(IX) Robots and Jobs

Bocconi University, 2017/18

Most of the sentences are simply quoted from Autor (2015)

Anxiety over automation

- Anxiety in the past
  - "We are being afflicted with a new disease of which some readers may not have heard, but of which they will hear a great deal in the years to come, technological unemployment" (Keynes, 1930)
  - "Labor will become less important. More workers will be replaced by machines. I do not see that new industries can employ everybody who wants a job" (Leontief, 1952)

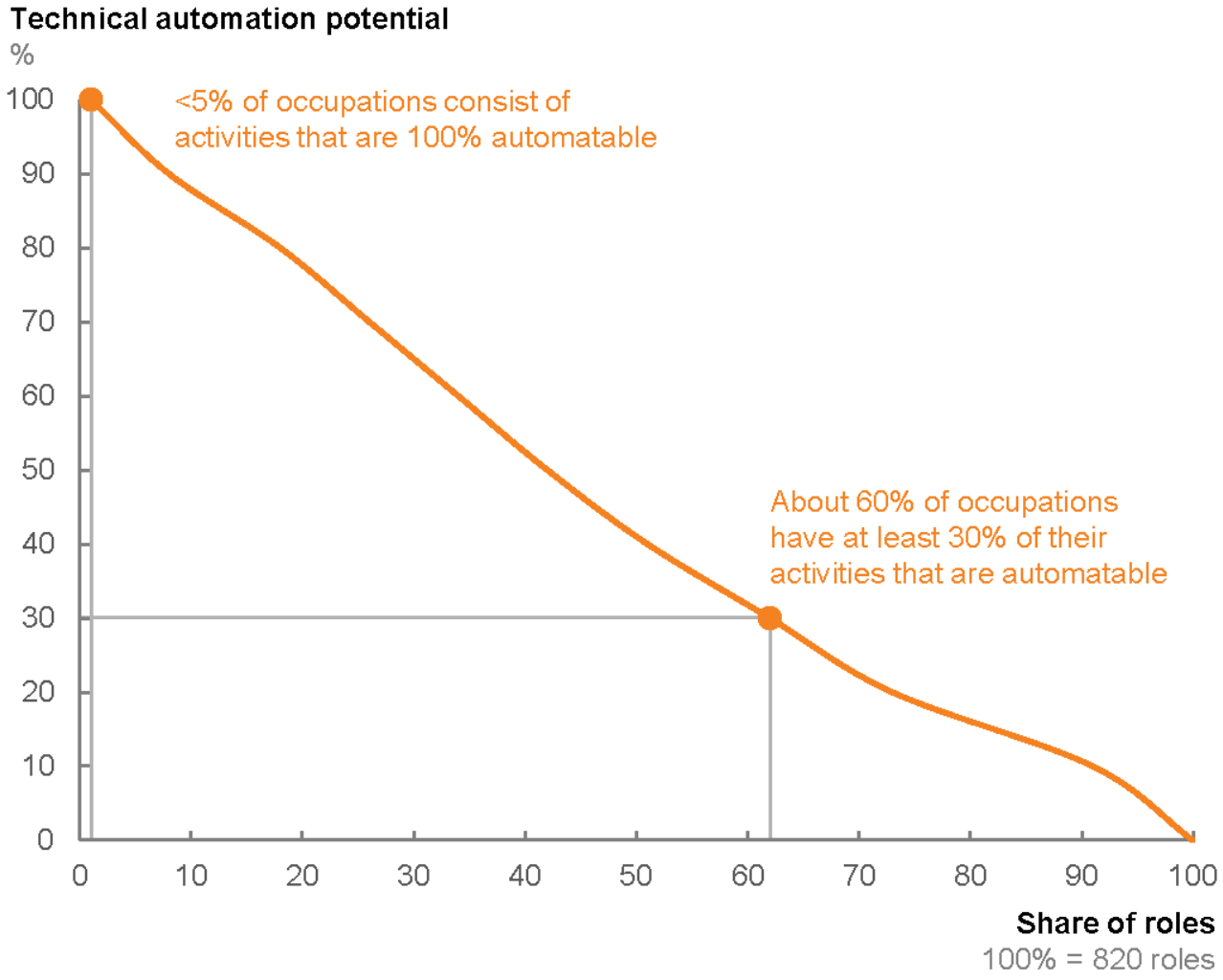
- Anxiety now
  - Based on the tasks that workers perform, Frey and Osborne (2013) classify 702 occupations at risk of automation. Over the next two decades, 47 percent of US workers are at risk of automation
  - Using a related methodology, McKinsey (2017) puts the same number at 45 percent
  - The World Bank (2016) estimates that 57 percent of jobs in the OECD could be automated over the next two decades

While few occupations are fully automatable, 60 percent of all occupations have at least 30 percent technically automatable activities

Automation potential based on demonstrated technology of occupation titles in the United States (cumulative)[1]

Example occupations

- Sewing machine operators, graders and sorters of agricultural products
- Stock clerks, travel agents, watch repairers
- Chemical technicians, nursing assistants, Web developers
- Fashion designers, chief executives, statisticians
- Psychiatrists, legislators



1 We define automation potential according to the work activities that can be automated by adapting currently demonstrated technology.

