

# Race Against The Machine

Erik Brynjolfsson

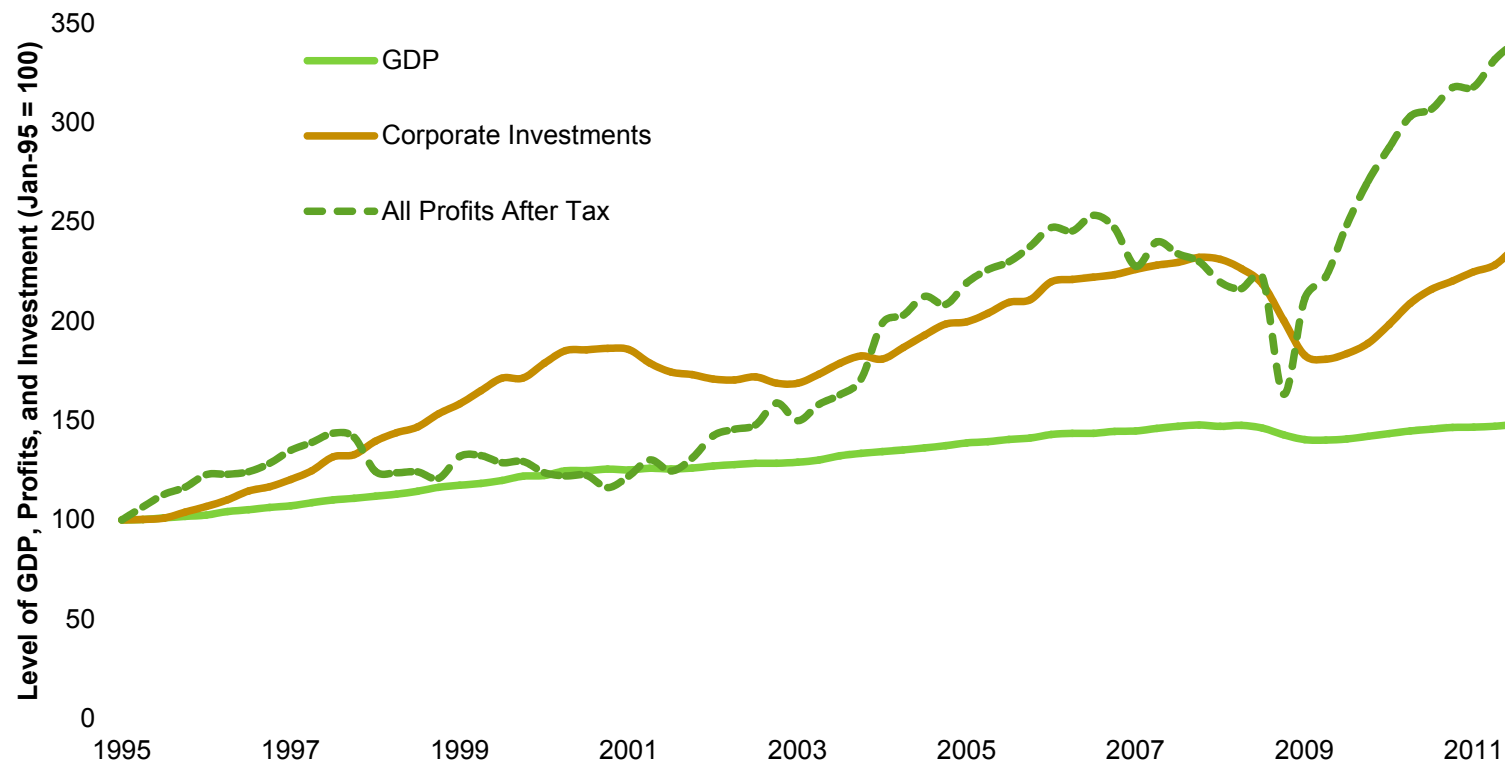
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# GDP, Profits and Investment



