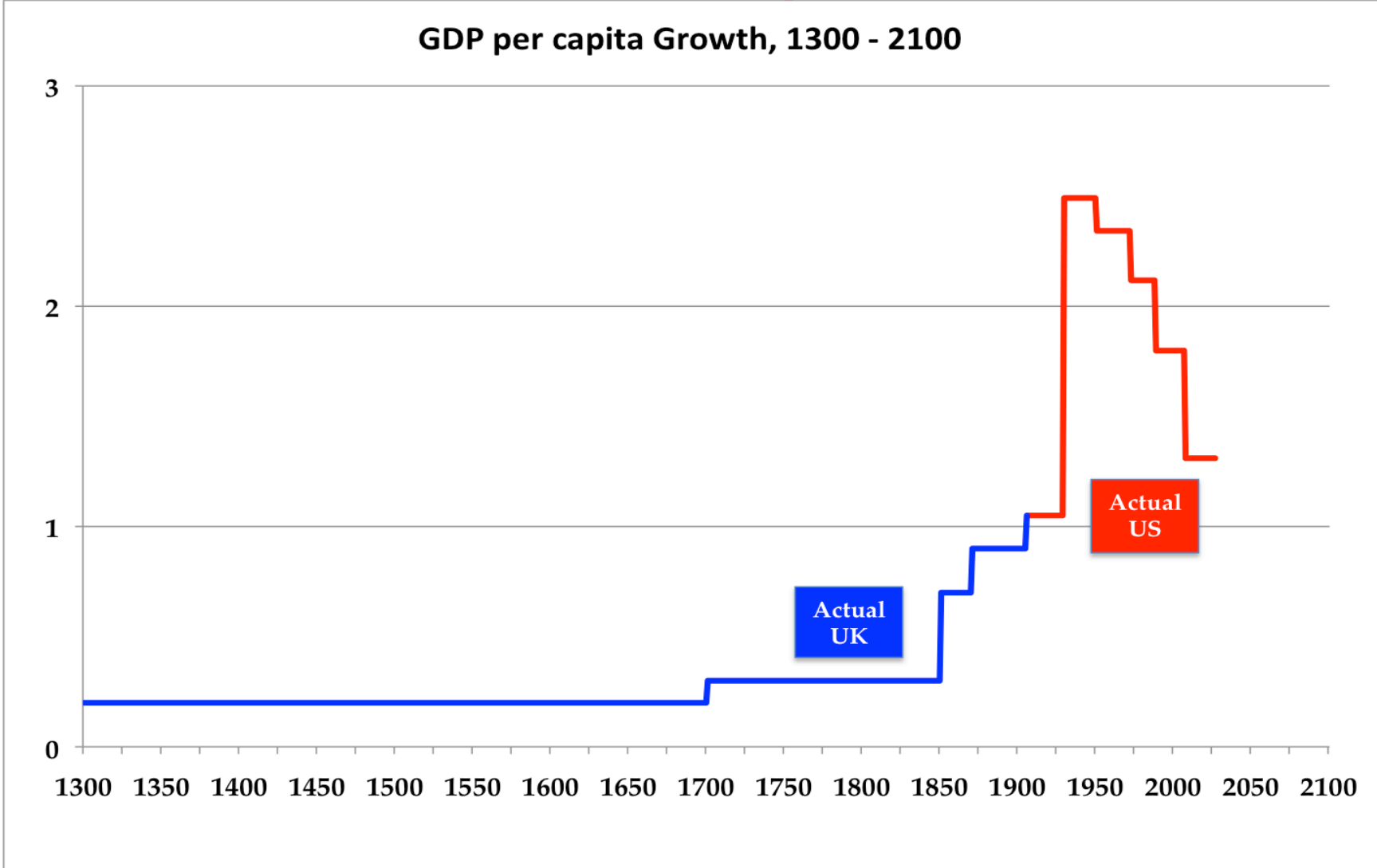
**ISI Conference**

**New York City, September 19, 2014**

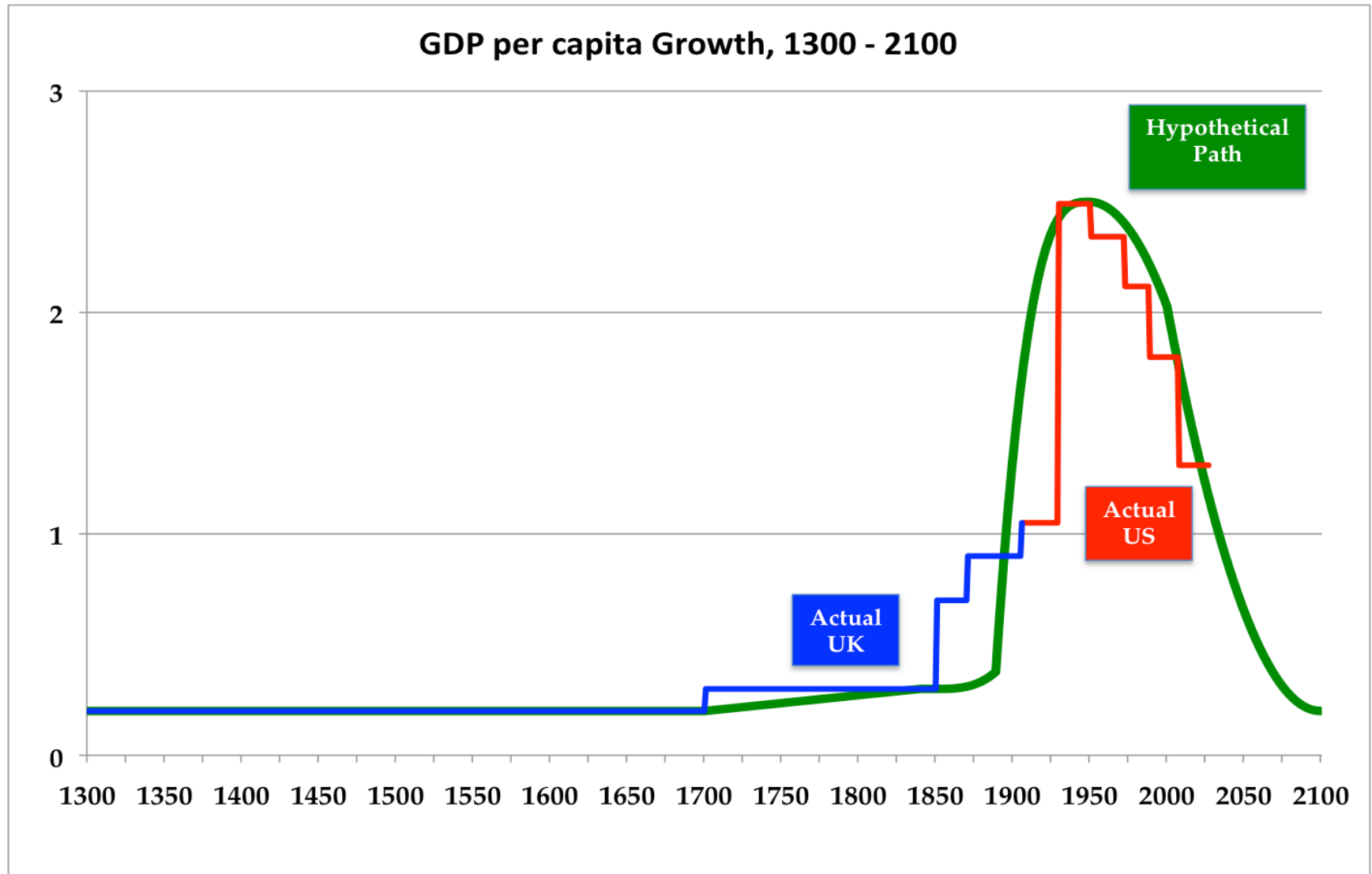
# **Background: the Startling Round Trip**

- **Economists have always assumed that economic growth is a steady process and their theories of growth are built on that foundation**
- **Economic historians don't buy that, because they know that there was no growth for most of economic history until about 200 years ago.**
- **After its millenia-long slumber, economic growth woke up in the first industrial revolution which created the steam engine, textile mills, the railroad, and the steam ship.**
- **The initial awakening was in Britain, the dominant economy of the 19<sup>th</sup> century, the U.S. caught up and surpassed British per-capita GDP as the 20<sup>th</sup> century began**

# The Remarkable Three Centuries: Growth of the UK/US Frontier



# I Speculated in 2011, If Growth Can Wake Up, Could It Go Back to Sleep?



# Growth in What Concept?

- Growth can be measured for any ratio of the four main concepts
  - Real GDP, total production (Y)
  - Aggregate hours of work (H) (e.g.,  $150\text{m} * 2000 = 300\text{b}$ )
  - Population (N)
  - Capital Input (K)
- These are tied together by  $Y/N = Y/H * H/N$
- Growth can refer to output per capita (Y/N) or to labor productivity (Y/H)
- The third concept called total factor productivity is a weighted average of labor productivity (Y/H) and the productivity of capital (Y/K)
  - TFP = weighted average of Y/H and Y/N
- ***For economists TFP is the closest representation we have to the role of invention and innovation in economic growth.***

