The Economics Behind Value and Growth Investing

Dimitris Papanikolaou

Kellogg School of Management

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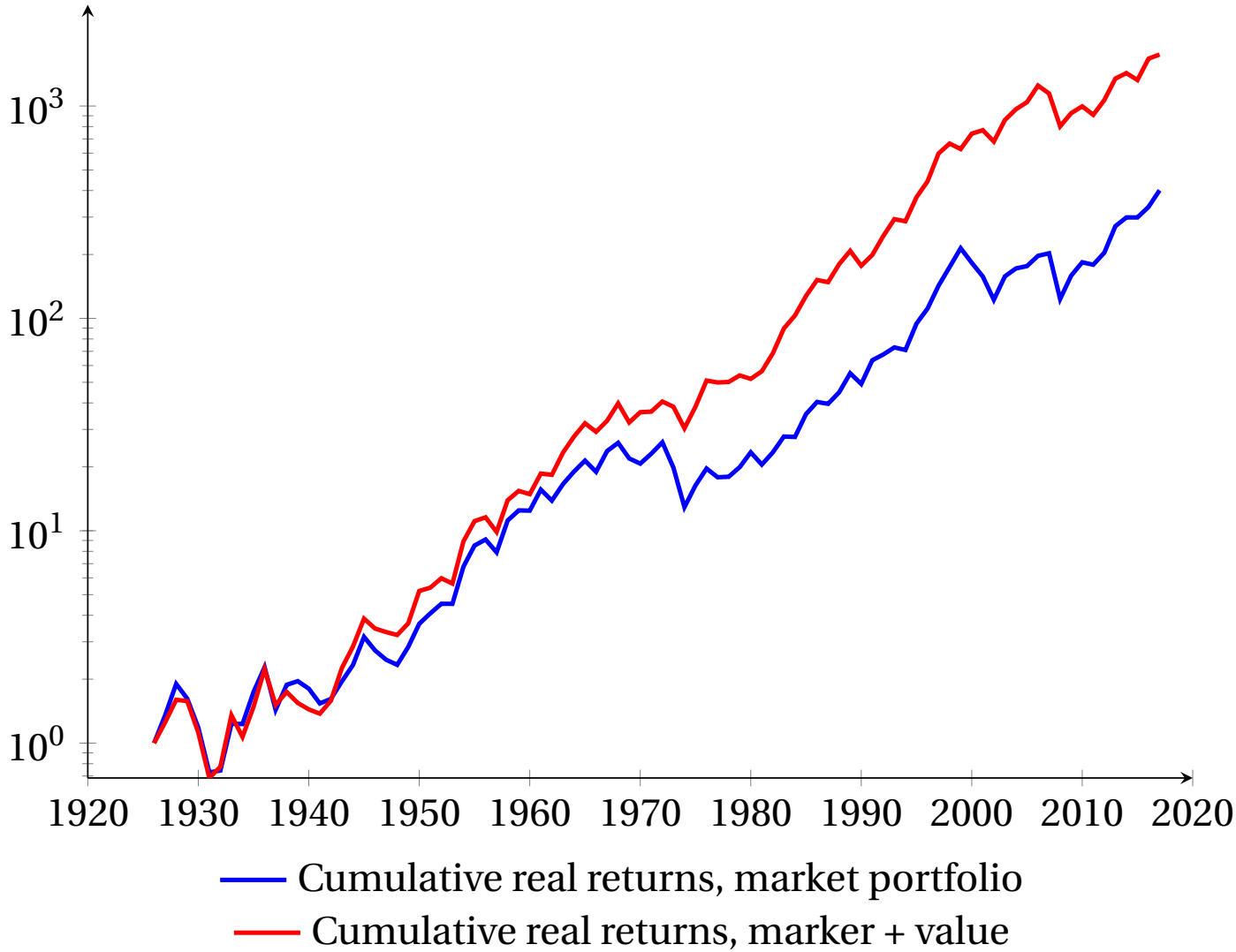
Modern Portfolio Theory (in a nutshell)

1. Market Portfolio has the highest Sharpe Ratio (expected return per unit of overall risk).

2. All investors should hold a combination of the risk-free asset and the market.

How does it work in the real world?

VALUE HAS CONSISTENTLY BEAT THE MARKET



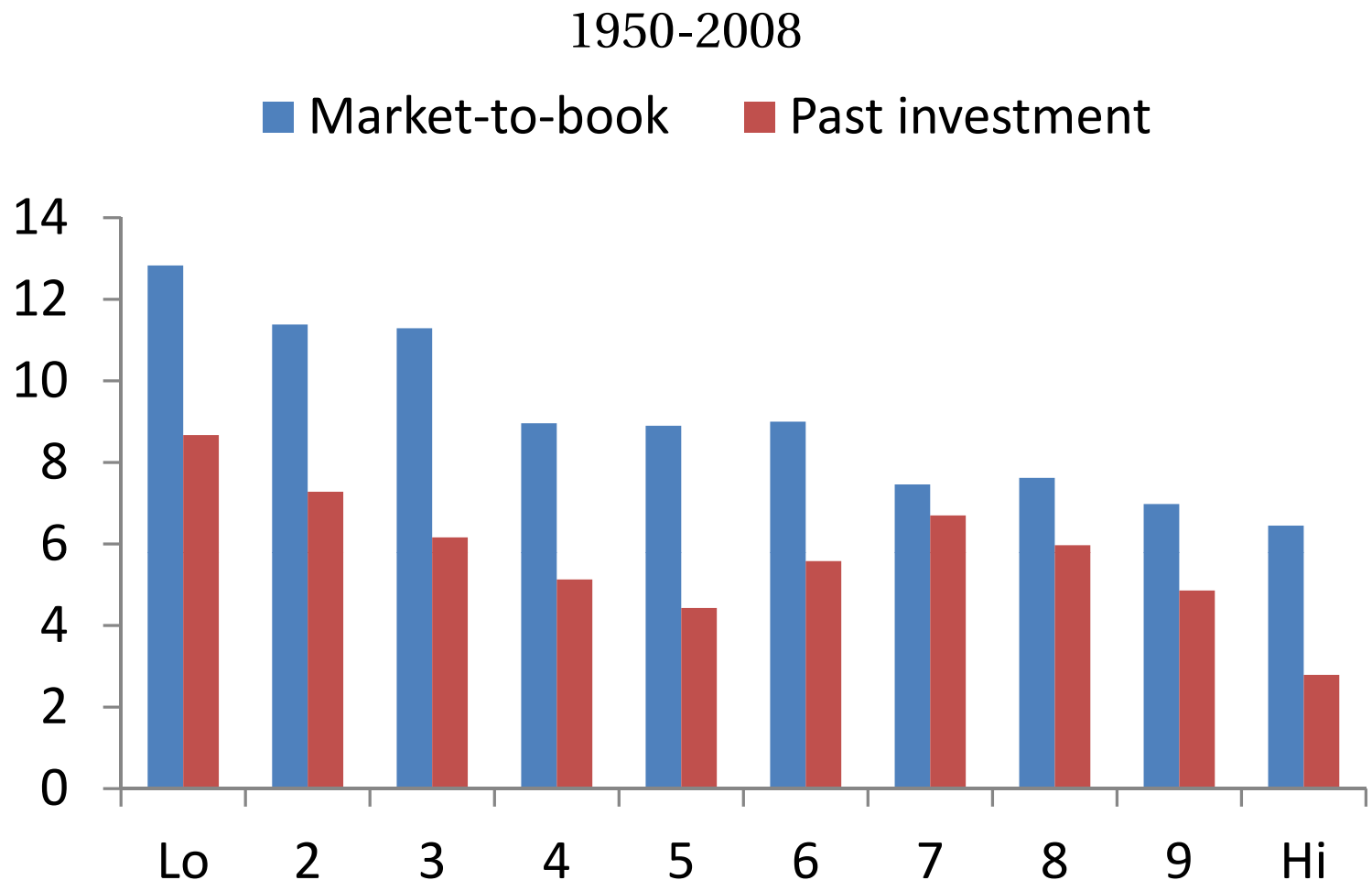
- post WW2, a portfolio that overweighs value stocks has handily outperformed the market (SR 0.5 vs 0.4).

VALUE AND GROWTH

- Value Firms have **low valuation** ratios (P/E, M/B), tend to be **more profitable**, but are expected to **grow slower**.

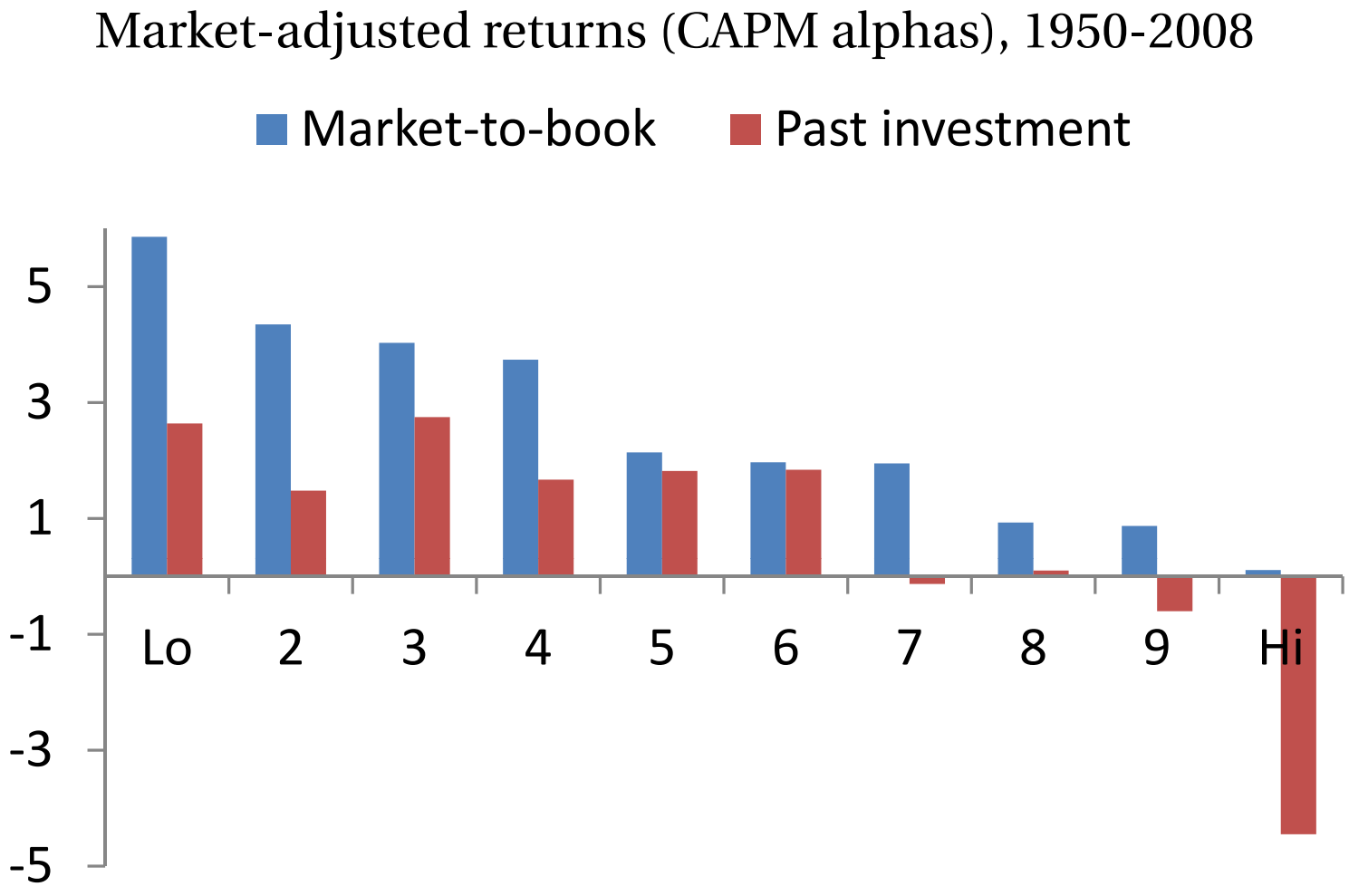
- Growth Firms have **high valuation** ratios (P/E, M/B), tend to be **less profitable**, but are expected to **grow faster**.

AVERAGE EXCESS RETURNS



- Patterns robust across different definitions of value and growth

IT IS NOT ALL ABOUT MARKET RISK



- Growth firms produce low stock returns after adjusting for market risk

WHO ARE THE GROWTH INVESTORS?