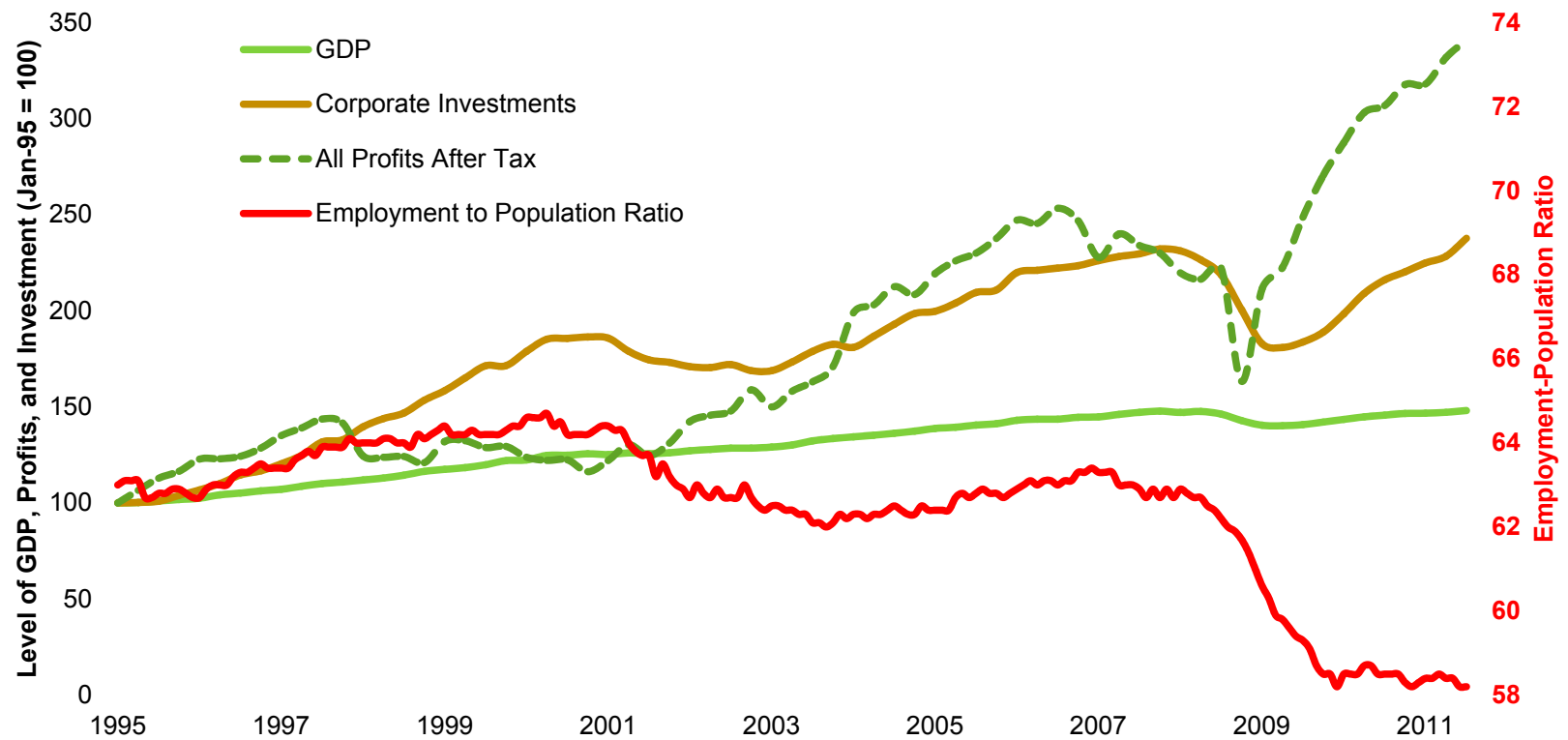
## Trends in US GDP, Profits, and Investment 1995-2011



# GDP, Profits, Investment, and Employment



## Trends in US GDP, Profits, Investment, and Employment, 1995-2011



# WHAT'S GOING ON?

# Our View



Erik Brynjolfsson  
Andrew McAfee

## Race Against The Machine



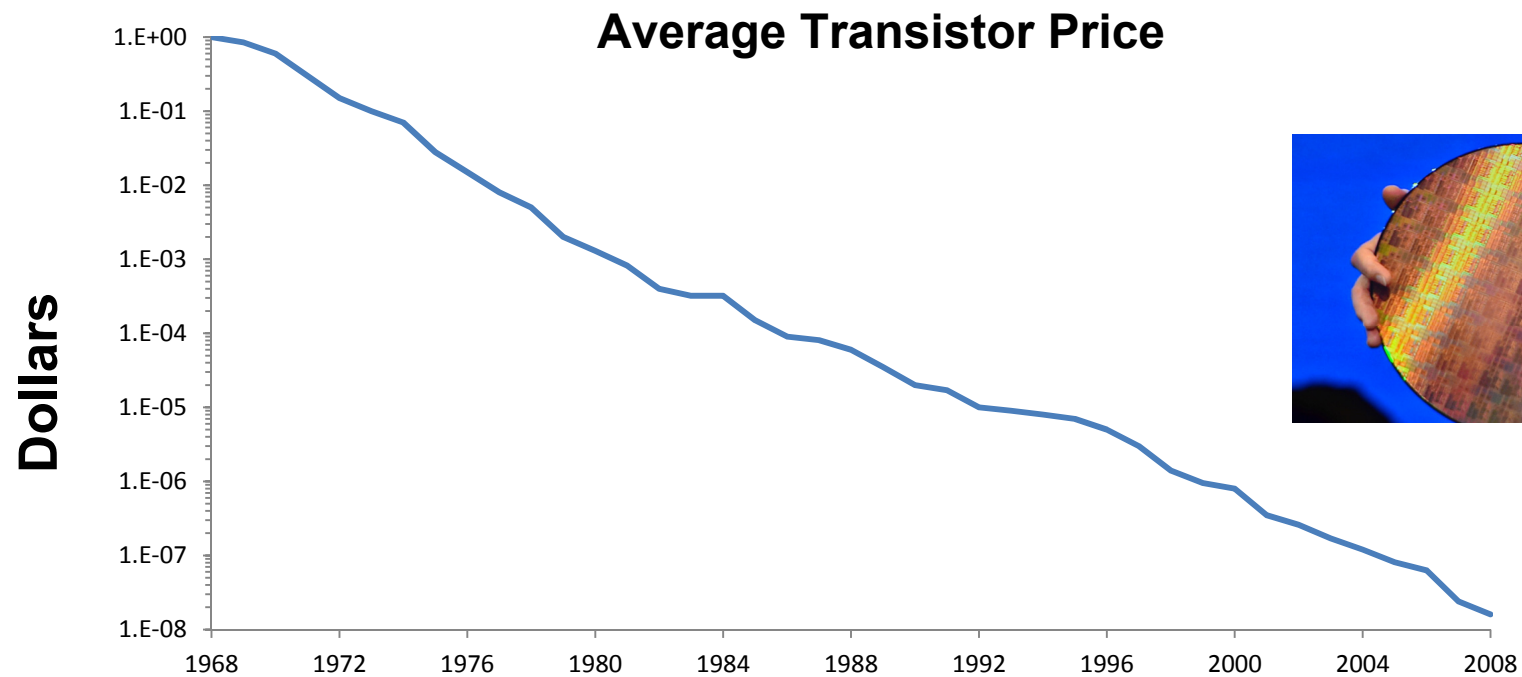
How the Digital Revolution is Accelerating Innovation,  
Driving Productivity, and Irreversibly Transforming  
Employment and the Economy

“Digital technologies change rapidly, but organizations and skills aren’t keeping pace.