# Preview: Dimensions of Slowing U.S. Growth

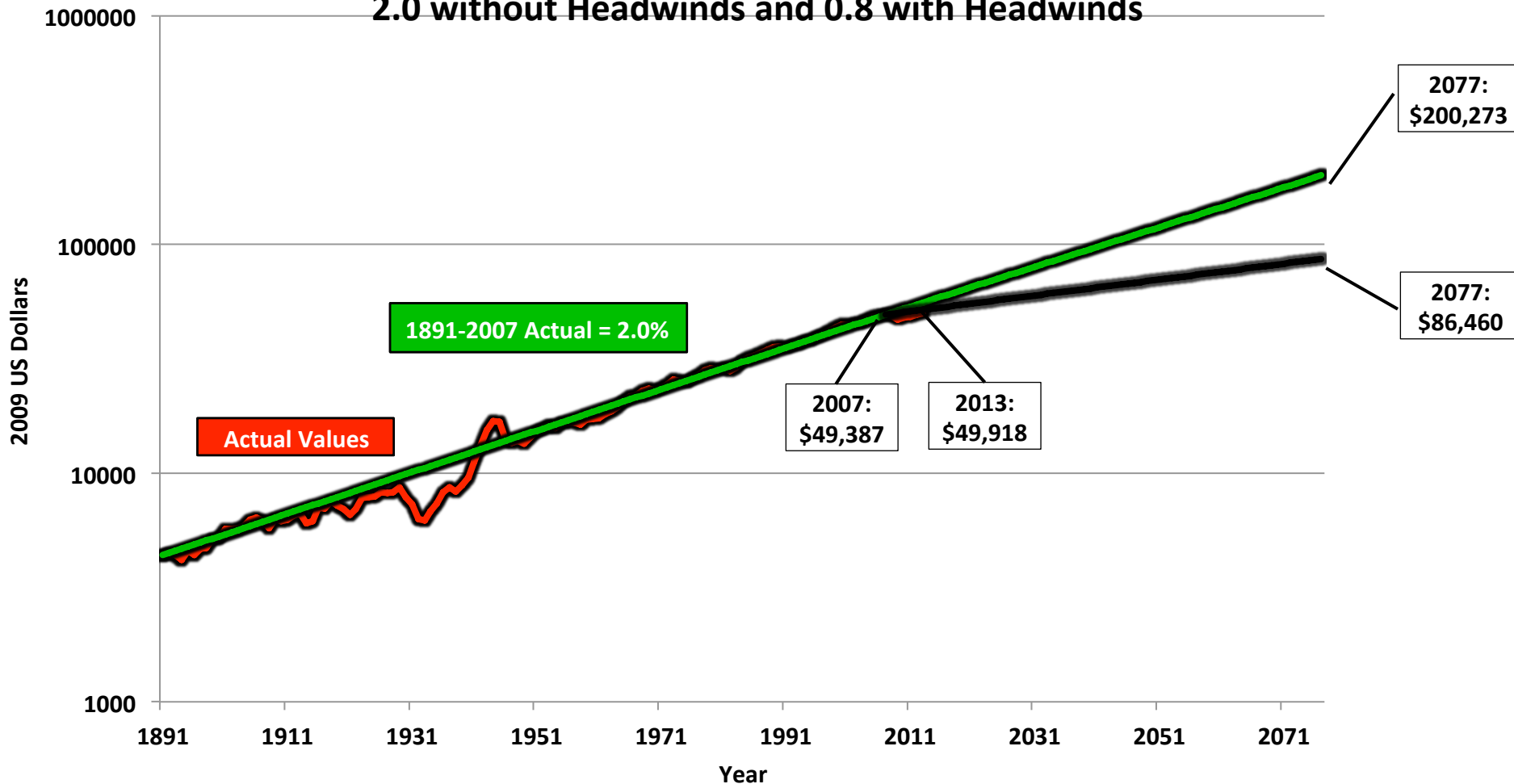
- **Preview (note future begins in 2007 not 2014)**

	<b>1891-2007</b>	<b>2007-2032</b>
<b>Real GDP per Hour</b>	<b>2.2</b>	<b>1.3</b>
<b>Real GDP per Person</b>	<b>2.1</b>	<b>0.9</b>
<b>Bottom 99%</b>	<b>2.0</b>	<b>0.4</b>
<b>Disposable Bottom 99%</b>	<b>1.9</b>	<b>0.2</b>

- **No Prediction for TFP growth**

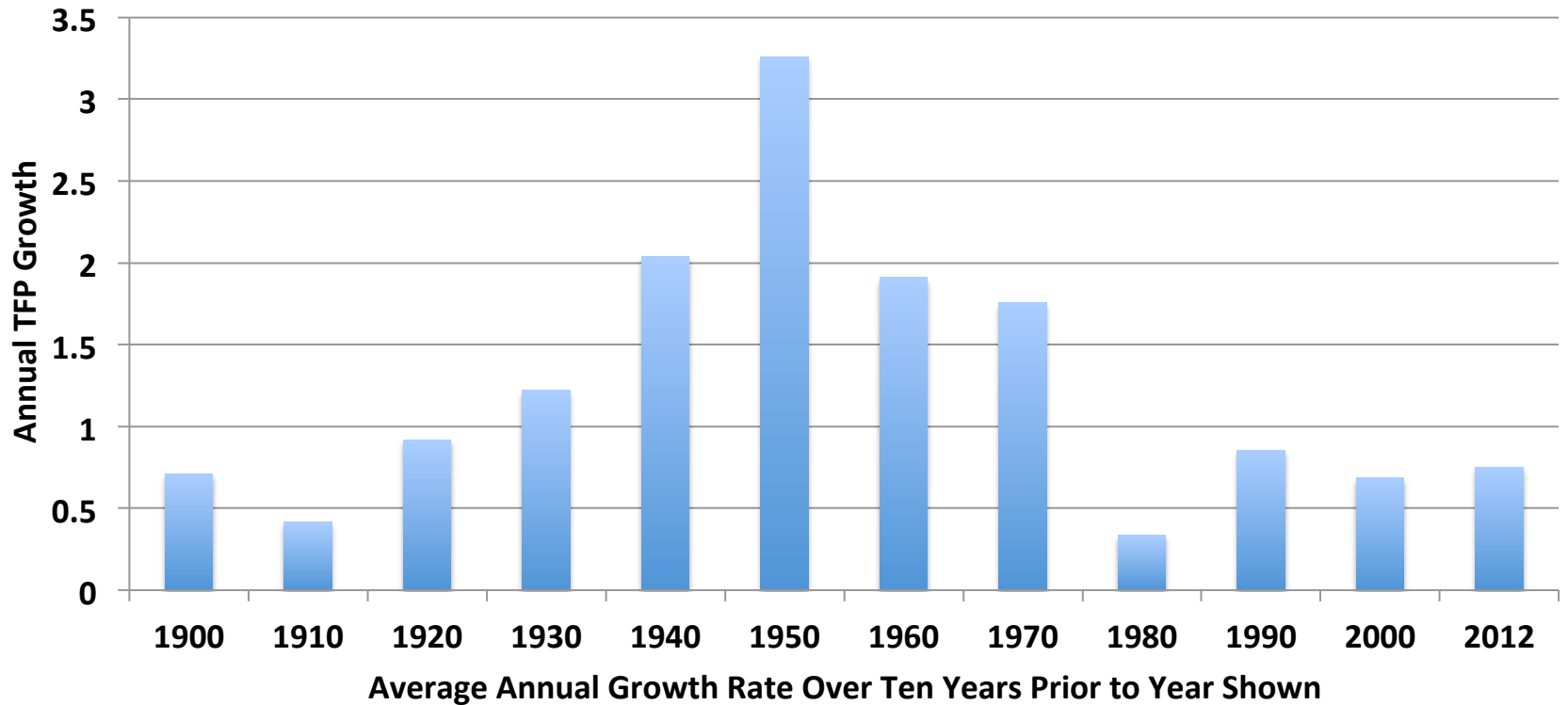
# Per-Capita Output Growth Was Steady 1891-2007, Will It Continue?

Figure 3. Future Economic Growth, 2.0 without Headwinds and 0.8 with Headwinds



# Stairway to Paradise and Path Downwards Toward the Future

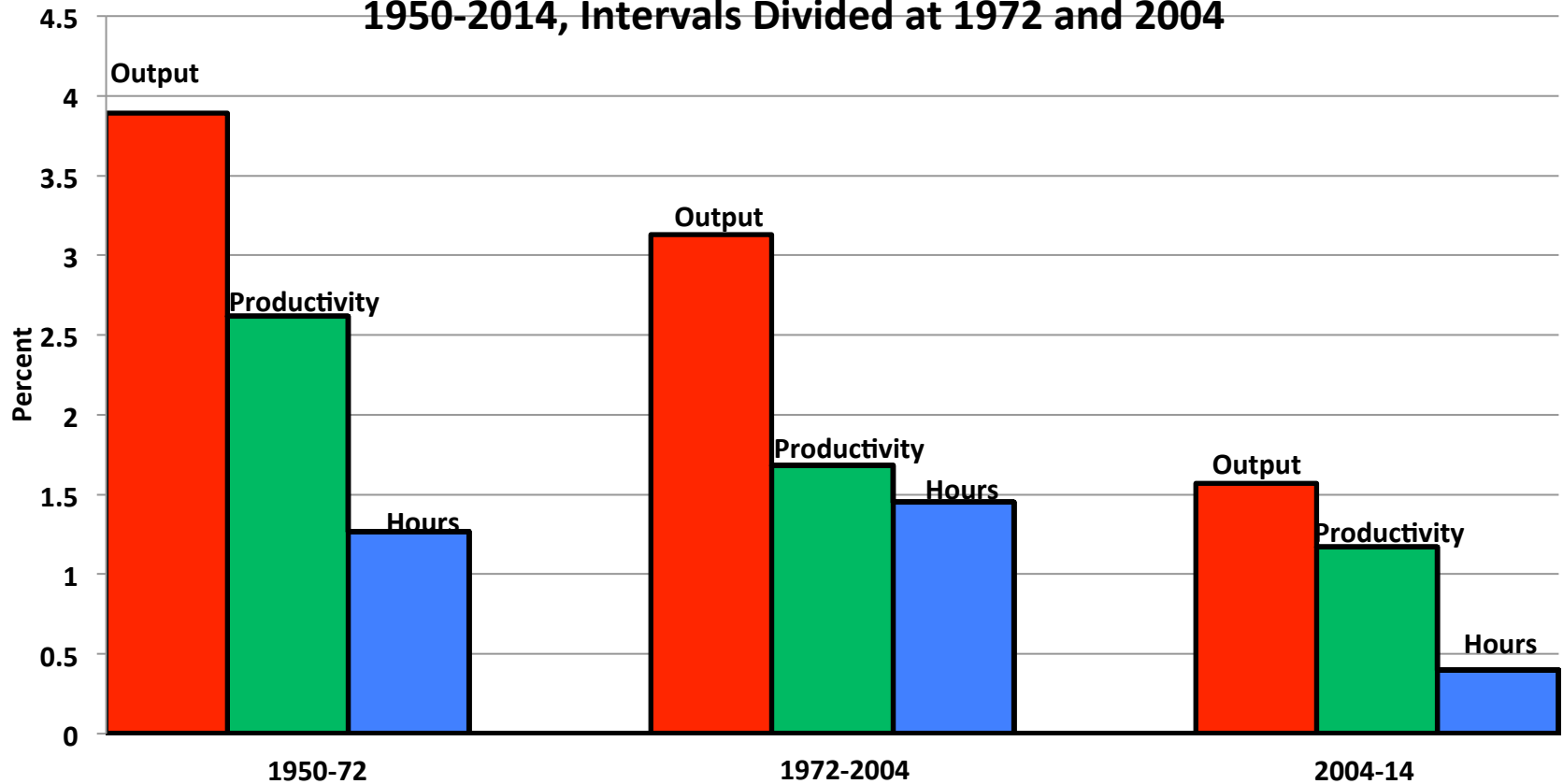
10-Year Average Annual Growth in Total Factor Productivity,  
1900-2012





