

Technology Anxiety Past and Present

David Autor, MIT and NBER

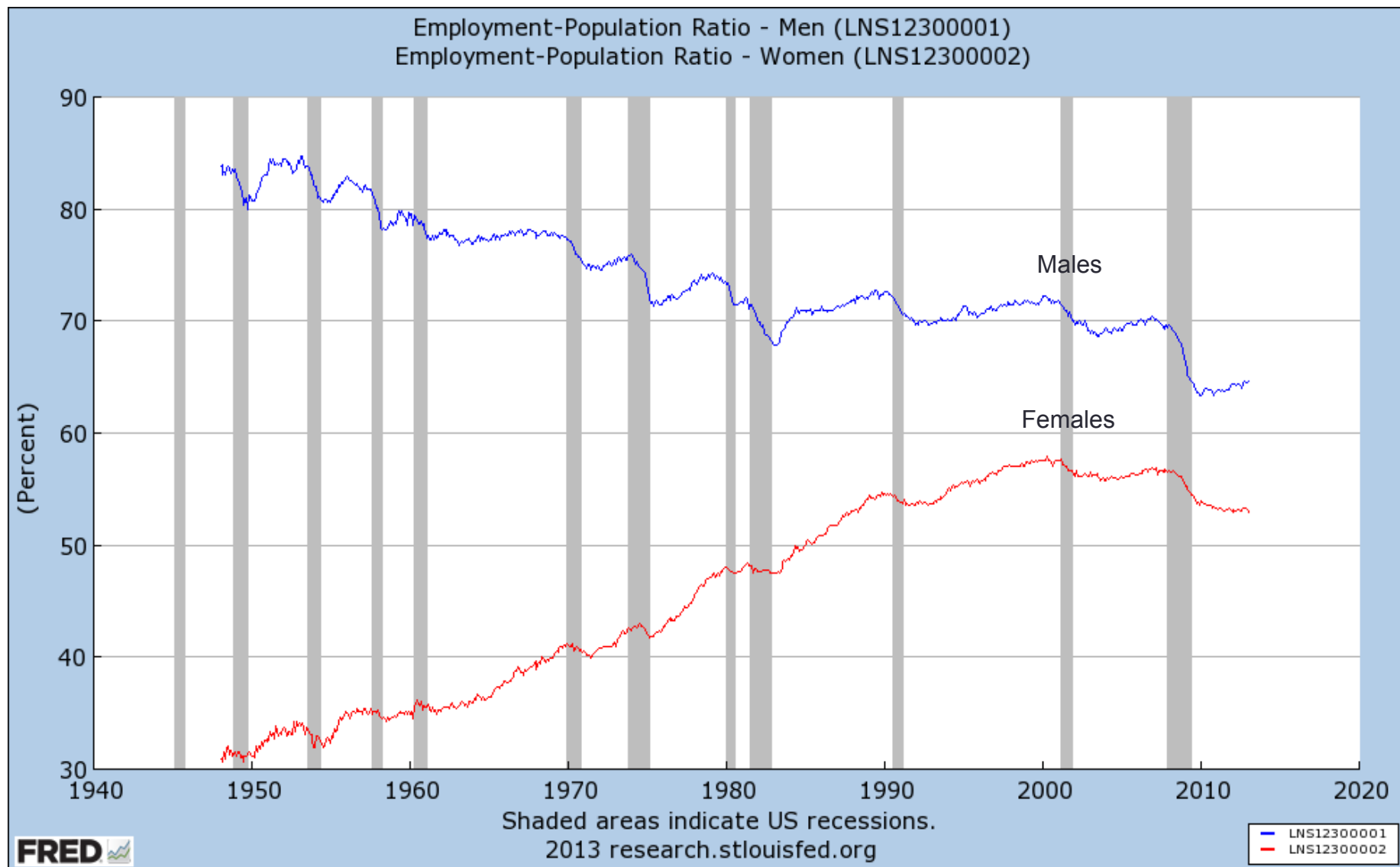
MIT 6.141 Guest Lecture

May 8, 2013

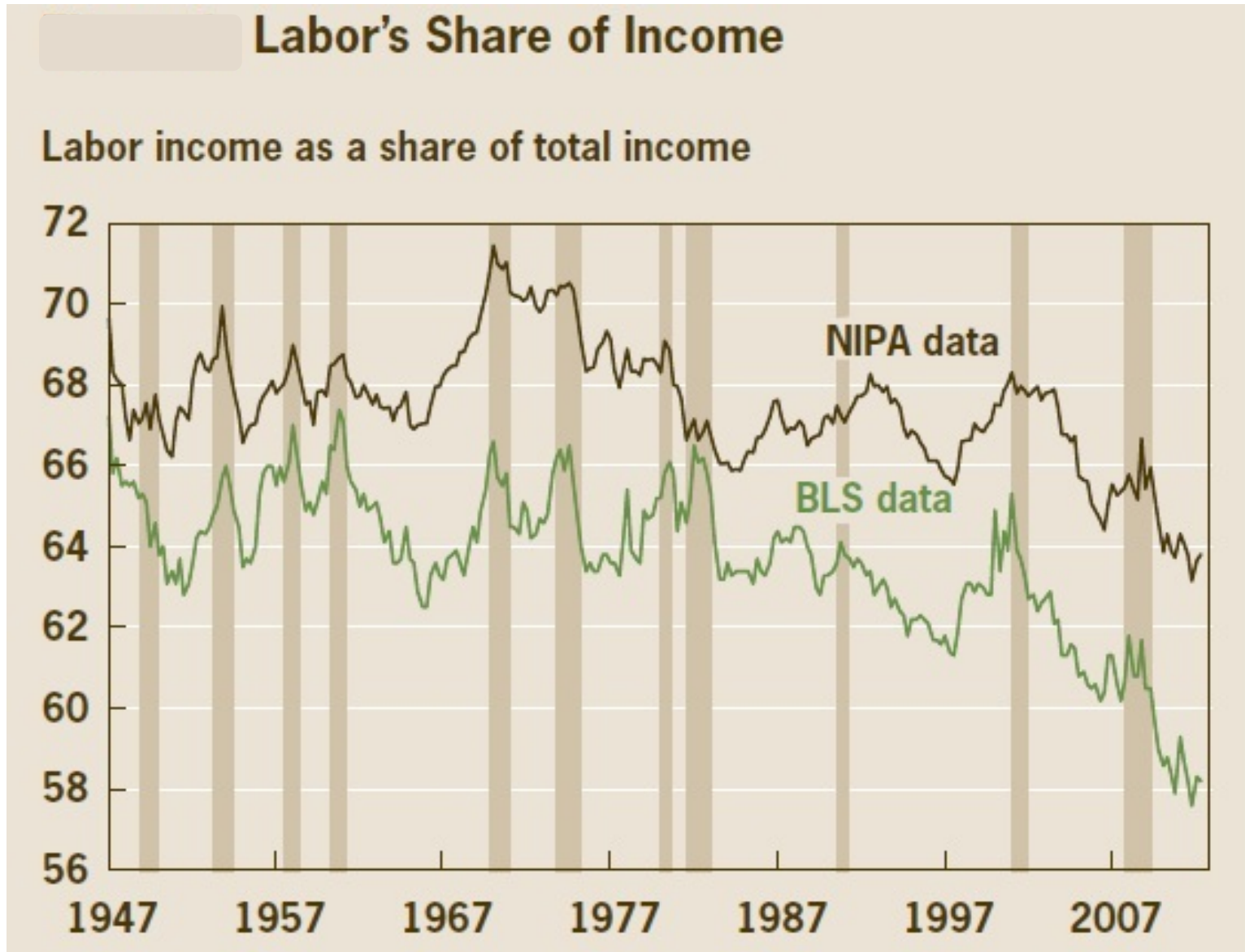
Agenda – Technology Anxiety, Past and Present

1. **The case for concern**
2. A brief history of technology anxiety
3. Not enough jobs versus the ‘wrong’ jobs
4. What should the Luddites have worried about?
5. Why *you* should care if *other* people go to college

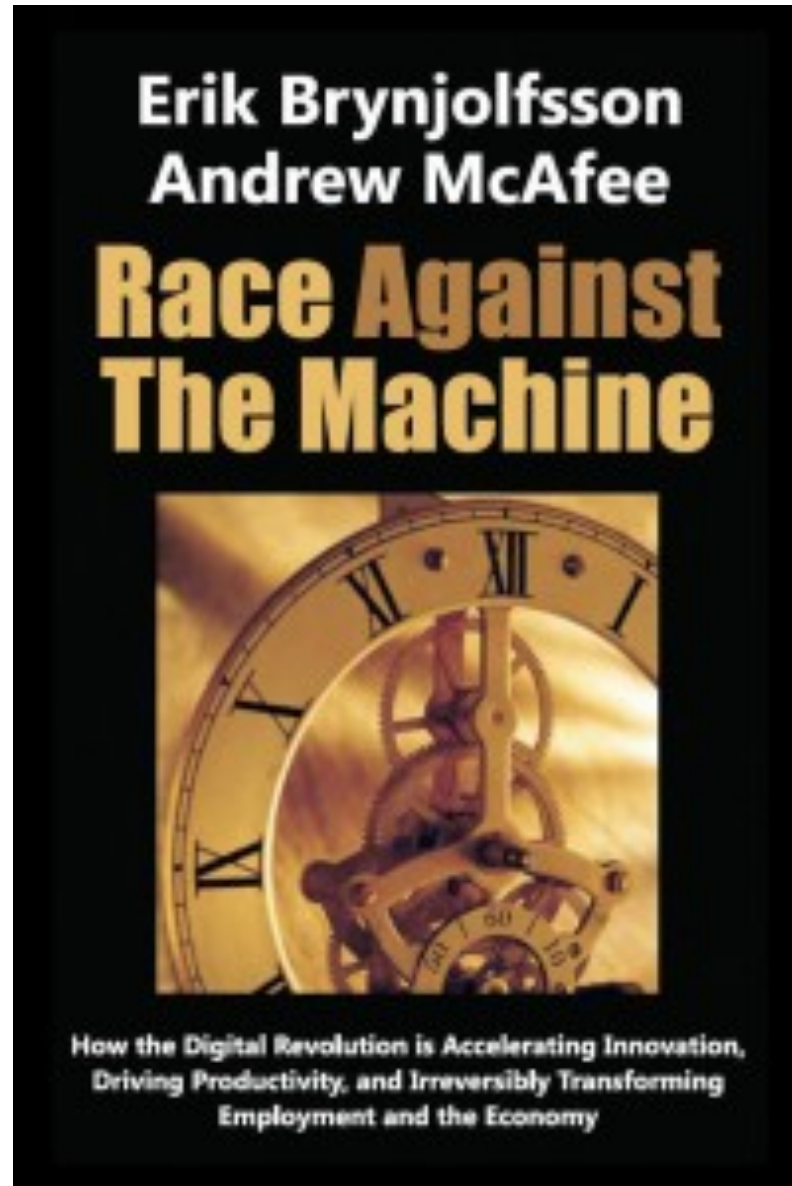
Declining U.S. Labor Force Participation Since 2000