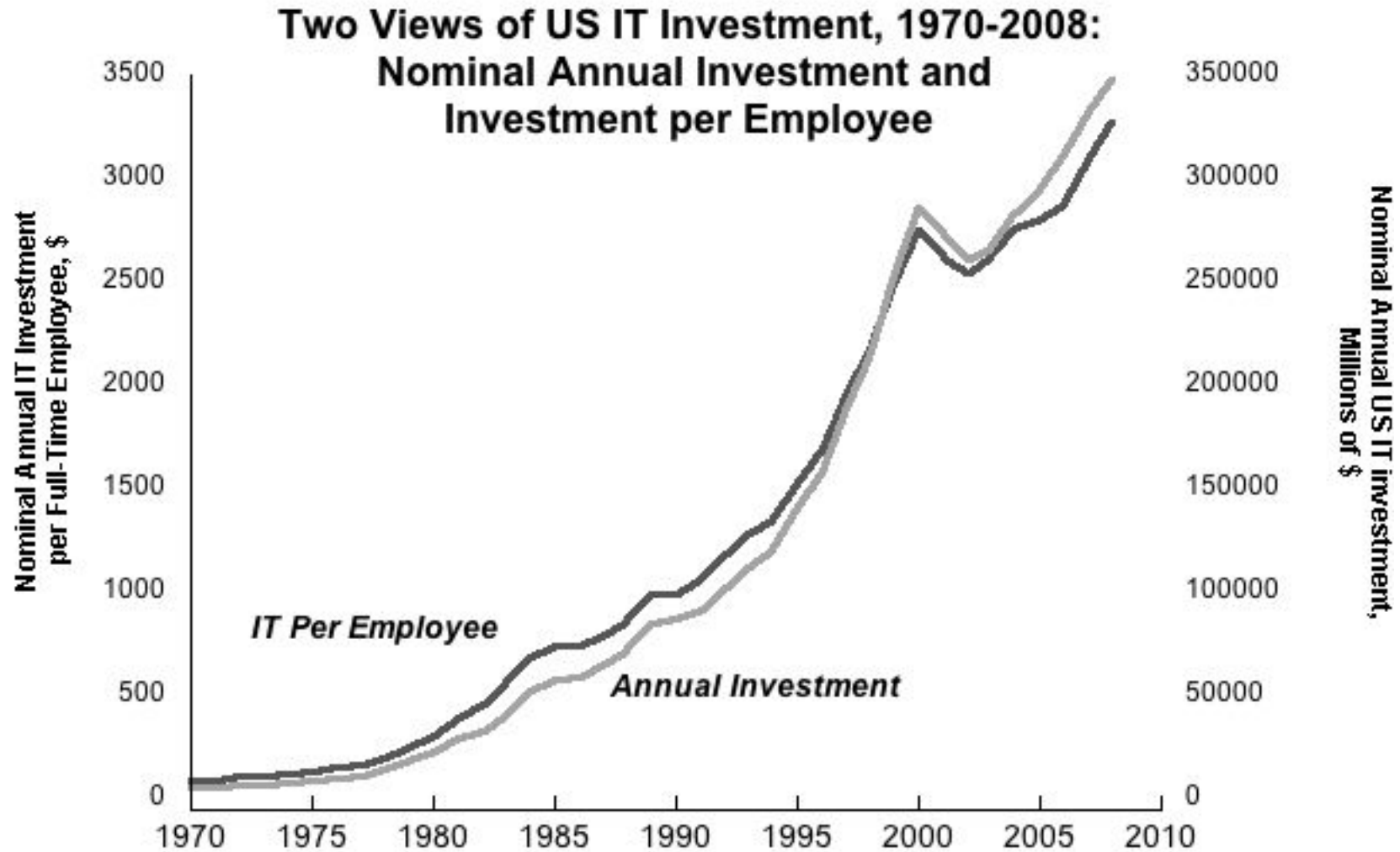
As a result, millions of people are being left behind. Their incomes and jobs are being destroyed, leaving them worse off ... than before the digital revolution...”

