

Technological Disruption & the Labor Market: Should We Be Worried?

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About ITIF

- The leading science and tech policy think tank in the Americas
- Formulates and promotes policy solutions that accelerate innovation and boost productivity to spur growth, opportunity, and progress
- Focuses on a host of issues at the intersection of technology innovation and public policy:
 - Innovation processes, policy, and metrics
 - Science policy related to economic growth
 - E-commerce, e-government, e-voting, e-health
 - IT and economic productivity
 - Innovation and trade policy

ITIF Publication Highlights



Today's Presentation

- 1 Claims Regarding Tech & Work
- 2 An Historical Perspective
- 3 Will the Future Be Different?
- 4 What Should Policy Makers Do?

Prognosticators Say Tech Will Transform Everything

A few recent books:

- *The Singularity*
- *The Second Machine Age*
- *The Third Wave*
- *The Fourth Industrial Revolution*
- *The Fifth Technology Revolution*
- *The Sixth Wave*
- *Infinite Progress*



Moore's Law is Speeding Up

- “We are entering the second half of the “exponential chess board.”
– Erik Brynjolfsson
- “Information technology ... progresses exponentially.”
– Ray Kurzweil



Leading to Unprecedented Change

- “We are entering into an era in which the pace of innovation is growing exponentially.”

– Peter Diamandis and Steve Kotler

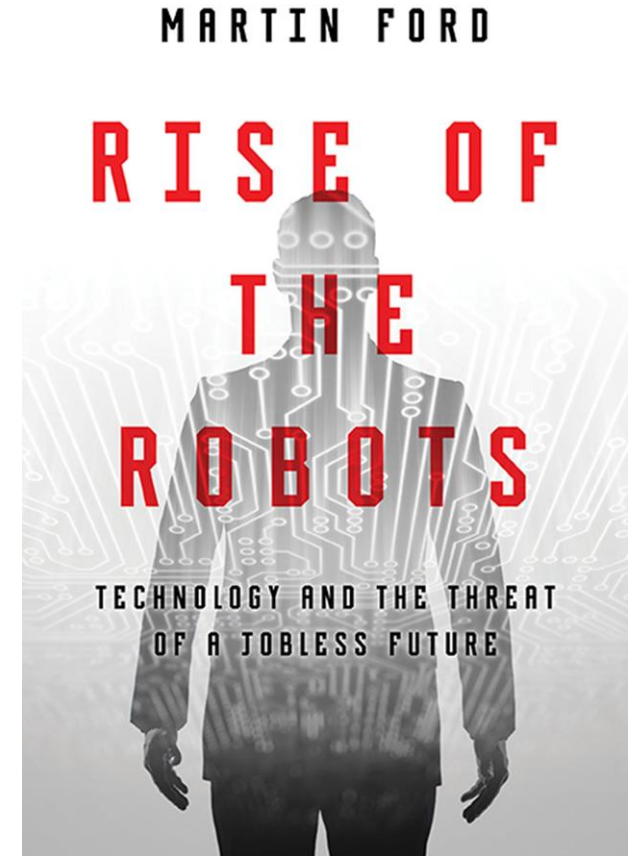
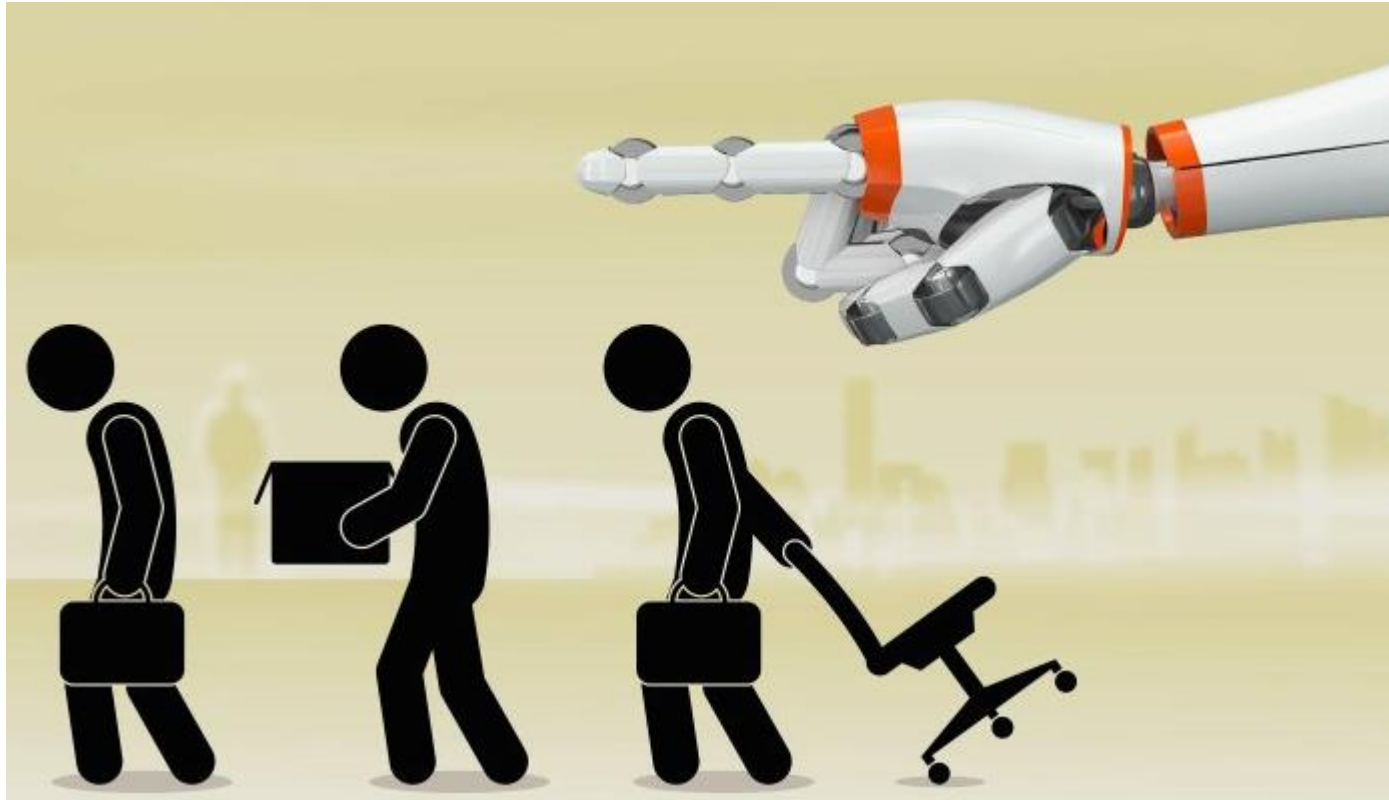
- “We’re in a world of exponential transformational change.”

– Daniel Burrus

- “Explosive and exponential advances.”