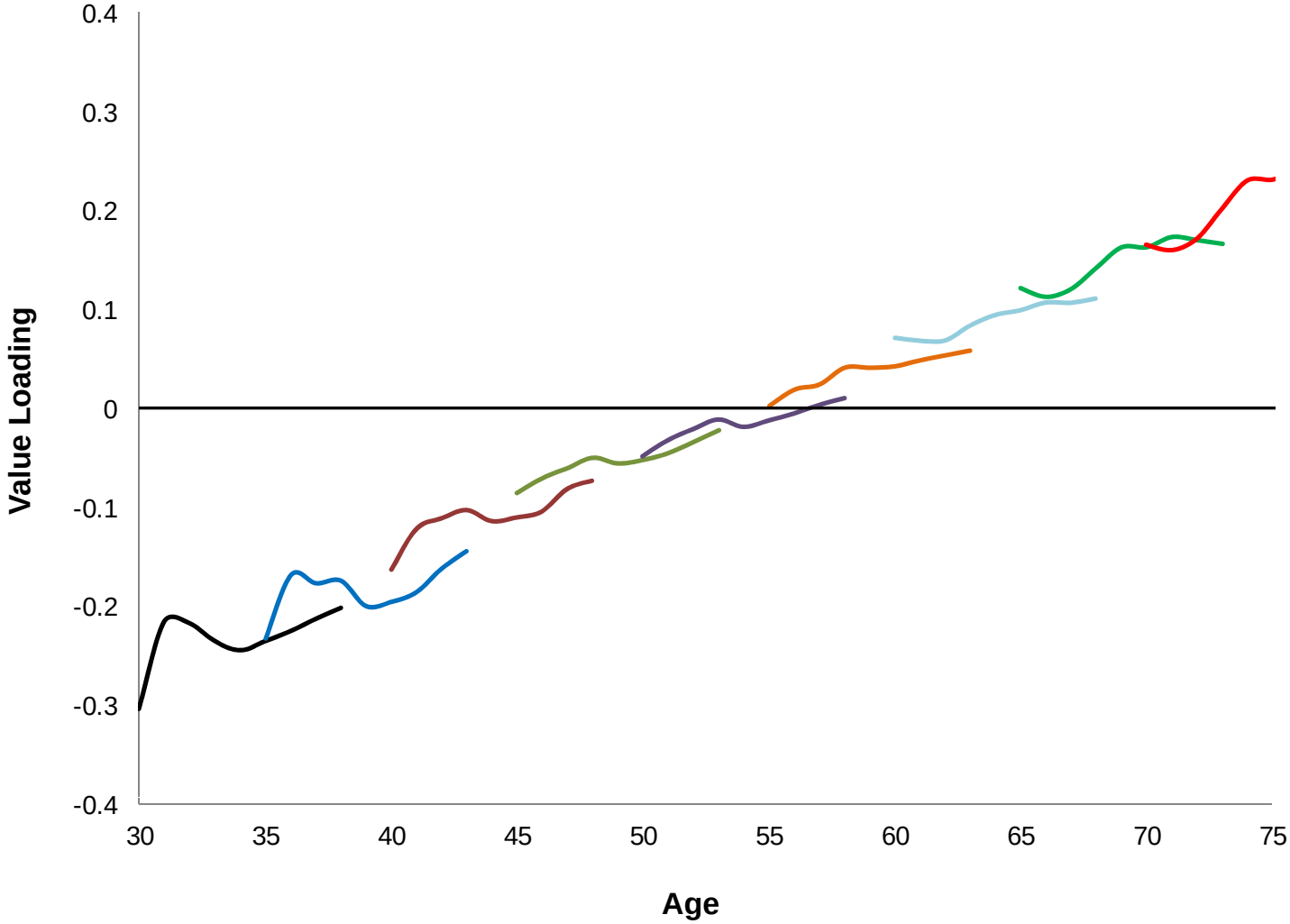
- Not everyone can overweigh value stocks: investors collectively hold the market
- Some investors have a growth tilt; for some reason, they must prefer it to a value tilt
- Sodini, P., S. Betermier and L. Calvet, "Who are the Value and Growth Investors?", *Journal of Finance*, 2017
  - Use Swedish household data

"Value investors are substantially older, tend to have higher financial wealth, higher real estate wealth, lower leverage, lower income risk, lower human capital, and are also more likely to be female, than the average growth investor."

"By contrast, males, entrepreneurs, and educated investors are more likely to invest in growth stocks."

OLDER INVESTORS HAVE A VALUE TILT

1999 to 2007



Modern Portfolio Theory vs the World

1. Market Portfolio has the highest Sharpe Ratio (expected return per unit of overall risk).
   - Not true in practice: tilting the portfolio towards value yields higher Sharpe Ratios.

2. All investors should hold a combination of the risk-free asset and the market.
   - Not true in practice: older investors hold value, younger investors hold growth.

What are we missing?

- Growth stocks are a hedge against technological displacement.

Outline/ Key questions

What is technological displacement?

Can we measure it?

Why are growth firms a hedge?

Why do investors want to hedge innovation?

Outline

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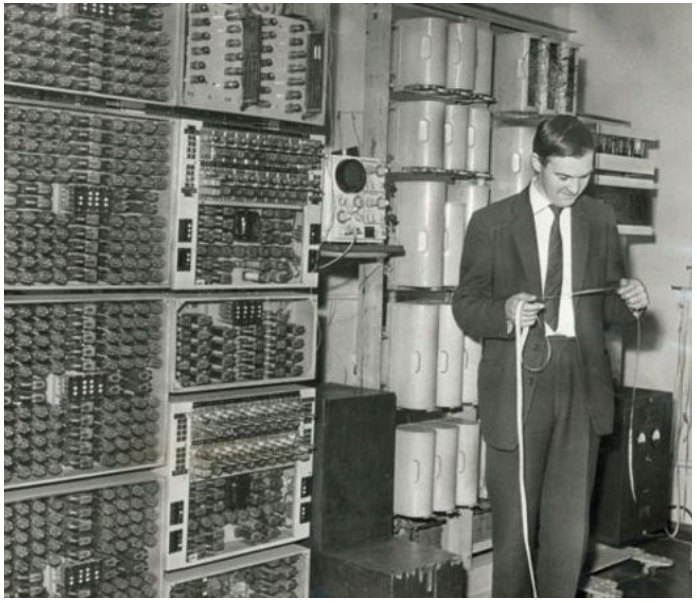
Why do investors want to hedge innovation?

INNOVATION OFTEN MANIFESTS AS IMPROVEMENTS IN CAPITAL GOODS



- Cost in 2010 dollars
  - **$ 5,000**; state-of-the-art IBM server
  - **$ 5,100,000**; Burroughs 205, in 1960
  - **$ 160,833,333**; computer with same CPU power as IBM server, in 1960

INNOVATION CYCLES ARE NOT BUSINESS CYCLES

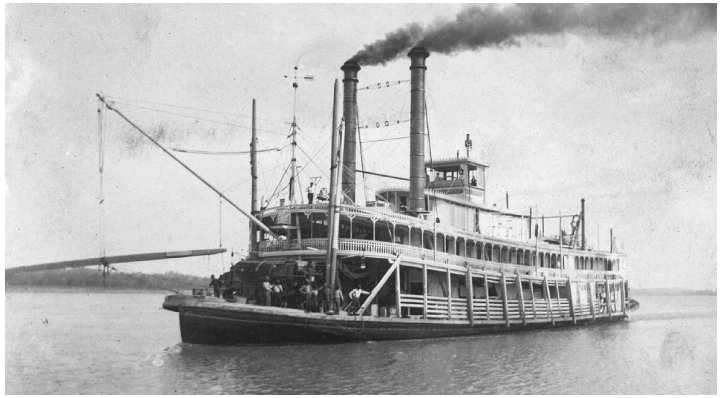
- Different horizon: innovation cycles occur at lower frequency
- Different timing: innovation booms need not coincide with business cycle booms
- Field (2003) "the years 1929-1941 were, in the aggregate, the most technologically progressive of any comparable period in U.S. economic history."

  "... throughout the Depression, behind the dramatic backdrop of continued high unemployment, technological and organizational innovations were occurring across the American economy, especially but not exclusively in chemical engineering (including petrochemicals and synthetic rubber), aeronautics, electrical machinery and equipment, electric power generation and distribution, transportation, communication, and civil/structural engineering ..."

TECHNOLOGICAL ADVANCES CREATE WINNERS AND LOSERS

- Schumpeter (1942) and creative destruction
- Benefits and costs are asymmetrically distributed
  - innovators versus investors in existing firms
  - labor versus vs owners of physical capital
  - “new economy” versus “old economy” firms

EXAMPLE: RAILROADS DISPLACED WATER TRANSPORTATION



- *"The early opinion that railroads could not compete with waterways gave ground before practical proofs to the contrary. . . during the last few years of rapid progress in railroad building no new canals were planned, and those which existed near railroads had decreased in their receipts from 33 to 66 percent."*

  Balthasar H. Meyer, 1917, Transportation in the United States before 1860, Ch. 17 p. 553

EXAMPLE: AUTOMOBILES DISPLACED RAILROADS

- *"The triumph of the private passenger car over rail transportation in the United States was meteoric. Passenger miles traveled by automobile were only 25 percent of rail passenger miles in 1922 but were twice as great as rail passenger miles by 1925, four times as great by 1929."*

  James J. Flink, 1990, The Automobile Age, Ch. 19 p. 360

INNOVATION POSES RISK TO INVESTORS IN OLD-TECHNOLOGY FIRMS

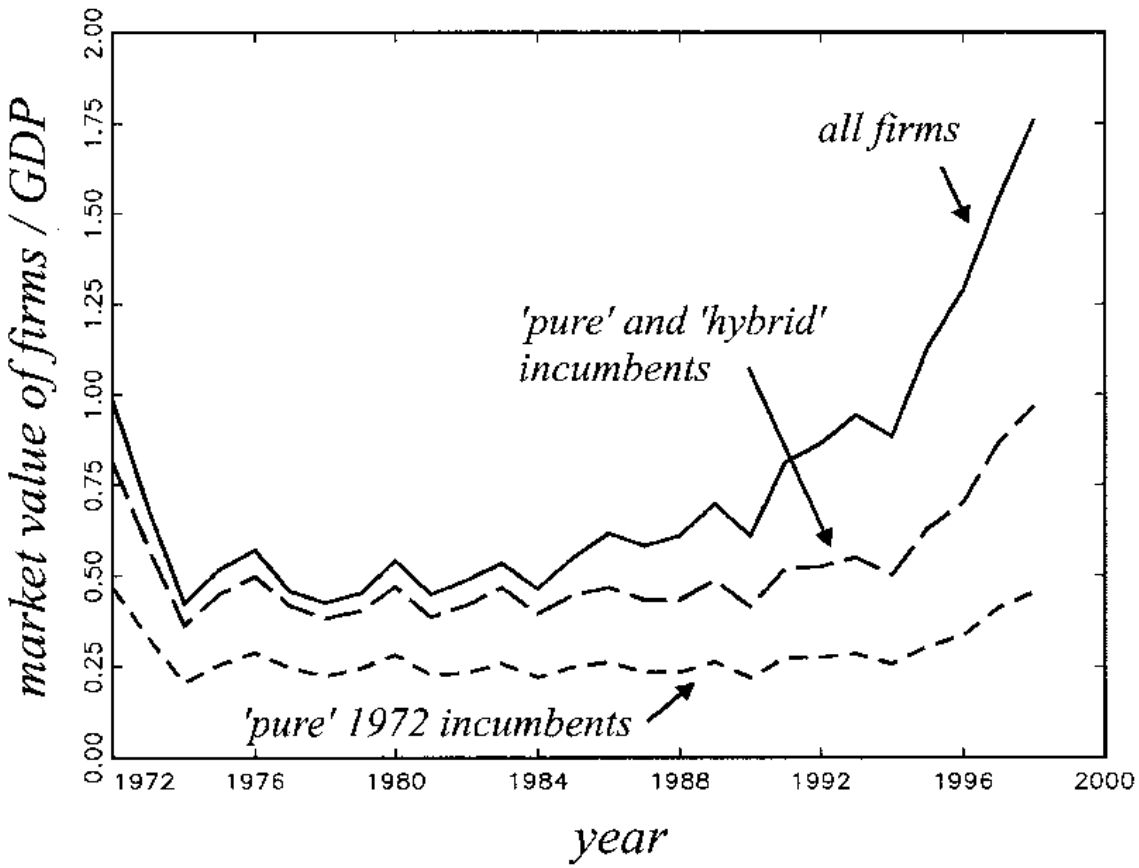
- In 1900, railroads account for over 50% of market cap of all NYSE firms
- Between 1927 and 1975, go from 23% to 2% of NYSE market cap

EXAMPLE: UBER VS TAXI

- Uber, a privately held firm founded in 2009, takes advantage of advances in communication technology to provide taxi services with minimal waiting time. As of December 2014, Uber is valued at $41 billion.
- Between December 2009 and February 2015, the value of Medallion Financial Corp. (NASDAQ: TAXI), a specialty finance company that originates, acquires, and services loans that finance taxicab medallions has dropped by more than 50% in value relative to the level of the NASDAQ index.
- Uber has been the target of multiple lawsuits by taxi companies.