# THE DIGITIZATION OF THE ECONOMY

# Computers are getting dramatically cheaper and more powerful



# IT Investment Over Time





# What are the Economic Consequences of this Rapid Digitization of the Economy?

# The Hard Truth



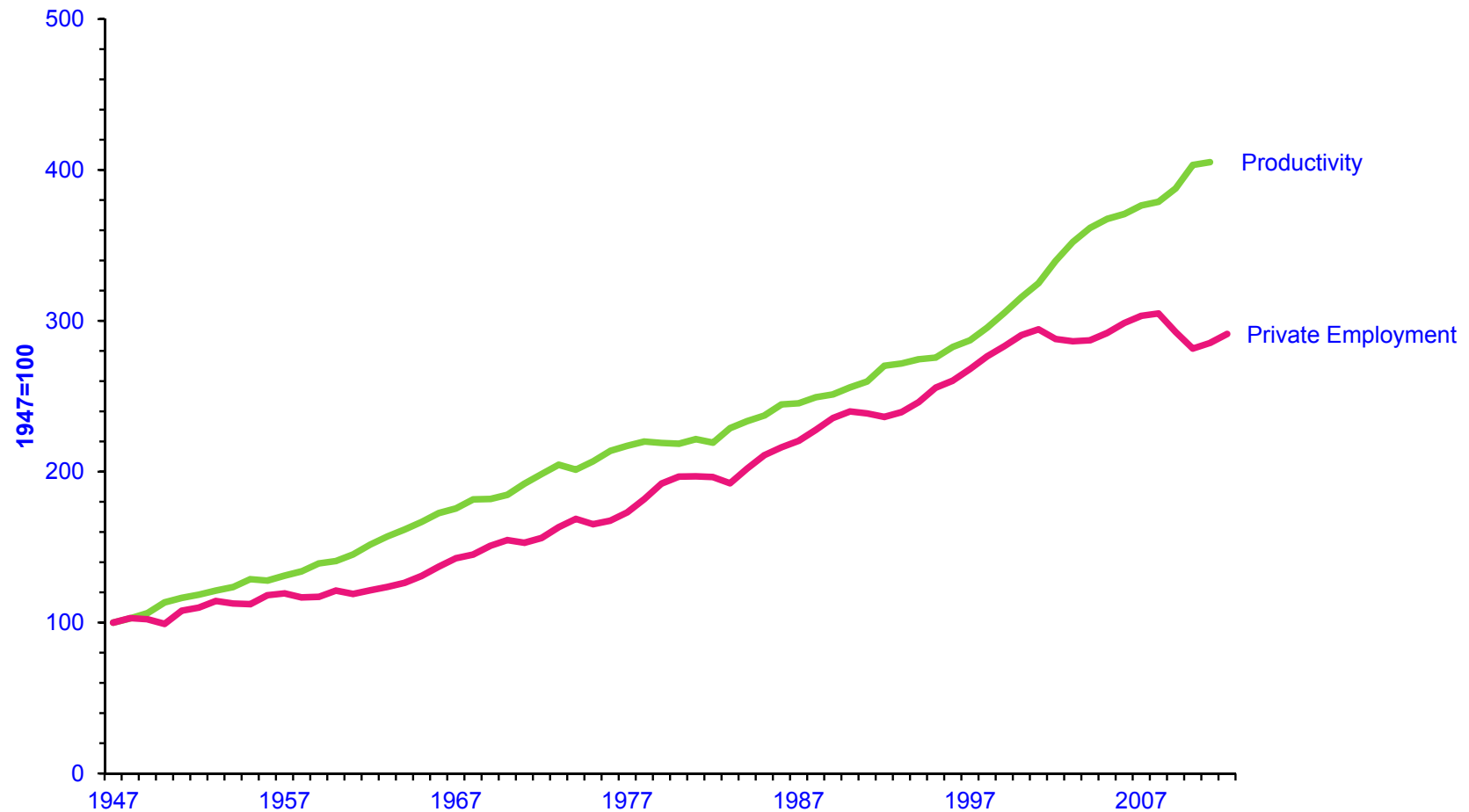
Digital progress makes the economic pie bigger.

But there is no economic law that everyone, or even most people, will benefit.