– Joseph Jaffe

Leading to Unprecedented Job Destruction



Leading to Unprecedented Job Destruction

- “...half the jobs ... might be eliminated by innovations such as self-driving vehicles, automatic checkout machines and expert systems. (Larry Summers)
- “Highly educated workers are as likely as less educated workers to find themselves displaced.” (Paul Krugman)
- “Brain work may be going the way of manual work.” (*The Economist*)
- “75% unemployment by 2100.” (Martin Ford, *The Rise of the Robots*)
- “47% of U.S. jobs eliminated by 2035.” (Osborne and Frey).
- “80 to 90% of U.S. jobs eliminated in 10 to 15 years.” (Vivek Wadwa)

Today's Presentation

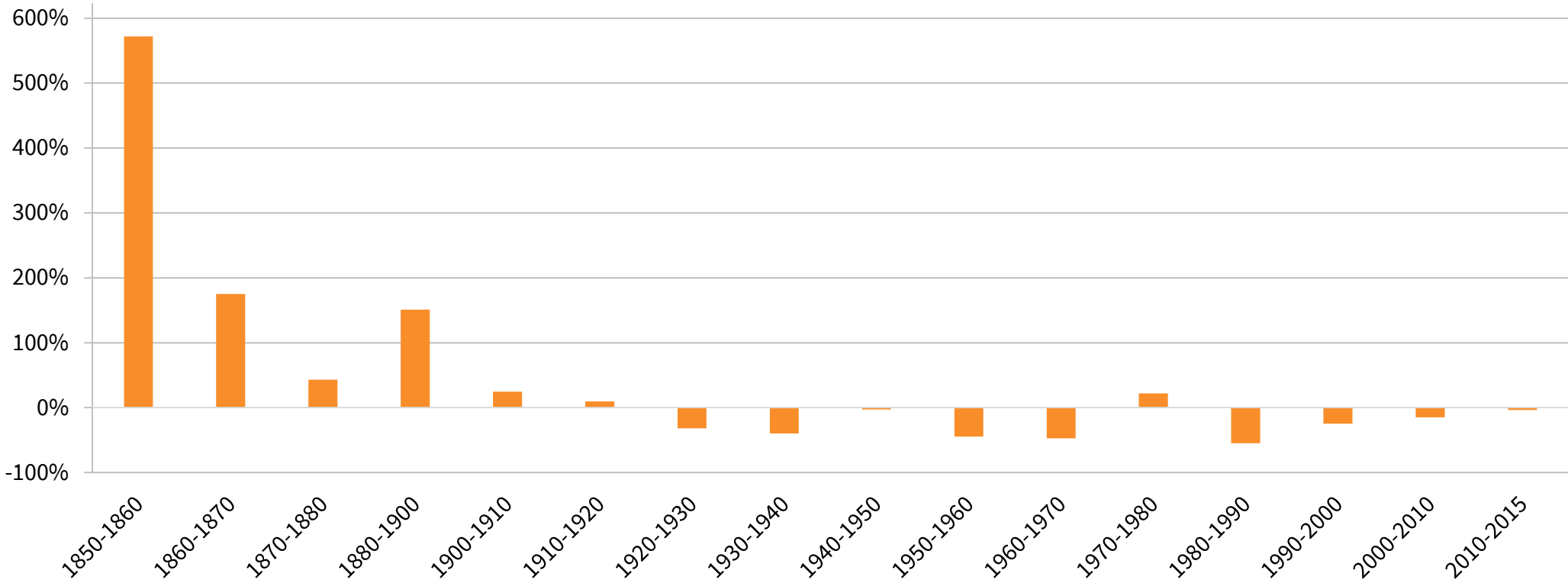
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Historical Patterns: Methodology

- The Minnesota Population Center used BLS and Census's decennial American Community Survey (and its other historical iterations), to create two occupational datasets
 - One using 1950 occupational classifications to examine change from between 1850 (the earliest year of data collection) and 2015,
 - Another using 2010 occupational classifications looking at change from 1950 to 2015.
- Researchers estimated employment by occupation at the national level by weighting the individual responses of a census. Because occupation categories change from decade to decade, they harmonize historical occupation categories to either occupation codes in 1950 or 2010.

Examples of Technology-Driven Change in Occupations

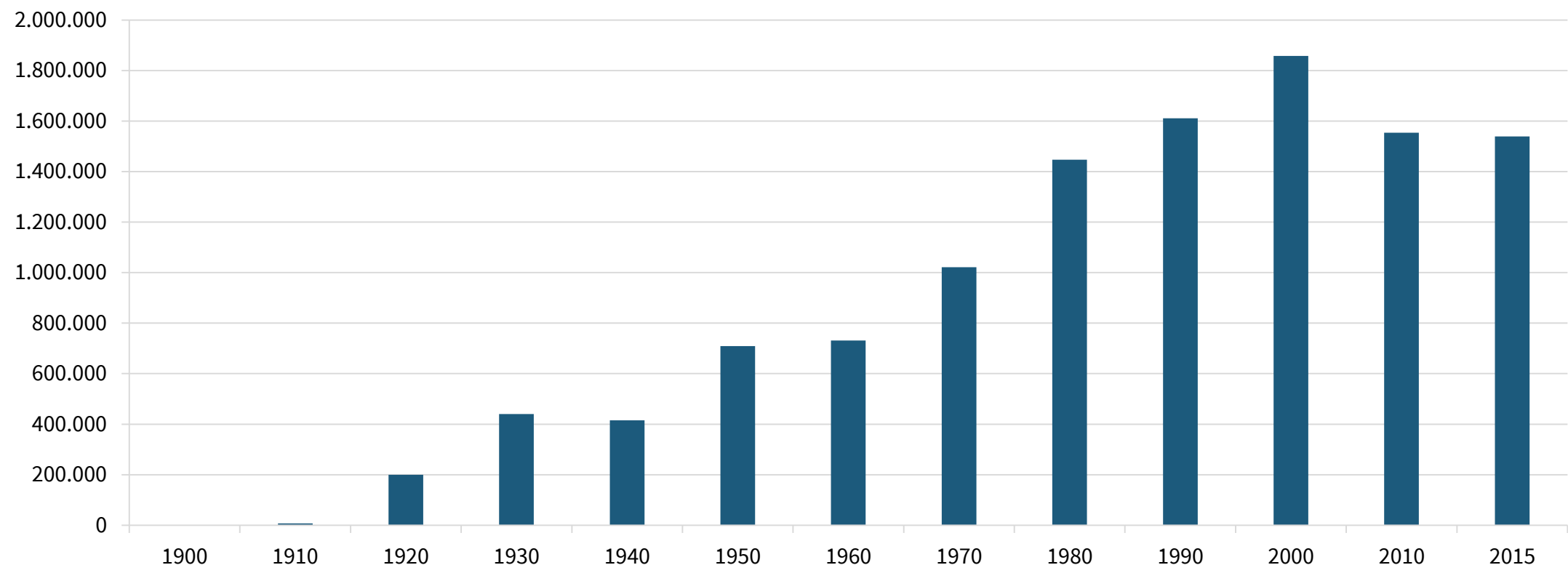
Locomotive Engineers, Railroad Conductors, and Railroad Brakemen



Source: ITIF analysis of IPUMS occupation data.