Declining Labor Share of National Income Since 2000



An Era of Technology Anxiety



An Era of Technology Anxiety



The Conscience of a Liberal

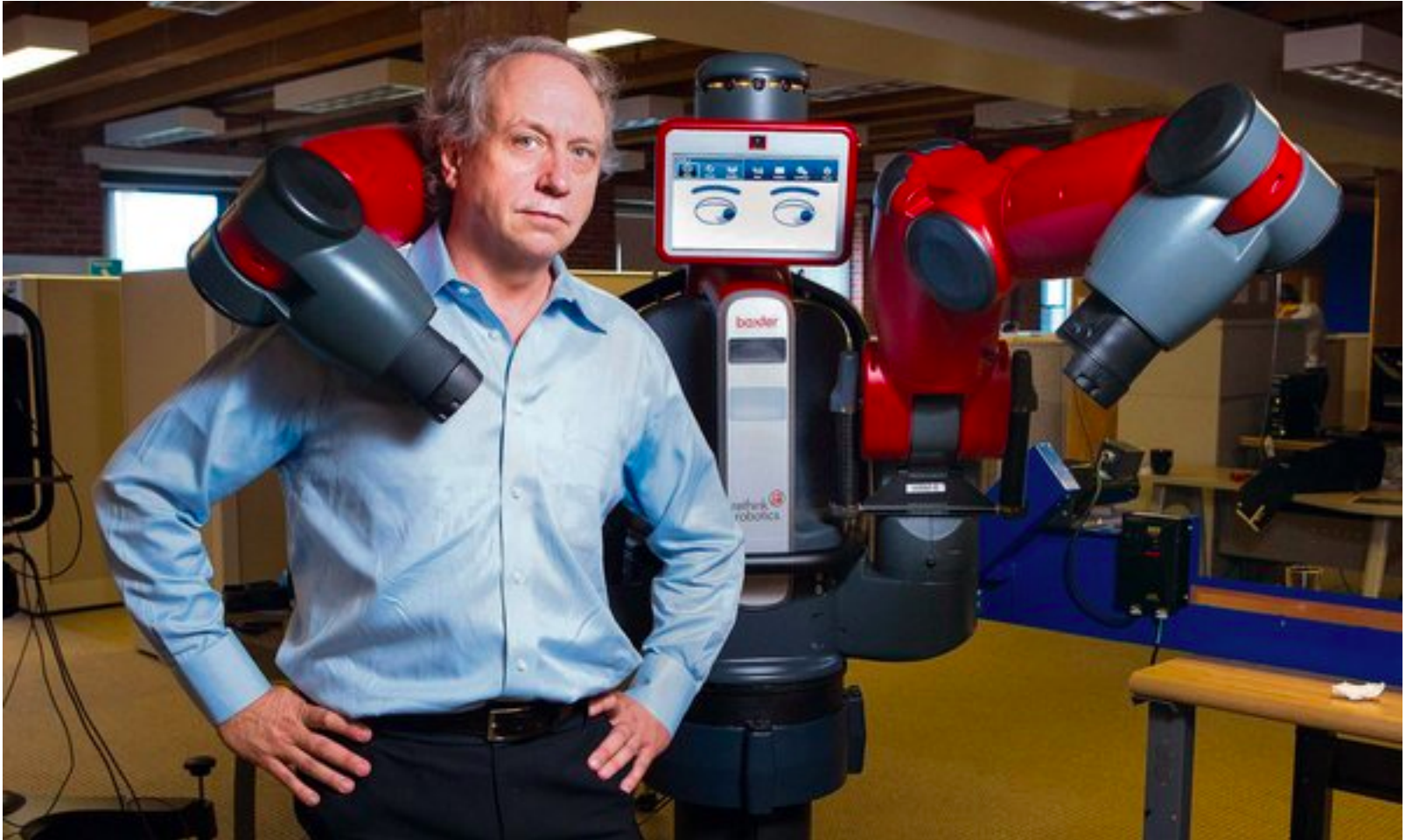
PAUL KRUGMAN

December 8, 2012, 8:37 am |  401 Comments

Rise of the Robots

Are We Entering the “PC Era” of Workplace Robotics?

Rodney Brooks with “Baxter”



Are We Entering the “PC Era of Workplace Robotics”?



buy
Baxter



product name

quantity

price

Baxter Robot

Includes two 7 DOF arms with torso and head, integrated vision system, integrated robot control system, integrated safety system. Also includes one-year subscription to software capability upgrades and a one-year (2100 hour) warranty.



0



\$22,000

Capability Upgrade Subscription and Extended Warranty:

- No extended warranty
- One year or 2100 hours of robot use
(extending coverage to a total of 2 years/4200 hours) - add \$3,000
- Two years or 4200 hours of robot use
(extending coverage to a total of 3 years/6300 hours) - add \$5,000

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An Earlier Era of Technology Anxiety

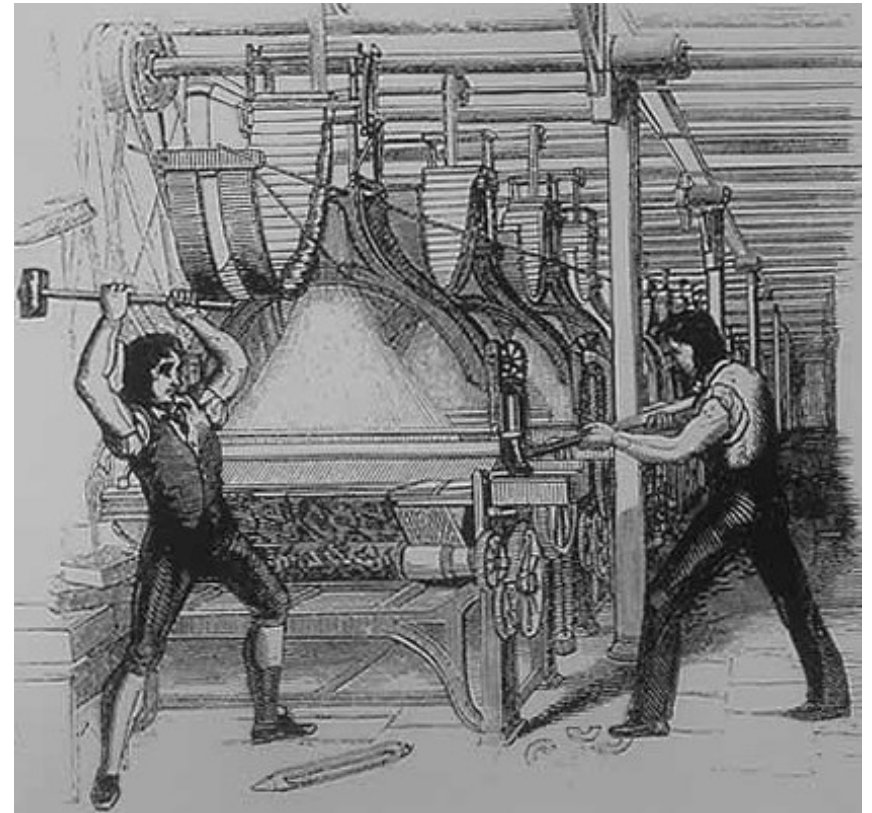
Ned Ludd



THE LEADER OF THE LUDDITES

Full length as in the original engraving by H. J. Pye.

“Machine Trashing”
1812 – 1813



A Long History of Popular Anxiety...
But Traditional Economic View: Don't Worry, Be Happy

1. **Technological change is a win-win**

- The only free lunch that economists can believe in (Mokyr, 1990)

2. **Labor demand is unlimited**

**The
Economist**

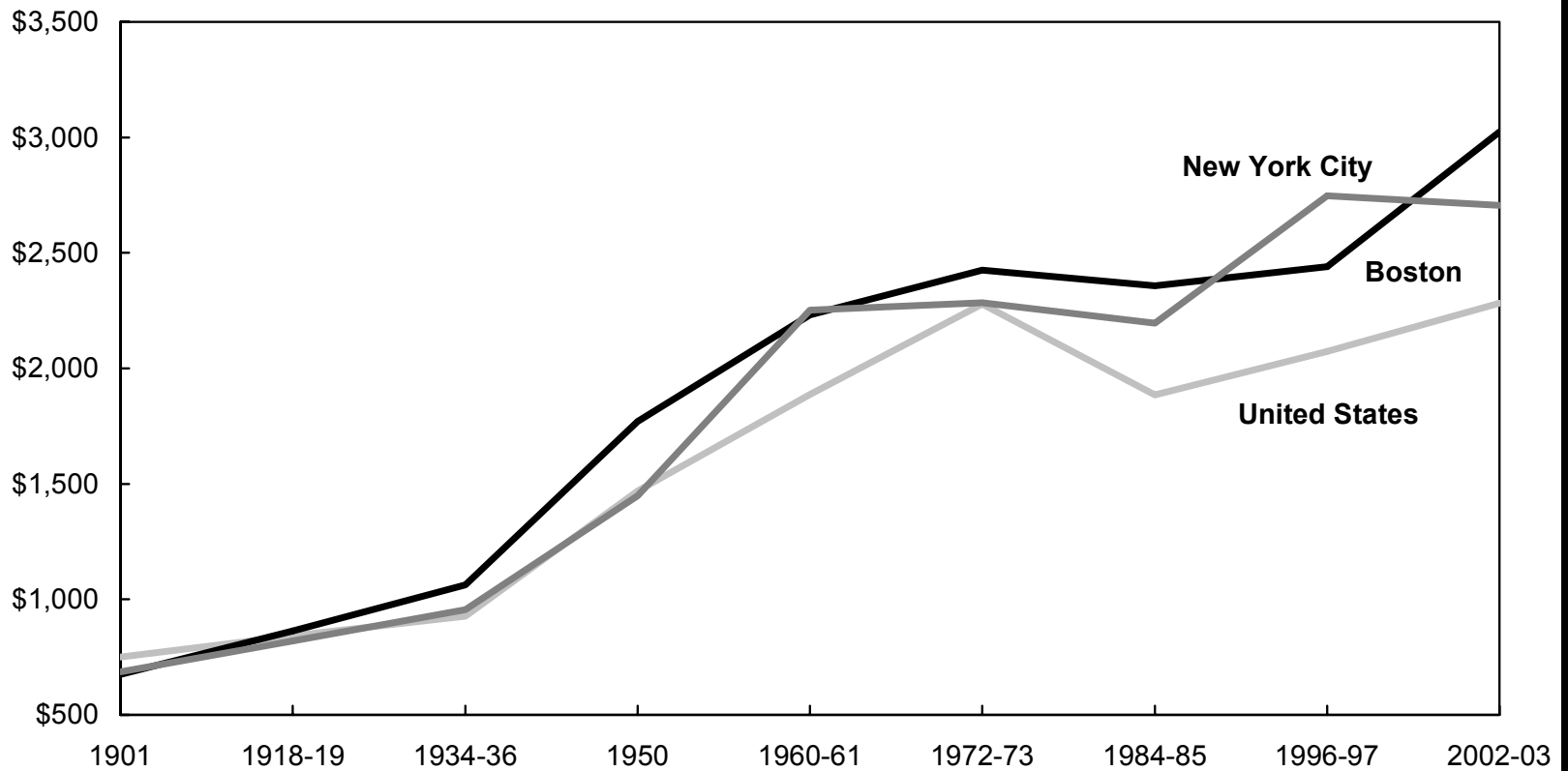
**The Lump of Labor
Fallacy**

- “One of the best-known fallacies in economics is the notion that there is a fixed amount of work to be done—a **lump of labor**—which can be shared out in different ways to create fewer or more jobs.”