# The Great Decoupling



## Labor Productivity & Employment, 1947-2010

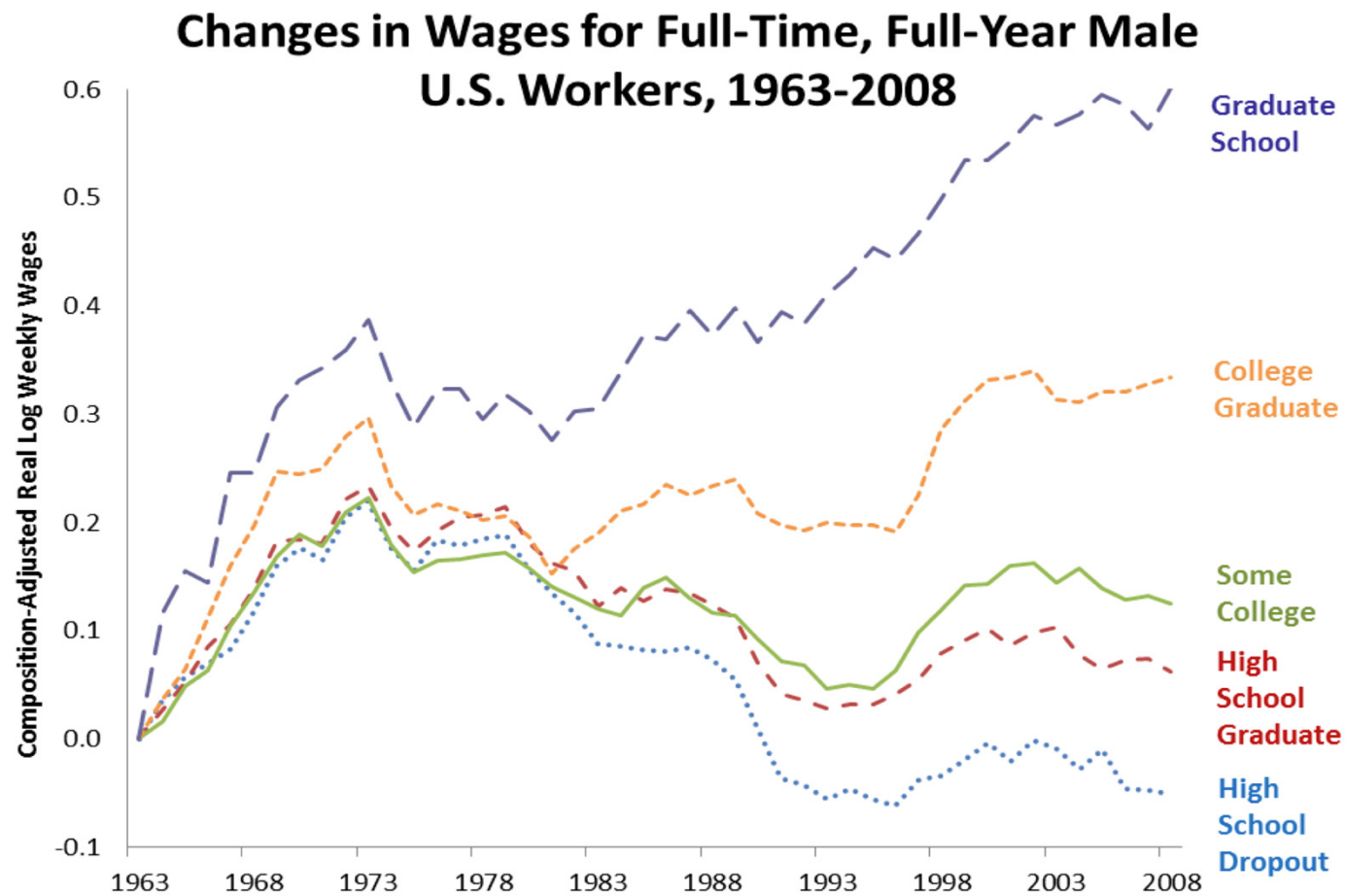


# Three Sets of Winners and Losers



## 1. High Skilled vs. Low & Mid Skilled Workers

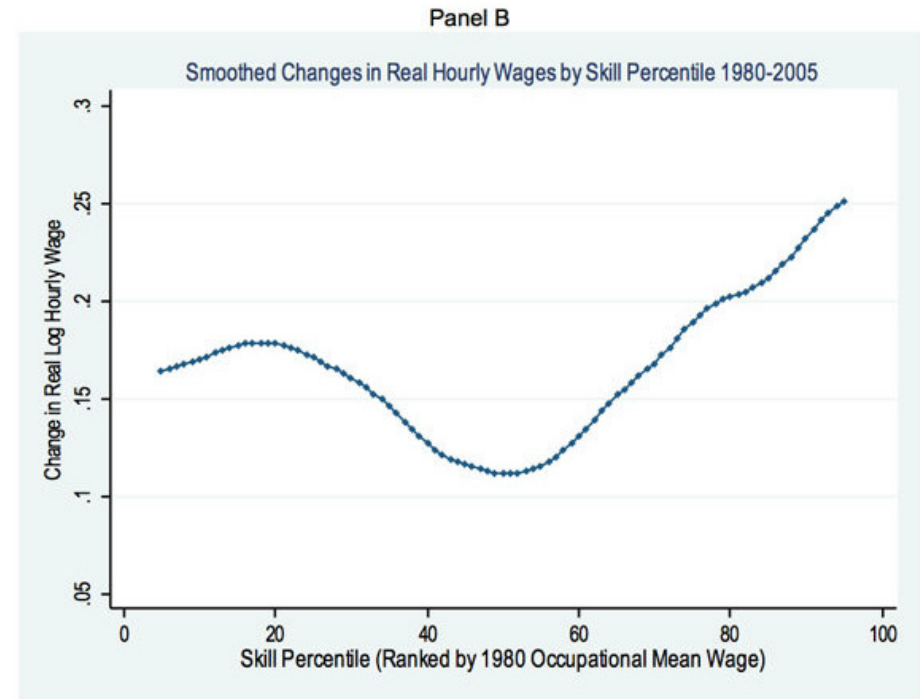
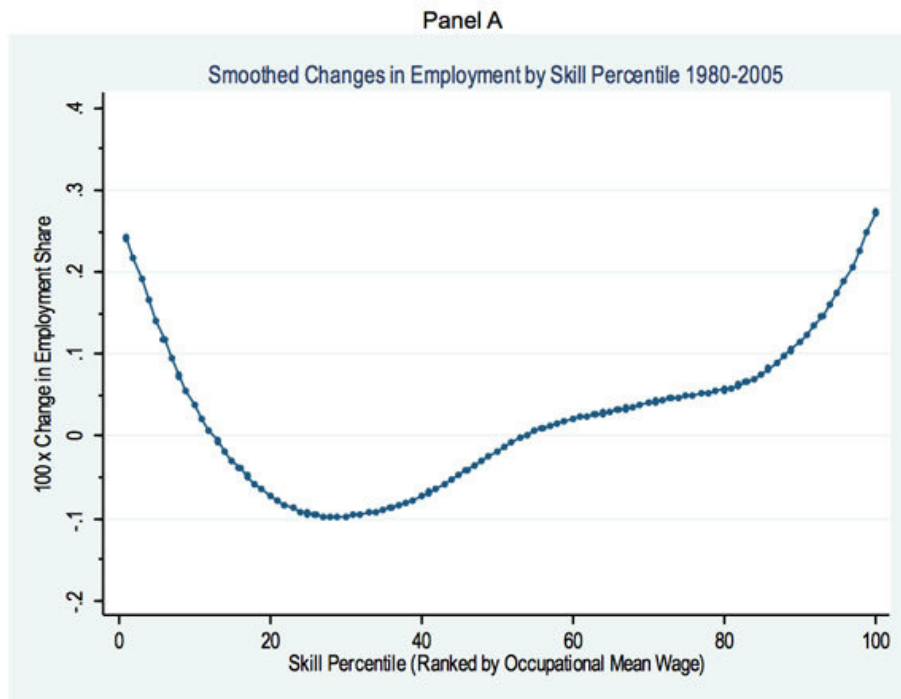
# Skill Disparities