Examples of Technology-Driven Change in Occupations

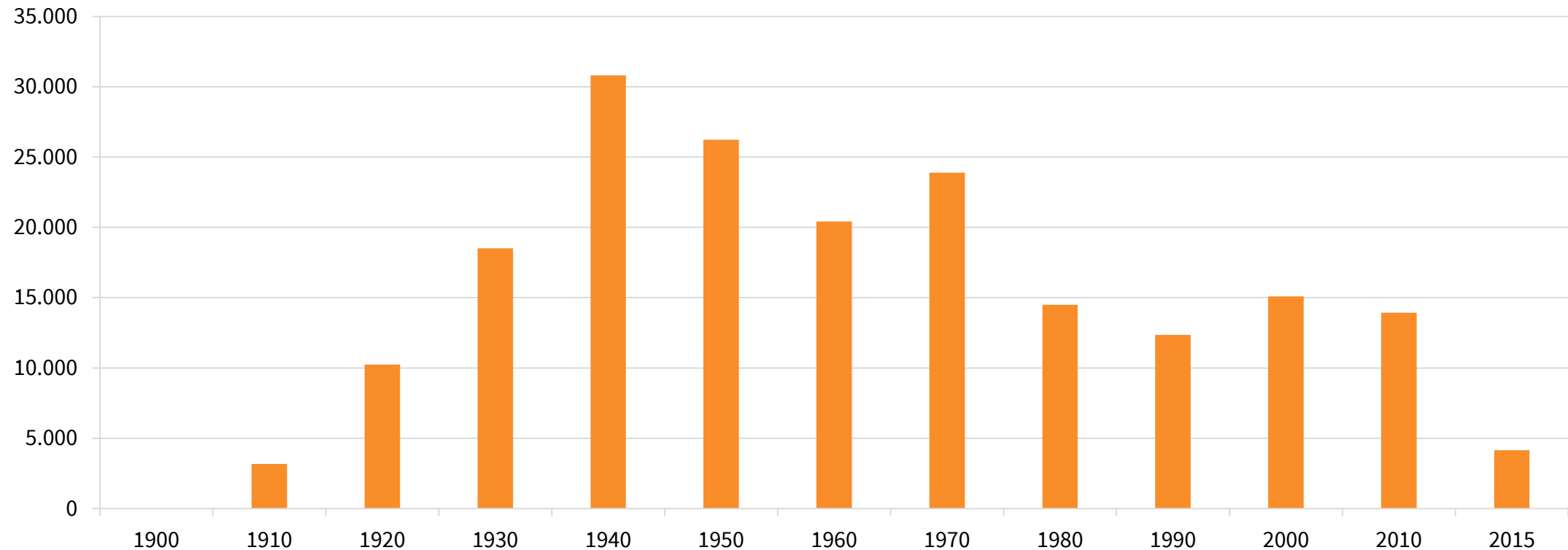
Mechanics and Repairmen, Automobile



Source: ITIF analysis of IPUMS occupation data.

Examples of Technology-Driven Change in Occupations

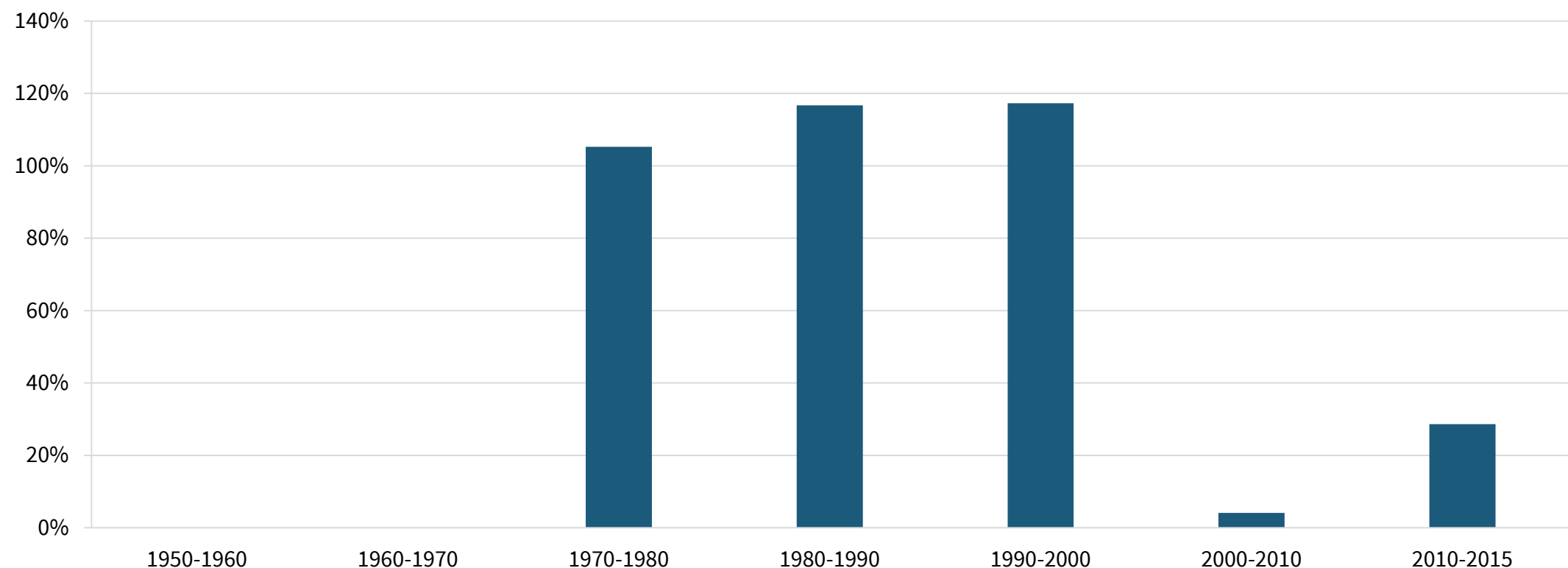
Motion Picture Projectionists



Source: ITIF analysis of IPUMS occupation data.