EXAMPLE: IT REVOLUTION

- IT revolution 1972–1974 reduces stock market values of incumbent firms



Hobijn, B., and B. Jovanovic "The Information-Technology Revolution and the Stock Market: Evidence," *American Economic Review* 2001

Outline

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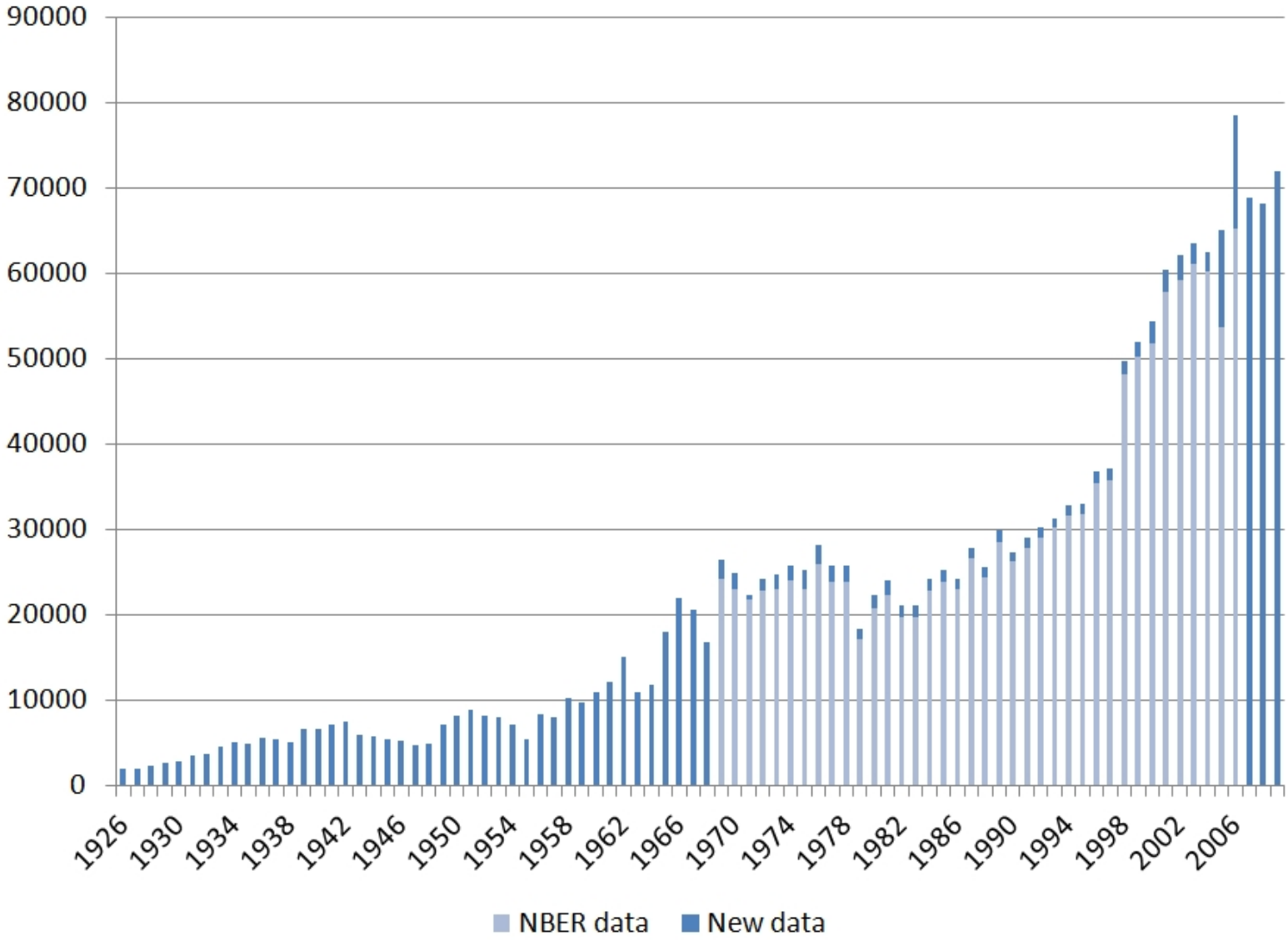
USE PATENTS TO MEASURE INNOVATION

- Cover patented innovations
- Patents differ in economic value – most patents have little value
- In the literature it is common to weight patents by forward citations...
  - ...we need an economic measure of private value
- Follow approach similar to Kogan, Papanikolaou, Seru and Stoffman, "Technological Innovation, Resource Allocation, and Growth," *Quarterly Journal of Economics*, 2017
  - Infer value added associated with a patent by firm's stock market reaction to patent issue

CONSTRUCT PATENT DATA

- Build a measure of innovation from the ground up, by combining a database of patent filings and issues with stock return data
- Download the entire history of U.S. patent documents from Google Patents (7.8 million patents):
  - Google provides text (OCR) version of patent documents
- Match patents to publicly traded firms using text analysis algorithms

1.9 MILLION MATCHED PATENTS



ISOLATE ECONOMIC VALUE OF A PATENT USING STOCK MARKET REACTION

- Every Tuesday, the USPTO publishes the Official Gazette describing newly granted patents
  - Focus on 3-day window: $[t, t+2]$ around patent grant day
- On patent grant day market learns application is successful
  - Assume that quality of patent is public information prior to patent grant
- On issue day, stock price should increase in proportion to patent value

EXAMPLE: PROTEIN DESIGN

The New York Times

Business Day

A broad patent is spurring the shares of Protein Design Lab.

By Lawrence M. Fisher
Published: December 20, 1996

SHARES of Protein Design Labs Inc. have gained nearly 25 percent since the company disclosed on Monday that it had been awarded a broad patent covering the production of so-called humanized antibodies in mice.

Despite the sharp rise, some analysts say the company's shares are still a compelling buy, based not only on the prospect for royalties created by the patent, but also on Protein Design's own product pipeline.

The awarding of the patent, which could affect as much as a fourth of all biotechnology drugs currently in clinical trials, is the second recent hit for Protein Design after a big miss last year. In September, the company, based in Mountain View, Calif., reported that a drug it developed with Hoffmann LaRoche, a unit of Roche Holding, had proved effective in preventing the rejection of transplanted kidneys in human trials. The same drug had failed an earlier trial for graft versus host disease, a common complication of bone marrow transplants.

Shares in Protein Design Labs rose 53.125 cents yesterday, to $34.25, in Nasdaq trading. On Wednesday, the stock rose $2.21875, and gained $4 on Tuesday. The stock had traded as low as $12 after last summer's disappointment.

Matthew Geller, an analyst with Oppenheimer & Company, has maintained Protein Design Labs as a strong buy. He said that the company had both broad enabling technology that could produce drugs for many different diseases and a sound business strategy of using multiple corporate partners, which has allowed it to build a pipeline of several drug candidates while conserving its financial resources.

"It is one of the few companies with a platform," Mr. Geller said. "It's one of the few biotech companies with sufficient backbone to become a major pharmaceutical company." He noted that the stock had traded in the mid-30's two years ago, and since then the company had added nine corporate partners and had a drug that could reach the market as soon as next year.

EXAMPLE: VALUABLE PATENT

Stock price (left axis) and trading volume (right axis) of GENEX Co on August 7, 1990, after award of patent no. 4946778 for "Single-Chain Polypeptide Binding Molecules"

US006368227B1

(12) **United States Patent**
Olson

(10) **Patent No.: US 6,368,227 B1**
(45) **Date of Patent: Apr. 9, 2002**

(54) **METHOD OF SWINGING ON A SWING**

(76) Inventor: **Steven Olson**, 337 Otis Ave., St. Paul, MN (US) 55104

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/715,198**

(22) Filed: **Nov. 17, 2000**

(51) **Int. Cl.**[7] **A63G 9/00**
(52) **U.S. Cl.** **472/118**
(58) **Field of Search** 472/118, 119, 472/120, 121, 122, 123, 125

(56) **References Cited**

U.S. PATENT DOCUMENTS

242,601 A * 6/1881 Clement 472/118
5,413,298 A * 5/1995 Perreault 248/228

* cited by examiner

Primary Examiner—Kien T. Nguyen
(74) *Attorney, Agent, or Firm*—Peter Lowell Olson

(57) **ABSTRACT**

A method of swing on a swing is disclosed, in which a user positioned on a standard swing suspended by two chains from a substantially horizontal tree branch induces side to side motion by pulling alternately on one chain and then the other.

4 Claims, 3 Drawing Sheets

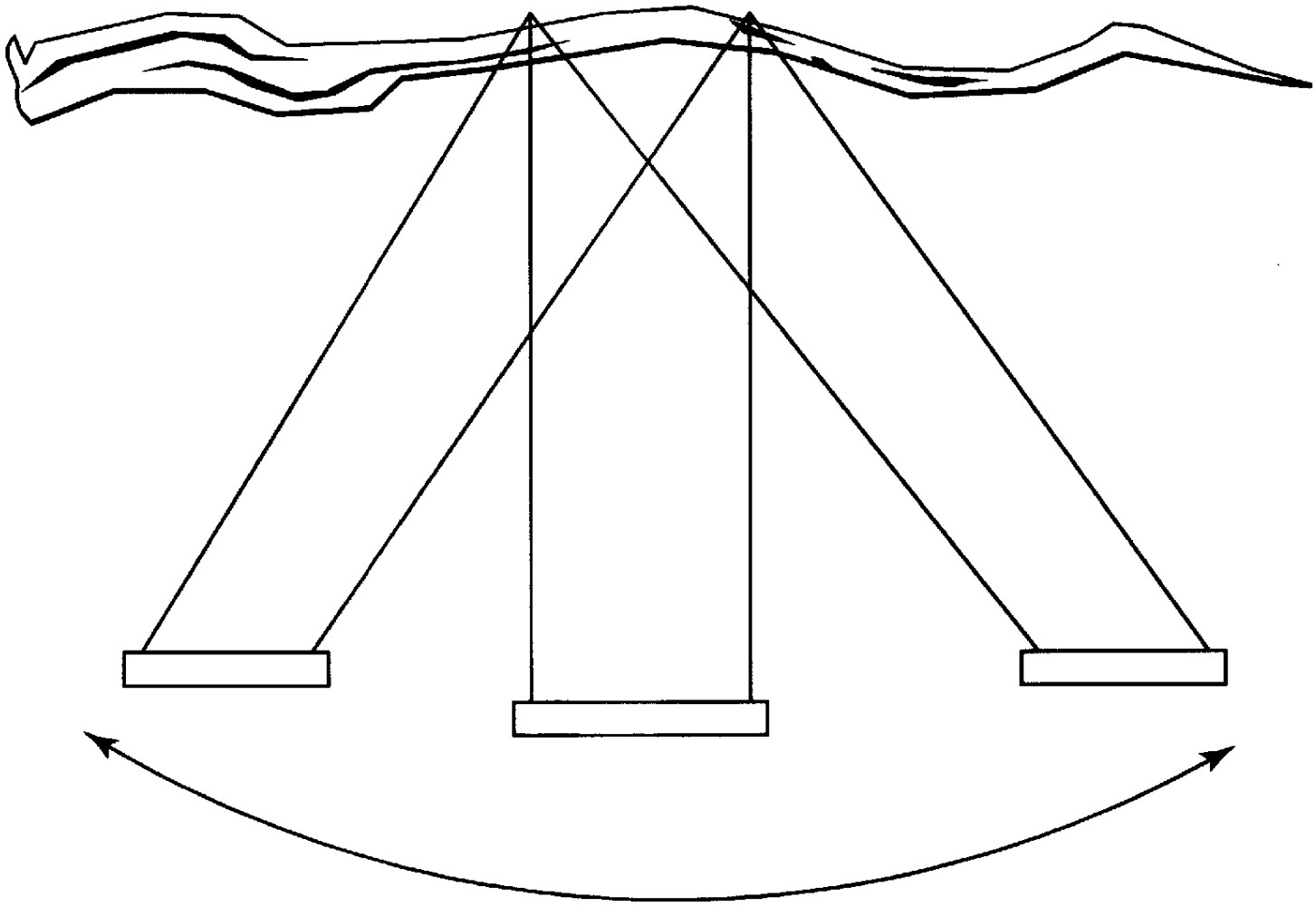


Figure 2

US006329919B1

(12) **United States Patent**
Boies et al.