# Polarization of the Labor Market



Mid-wage workers have been hit hardest  
in both employment and wages

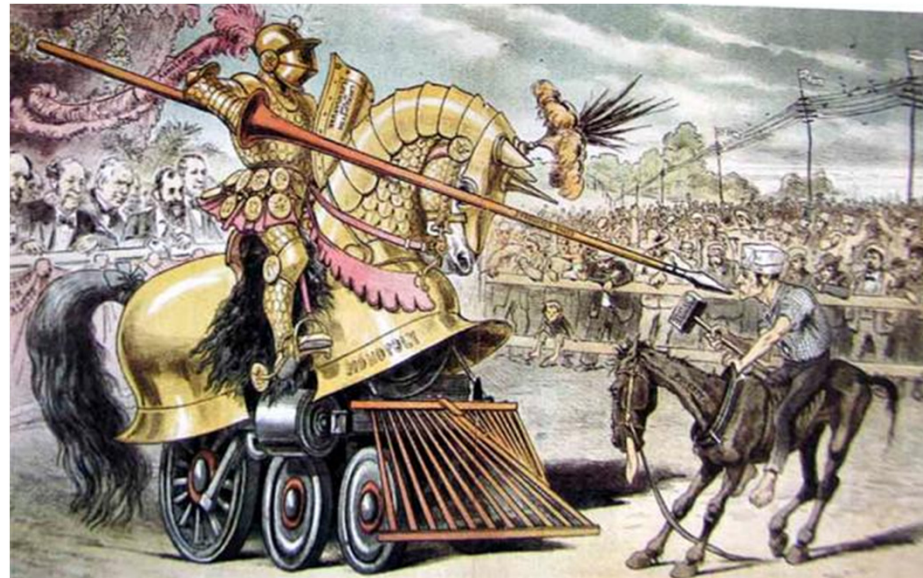


Source: Autor and Dorn, MIT Working paper, 2013

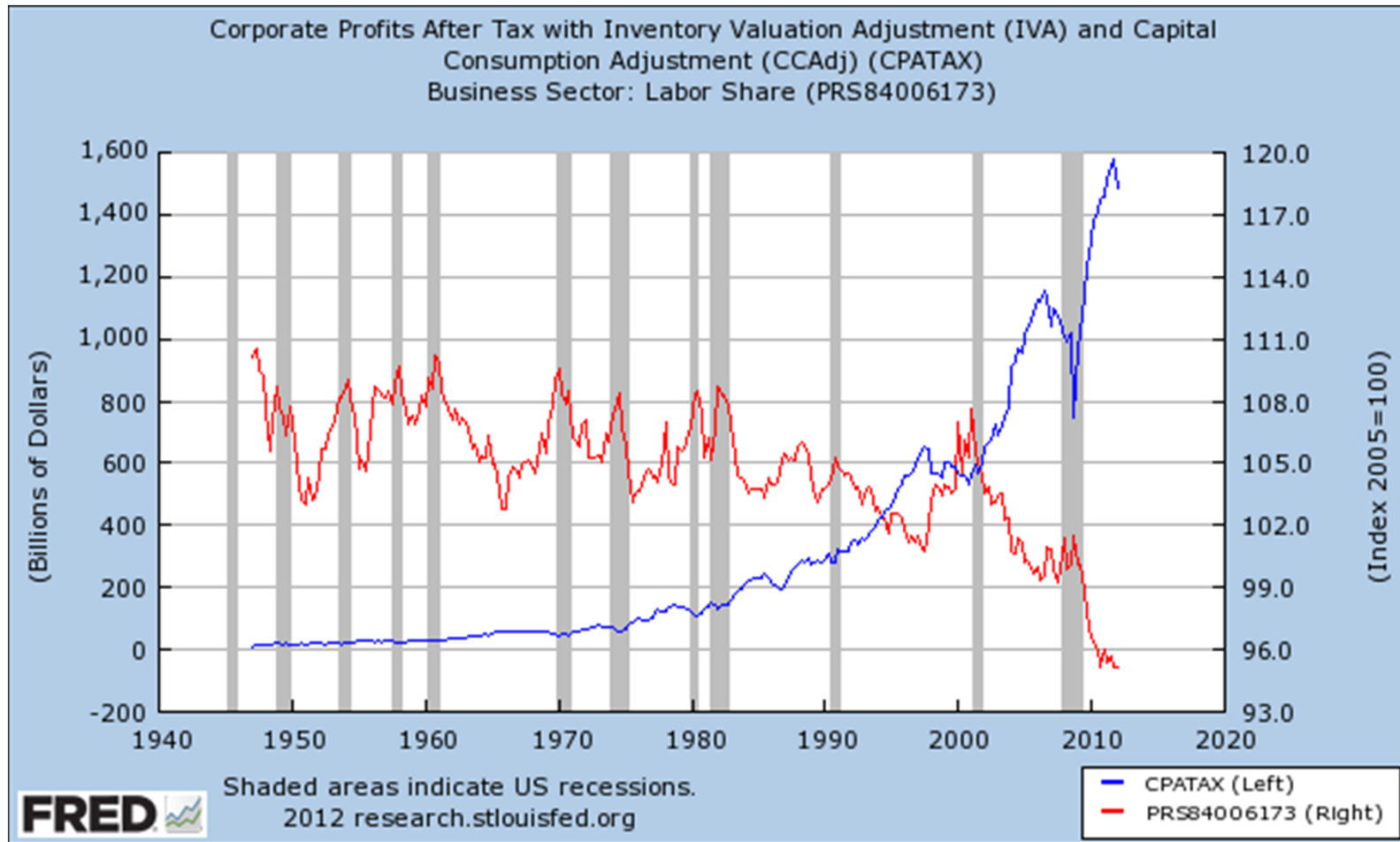
# Three Sets of Winners and Losers



1. High Skilled vs. Low & Mid Skilled Workers
2. Capital vs. Labor



# Capital and Labor





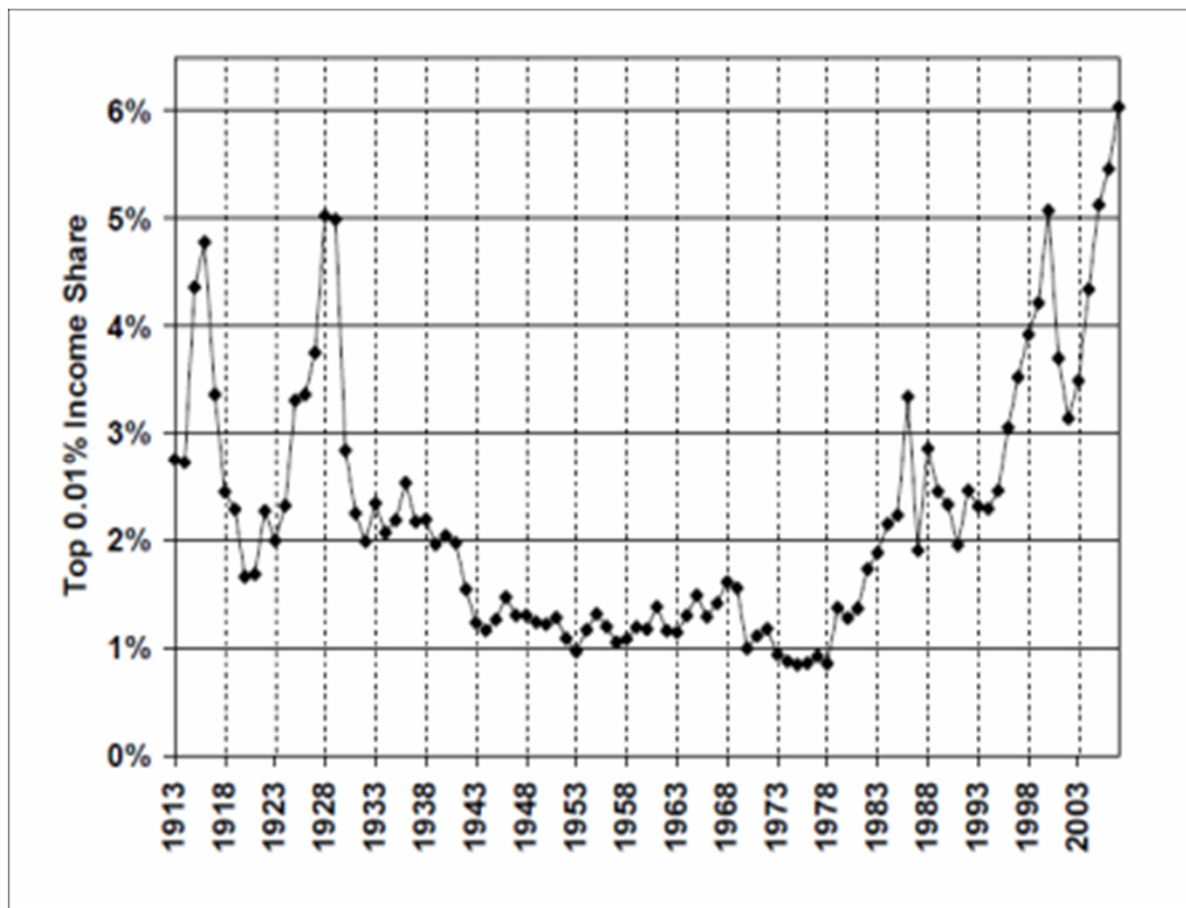
# Three Sets of Winners and Losers



1. High Skilled vs. Low & Mid Skilled Workers
2. Capital vs. Labor
3. Superstars vs. Everyone Else



# Superstars



Source: Piketty and Saez

*WE AIN'T SEEN NOTHING YET...*

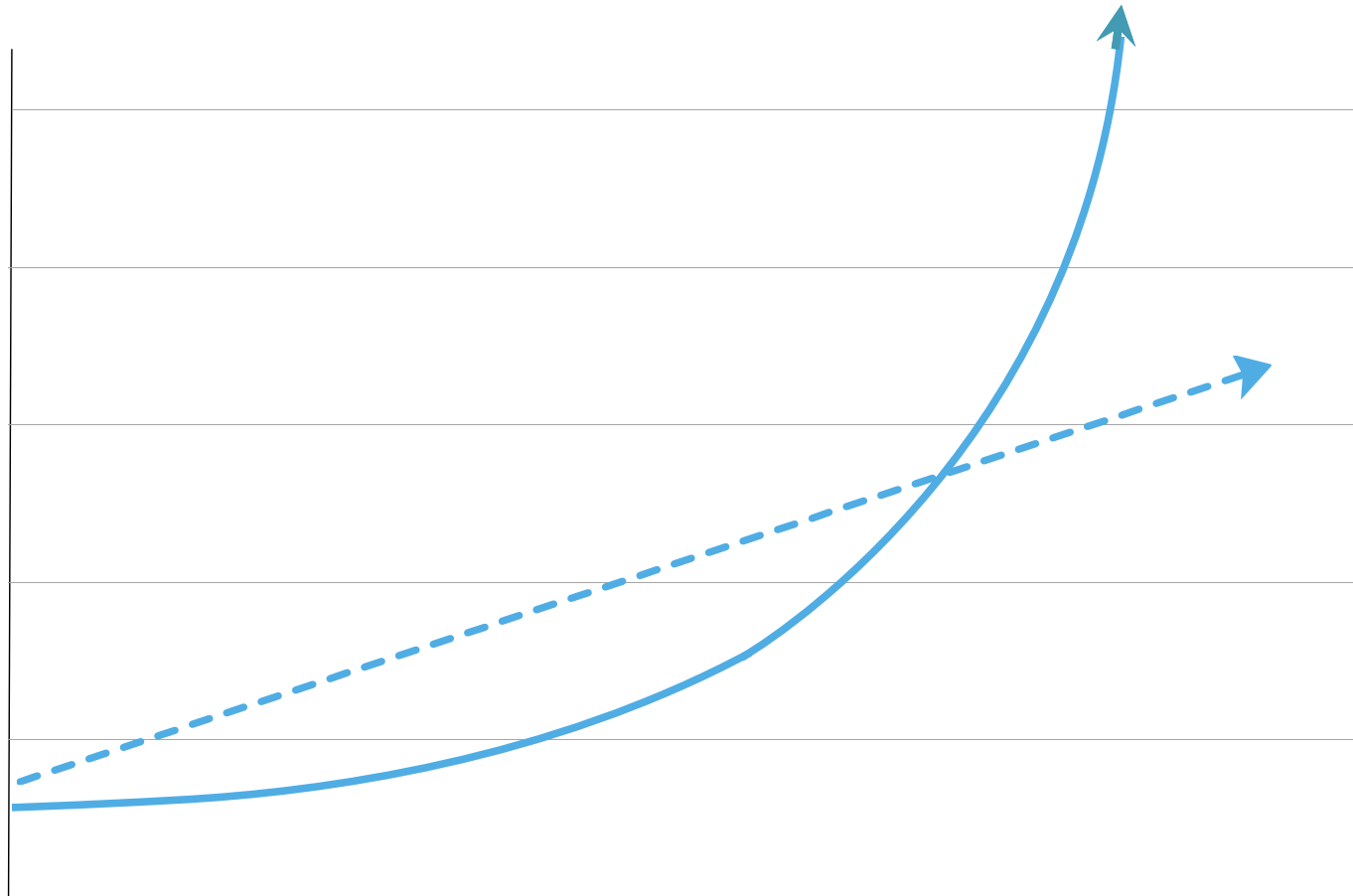




# The Digital Frontier



# Linear versus Exponential Growth



# WHAT IS TO BE DONE?



# The New Grand Challenge



- Digital technologies will continue to accelerate.
- Our skills, organizations and institutions are lagging.
- Business as usual won't solve this problem.

# Education and Entrepreneurship



Work on *both* aspects of skill/work mismatch