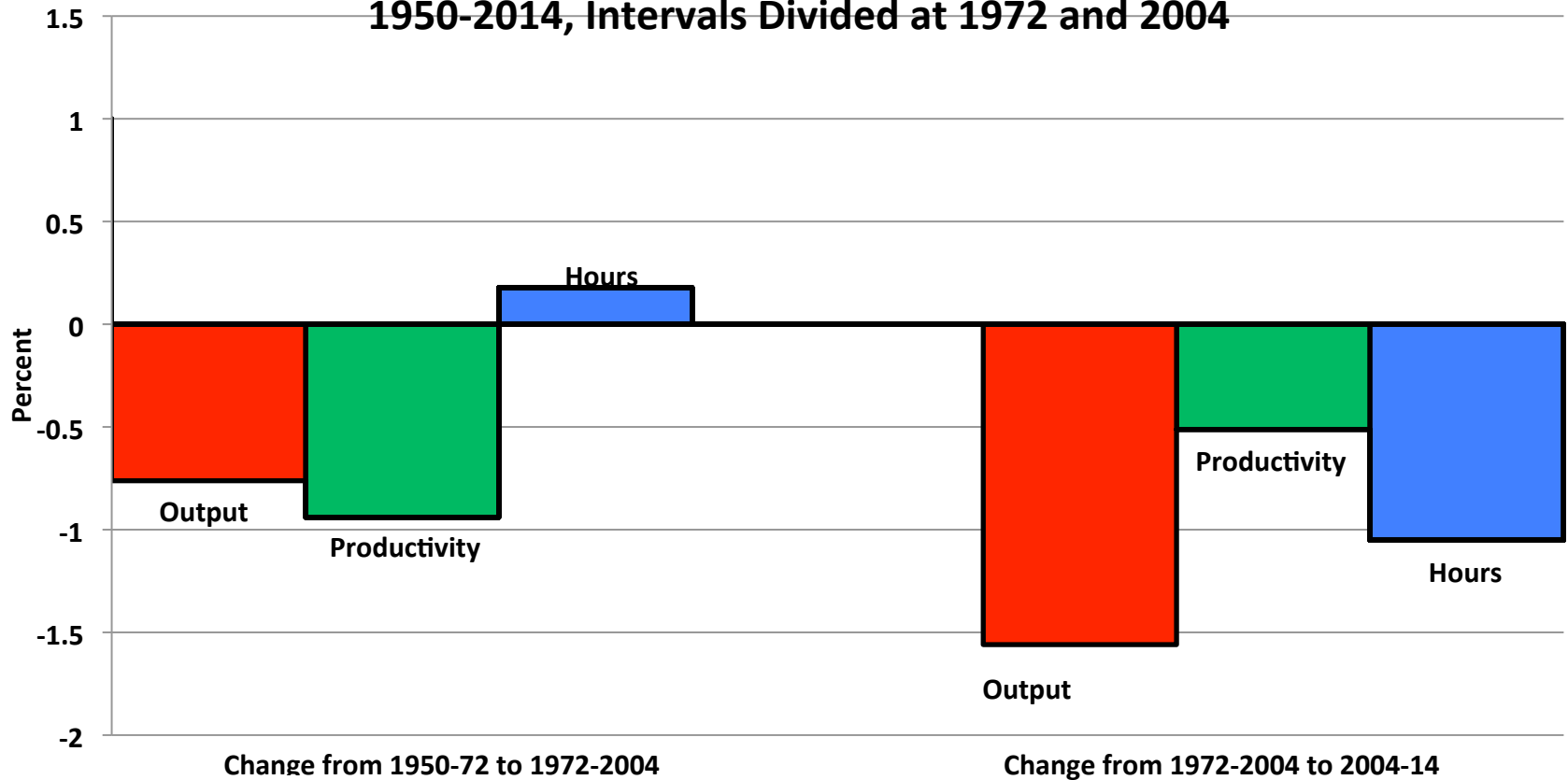
# A Closer Look at 1950-2014, A Two-Stage Slowdown

Growth Rates of Output, Labor Productivity, and Hours,  
1950-2014, Intervals Divided at 1972 and 2004



# A Diagnosis of the Slowdown: Different Between 1<sup>st</sup> and 2<sup>nd</sup> Vs. Between 2<sup>nd</sup> and 3<sup>rd</sup> Periods

Change in Growth Rates of Output, Labor Productivity, and Hours,  
1950-2014, Intervals Divided at 1972 and 2004



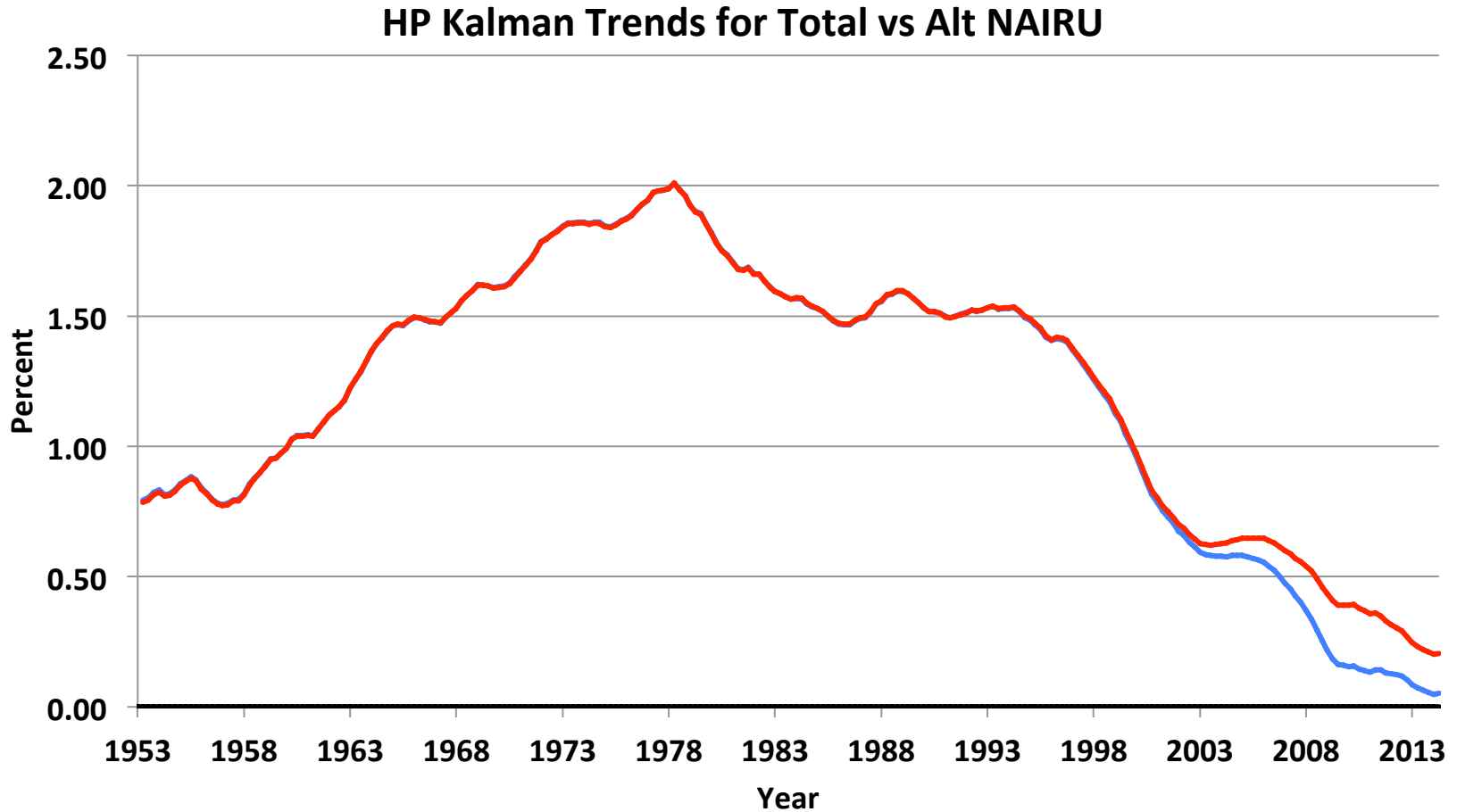
# **Sources of Slowing U.S. Growth: Headwinds vs. Innovation**