(10) **Patent No.: US 6,329,919 B1**
(45) **Date of Patent: Dec. 11, 2001**

(54) **SYSTEM AND METHOD FOR PROVIDING RESERVATIONS FOR RESTROOM USE**

(75) Inventors: **Stephen J. Boies**, Mahopac, NY (US); **Samuel Dinkin**, Austin, TX (US); **Paul Andrew Moskowitz**, Yorktown Heights; **Philip Shi-Lung Yu**, Chappaqua, both of NY (US)

(73) Assignee: **International Business Machines Corporation**, Armonk, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/639,254**

(22) Filed: **Aug. 14, 2000**

(51) **Int. Cl.**[7] **G08B 23/00**
(52) **U.S. Cl.** **340/573.1**; 340/825.28; 340/825.29; 705/5; 705/6
(58) **Field of Search** 340/539, 573.1, 340/540, 531, 825.28, 825.29; 705/5, 6; 701/201; 707/100; 395/205

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,272,474	*	12/1993	Hill	340/825.29
5,864,818	*	1/1999	Feldman	395/205
5,948,040	*	9/1999	DeLormet et al.	701/201
5,963,948	*	10/1999	Shilcrat	707/100
5,978,770	*	11/1999	Waytena et al.	705/5

* cited by examiner

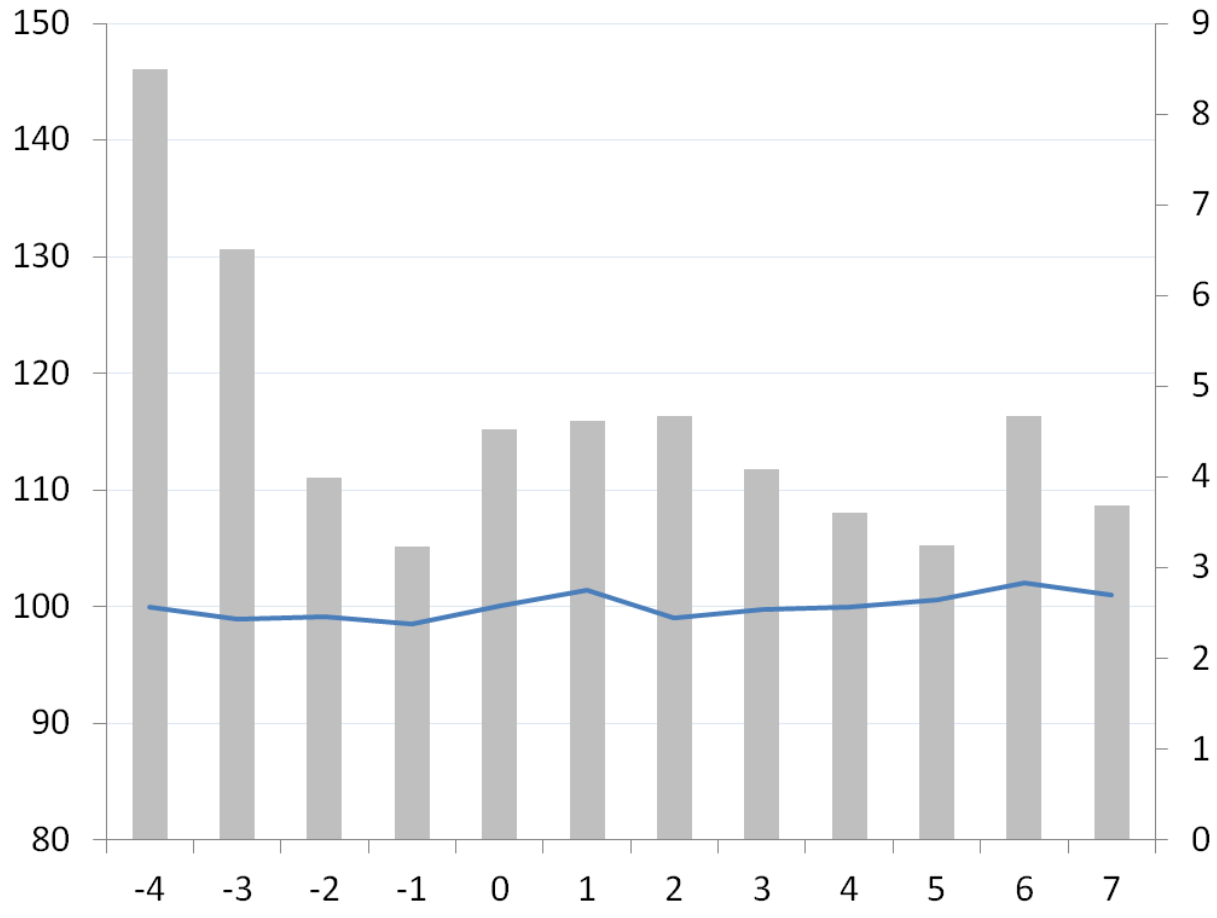
Primary Examiner—Benjamin C. Lee
(74) *Attorney, Agent, or Firm*—Morgan & Finnegan, L.L.P.

(57) **ABSTRACT**

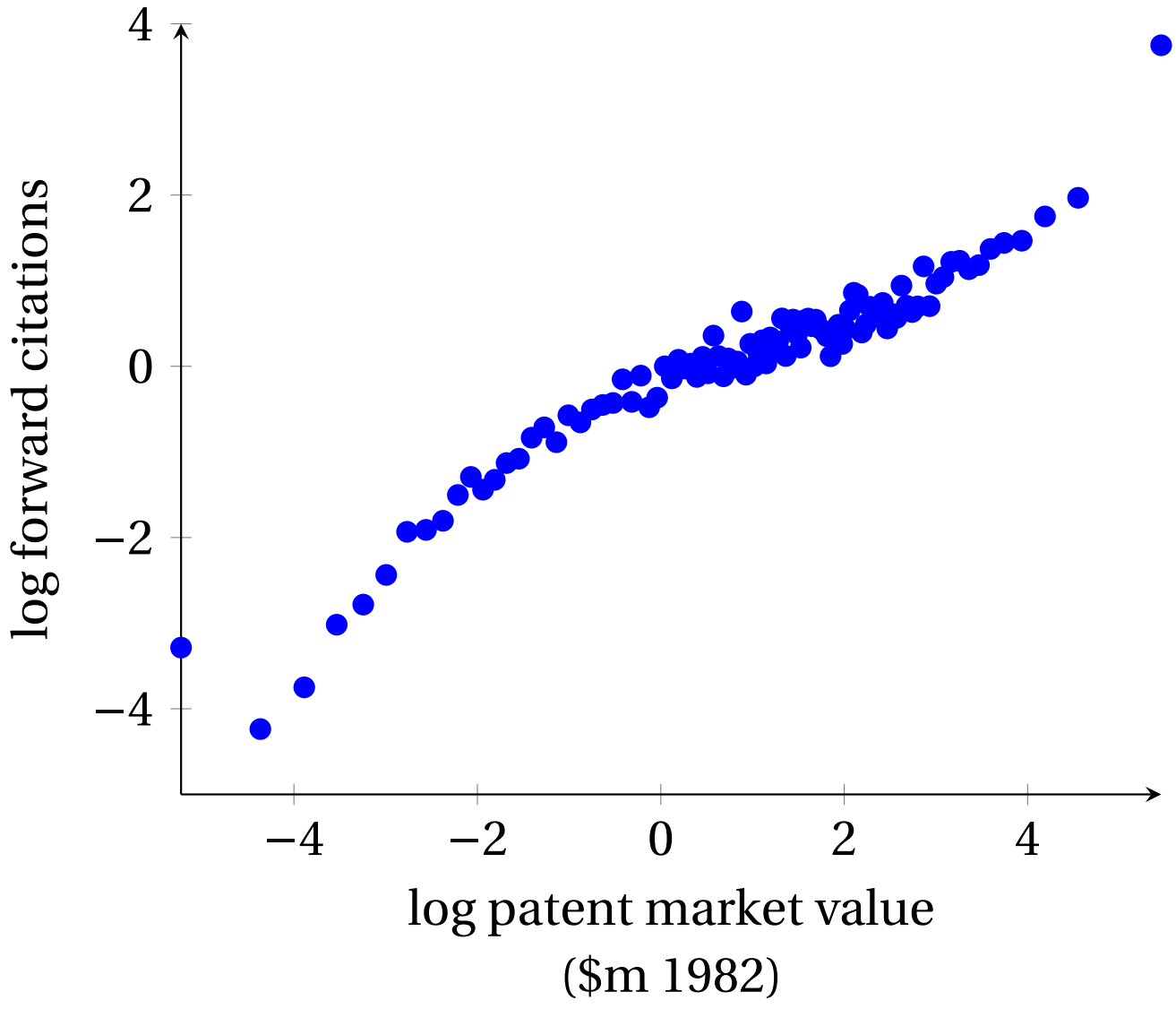
The present invention is an apparatus, system, and method for providing reservations for restroom use. In one embodiment, a passenger on an airplane may submit a reservation request to the system for restroom use. The reservation system determines when the request can be accommodated and notifies the passenger when a restroom becomes available. The system improves airline safety by minimizing the time passengers spent standing while an airplane is in flight.