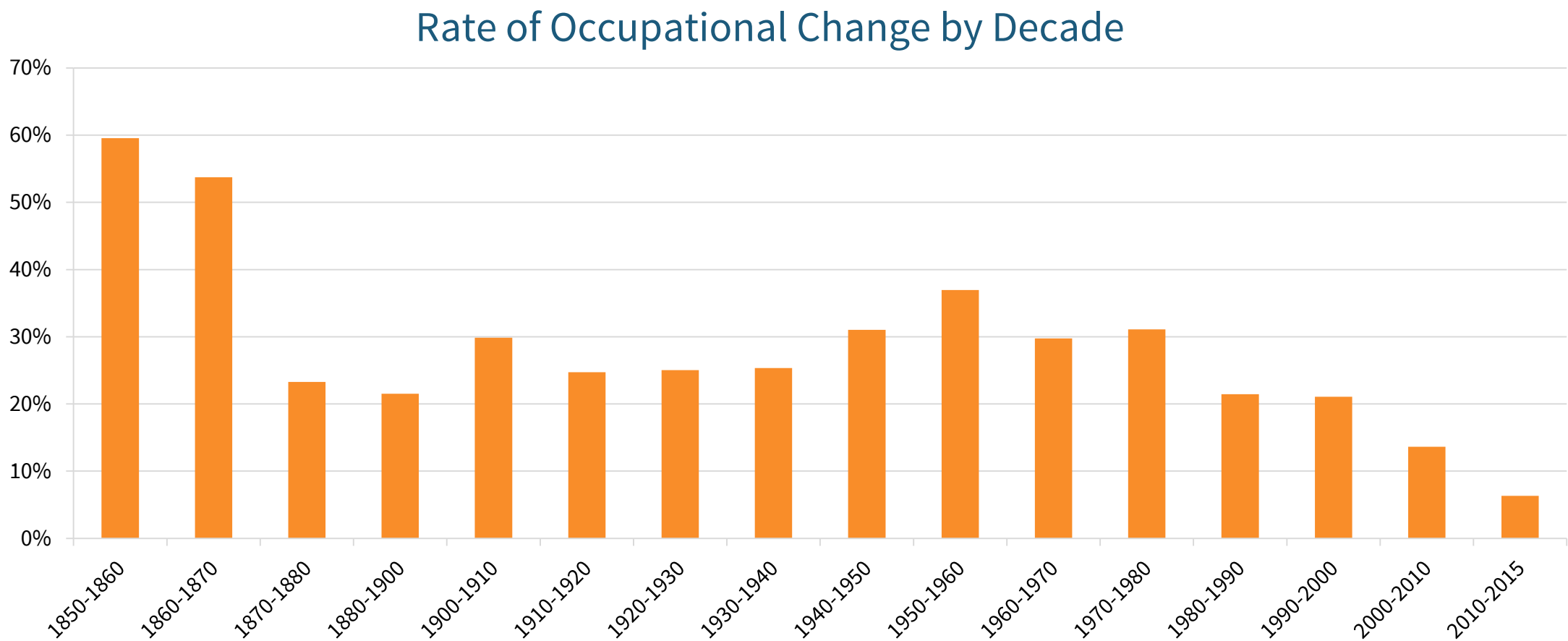
Examples of Technology-Driven Change in Occupations

Growth of Computer Occupations Relative to Overall Employment Growth



Source: ITIF analysis of IPUMS occupation data.

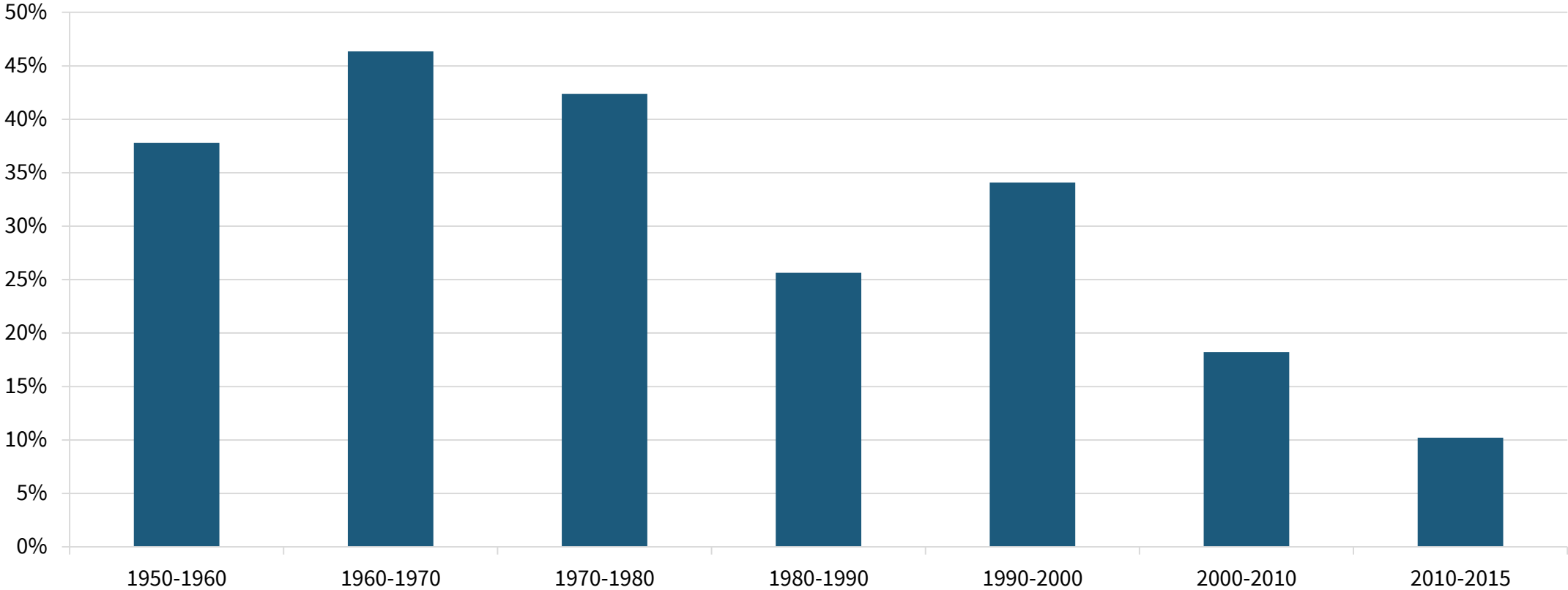
Examples of Technology-Driven Change in Occupations



Source: ITIF analysis of IPUMS occupation data.

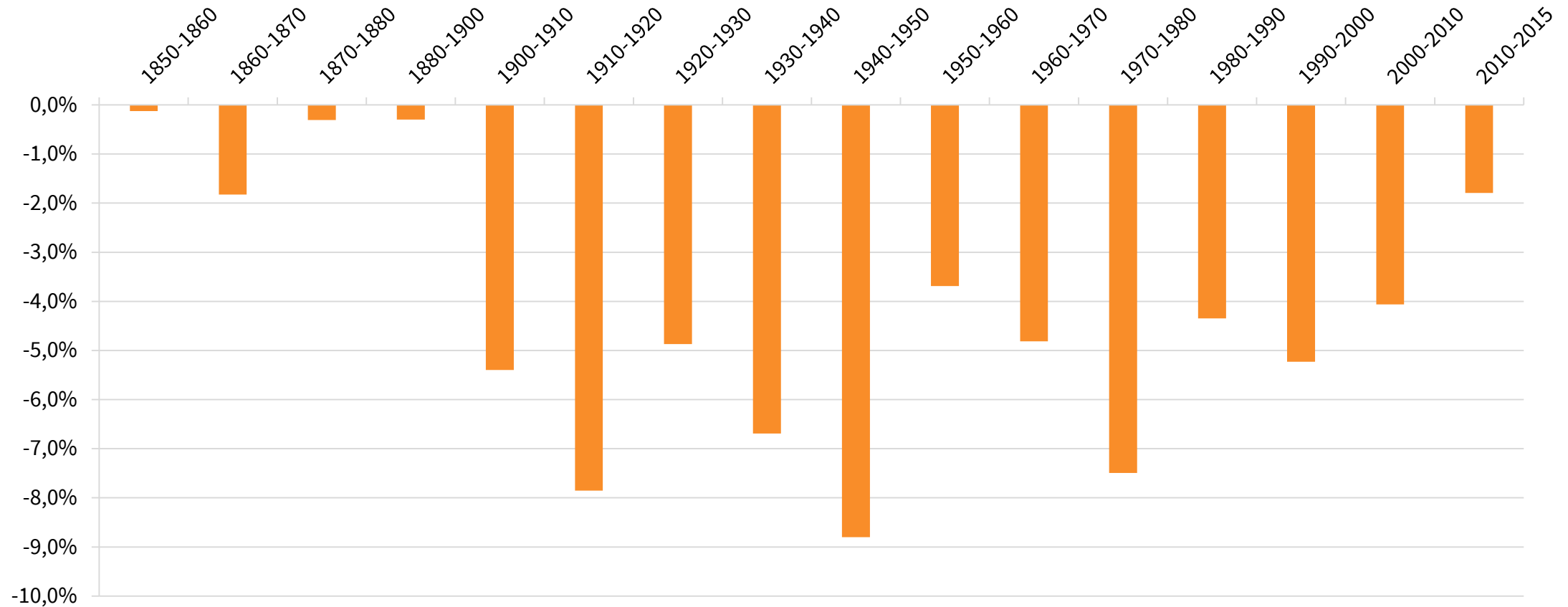
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Rate of Occupational Change by Decade