3. **Those who fear technological change are “Luddites”**

Over the Course of a Century... Six-Fold Rise in Real Incomes, 1901 - 2002

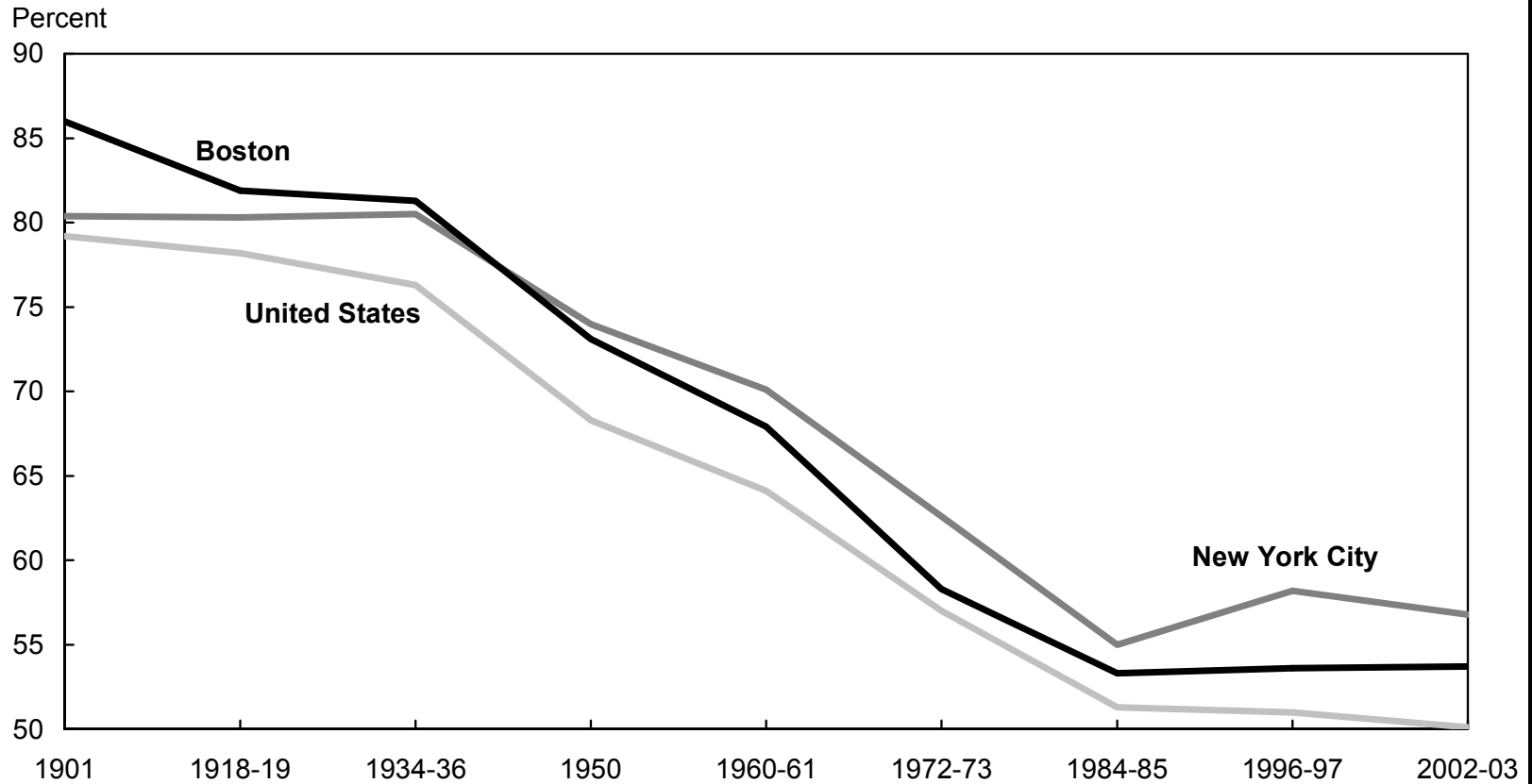
**Chart 38. Income deflated to 1901 for the United States,
New York City, and Boston**



SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey

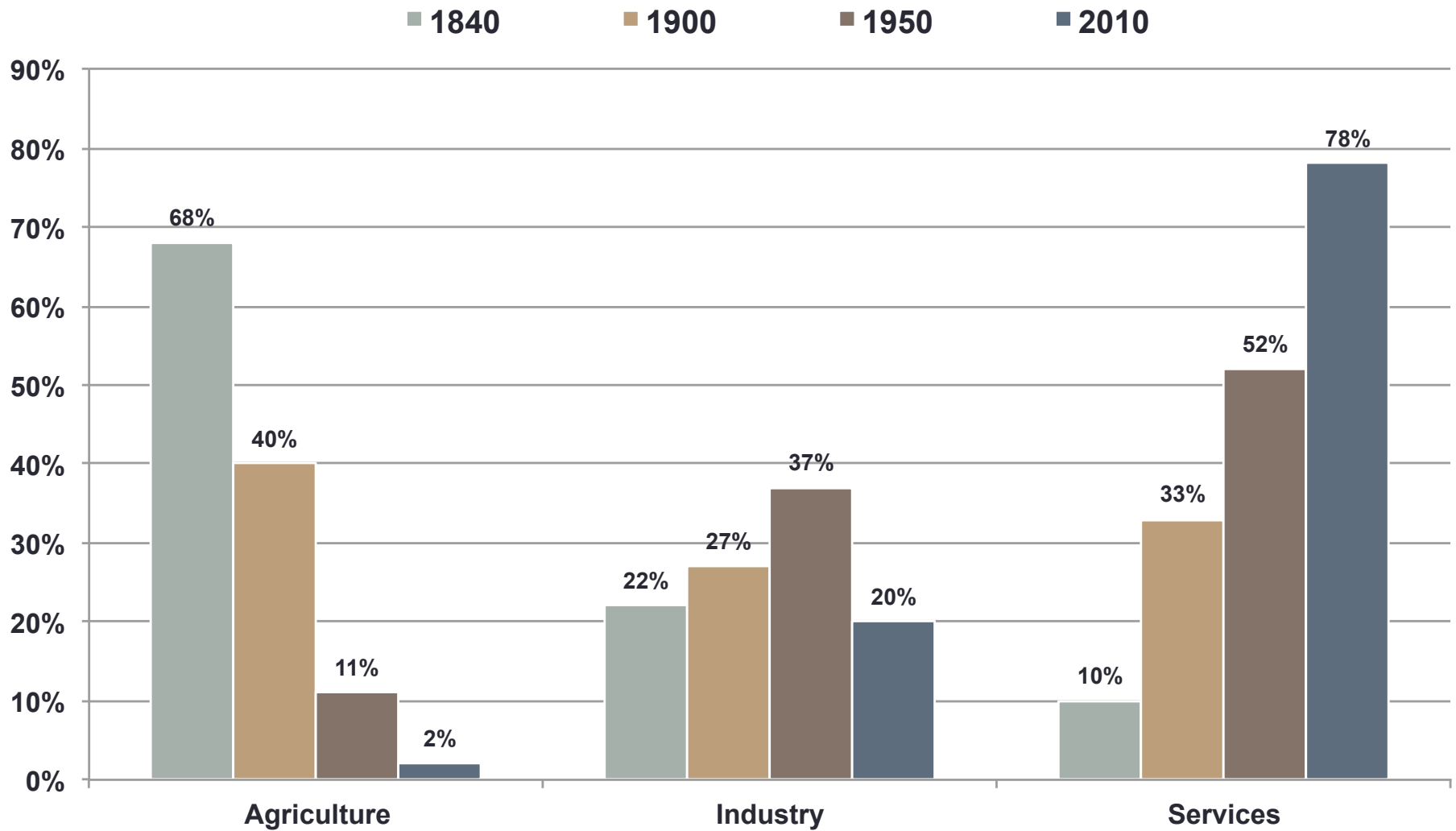
Over the Course of a Century... Share of Income Spent on Necessities Falls from 85% to 55%

Chart 41. Food, clothing, and housing expenditure shares for the United States, New York City, and Boston

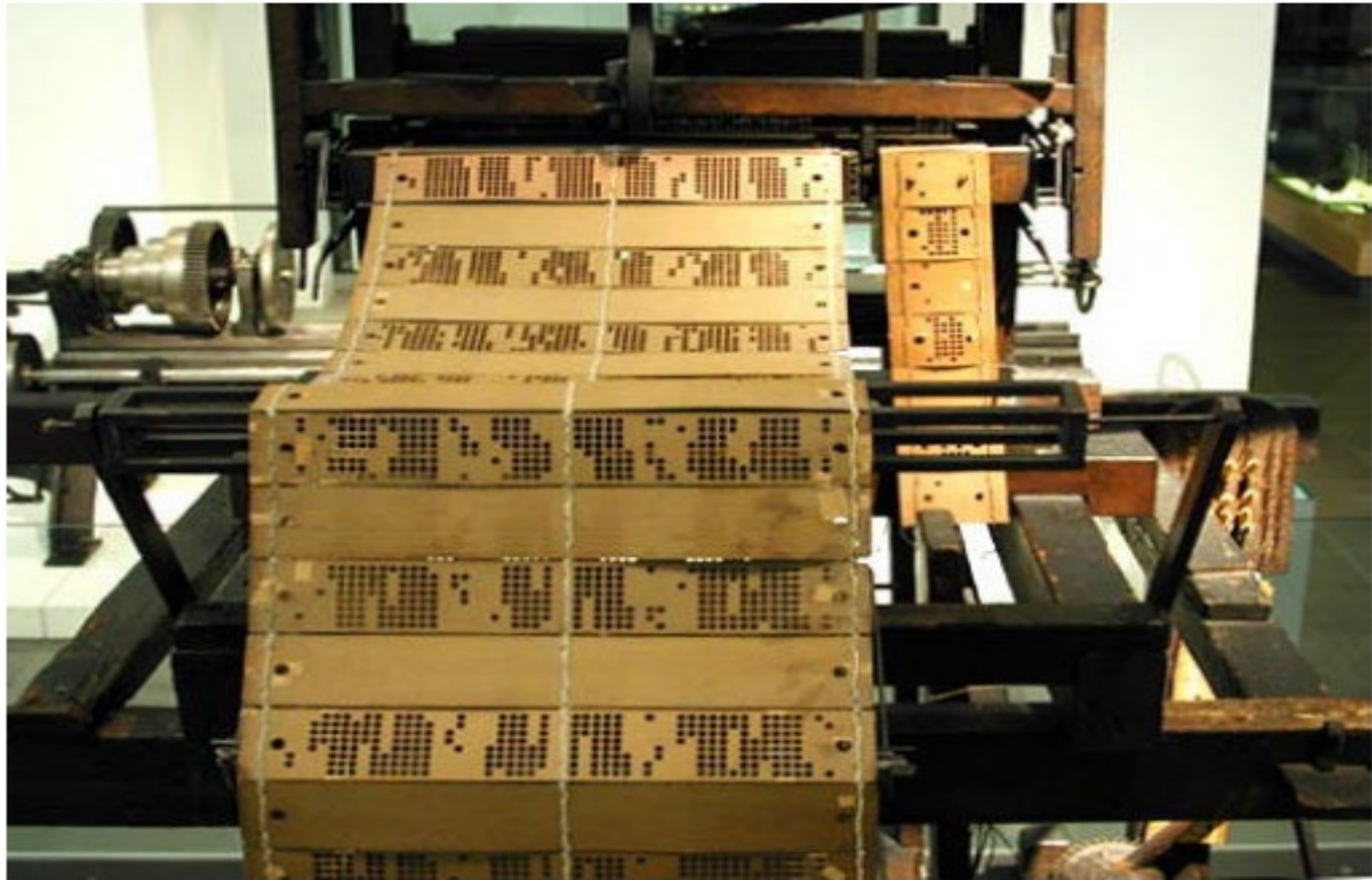


SOURCE: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey

Not One but Two Technological Revolutions: The Green Revolution and the Industrial Revolution