64 Claims, 4 Drawing Sheets

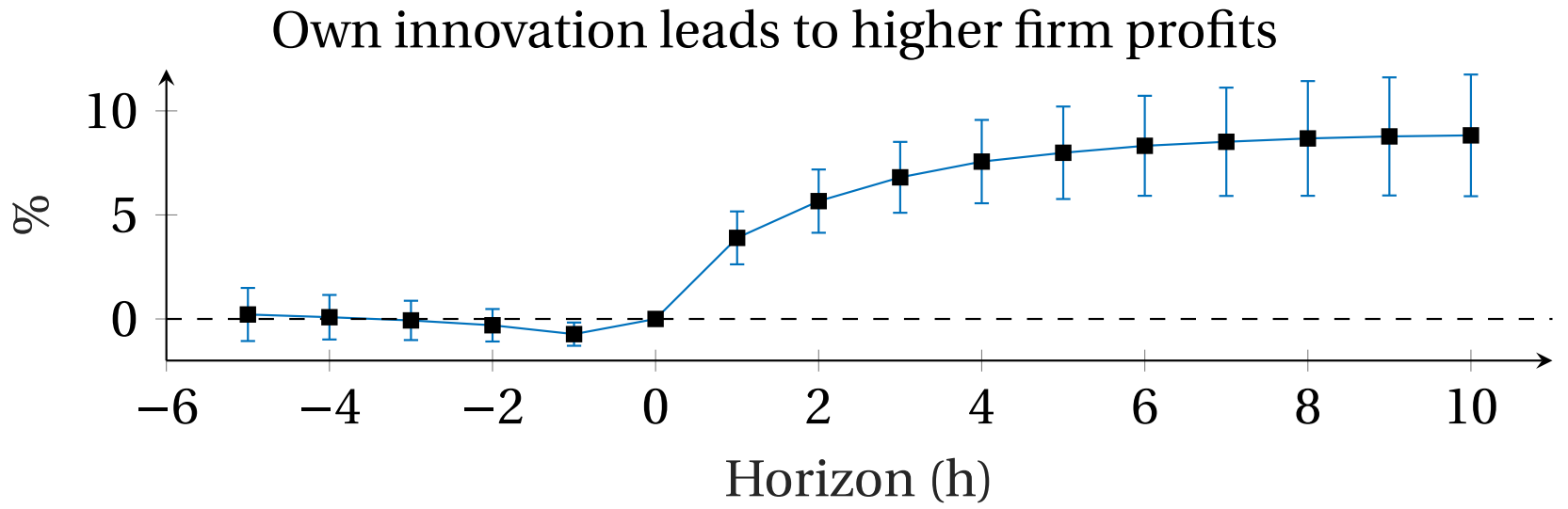
EXAMPLE: IBM

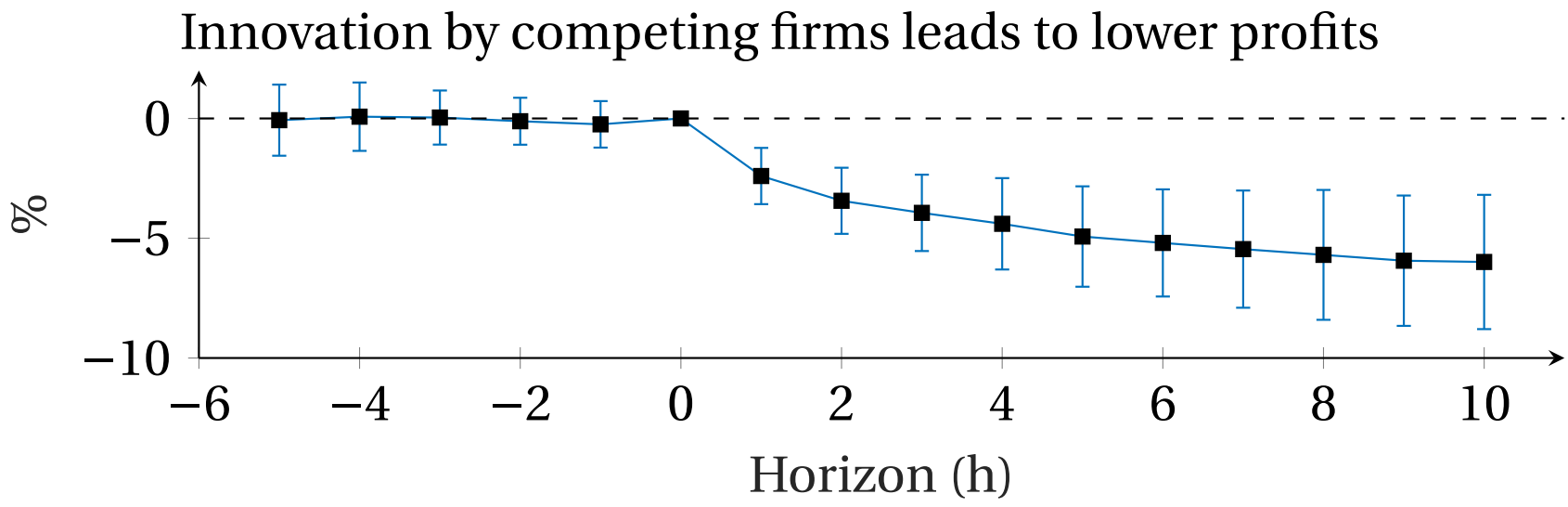


Stock market predicts future patent citations

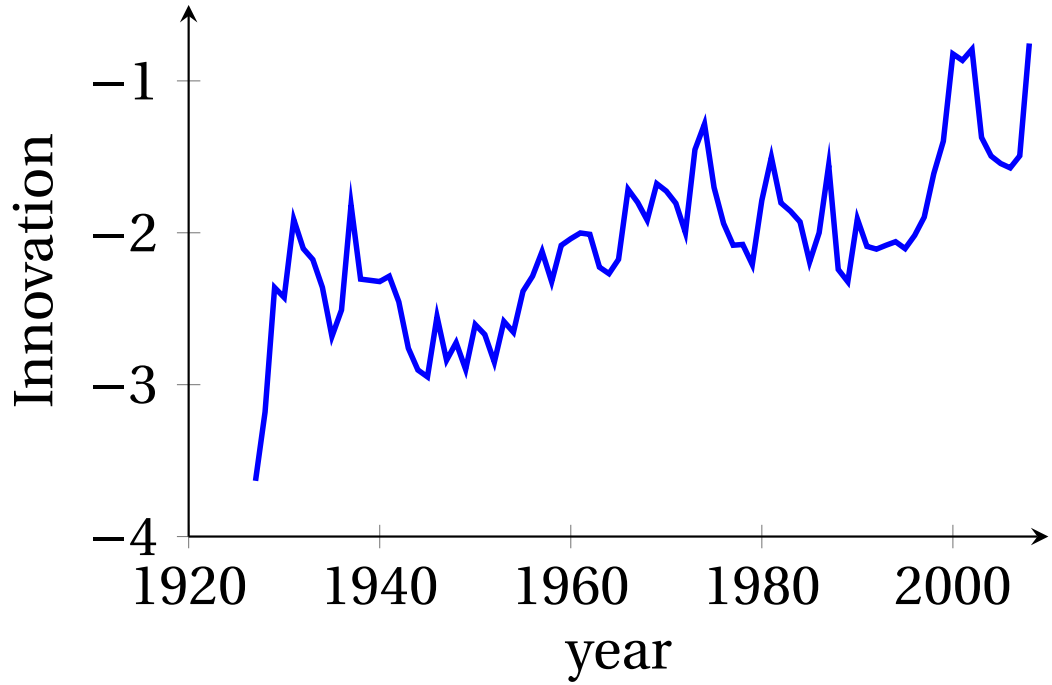


Innovation and Firm profitability





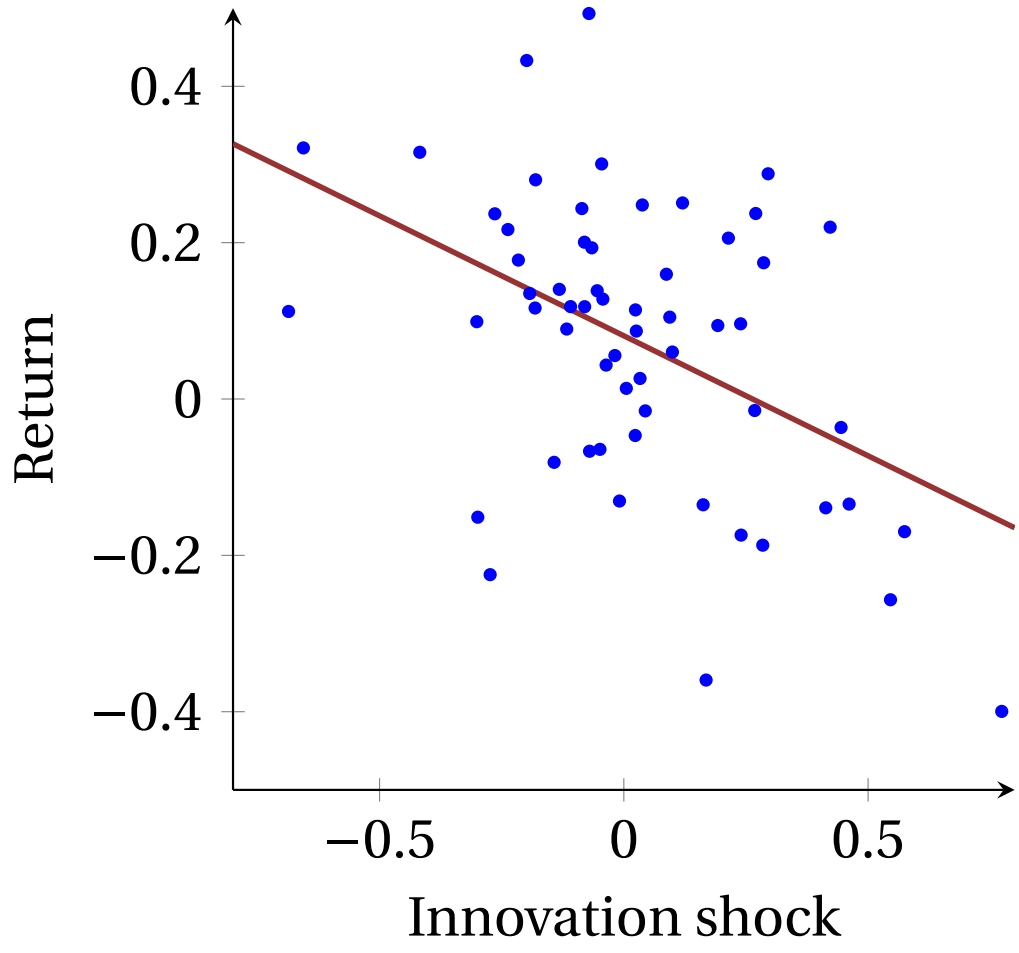
ROTATING LEADERSHIP



’30s	Automobiles, telecommunication General Motors, AT&T
’60s, early ’70s	Chemicals, oil and computing/electronics IBM, GE, 3M, Exxon, Eastman Kodak, du Pont, Xerox
’90s, ’00s	Computer hardware and software Sun Microsystems, Oracle, Dell, Intel, IBM, AT&T, Cisco, Microsoft, Apple

INNOVATION SPIKES HURT EXISTING FIRMS

Stock market - TBills, 1950-2008



Outline

What is technological displacement?

Can we measure it?

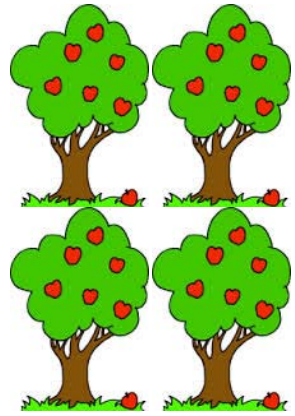
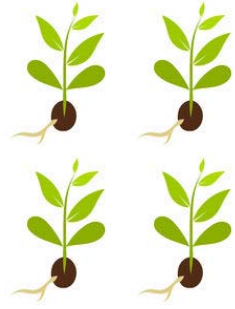
Why are growth firms a hedge?

Why do investors want to hedge innovation?

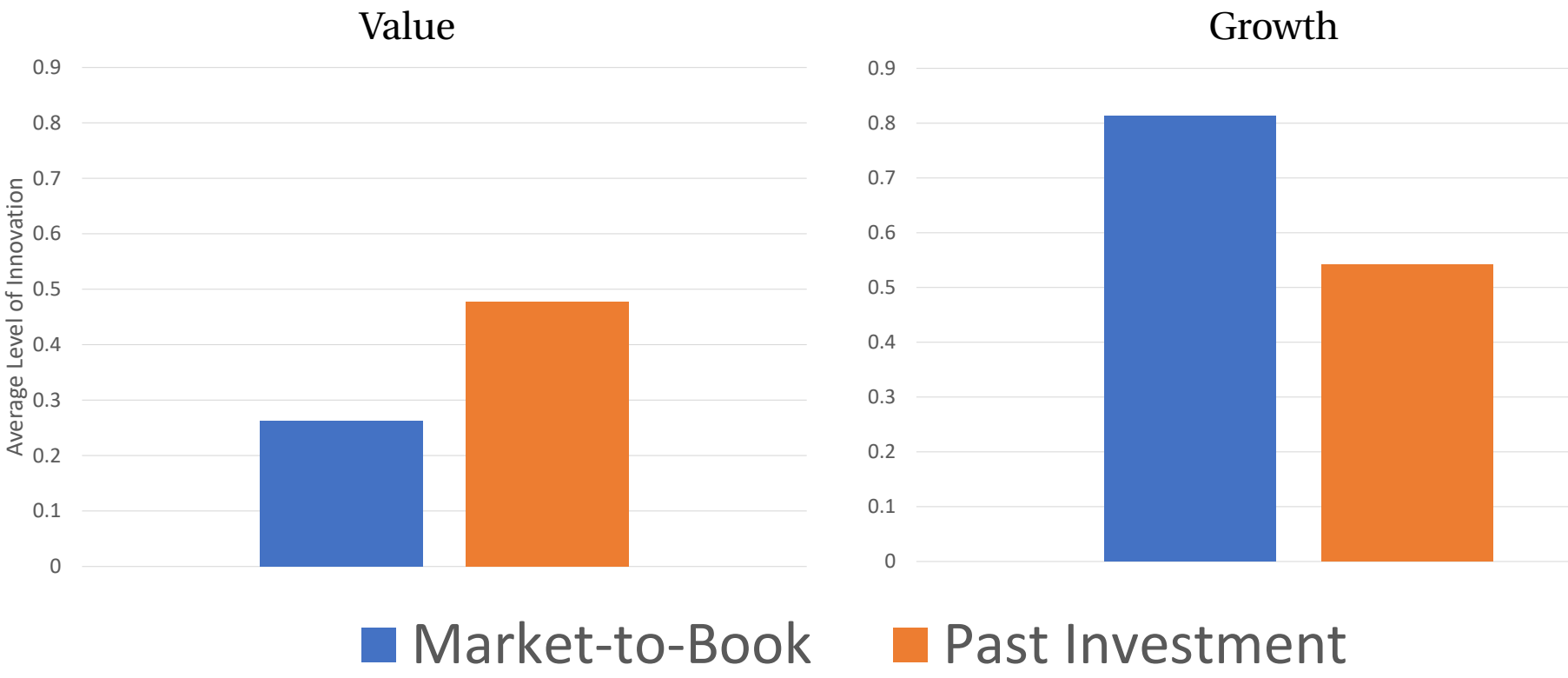
GROWTH FIRMS CAN HELP HEDGE INNOVATION SHOCKS

- Growth firms derive more value from growth opportunities; value firms – from assets in place
- Firms are exposed to disruptive innovation shocks
  - Advances in technology disrupt existing business operations...
  - ...but are beneficial to growth opportunities
- Increase in the rate of innovation raises prices of growth firms relative to value firms
- Even though public market index does not protect investors from displacement by innovation, growth tilt can be a hedge