- **The Primary Role of the Headwinds**
  - These have nothing to do with innovation
  - They are relatively uncontroversial
- **Total slowdown: 1.8 points from 2.0 to 0.2**
  - Of this, 1.2 is accounted for by the headwinds that began their gale force wind slowing economic growth about ten years ago
  - The other 0.6 is caused by slowing innovation that occurred 40 years ago

# **Sources of Slowing U.S. Growth: Headwinds vs. Innovation**

- **It is exactly three years after my first speech on “The End of Growth” in September 2011**
- **The Primary Role of the Headwinds**
  - These have nothing to do with innovation
  - They are relatively uncontroversial; nobody denies they have happened and will continue
- **Slower innovation began in 1972, not now**
  - Slower innovation after 1972 compared to pre-1972 accounts for the other 0.6 of the slowdown.
- **Total slowdown: 1.8 points from 2.0 to 0.2**
  - Of this, 1.2 headwinds and 0.6 innovation 40 years ago

# The Trend in Hours Growth (Blue and Red Alternatives)



# The Decline in Hours per Capita is Not Just About Baby-boom Retirement

- **Prime-Age Males**

- Employment/Population Ratio 95% in 1968 to 83% in 2012

- **Youth**

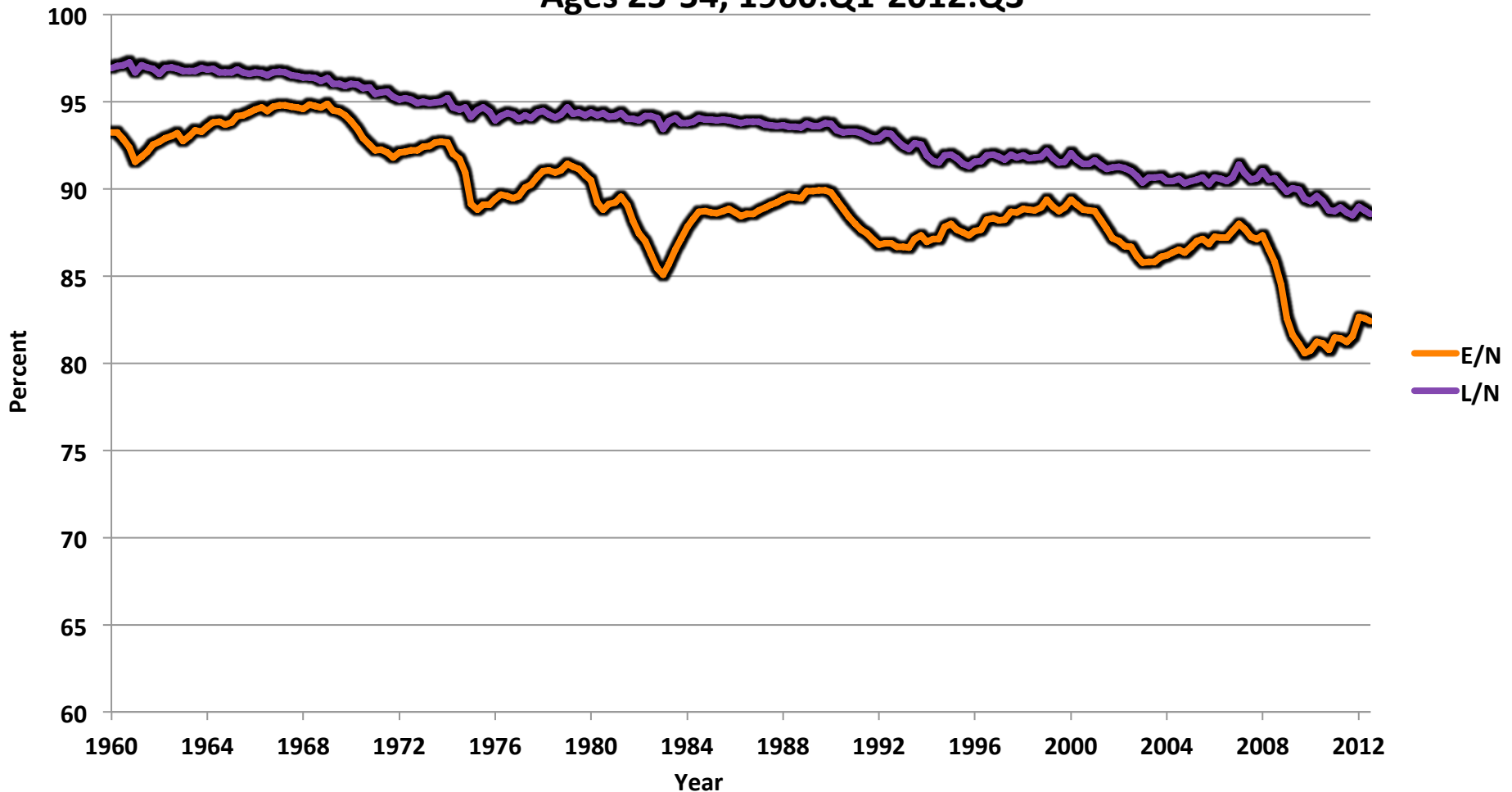
- Employment/Population Ratio 65% in 1988 to 46% in 2012. Only about 1/3 of this decline is accounted for by increased school participation

- **Females 20 and Over**

- Labor Force Participation Rate rose 35% in 1968 to 58% in 2000, then fell back to 55% in 2012

# Prime-Age Male Participation Is Part of the Demographic Headwind

Figure 20: Employment per Capita and Labor Force Participation Rate, Males  
Ages 25-54, 1960:Q1-2012:Q3



# Second Headwind: Education

- **A major driver of that epochal 20<sup>th</sup> century productivity achievement was education**
  - **High school completion rate has barely changed since 1970.**
  - **Most people drop out of 2-year community colleges**
  - **College completion is increasing but 40% of recent graduates are in jobs that do not require a college education**
  - **The U. S. is the only developed country where the educational attainment of the 55-64 cohort is the same as 25-34 cohort**
- **U.S. has dropped from #1 to #16 in college completion as percent of population; same for high-school dropouts**
- **This will reduce future economic growth by -0.3 percent per year compared to the contribution of education to 20<sup>th</sup> century growth**



# Third Headwind: Inequality

- **For 1993-2012 the gap between average real income growth of total vs. bottom 99% is -0.53 percent per year.**
- **This is continuing, it's not over. Count the ways**
  - **CEO pay, sports and entertainment stars. (\$10-15 million)**
  - **Wage pushbacks – lower wages, two-tier wages, shaving pension and medical care benefits (Caterpillar, Boeing)**
  - **Firms pushing employees into part-time work as a byproduct of our dysfunctional medical care system**

# **Interaction Demographics, Education, Inequality**

- **Charles Murray's division of white population into Belmont (top 20%) and Fishtown (bottom 30%)**
- **Social instability in Fishtown**
  - **Percent of children of women aged 40 living with both biological parents, change from 1960 to 2010**
  - **Fishtown 95% to 35%**
- **Interaction with education: for a child to live without a father at home is a predictor of more high school drop outs in the future**

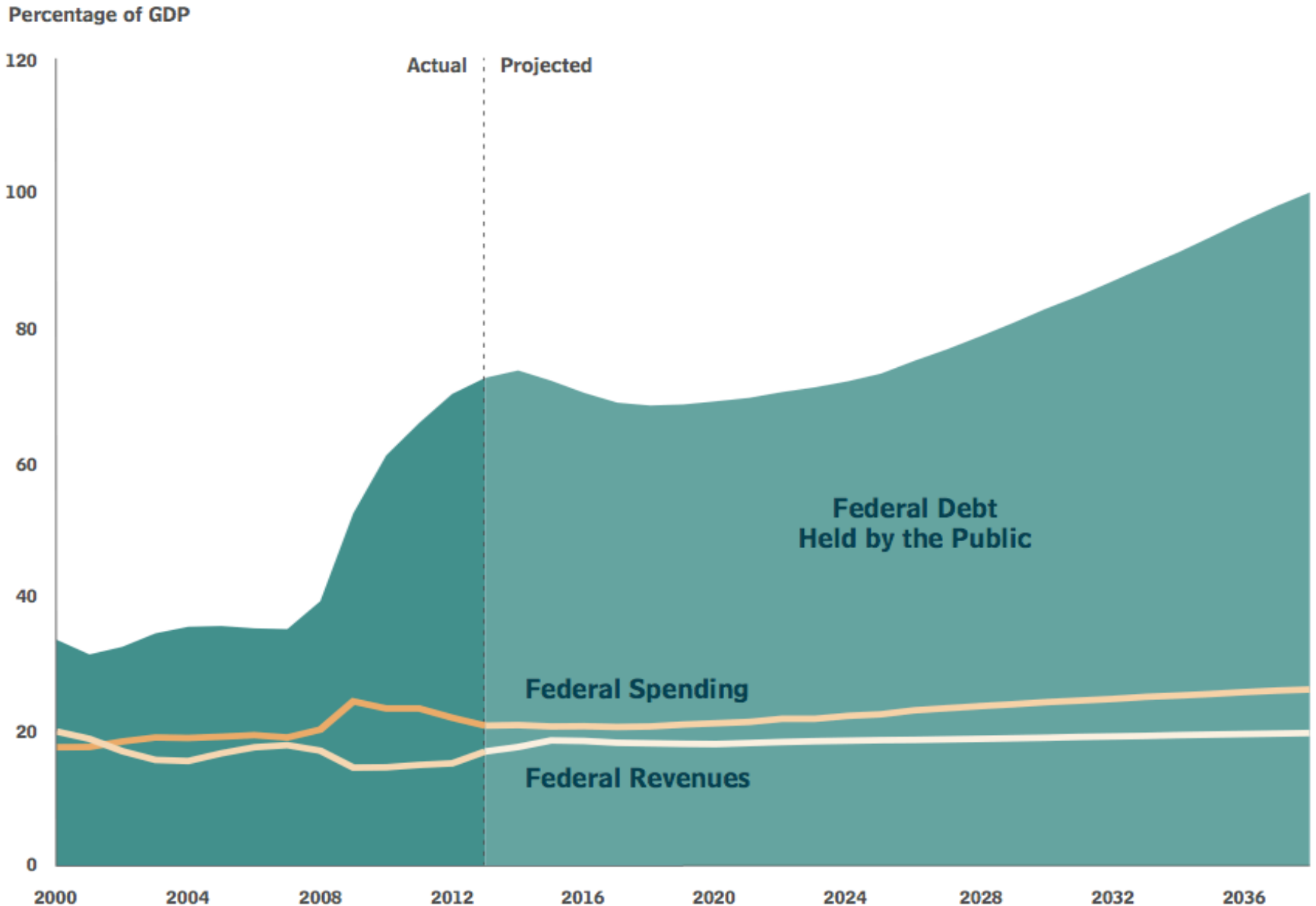
# **A Startling Measure of Social Decay in America**