Automation of 'Routine Tasks:' Jacquard Loom (1801)



Source: Collection, Science Museum, London. Photograph by George P. Landow, June 2000; downloaded from <http://65.107.211.206/technology/jacquard2.html> (8/27/2002).

Two Centuries of Productivity Growth in Computing: 2+ Trillion Fold Decline in Cost of Computing v. Labor

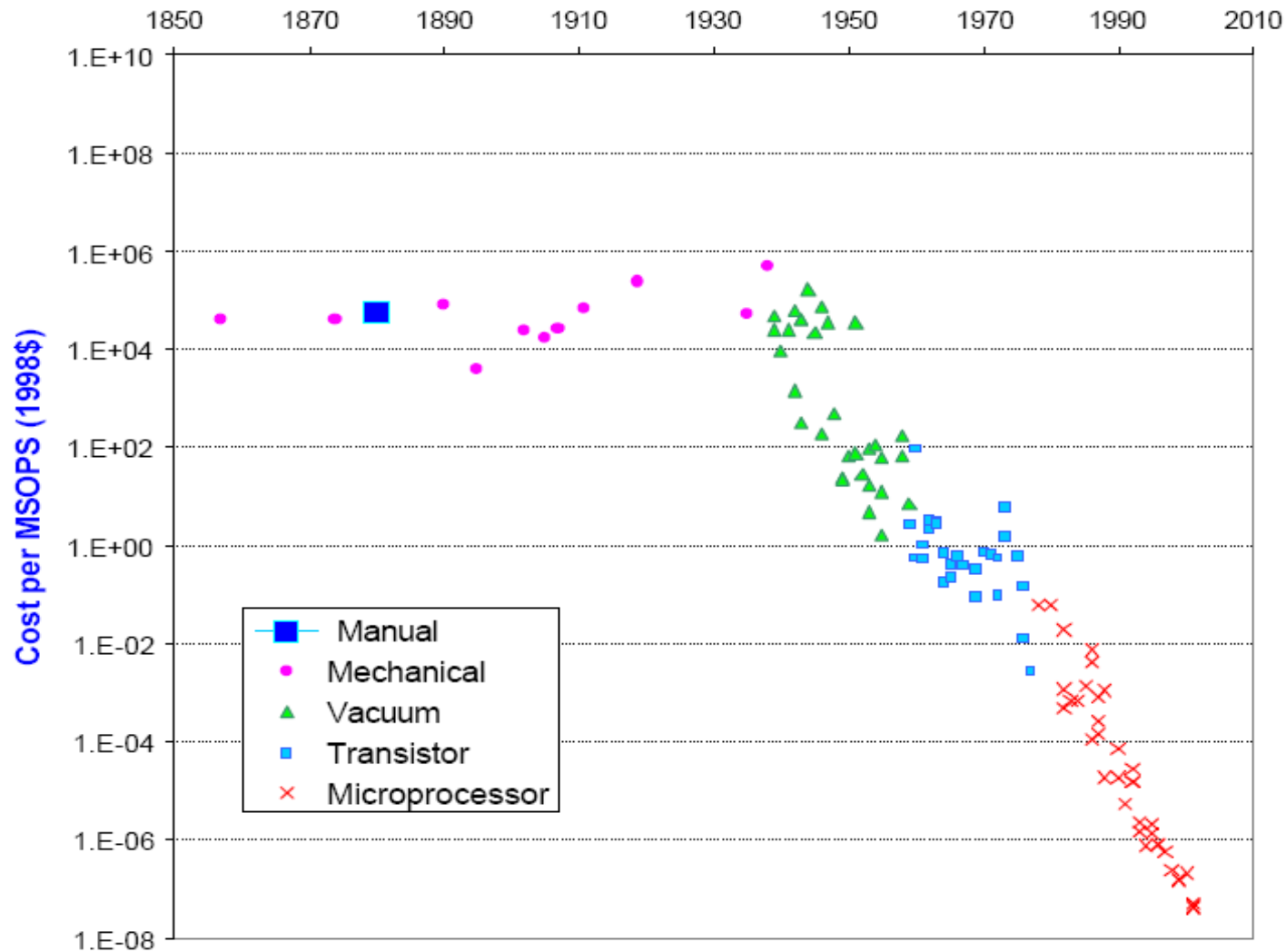
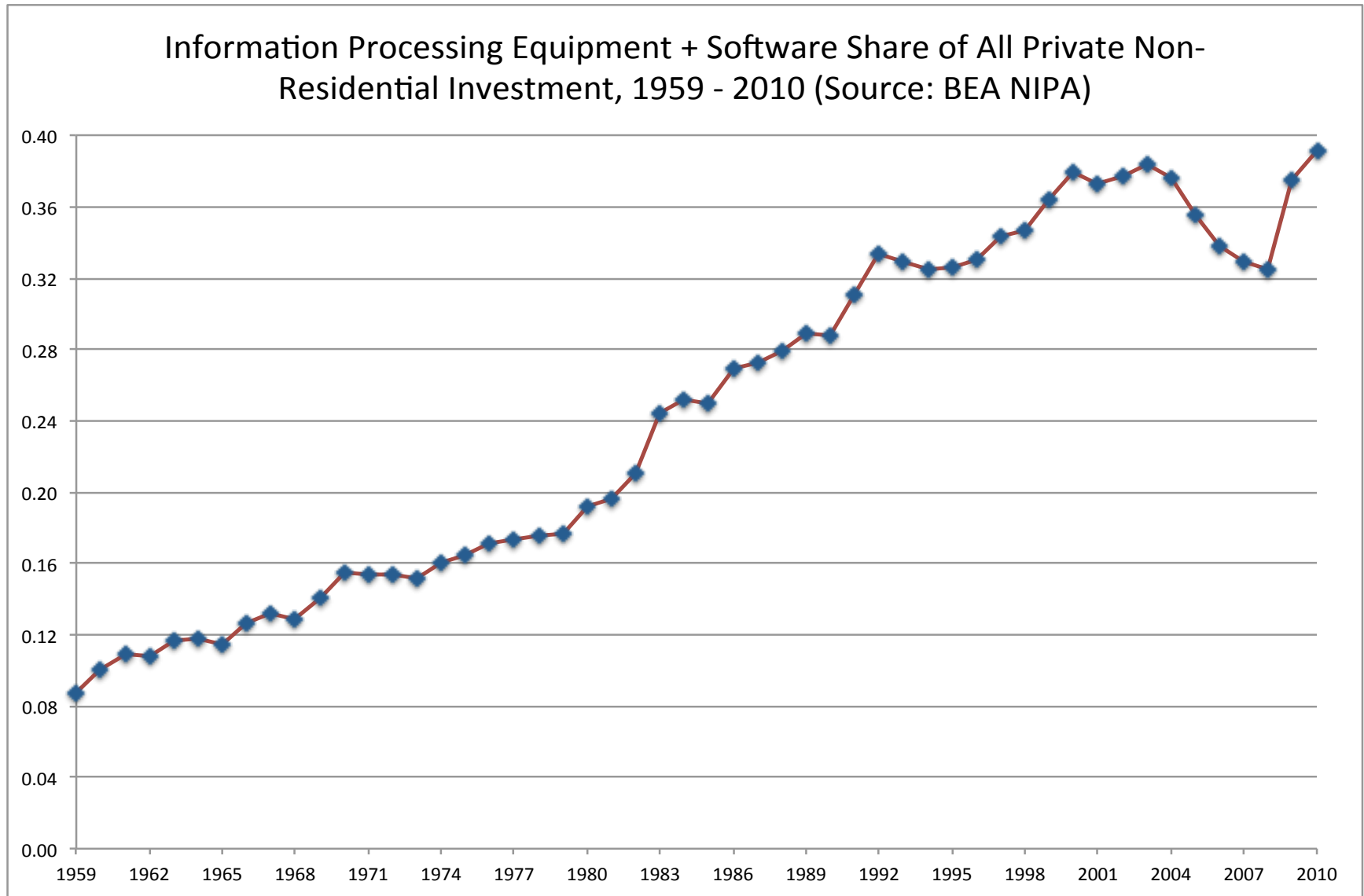