SOURCE: US Bureau of Labor Statistics; McKinsey Global Institute analysis

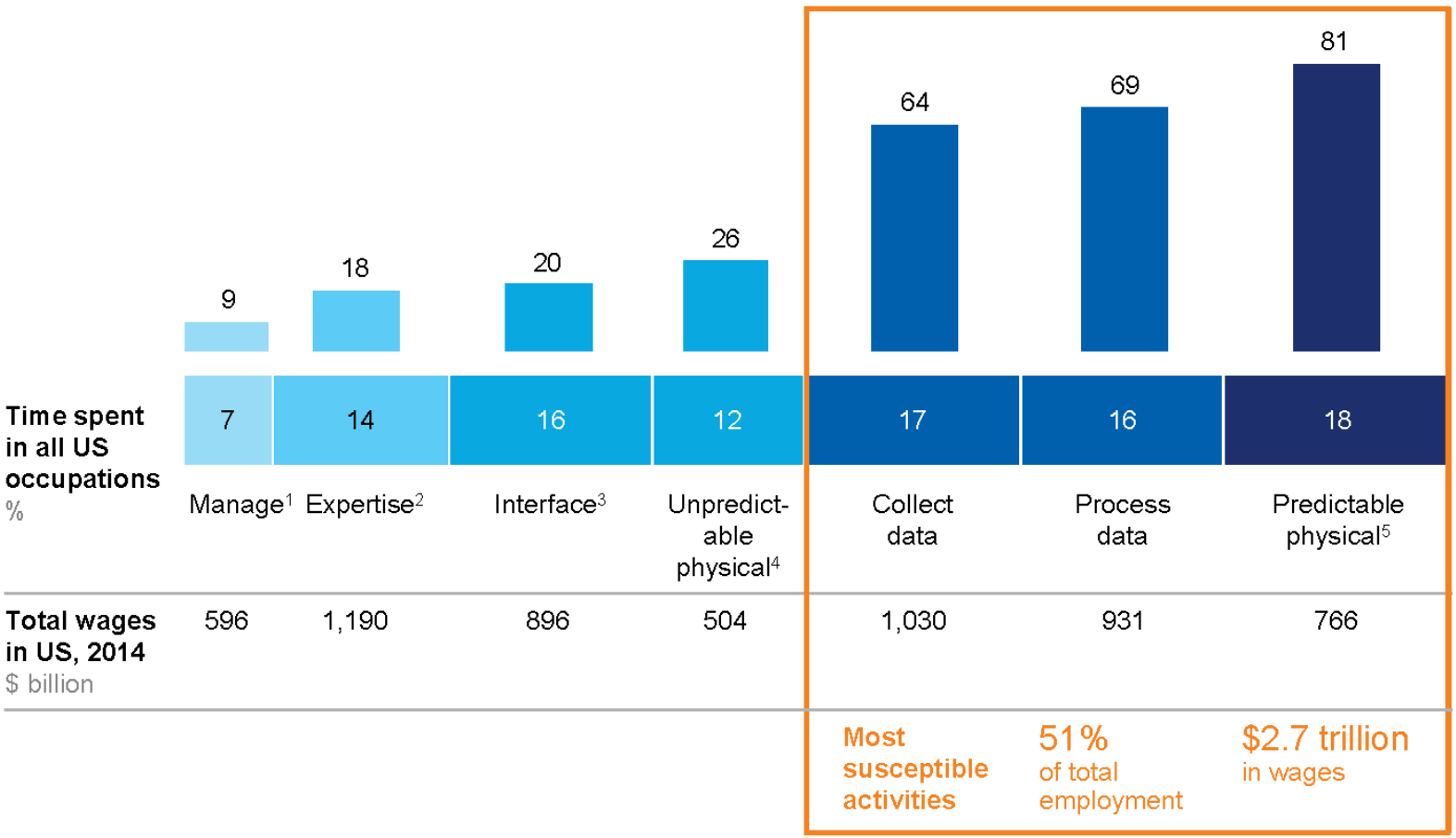
Catalogue of fears

Probability of computerisation of different occupations, 2013
(1 = certain)