NOT EXACTLY A MORNINGSTAR® BOX

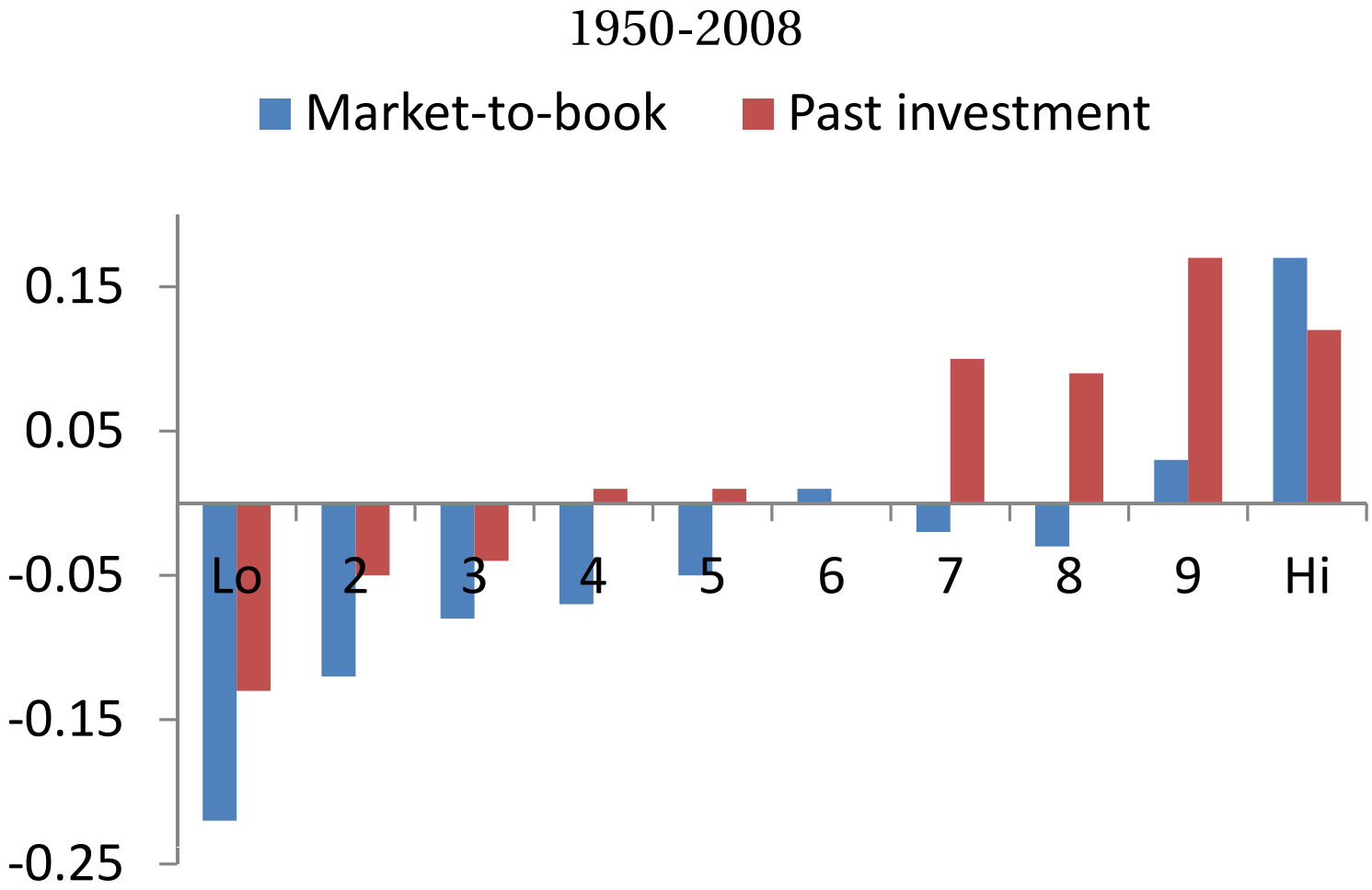
	Assets in Place	Growth Options	Market-to-Book
Value Firm			Low
Growth Firm			High

GROWTH FIRMS MORE LIKELY TO INNOVATE



- Growth firms more likely to be innovation leaders

GROWTH FIRMS ARE LESS VULNERABLE TO INNOVATION RISK



- Exposure of stock returns to innovation shocks: prices of value firms decline when innovation rate accelerates

INNOVATION RISK CAN GIVE RISE TO VALUE PREMIUM

- Growth firms can provide a hedge against displacement
- Investors willing to buy growth firms despite higher valuations (and low discount rates)
- Positive value premium in the cross-section of stock returns

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TECHNOLOGICAL INNOVATION PLACES HUMAN CAPITAL AT RISK

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- Brynjolfsson, E., A. McAfee, "New World Order: Labor, Capital, and Ideas in the Power Law Economy." *Foreign Affairs*, July/August 2014

  "... the real winners of the future will not be the providers of cheap labor or the owners of ordinary capital, both of whom will be increasingly squeezed by automation. Fortune will instead favor a third group: those who can innovate and create new products, services, and business models."

TECHNOLOGICAL INNOVATION PLACES HUMAN CAPITAL AT RISK

- Lawrence Summers (Washington Post interview, March 3, 2015)

"The rise of the top 1 percent is likely very tied up with technology. When George Eastman had a fantastic idea for photography, he got quite rich, and the city of Rochester became a flourishing city for generations, supporting thousands of middle-class workers. When Steve Jobs had had remarkable ideas, he and his colleagues made a very large fortune, but there was much less left over – there was no flourishing middle class that followed in their wake."

JOB POLARIZATION

"One of the most remarkable developments in the US labor market of the past two and a half decades has been the rapid, simultaneous growth of employment in both the highest- and lowest-skilled jobs...

"A leading explanation for the hollowing out of the occupation distribution in industrial countries is that **nonneutral technical change, augmented by offshoring, is eroding demand for middle-skilled "routine" cognitive and manual activities**, *such as bookkeeping, clerical work, and repetitive production tasks... Because the core job tasks of these occupations follow precise, well-understood procedures, they are increasingly codified in computer software and performed by machines, or, alternatively, offshored over computer networks to foreign work sites."*

–Autor and Dorn, 2009

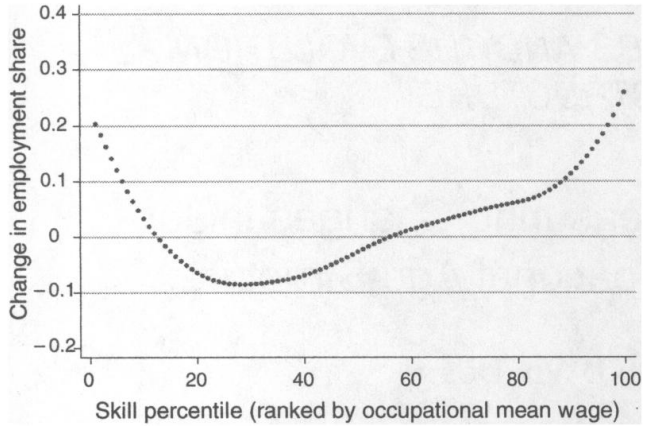
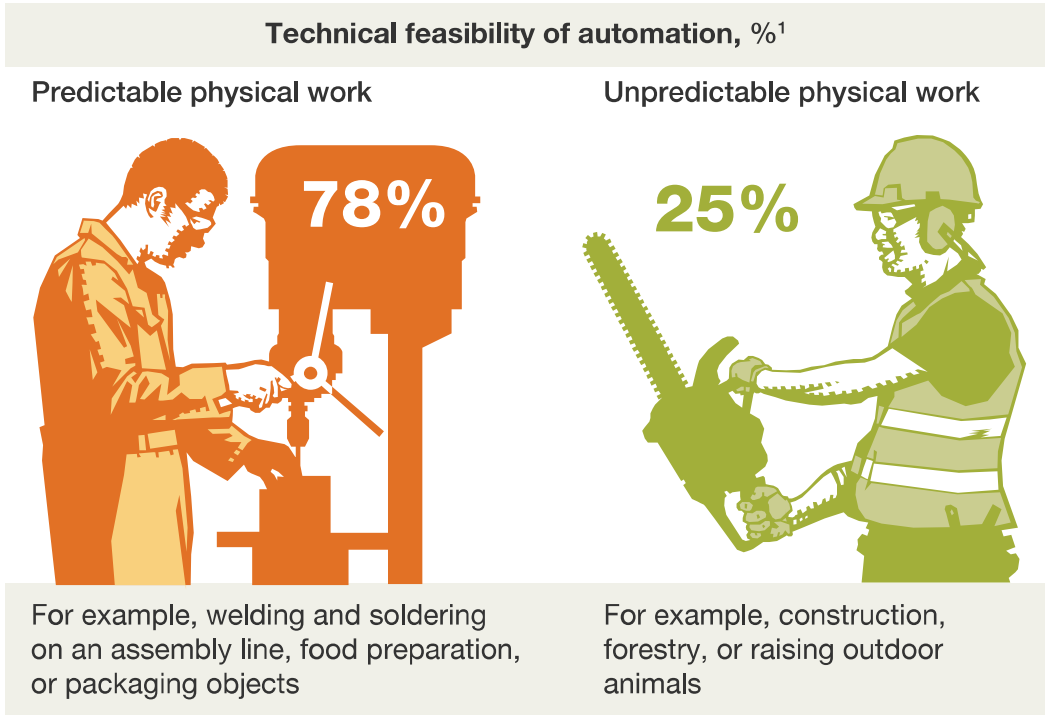


FIGURE 1. SMOOTHED CHANGES IN EMPLOYMENT SHARE BY OCCUPATIONAL SKILL PERCENTILE, 1980–2005

Risk of automation

- Frey and Osborne (2013): next 20 years, **47% of US workers** have jobs at risk of automation
- McKinsey: 45% of all activities could see significant (>30%) automation using today's technology

It's more technically feasible to automate predictable physical activities than unpredictable ones.



[1]% of time spent on activities that can be automated by adapting currently demonstrated technology.

Some concerns from the Economist

SPECIAL REPORT

Artificial intelligence: The impact on jobs

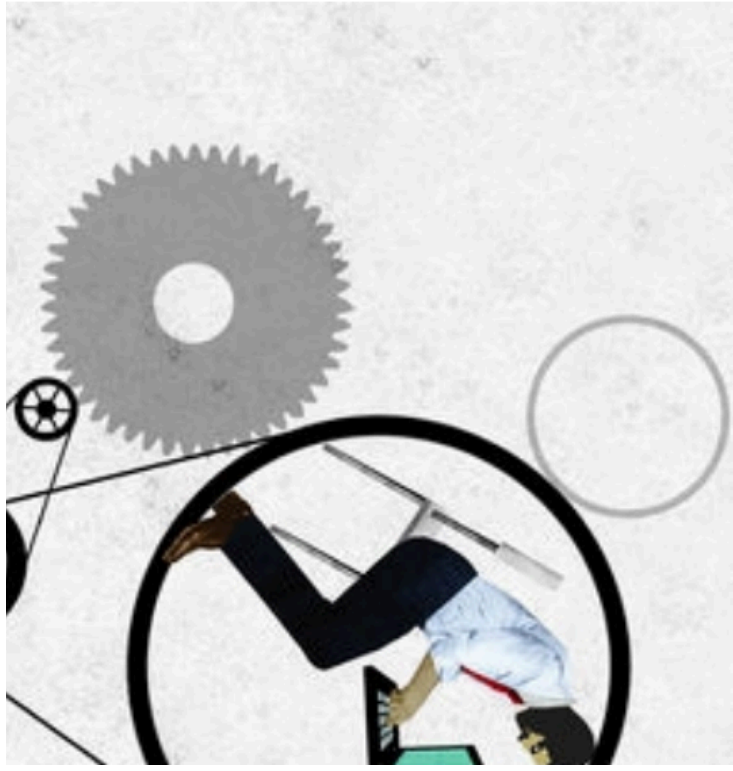
Automation and anxiety

Will smarter machines cause mass unemployment?

Free exchange

Will robots displace humans as motorised vehicles ousted horses?