- **Excellent statistics on every aspect of our criminal justice system, e.g, the age of inmates**
- **The percentage of those aged 30-34 who have been in prison at any time in their lives**
- **For whites, 4 percent in 1979 and 28 in 2009**
- **For blacks, 15 percent in 1979 and 60 in 2009**
- **Many but not all for petty drug offenses**

# **Further Interactions Poverty, Education, and Inequality**

- **Proponents of subsidized early childhood education emphasize the vocabulary gap**
  - **Children in the top half arrive in kindergarten with 2 to 3 times the vocabulary of children coming from poverty families**
- **In the CPS last year, 20% of children were absent more than one month during the academic year**
  - **Only 12% went on to receive any college degree**
- **International OECD-run PISA test results for 2013 were released in December, 2013**
  - **Of 38 developed countries, U.S. ranked #21 in reading, #24 in science, and #31 in math**

# Fourth Headwind: Eventually We Have to Raise Taxes and/or Cut Entitlement Spending Growth

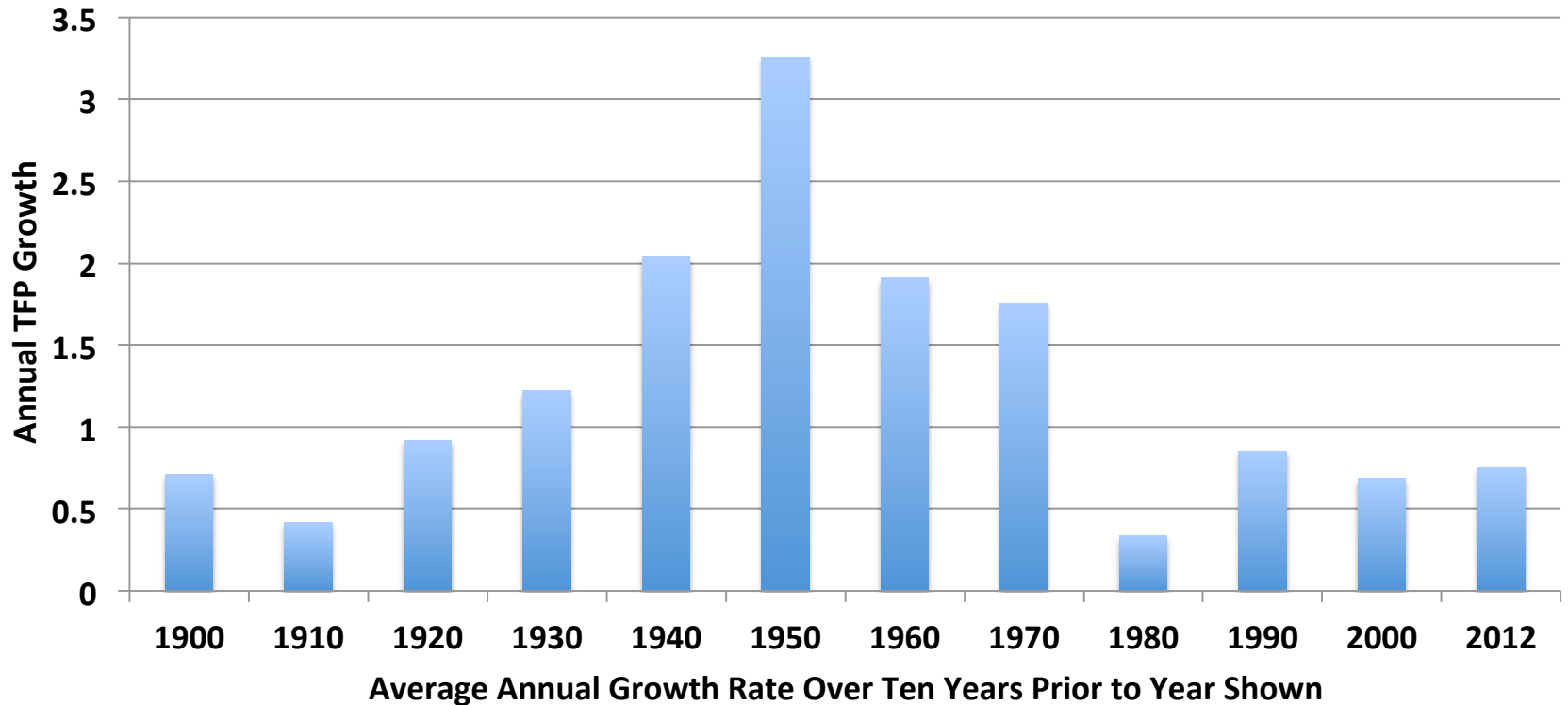


# **Fiscal Fix Will Reduce Growth in Disposable Income**

- **This chart understates future growth in debt/GDP ratio because it is overly optimistic on future GDP growth**
- **Estimates debt/GDP ratio for 2024**
  - **CBO in January: 70 percent**
  - **CBO since February: 78 percent**
  - **My new September WP: 87 percent**
- **Many state/local governments have huge pension liabilities**
- **Solutions at all levels of government will require faster growth of taxes and/or slower growth of benefits**

# How Did Innovation in the Past Compare with the Past 40 Years?

10-Year Average Annual Growth in Total Factor Productivity,  
1900-2012



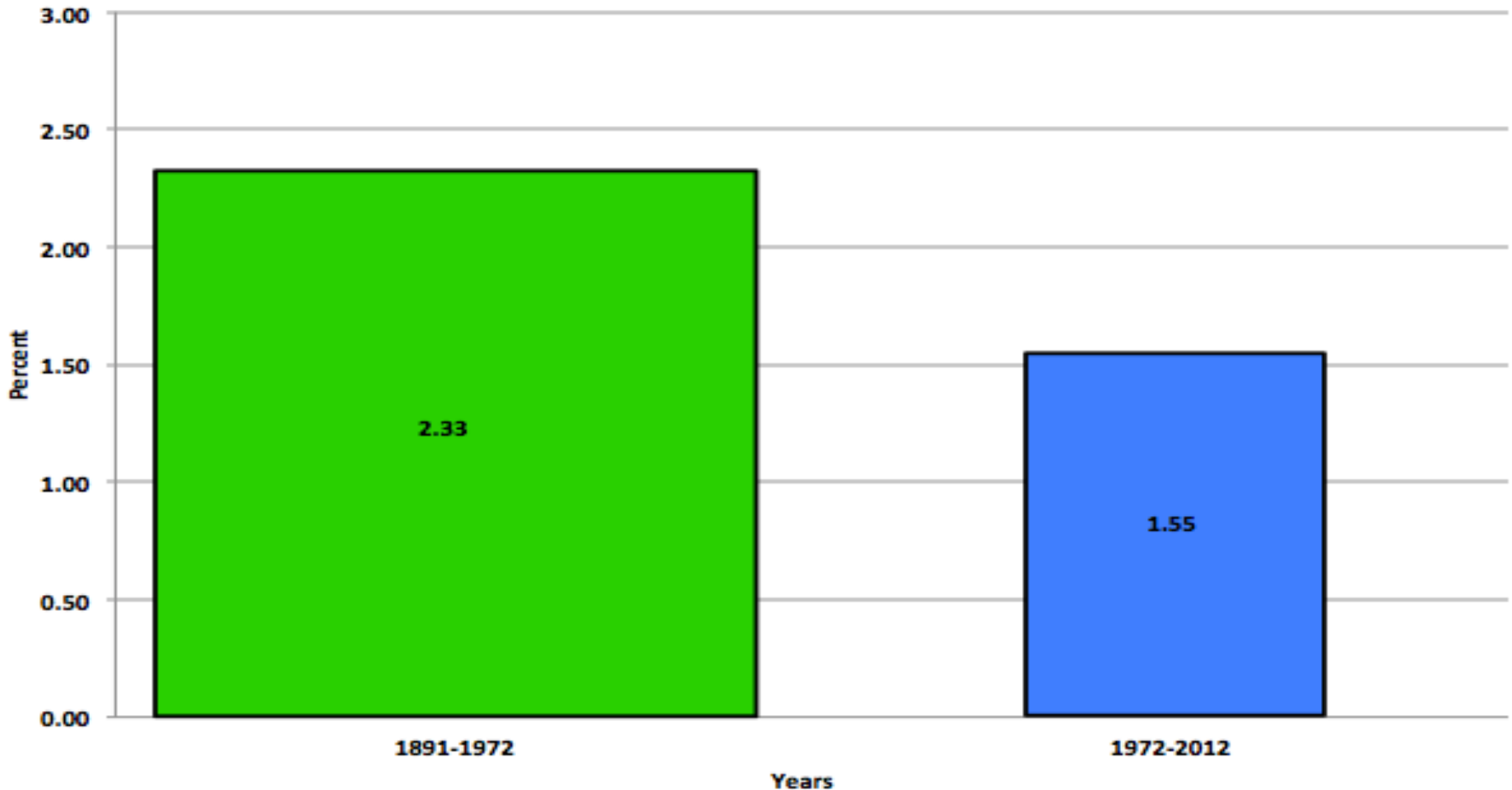
# Industrial Revolutions

- **#1. Steam engine, cotton spinning, railroad, steamship**
- **#2. Electricity, internal combustion engine, communication/entertainment, clean water and conquest of infant mortality, and radical improvement of working conditions**
- **#3. Computers and communications. Mainframe, PC, internet, flat screens, library catalogs, software applications (Amazon, Google, Wikipedia).**
- **How to gauge the importance of #2 vs. #3?**