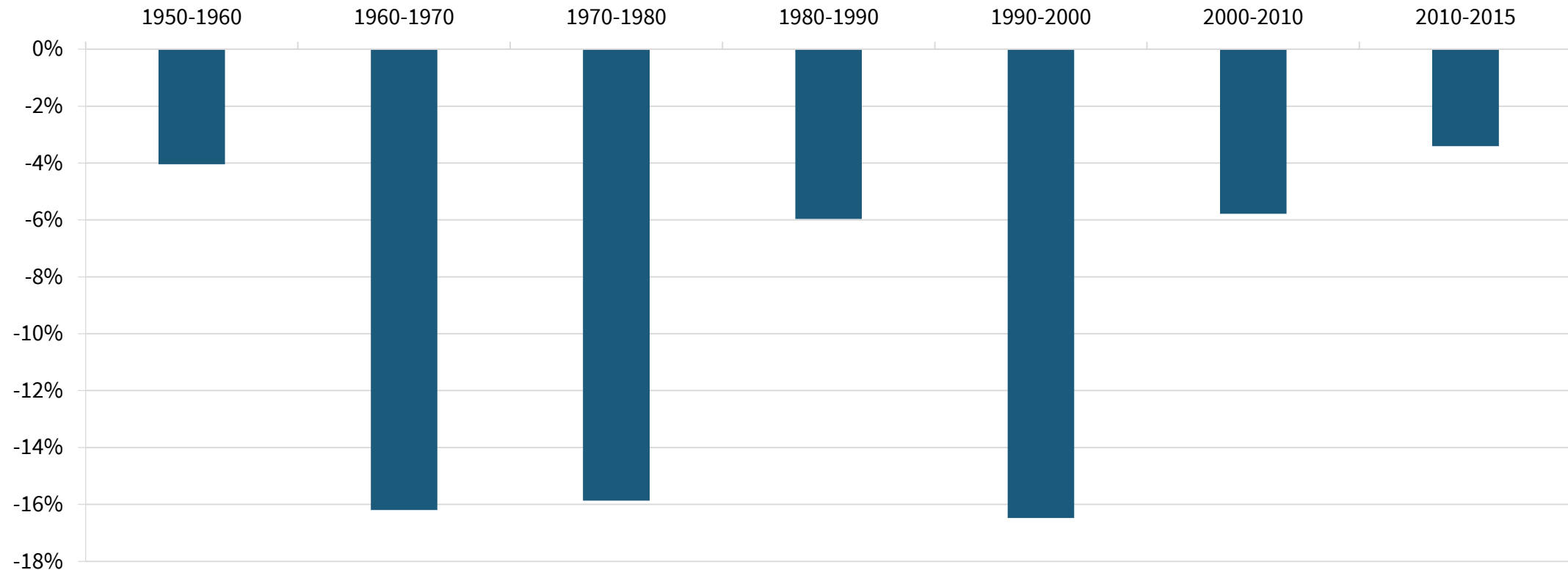
Source: ITIF analysis of IPUMS occupation data.

Absolute Losses in Occupations, 1850–2015



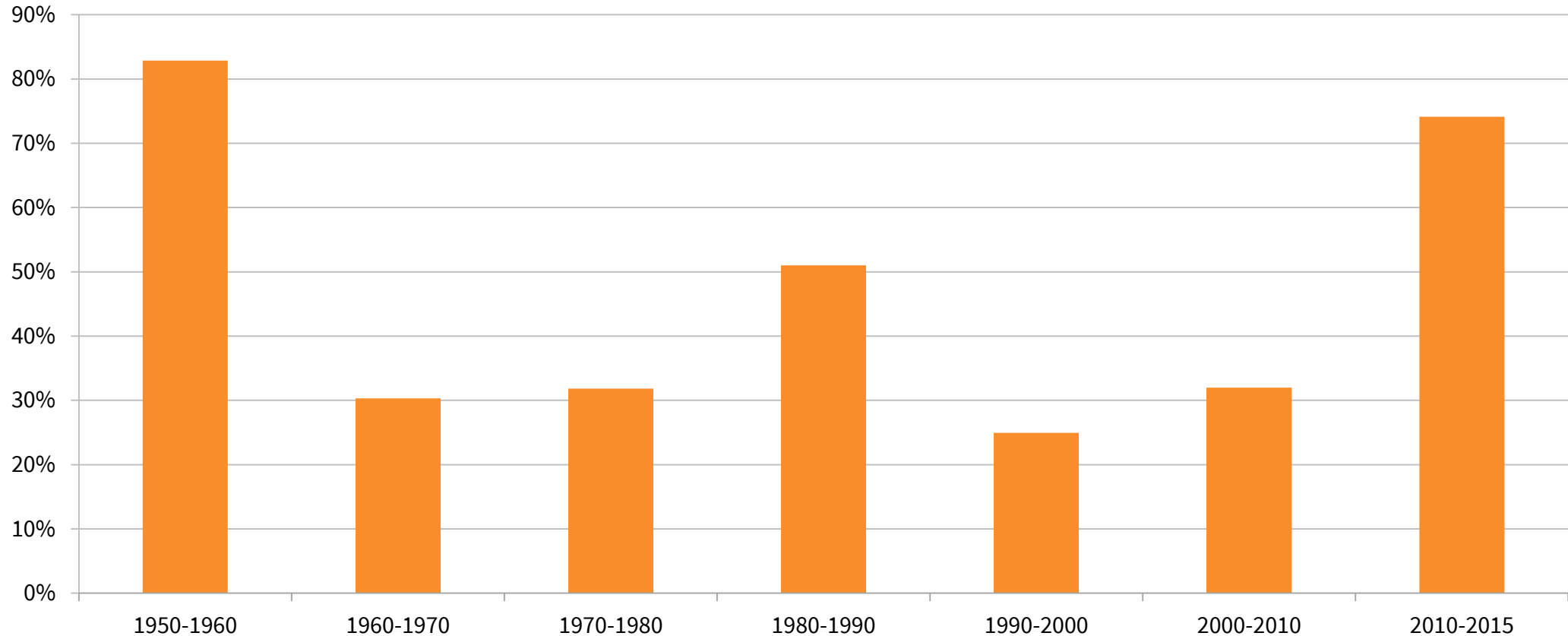
Source: ITIF analysis of IPUMS occupation data.