Figure 2. The cost of computer power for different technologies

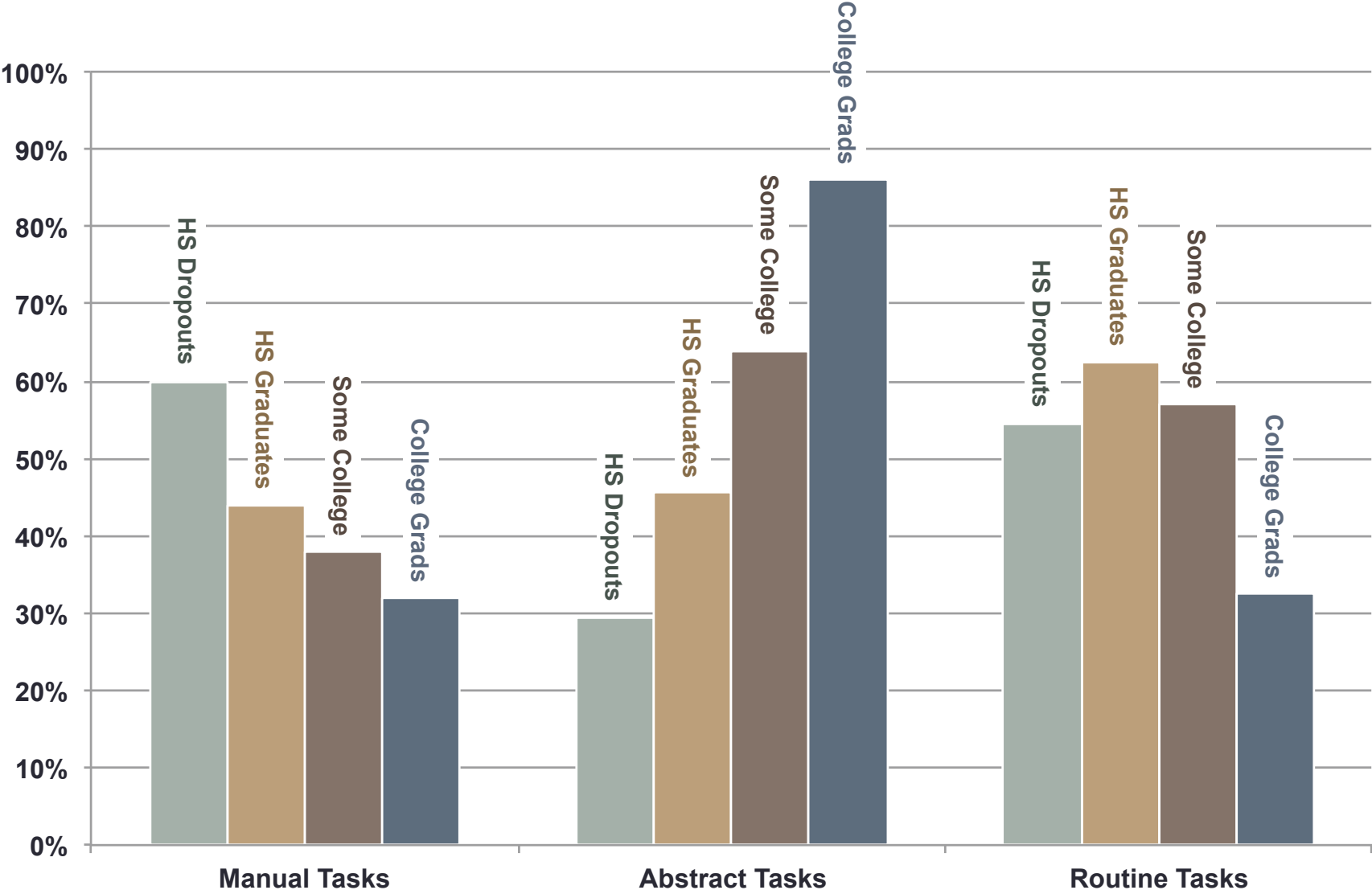
Information Technology Accounted for ~40% of Business Investment as of 2010



Substitution, Complementarity: Tasks and Technology

	Task Description	Example Occupations	Potential Impact of Computerization
Routine Tasks	<ul style="list-style-type: none">• 'Rules-based'• Repetitive• Procedural	<ul style="list-style-type: none">• Bookkeepers• Assembly line workers	<ul style="list-style-type: none">• Direct Substitution
Abstract Tasks	<ul style="list-style-type: none">• Abstract problem-solving• Mental flexibility	<ul style="list-style-type: none">• Scientists• Attorneys• Managers• Doctors	<ul style="list-style-type: none">• Strong Complementarity
Manual Tasks	<ul style="list-style-type: none">• Environmental Adaptability• Interpersonal Adaptability	<ul style="list-style-type: none">• Truck drivers• Security guards• Flight attendants• Home health aides• Waiters• Cleaners	<ul style="list-style-type: none">• Limited Complementarity or Substitution

U.S. Job Task Input by Education Group in 1980

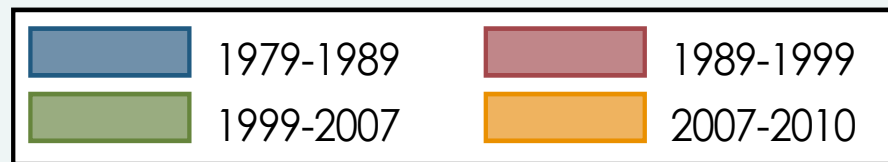
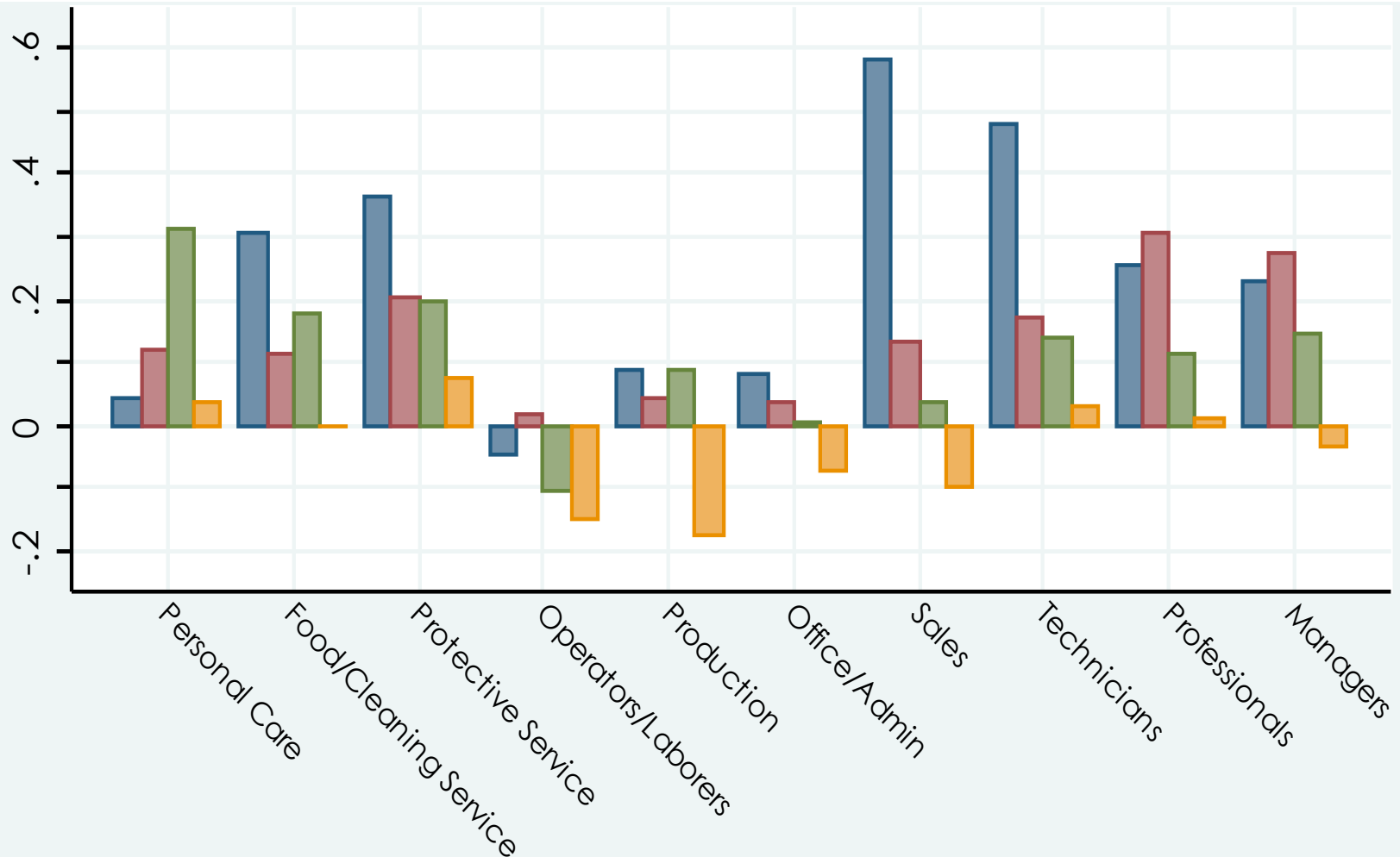


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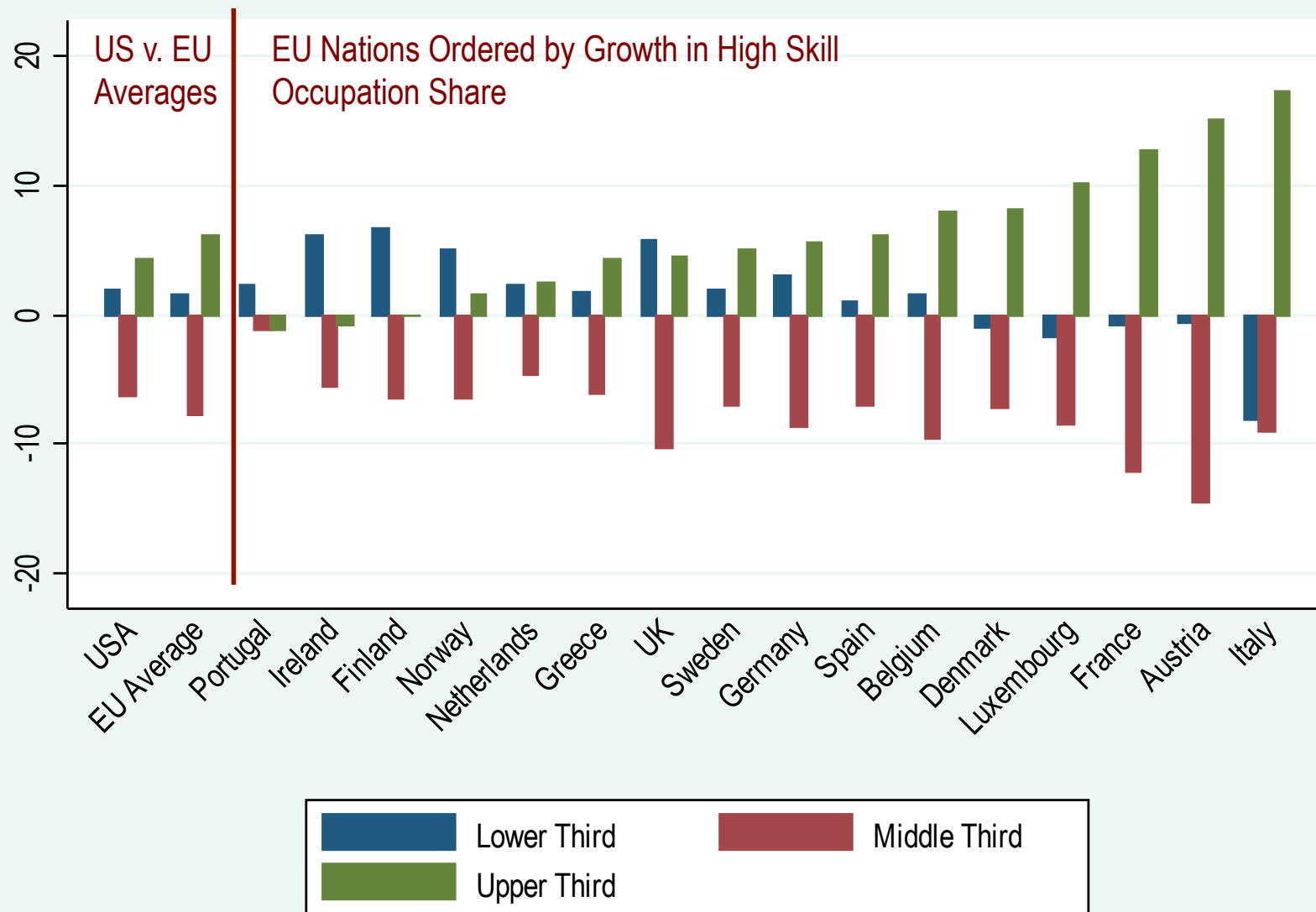
Employment Polarization, 1979 – 2010