# Education

## 1. Focus at all levels

- K-12, University, Vocational, On-the-job, Lifelong

## 2. Use technology

- Education has been a laggard => big upside!
- MOOCs: MITx, Kahn Academy, Udacity
  1. Low cost replication of best teachers, content and methods
  2. Data gathering creates feedback for continuous improvement
- Real-time data on skills needed by companies
- Recommendation systems for courses and jobs using big data

## 3. Give vocational schools and colleges “skin in the game”

- Tie tuition payment to future earnings: “equity” vs. “debt”
  - Forgivable loans
- More accountability: separate teaching from evaluation and certification

## 4. Simply invest more

- Higher teacher salaries to attract best and brightest
  - Very large social returns to better teachers
- More school hours, long school years, more after school, preschool

Goldin & Katz: *The Race Between Technology and Education*

# Entrepreneurship

## Boost Entrepreneurship

- Not because everyone can or should be an entrepreneur  
Although more could be!
- Because entrepreneurs lead creative destruction  
90% worked on on Farms in 1800, now 2%  
But Ford, Edison, Gates and others created new industries

### 1. Reduce regulation and certification, esp. at local level

- Lower all barriers to business formation
- Each regulation is like pebble in the stream with a cumulative effect.

### 2. Reduce employment taxes and decouple benefits from employment

- Employment has positive externalities so we should subsidize, not tax it.

### 3. Teach entrepreneurship not just in MBA programs, but everywhere

### 4. Nurture platforms, templates and new ways to organize work

- App economy, eBay, Facebook,
- Fold-it, reCAPTCHA, NASA clickworkers
- oDesk, Kaggle, RelayRides

### 5. New Grand Challenge for Entrepreneurs, Engineers and Economists

- Invent complements, not substitute for labor
- Replace labor saving and automation mindset with maker and creator mindset

# MIT Initiative on the Digital Economy

<http://digital.mit.edu/IDE>  
<http://digital.mit.edu/erik>