# The Second Industrial Revolution vs. the Third Industrial Revolution

Figure 2.2: Annualized Growth Rates of Output per Hour , 1891-2012



# **Why Did Productivity Grow Faster In the Century Before 1972? The One-Time-Only Inventions**

- Polluting flames for light >> instant on-off electric light**
- Factory power with steam engines and belts >> electric machine tools and hand tools**
- Offices and home cold and hot >> central heating and air-conditioning**
- Horses >> motor vehicles and air travel**
- Mainly rural 1870 >> mainly urban 1950**

# More One-Time Changes Before 1972

- Carrying pails of water >> running water
- Outhouses >> indoor bathrooms
- Infant mortality 20% >> infant mortality 1%
- Child labor. 1890 almost half of 14-15 year old boys were in the labor force >> almost none after 1940
- Isolation >> telephone + phonograph + radio + TV

# Summing Up, Why Was Productivity Growth Faster Before 1972 than After?

- *The 2<sup>nd</sup> IR consisted of at least five dimensions of Great Inventions*
  - Each invention had spinoffs developed over 1890-1972
- In contrast the post-1960 3<sup>rd</sup> IR has been limited to one dimension, the ICT revolution, the digital economy
  - Its productivity impact was limited to 1996-2004

# **Framing the Debate About Future Innovation**

- **My forecast of productivity growth for the 25 years after 2007 assumes that innovation will proceed at the same pace as the last 40 years**
- **Many innovations will occur over the next 40 years, but will they be as important as the last 40? They must be as important, or else my growth forecast is too optimistic**

# **The Next 40 Like the Last 40? What a Stunningly Optimistic Outlook!**

- **The next 40 years must bring us innovations as important as**
  - **The PC, the internet, e-commerce**
  - **Mobile phones, smart phones & ipads**
  - **Digitalization of library catalogues and parts catalogues**
  - **Instant free access to all the world's information**
  - **Revolution in office equipment and procedures**
  - **Bar-code scanning, the ATM machine, i-tunes, cable TV, CDs, DVDs, movie streaming**

# **Comments on Techno-optimists, Brynjolfsson and McAfee**

- **Their optimism centers on an explosion of data – billions >> trillions >> quadrillions (“BIG DATA”)**
- **Small, easily programmable robots**
- **Driverless cars, trucks, and taxis**
- **The genome will make possible advances in medical and pharmaceutical technology**

# They Are Slippery on Timing, Past vs. the Future

- Their book *Second Machine Age* claims that we are at a “point of inflection” toward an acceleration of technological change
- Yet they include as future progress things that have already happened in the past
- “Andy now sends Erik a file as an e-mail attachment whereas before he sent it as a floppy disk”.
- ***Sorry, guys, we’ve been doing this since at least 1993!***
- Productivity growth has not responded to the innovations of the last decade
- Examples of how different were the late 1990s from the past decade



# Comments on Their Favorite Inventions: Big Data and Small Robots

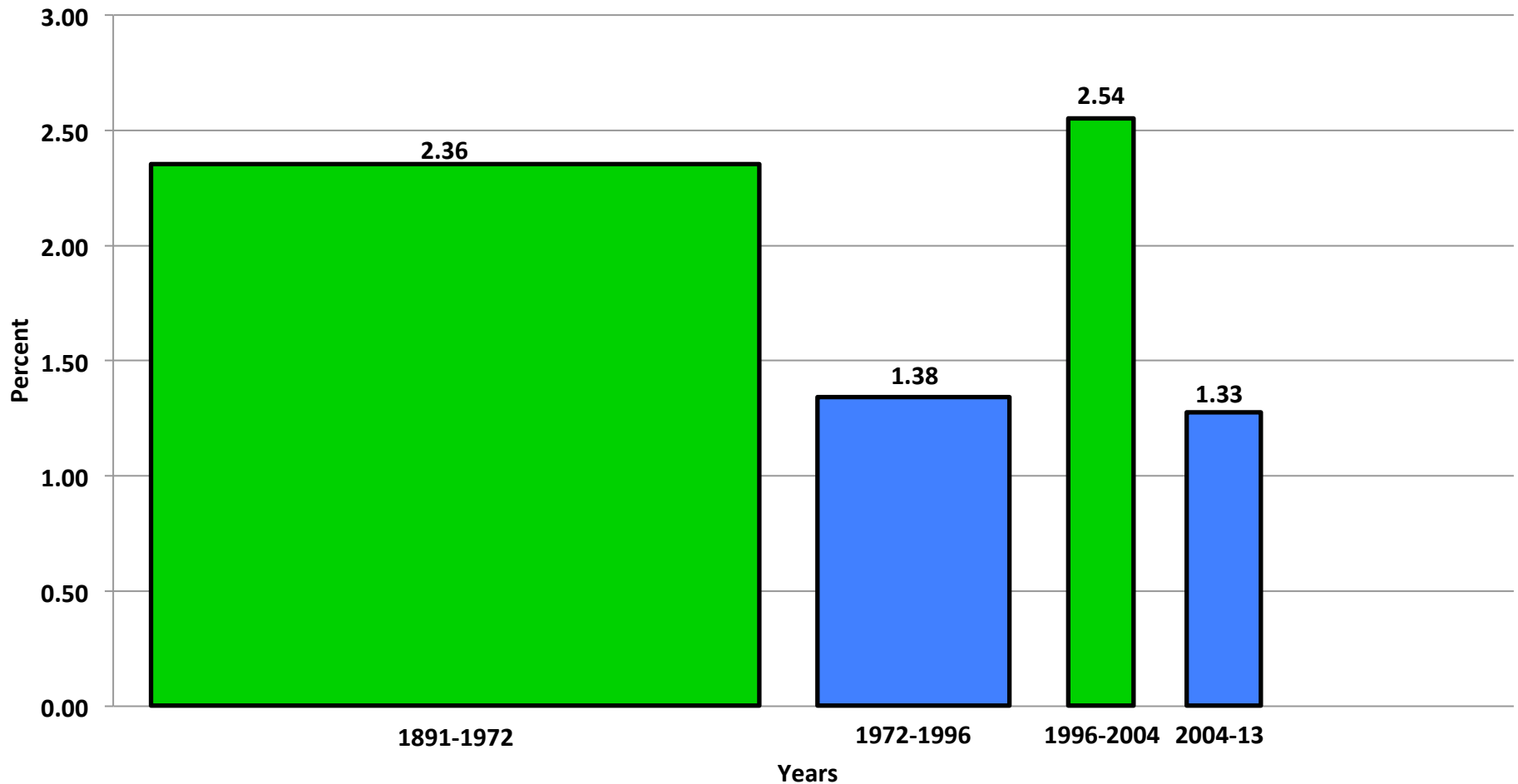
- **Big Data?** Most of this is being collected by marketing departments from bar-code scans and by airlines from internal data. Creates market share, not social value. The *Economist* reports the use of big data in marketing departments increased 3X faster than in other corporate departments.
- **Small robots?** They work at specialized tasks, like fetching the books in an Amazon warehouse. They still can't pack the boxes.