Absolute Losses in Occupations, 1950–2015



Source: ITIF analysis of IPUMS occupation data.

Technology Creating New Jobs/Technology Eliminating Jobs



Source: ITIF analysis of IPUMS occupation data.

Past Predictions of Employment Doom Have Been Wrong

- Marvin Minsky (1970): “in from 3 to 8 years we will have a machine with the general intelligence of an average human being.”
- Gail Garfield Schwartz (1982): “perhaps as much as 20% of the work force will be out of work in a generation.”
- Nil Nilson (1984): “We must convince our leaders that they should give up the notion of full employment. The pace of technical change is accelerating.”



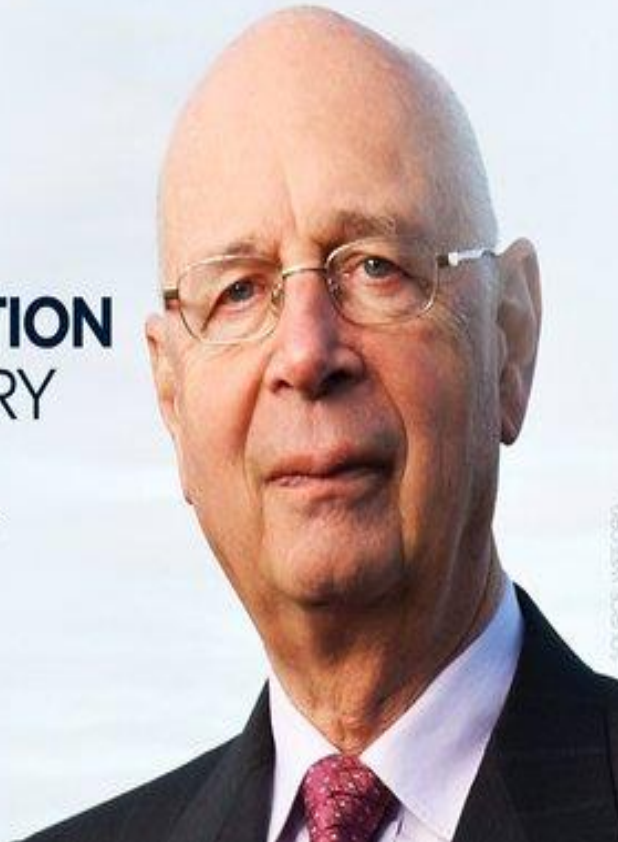
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Many Claim Unprecedented Change is Coming

“
THE FOURTH
INDUSTRIAL REVOLUTION
WILL AFFECT THE VERY
ESSENCE OF OUR
HUMAN EXPERIENCE.”

KLAUS SCHWAB
FOUNDER & EXECUTIVE CHAIRMAN,
WORLD ECONOMIC FORUM



THE SECOND MACHINE AGE

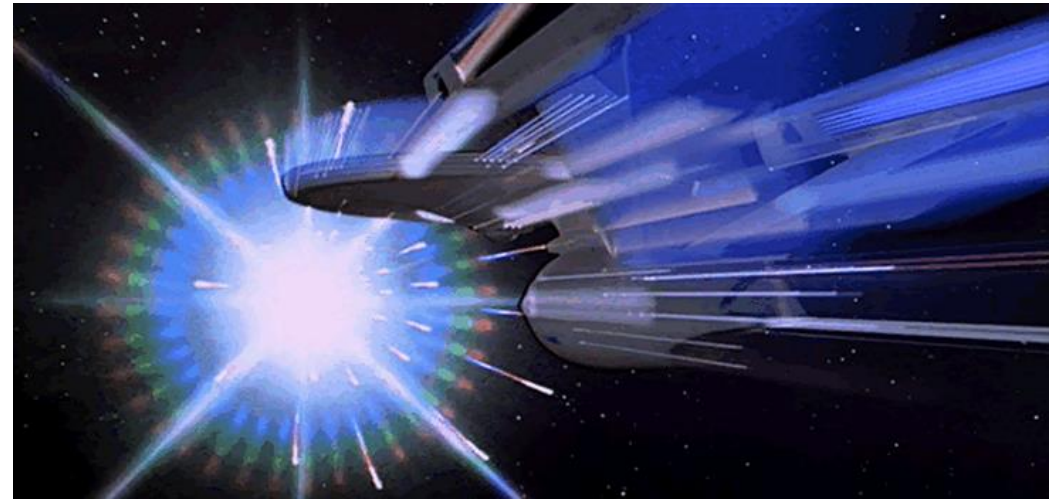
WORK, PROGRESS, AND PROSPERITY
IN A TIME OF
BRILLIANT TECHNOLOGIES

ERIK BRYNJOLFSSON
ANDREW McAFEE

But Technological Change Has Always Been Gradual

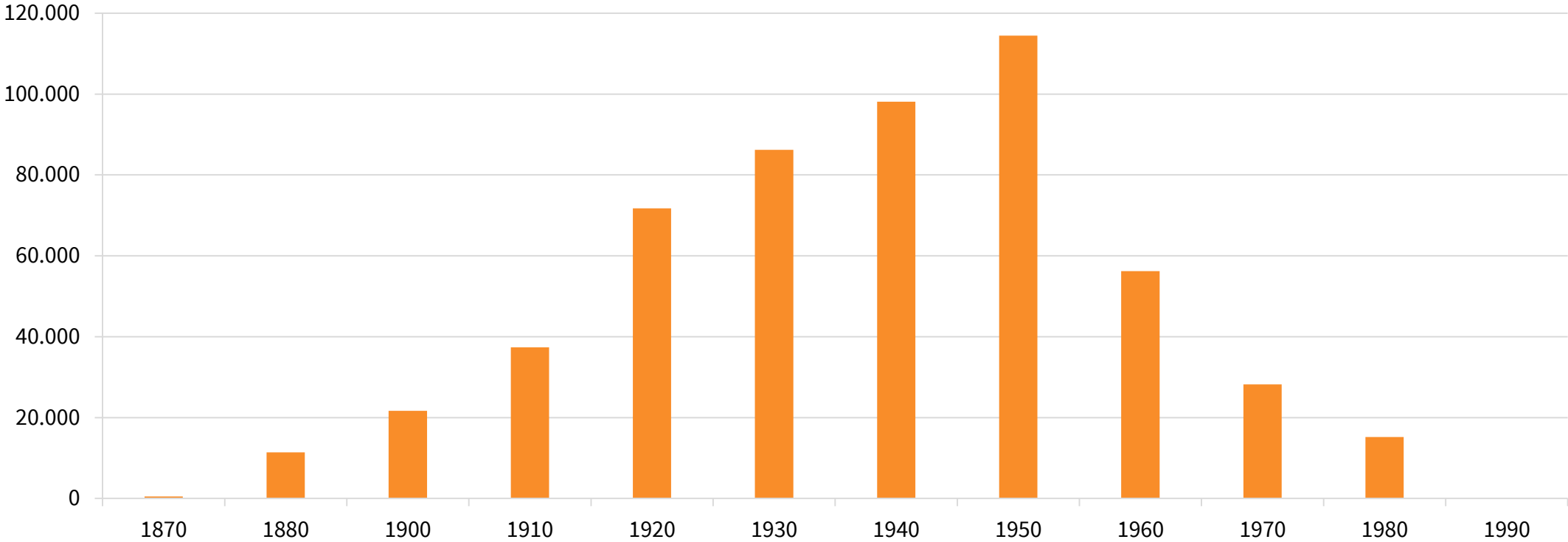
- “Misled by suitcase words, people are making category errors in fungibility of capabilities—category errors comparable to seeing the rise of more efficient internal combustion engines and jumping to the conclusion that warp drives are just around the corner.”