Percent Growth in Employment by Occupation



Changes in Employment Share by Job Skill Tercile, 1993-2006

Comparison of U.S. and European Union Countries



Source: Goos, Salomons and Manning (2009)

Occupations with Largest Projected Numerical Employment Increase, 2010 – 2020 (BLS)

OCCUPATION	NUMBER OF NEW JOBS (PROJECTED), 2010-20	2010 MEDIAN PAY
Registered Nurses	711,900	\$64,690 per year.
Retail Salespersons	706,800	\$20,670 per year.
Home Health Aides	706,300	\$20,560 per year.
Personal Care Aides	607,000	\$19,640 per year.
Office Clerks, General	489,500	\$26,610 per year.
Combined Food Preparation and Serving Workers, Including Fast Food	398,000	\$17,950 per year.
Customer Service Representatives	338,400	\$30,460 per year.
Heavy and Tractor-Trailer Truck Drivers	330,100	\$37,770 per year.
Laborers and Freight, Stock, and Material Movers, Hand	319,100	\$23,460 per year.
Postsecondary Teachers	305,700	\$62,050 per year.
Nursing Aides, Orderlies, and Attendants	302,000	\$24,010 per year.
Childcare Workers	262,000	\$19,300 per year.
Bookkeeping, Accounting, and Auditing Clerks	259,000	\$34,030 per year.
Cashiers	250,200	\$18,500 per year.
Elementary School Teachers, Except Special Education	248,800	\$51,660 per year.
Receptionists and Information Clerks	248,500	\$25,240 per year.
Janitors and Cleaners, Except Maids and Housekeeping Cleaners	246,400	\$22,210 per year.

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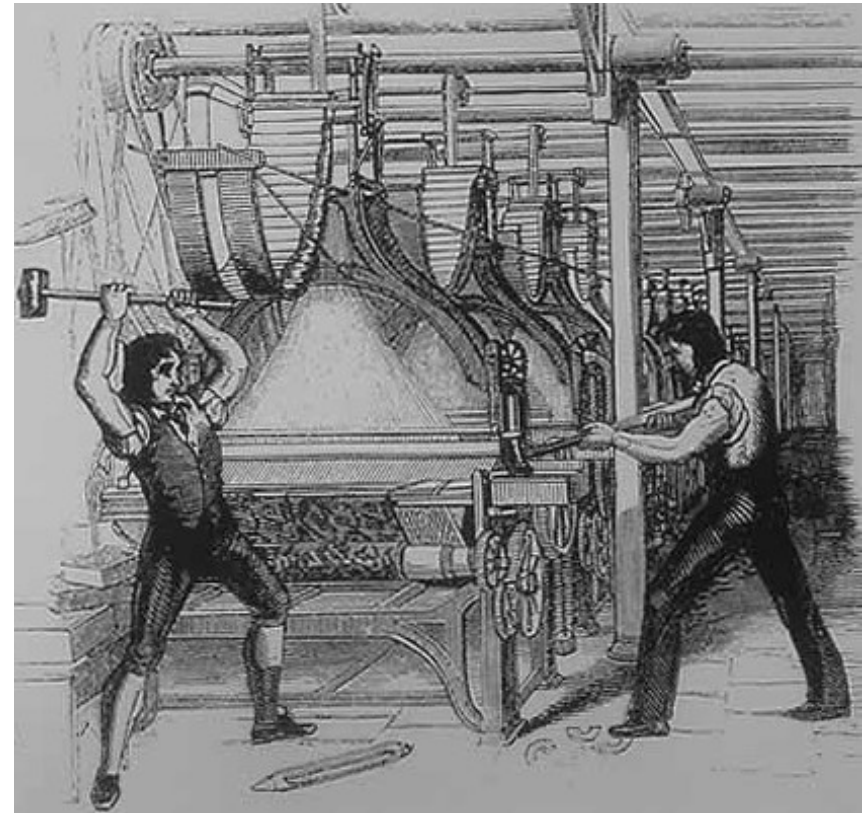
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But the Luddites did have Something to Fear

Ned Ludd



“Machine Trashing”
1812 – 1813

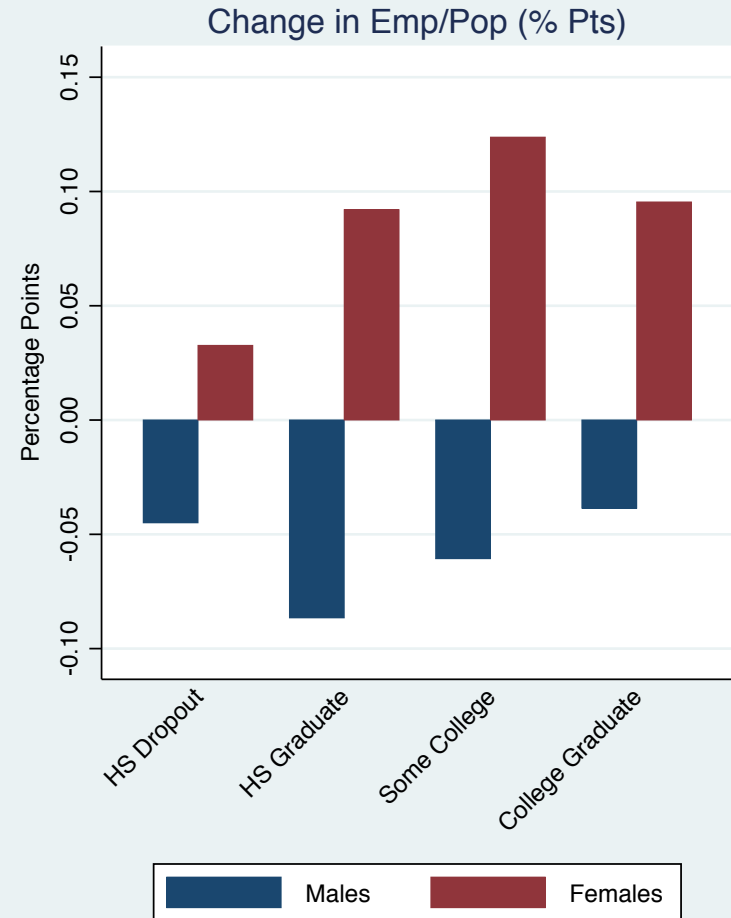
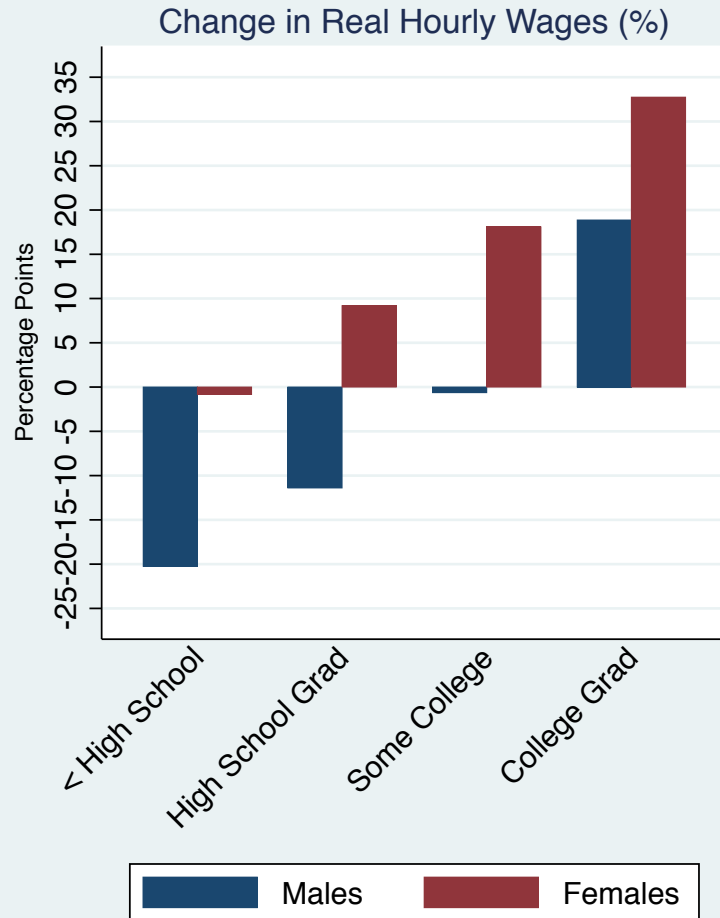


Technology Anxiety: Should We Worry?

- **What neoclassical economic theory predicts**
 - a. There is a market-clearing wage – but it need only be weakly positive
 - b. Labor's share of national income can *rise or fall* – Capital *can* directly displace labor
 - c. Rising productivity not necessarily *Pareto* improving – Raises national income, but can be winners *and* losers

Less Educated Workers Have Seen Falling Wage, Falling Employment to Population Rates

Changes in Wages and Employment, 1979 - 2007 by Education and Sex



Technology Anxiety: Is There a Cure?

1. **Three views of the problem**

- a. We lack imagination
- b. We have a labor demand problem
- c. We have an income distribution problem