# Other Great Inventions of the Future

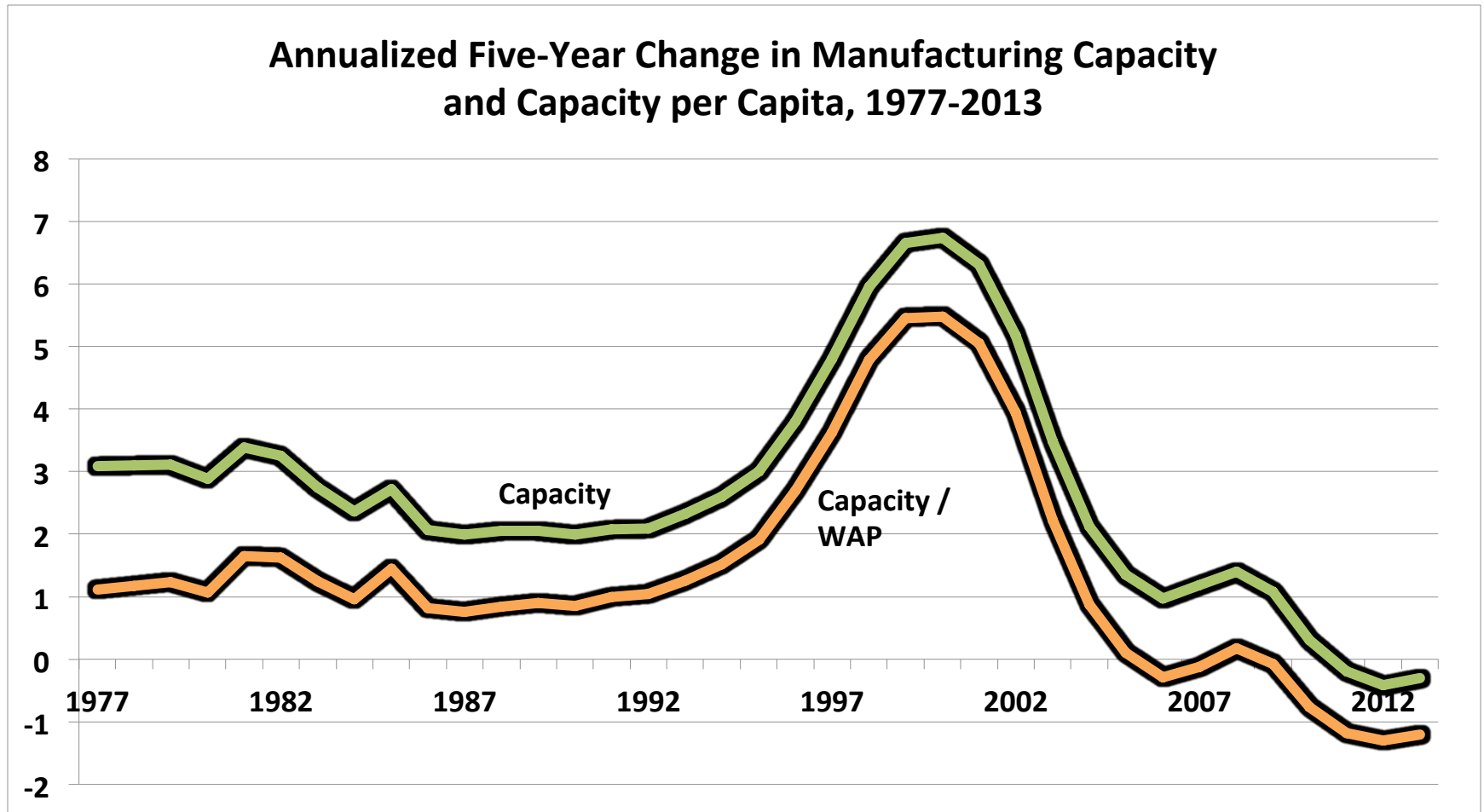
- **Driverless trucks? Think of the UPS driver. He doesn't just drive. He finds the packages and knows where to deliver them.**
- **Genome and medical advances**
  - They mainly consist of very high priced pharmaceutical treatments for rare forms of cancer
  - Future collision between longer life expectancy and intractability of dementia and Alzheimer's.
- **Tim Cook's Stage Appearance Last Week**

# Four Pieces of Evidence That the Late 1990s Were Special

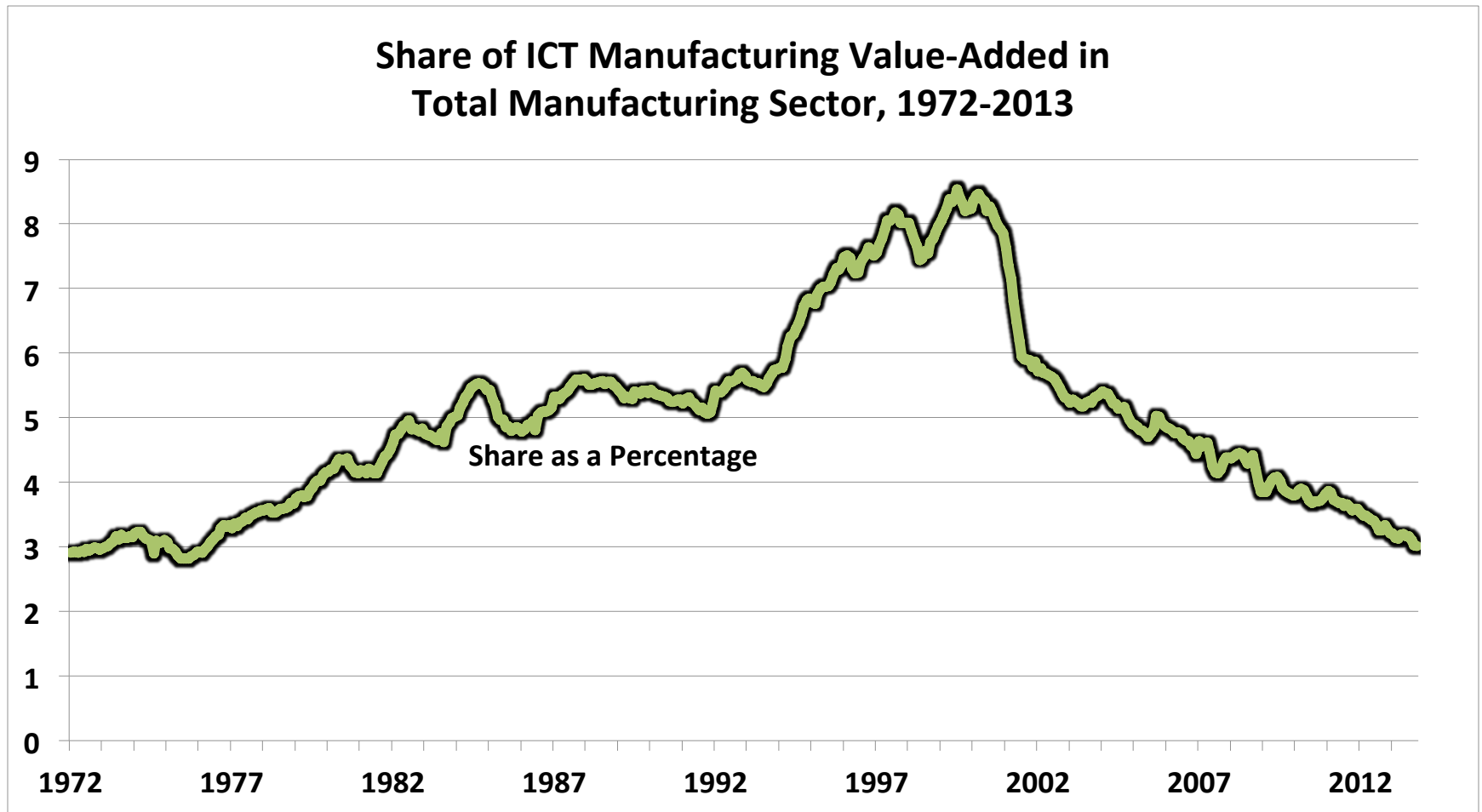
Figure 5. Annualized Growth Rates of Output per Hour, 1891-2013



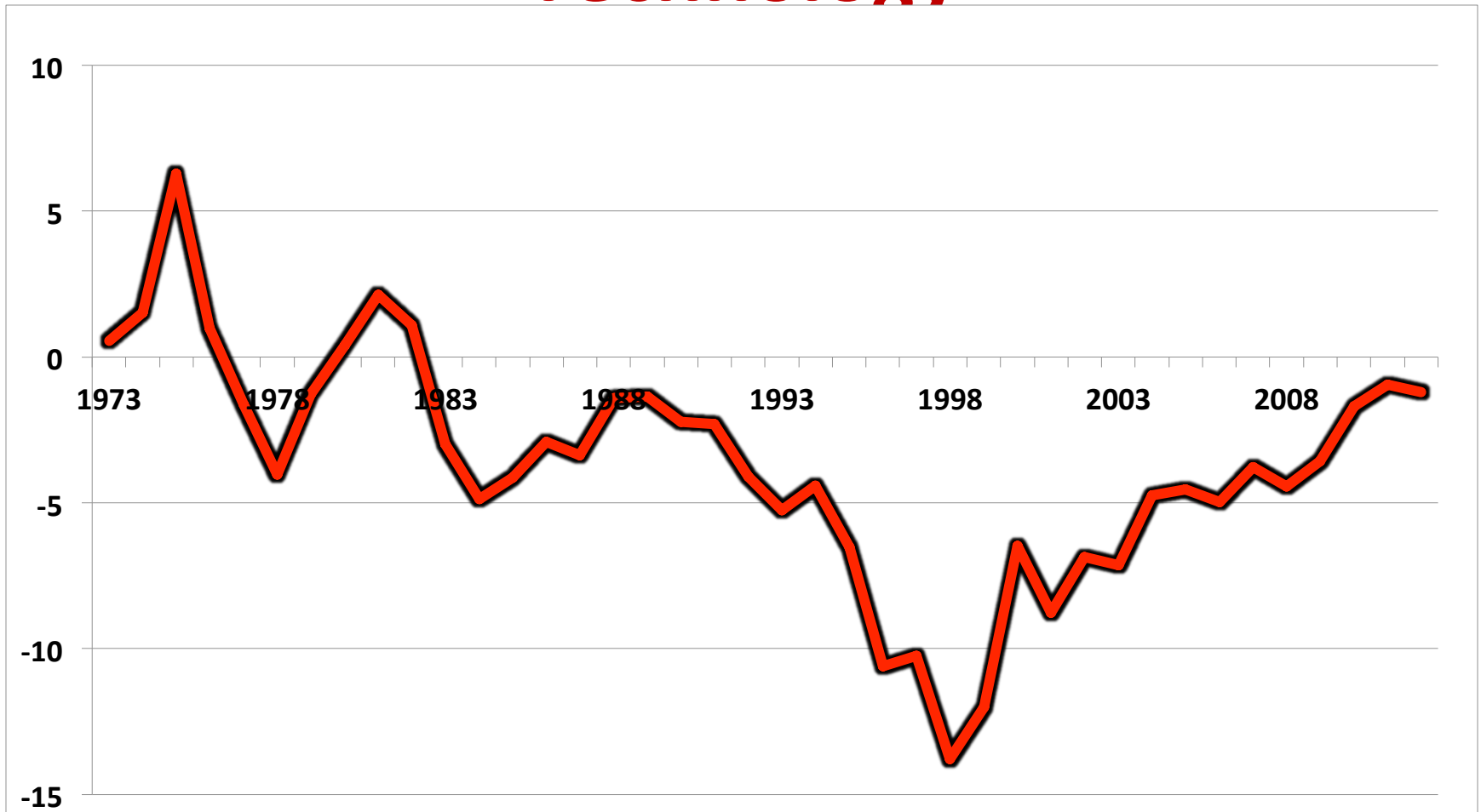
# Growth in Manufacturing Capacity Peaked in the late 1990s