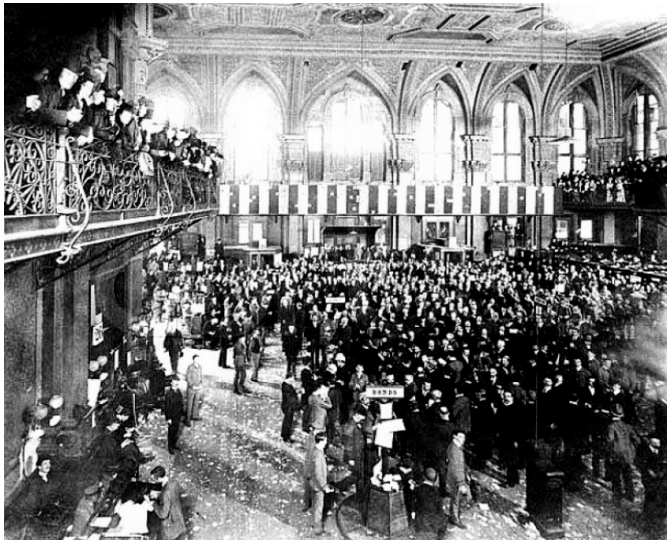
Probably not, but humans have a lot to learn from the equine experience



Print edition | Finance and economics ›

Wall Street: Then vs Now

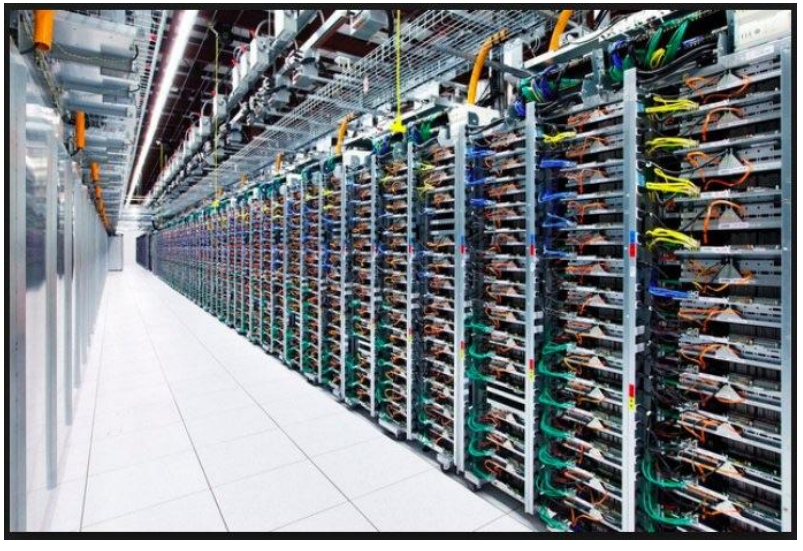
1900s



1960s

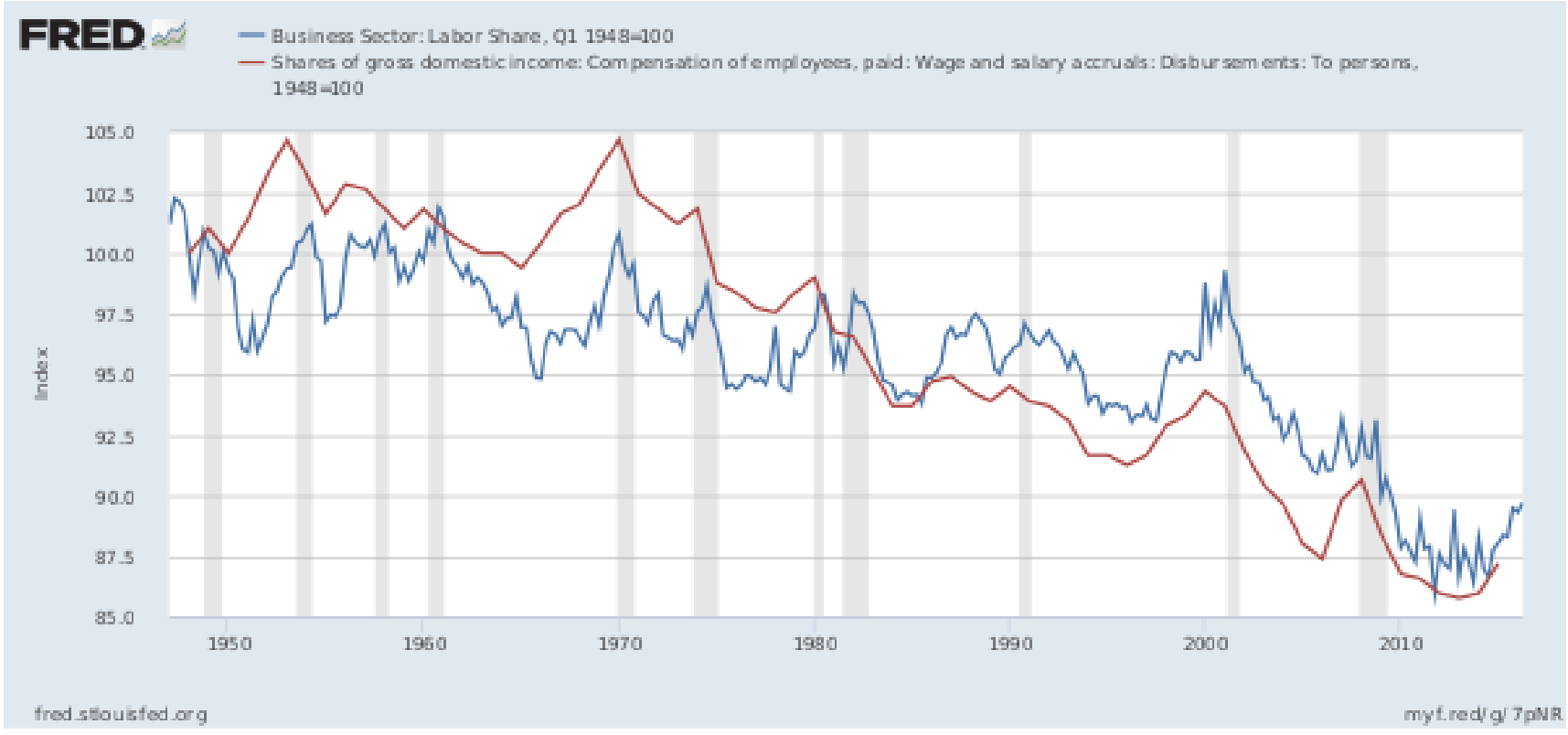
1990s

2010s



QUANTITATIVELY IMPORTANT?

- In general, share of output to labor has declined...



QUANTITATIVELY IMPORTANT?

- ...while income inequality has been rising

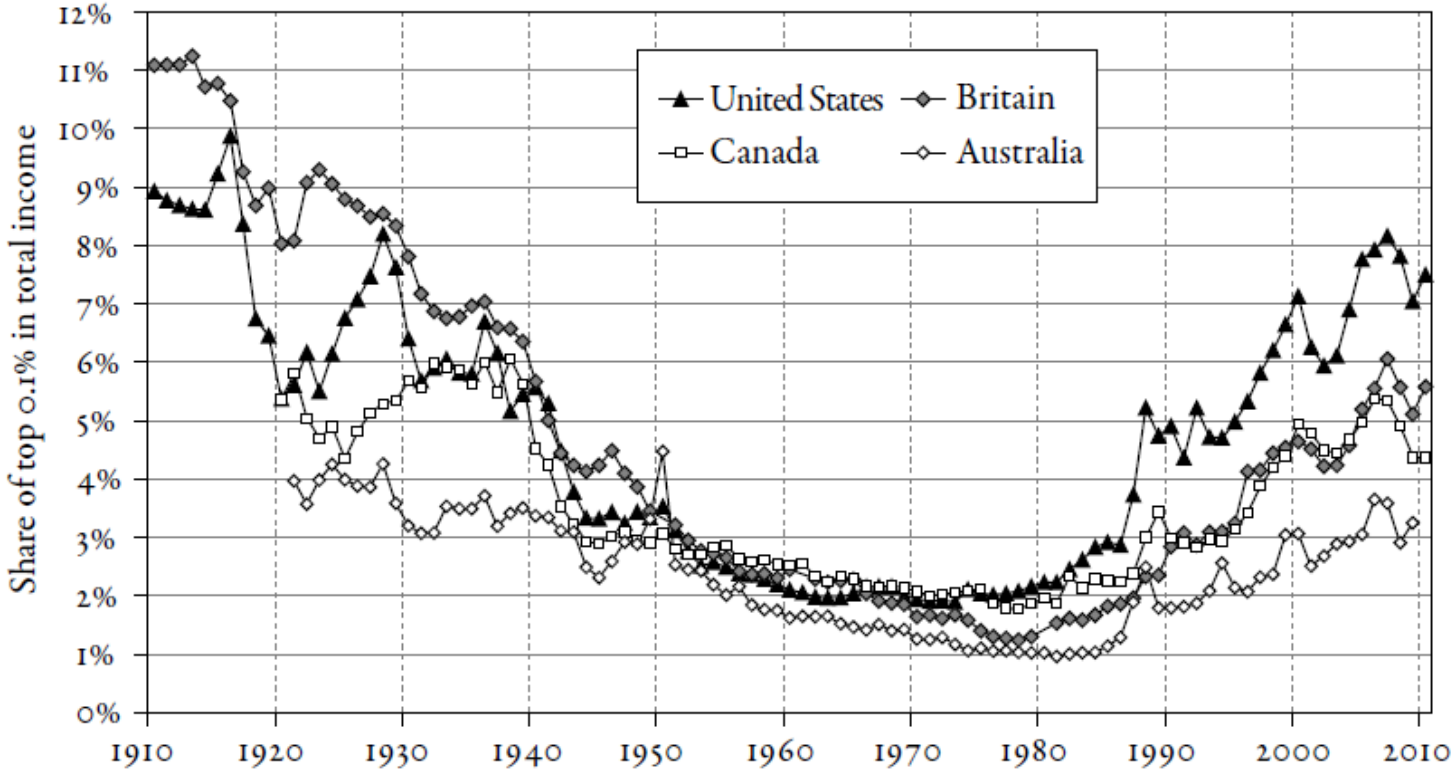
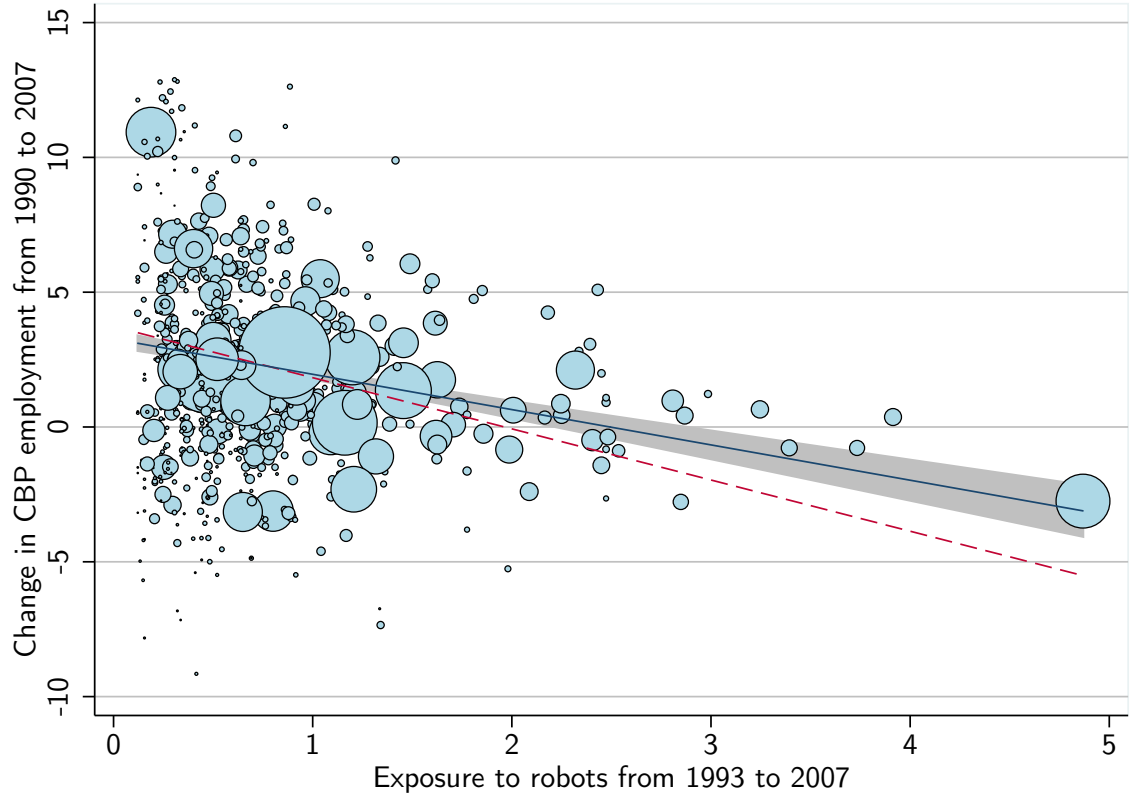


FIGURE 9.5. The top decile income share in Anglo-Saxon countries, 1910–2010

The share of the top 0.1 percent highest incomes in total income rose sharply since the 1970s in all Anglo-Saxon countries, but with varying magnitudes.
Sources and series: see piketty.pse.ens.fr/capital21c.