2. **Worst case economic scenario**

- Horses – The fax machines of the pre-automotive era

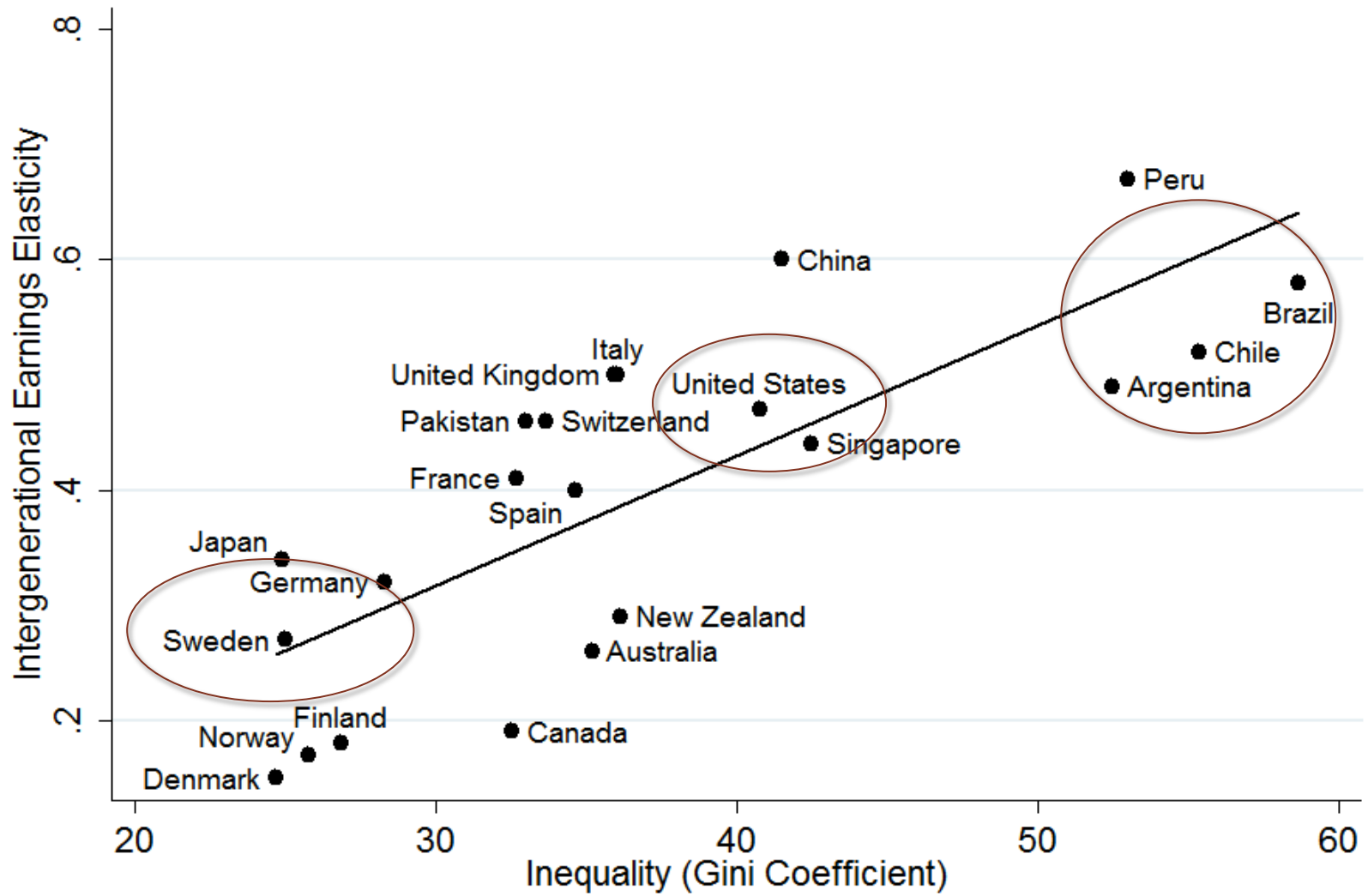
3. **Education: “America’s best idea”**

- Effective for raising incomes *and* economic mobility

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Cross-Sectional Income Inequality and Intergenerational Earnings Elasticity

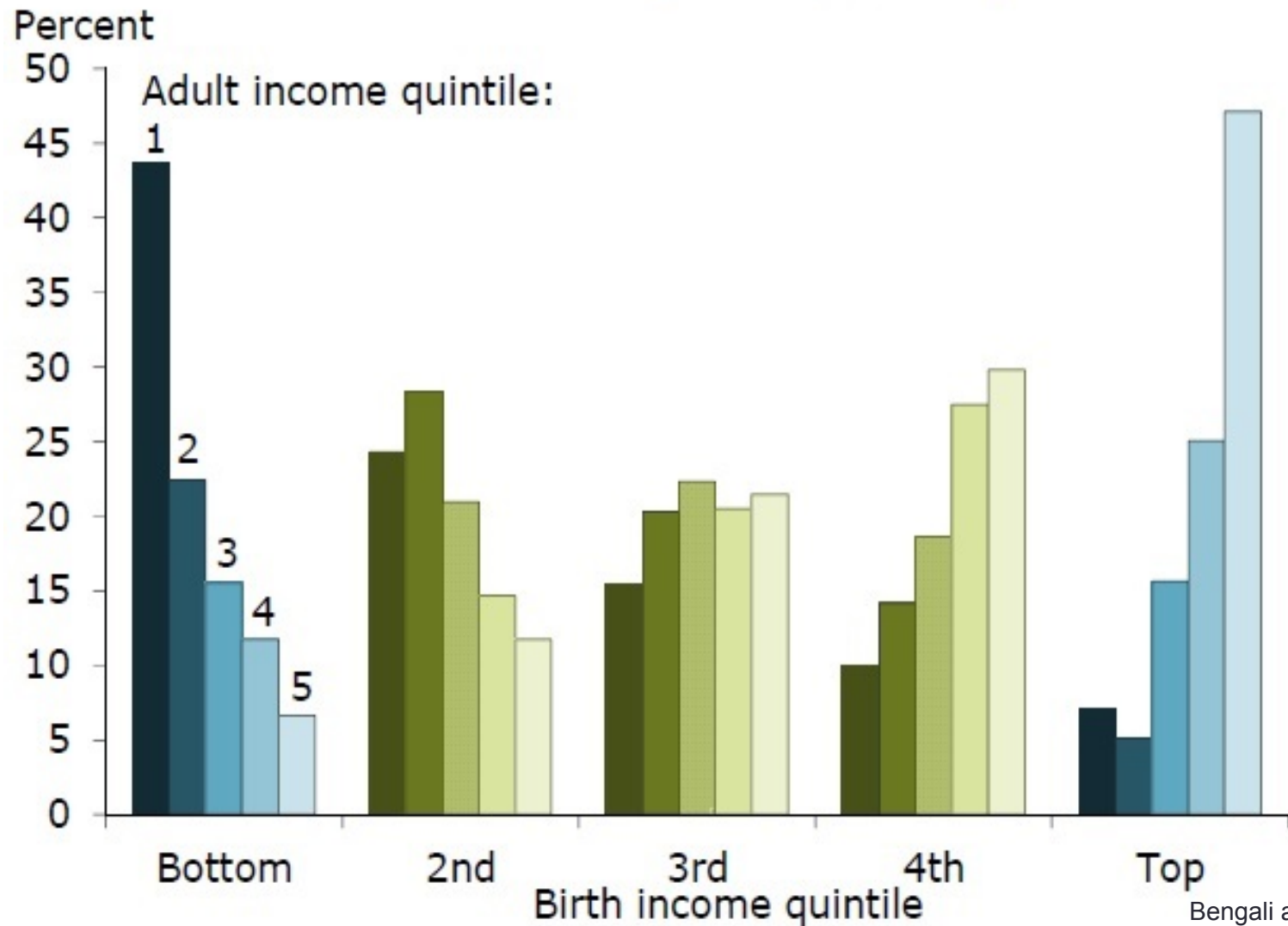


Source: Corak (2012)

Economic Mobility in the U.S. by Household Income Birth Quintile

Relative mobility

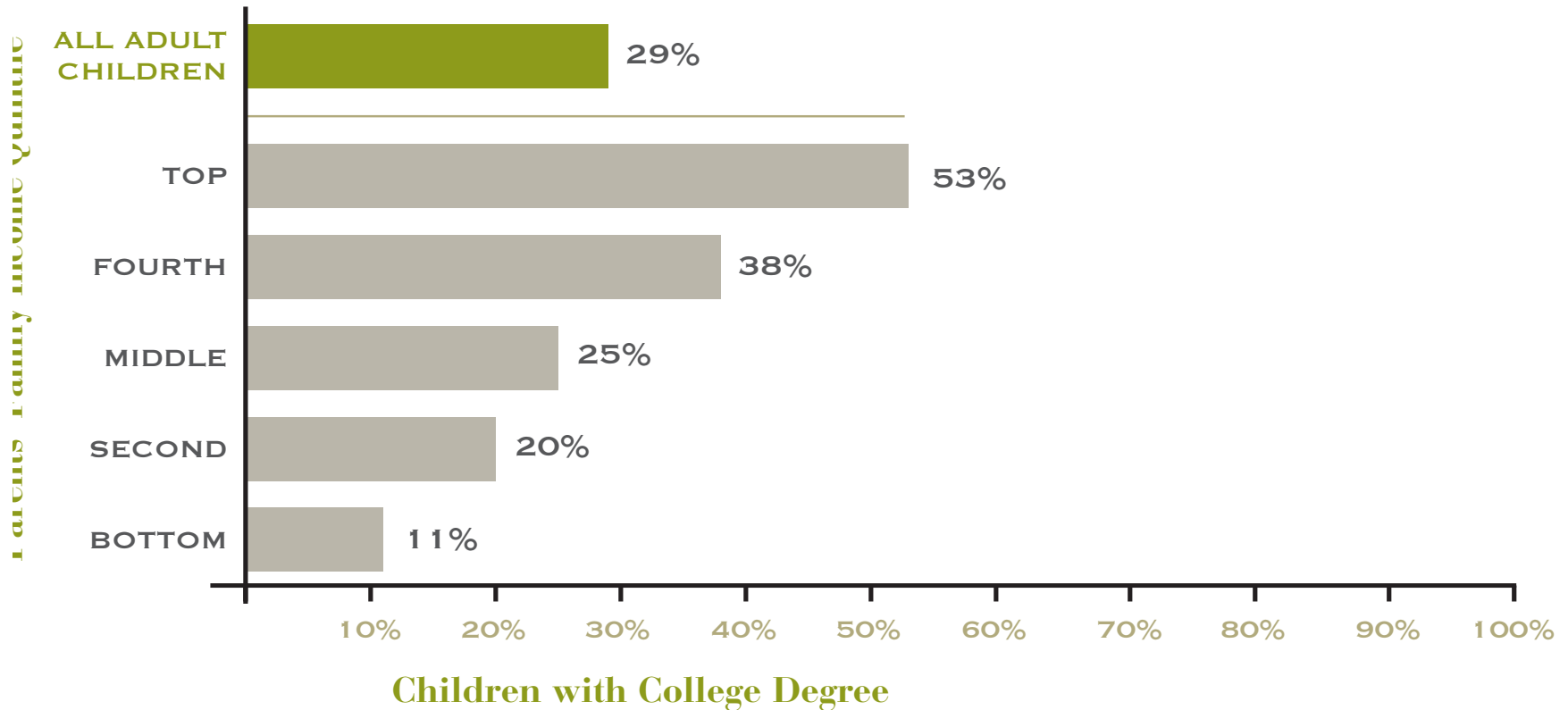
% adult children in each income quintile by birth quintile