— (Rodney Brooks, MIT)



Examples of Technology-Driven Change in Occupations

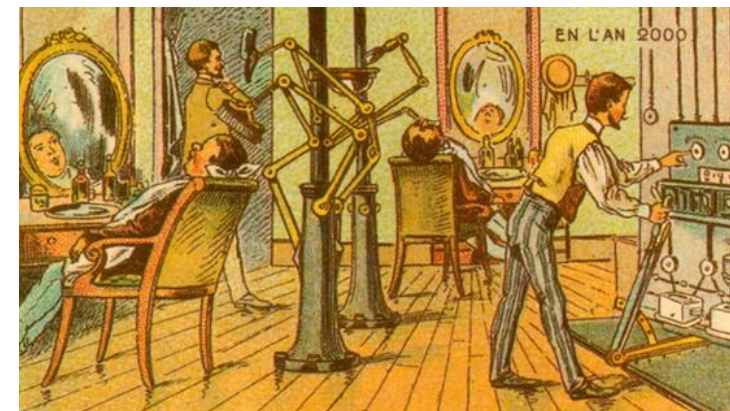
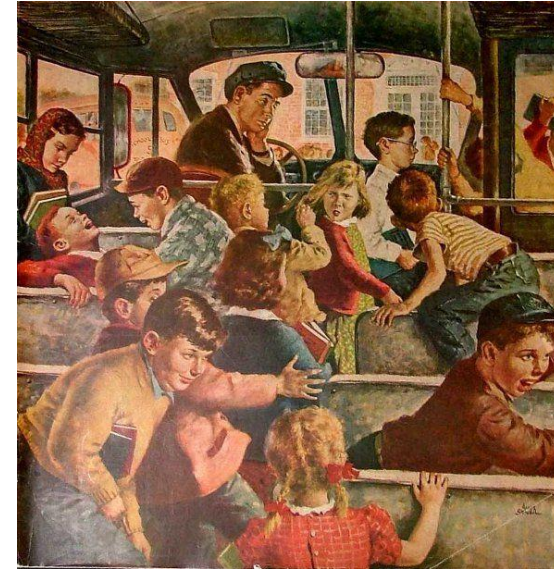
Number of Elevator Operators, 1870–1990



Source: ITIF analysis of IPUMS occupation data.

Occupations at High Risk According to Frey and Osborne

- Dental technicians
- Models
- Manicurists and pedicurists
- Bicycle Repairers
- Radio and Cellular Tower Installers and Repairers
- Fence Erectors
- Electrical and Electronics Installers
- School Bus Drivers
- Terrazo Workers and Finishers
- Carpet Installers
- Veterinary Assistants
- Insulation Workers
- Property Managers
- Barbers
- Shoppers
- Drywall and Ceiling Tile Installers
- Aircraft Mechanics

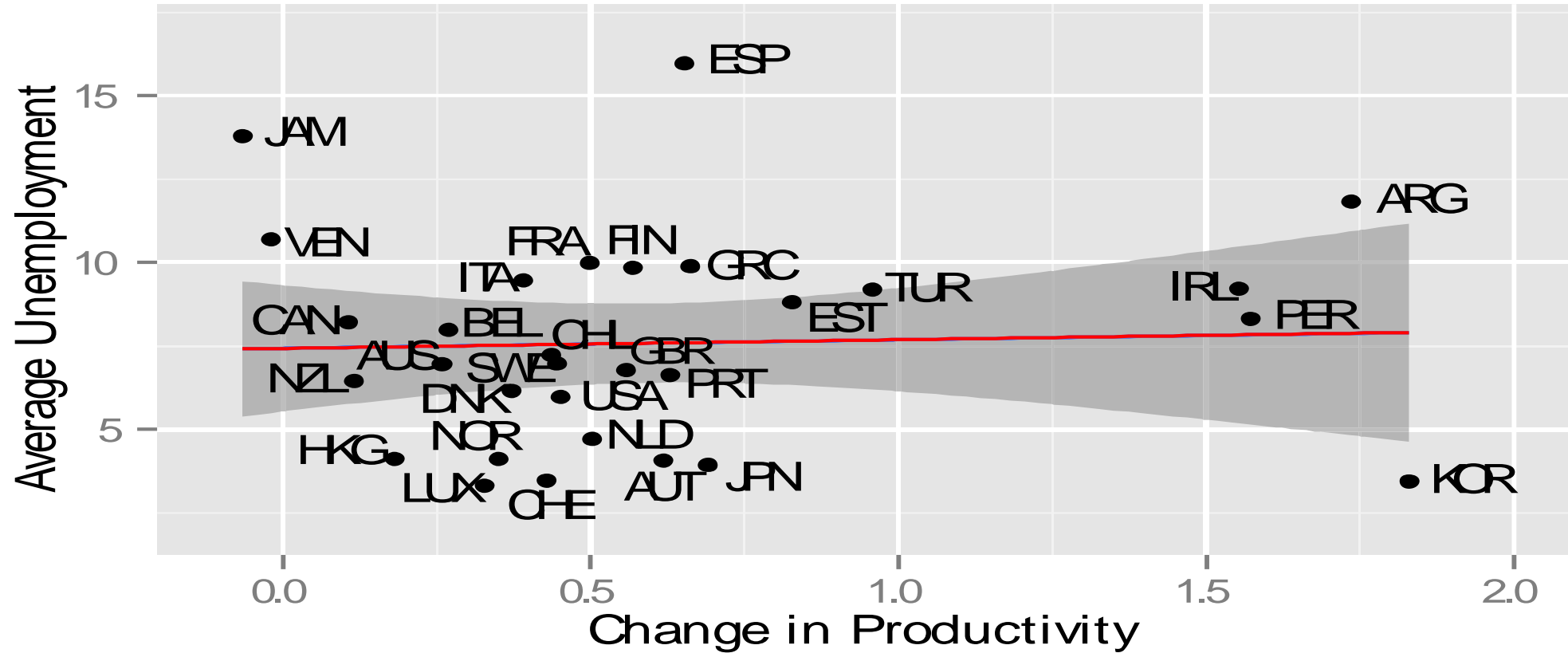


Most Occupations Are Hard to Automate

- Brick masons and block masons
- Machinists
- Cartographers and photogrammetrists
- Dental laboratory technicians
- Social science research assistants
- Firefighters
- Pre-school teachers
 - (Randomly selected U.S. occupations)