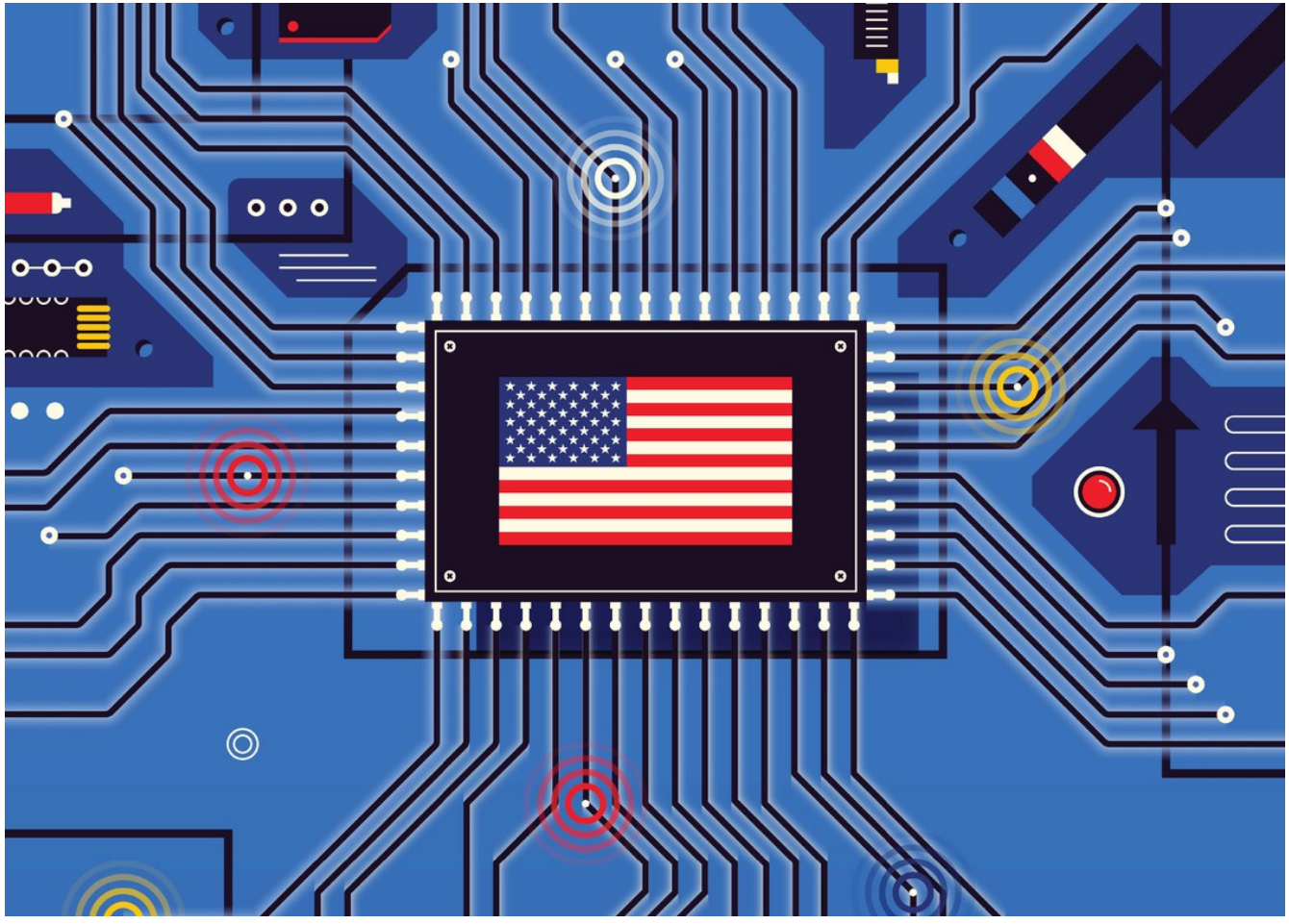
A recent example: robots (Acemoglu & Restrepo, 2017)



"According to our estimates, one more robot per thousand workers reduces the employment to population ratio by about 0.18-0.34 percentage points and wages by 0.25-0.5 percent."

No jobs are safe!

HEAR ME OUT: LET'S ELECT AN AI AS PRESIDENT



GETTY IMAGES

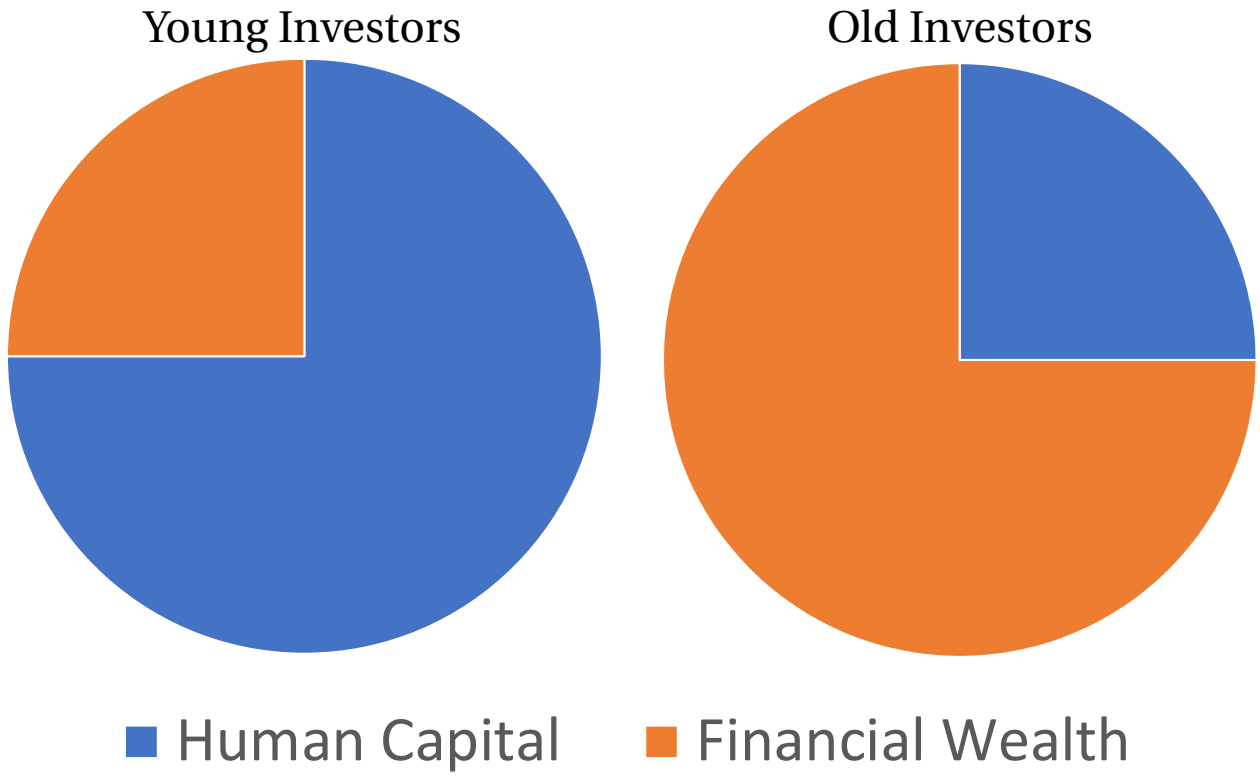
Innovation and wages: analysis with administrative data

- Kogan, Papanikolaou, Schmidt, and Song, 2017, "Technological Innovation and the Distribution of Labor Income Growth Rates," work in progress
- Combine direct measures of innovative activity constructed from patent data with panel income information from the Social Security Administration's administrative records
- Main Findings:
  - Technological innovation by other firms in the same industry is associated with increased **uncertainty** about future labor earnings: following positive innovation shocks, low wage outcomes become more likely.
  - Losses driven mostly by job loss.

INVESTORS MAY WANT TO HEDGE AGAINST TECHNOLOGICAL DISPLACEMENT

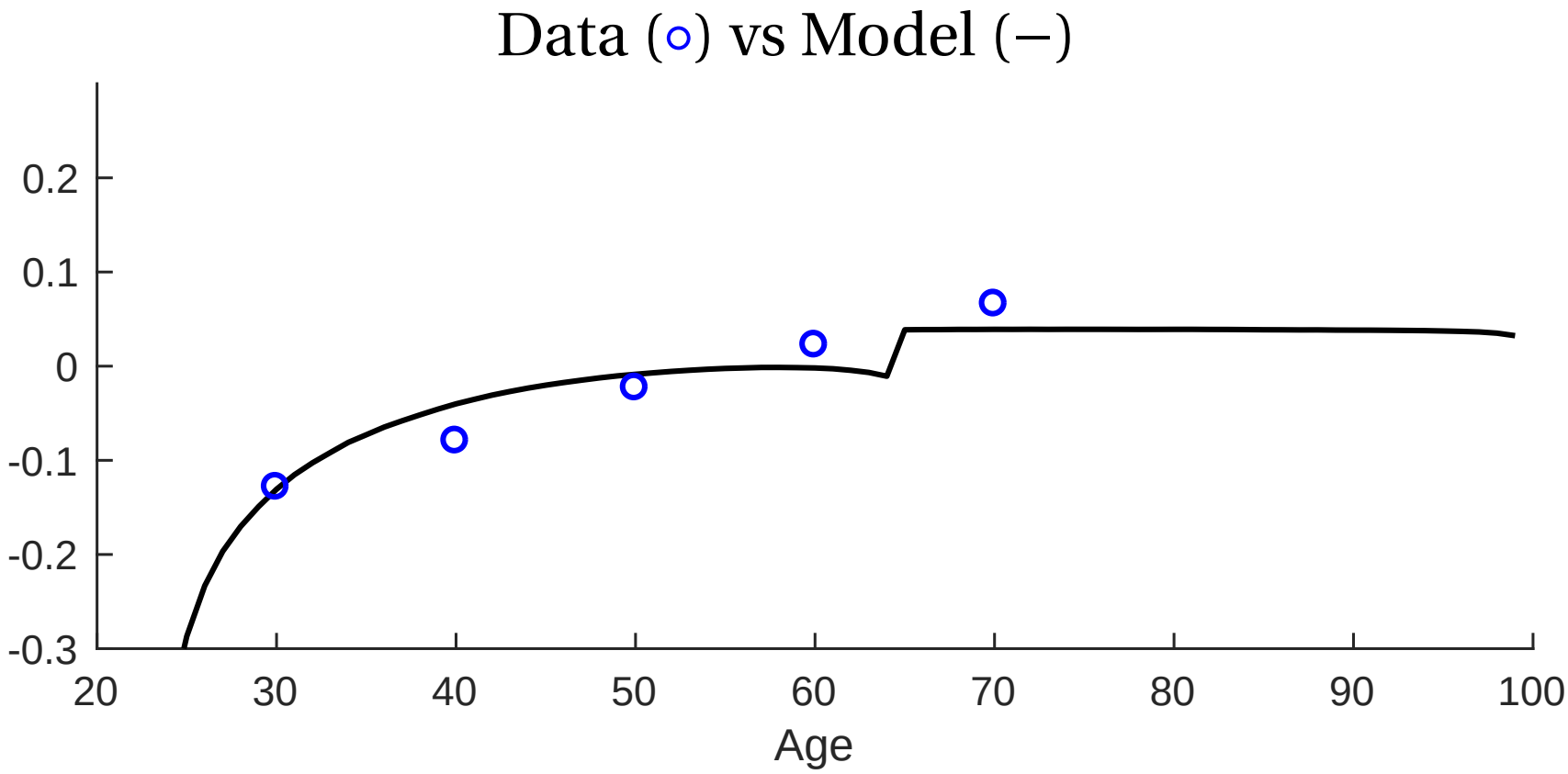
- Innovation can lead to winners and losers in the labor market
- Hard to predict who is most at risk:
  - routine tasks more likely to be automated
  - workers with skills that are specific to a particular technology are more vulnerable
- In addition to labor market considerations, investors may want to hedge against increases in income inequality — fear of missing out.
- Can hedge the risk of technological displacement by investing in growth stocks.

Human capital risk and growth investing



- Young investors have more human capital, hence more exposed to innovation shocks, hence hold growth stocks.
- Older investors are better positioned to absorb innovation shocks, hold value stocks.

Age and Value/Growth tilt



- Young Investors should hold growth stocks, older investors should hold value.

Conclusion

- Technological shocks are a risk factor
- Growth stocks are a hedge, tend to have higher valuations and lower average returns
- Growth tilt makes sense for investors with higher exposure to innovation risk
- Technological innovation is a significant risk factor in the labor market, in addition to financial markets