# The Most Dynamic Part of Manufacturing Has Disappeared



# Annual Change of Price Index for Information / Communication Technology

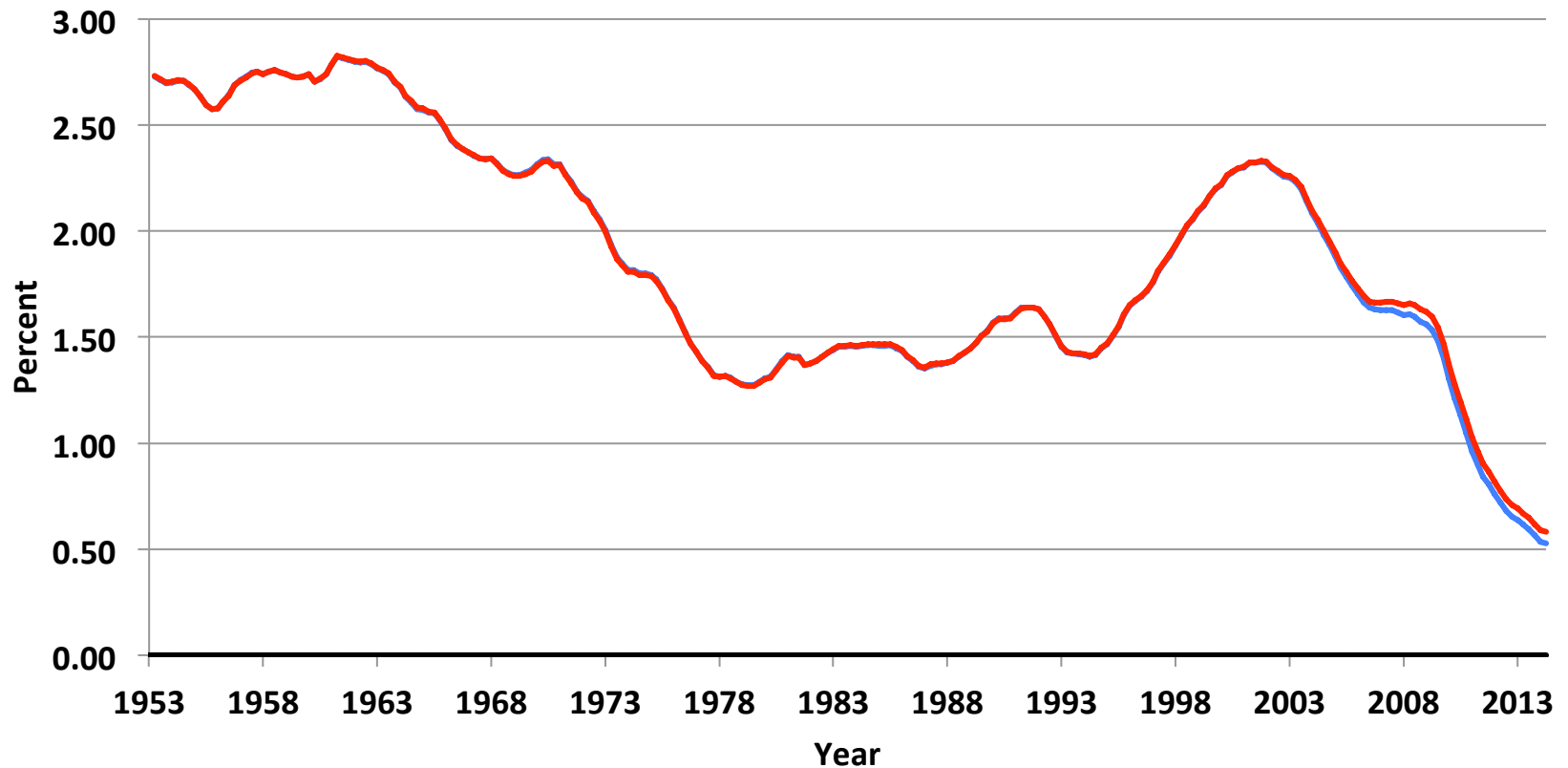


# Summing Up the Innovation Forecast

- **Computers, digitalization, and the internet created a quantum leap in the processing of information.**
- **Much of the world's information is available instantly and for free.**
- **But think of the dates. Amazon 1994, Google 1998, Wikipedia 2001, ipod and itunes 2001**
- **What if innovation fails and falls short of the pace of 1972-2014? What is in the pipeline now as important as the PC, the web, the search engine?**

# A Finely Tuned Depiction of the Productivity Growth Trend

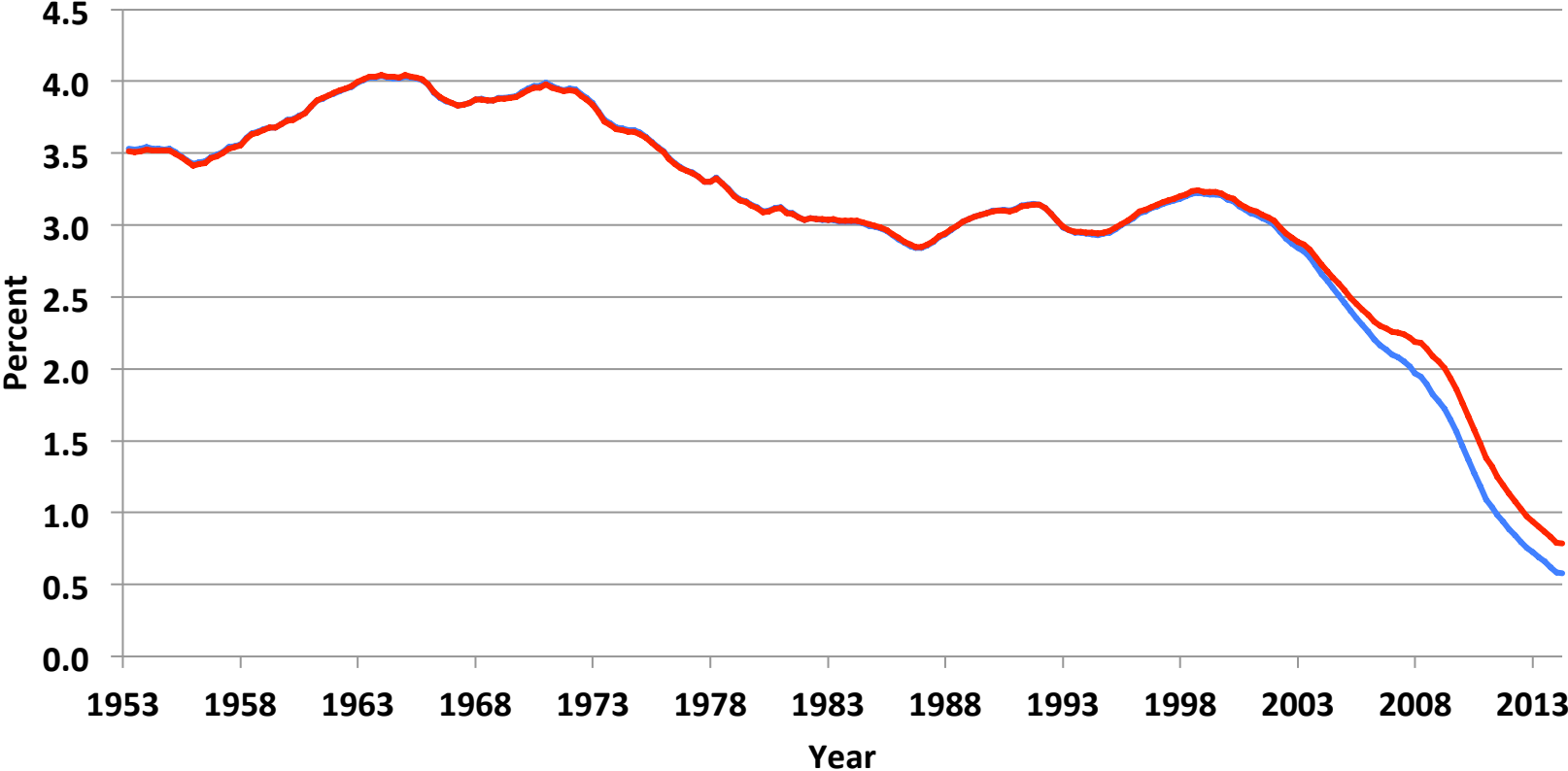
YP/HP Kalman Trends for Total vs Alt NAIURU





# Hours Change Plus Productivity Change Equals Rate of Output Change

YP Kalman Trends for Total vs Alt NAIRU



# **Are There Policy Solutions?**

## **Yes, and They Are Radical**

- **Demographics:** index the retirement age to life expectancy and sharply raise quotas for legal immigration
- **Reduce the share of the population in prison by legalizing drugs.**
  - This should have been done 50 years ago in response to Milton Friedman’s 1962 book *Capitalism and Freedom*.
- **Education:** impose higher standards in secondary school while investing in pre-school to reduce the “vocabulary gap”

# More Policy Solutions

- **Inequality: return capital gains and dividend tax rates to pre-1997 levels.**
- **Fiscal: eliminate \$1.6 trillion of tax loopholes, mainly benefitting the rich. Join Martin Feldstein in the campaign against “tax expenditures.”**
- **Make medical care a right of citizenship, not tied to employment status**

# Summary:

## Headwinds vs. Innovation

- **If future innovations are less important than the last 125 years and especially if they are less important than the last 40 years, all developed nations are affected**
  - Still room for catching up in emerging markets
- **Headwinds in other countries may be less serious**
  - Better education (Canada, Korea)
  - Less inequality (Japan, Korea, France, Scandinavia)
  - Less future burden of rising debt/GDP ratio
- **Assignment for the rest of this session: Comment on all of the above.**