No Correlation Between Productivity Growth and Unemployment



Average unemployment rate and total change in productivity in select nations, 1990-2011 (%) (World Bank and Penn World Tables)

Increased Productivity Creates Jobs

- Automation lowers prices which increases demand. (BLS)

Savings are spent



Spending creates demand

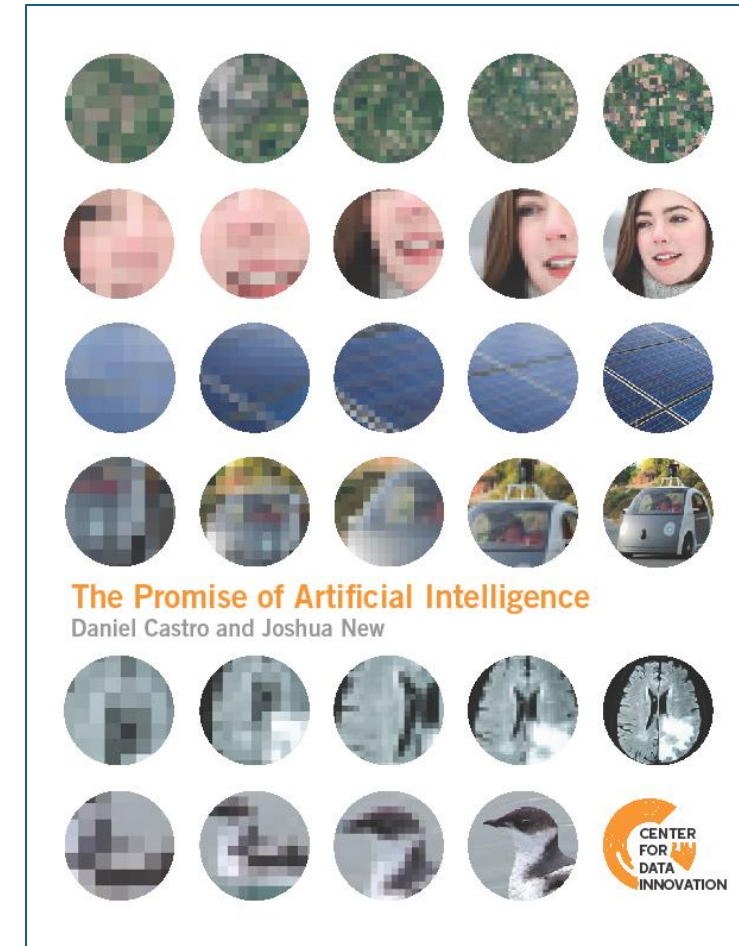


Demand creates jobs



Much of AI Will Boost Quality, **Not** Eliminate Jobs

- Health care diagnosis
- Fraud prevention
- Student feedback
- Disability access
- Reduced human trafficking



Human Wants and Needs Are Far From Being Satisfied



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What Should Policy Makers *Not* Do?

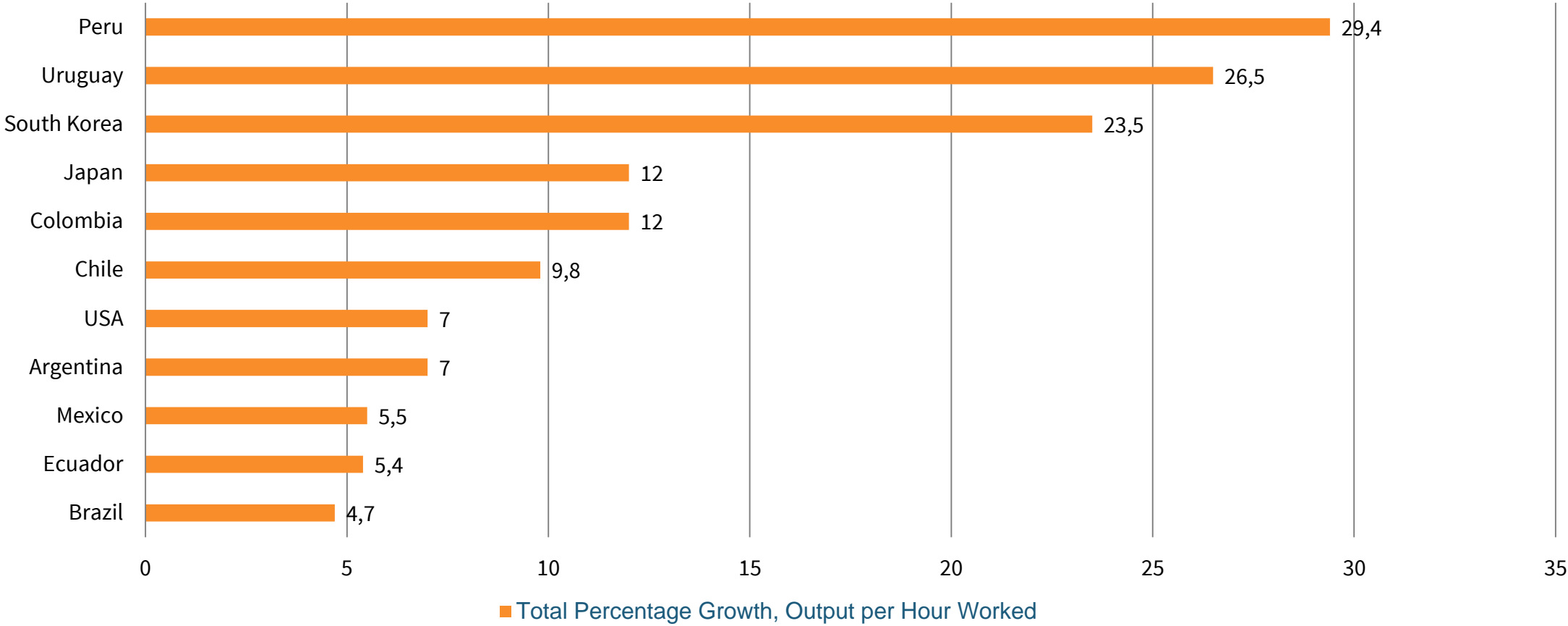
- Panic
- Slow the rate of innovation and automation (e.g., robot tax)
- Put in place Universal Basic Income



What Should Policy Makers Do?

- Speed the development and adoption of tech-based automation

Brazilian Productivity Growth Has Been Anemic (2009-2017)



What Should Policy Makers Do?

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- **Reduce the risk from job loss (e.g., universal health coverage, unemployment insurance)**

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- **Fundamentally restructure higher education to separate education and credentialing.**

What Should Policy Makers Do?

- Speed the development and adoption of tech-based automation
- Reduce the risk from job loss (e.g., universal health coverage, unemployment insurance)
- Fundamentally restructure higher education to separate education and credentialing.
- **Improve worker training (e.g., worker training tax credit, industry-led skills alliances, apprenticeships, etc.)**

Obriagdo!

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