Education and Economic Mobility

FIGURE 7

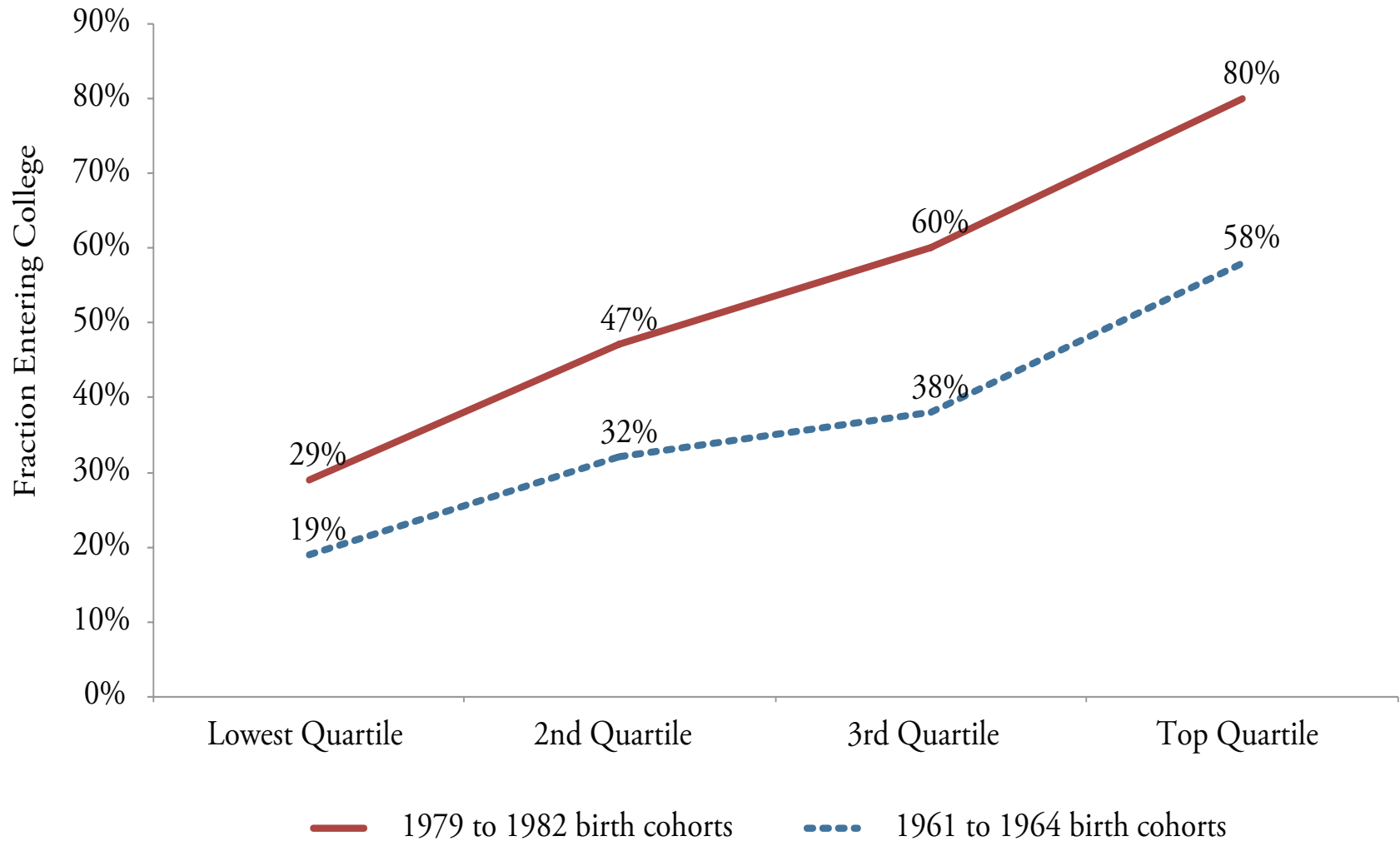
**Percent of Children with a College Degree
by Parents' Family Income Quintile, 2005**



Source: Brookings tabulations of PSID data.

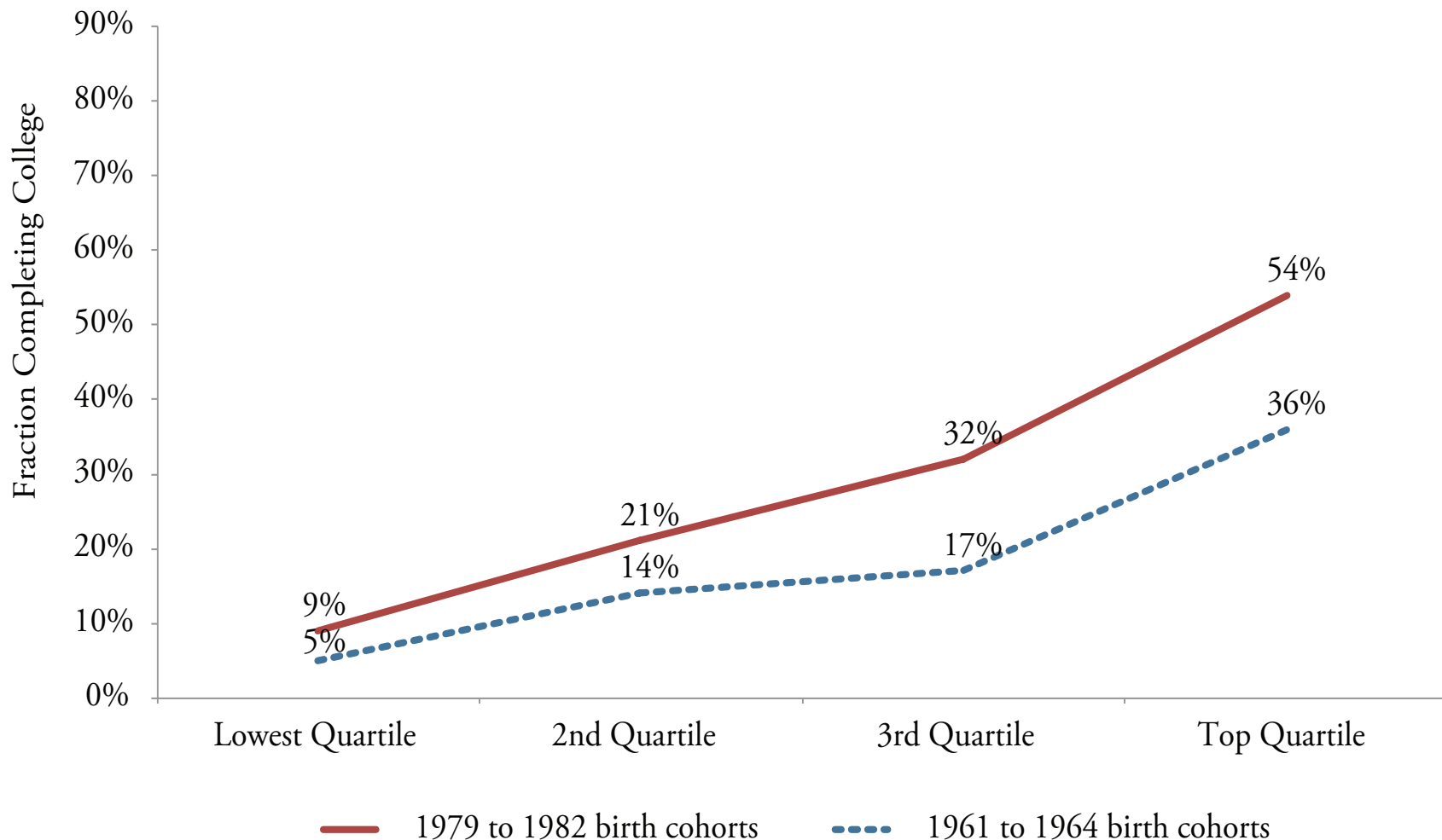
Household Income and College Attendance: Baby Boomers v. Millennials

Figure 19a: Fraction of Students Entering College, by Income Quartile and Birth Year⁸⁶



Household Income and College Completion: Baby Boomers v. Millennials

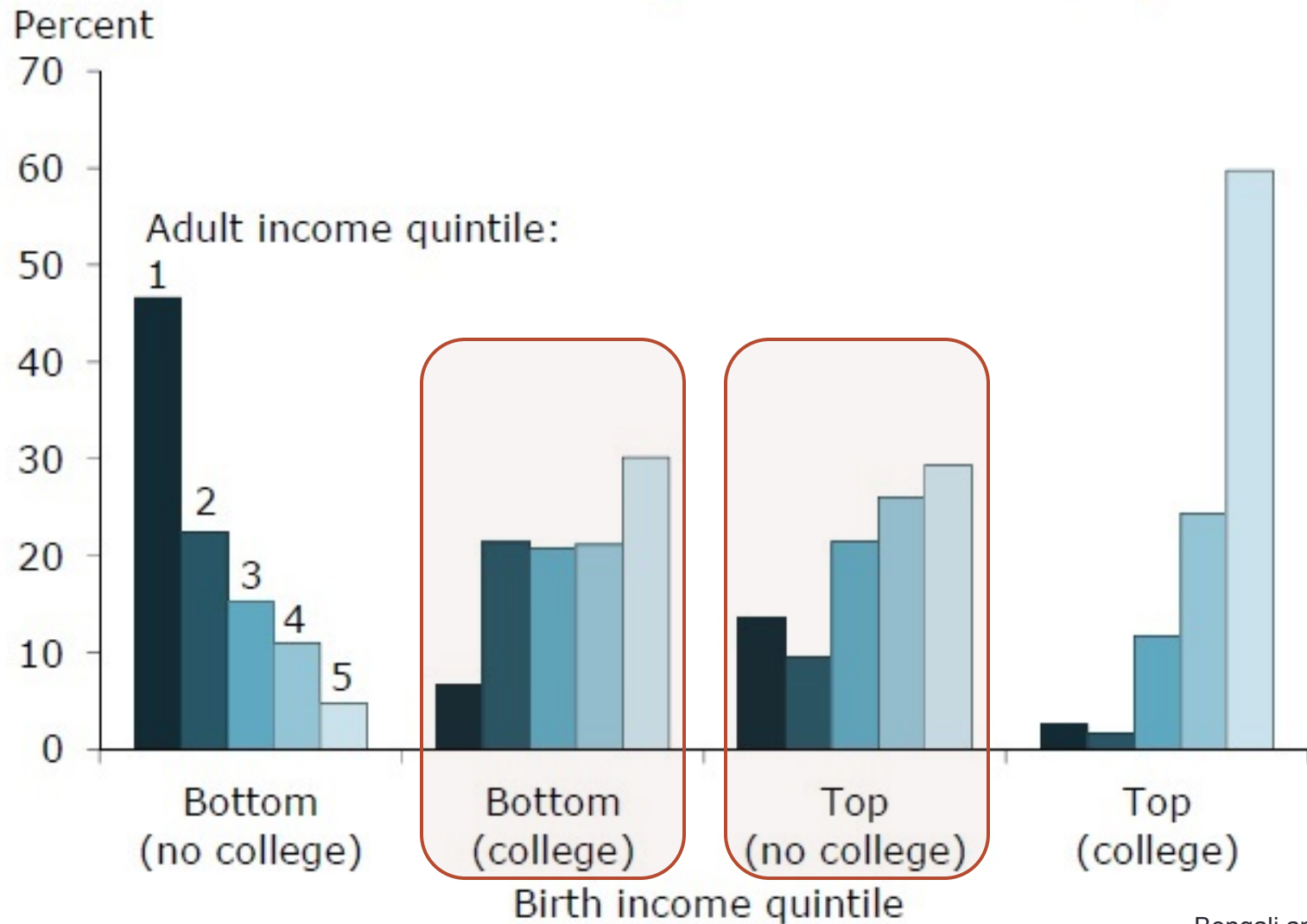
Figure 19b: Fraction of Students Completing College, by Income Quartile and Birth Year⁸⁷



Of course, Education Does Not Erase All Advantages of Family Background

Education and relative mobility

% adult children in each income quintile from bottom/top



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