Job	Probability
Recreational therapists	0.003
Dentists	0.004
Athletic trainers	0.007
Clergy	0.008
Chemical engineers	0.02
Editors	0.06
Firefighters	0.17
Actors	0.37
Health technologists	0.40
Economists	0.43
Commercial pilots	0.55
Machinists	0.65
Word processors and typists	0.81
Real-estate sales agents	0.86
Technical writers	0.89
Retail salespeople	0.92
Accountants and auditors	0.94
Telemarketers	0.99

Source: "The Future of Employment: How Susceptible are Jobs to Computerisation?", by C. Frey and M. Osborne (2013)

Three categories of work activities have significantly higher technical automation potential

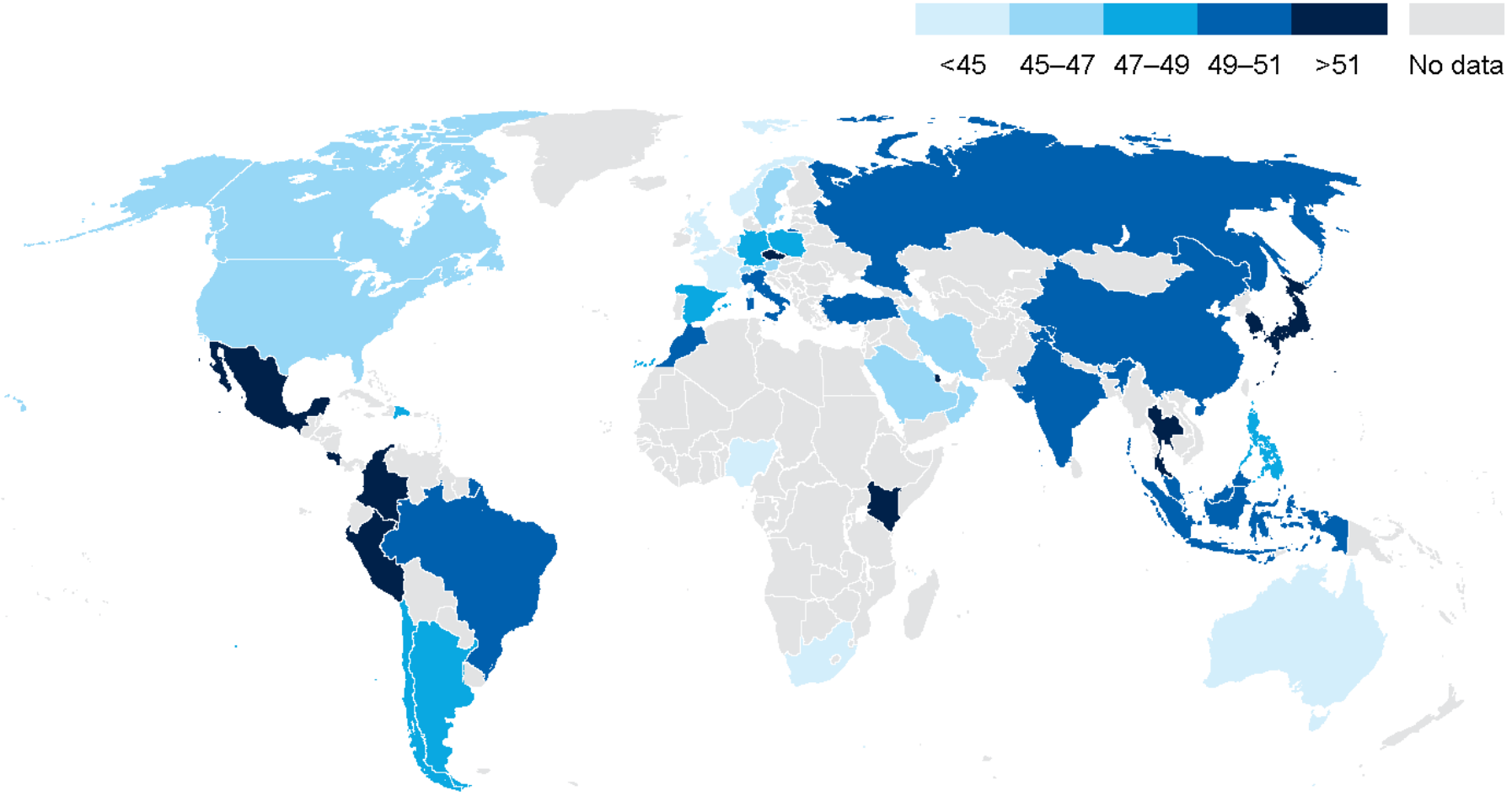


1 Managing and developing people.
2 Applying expertise to decision making, planning, and creative tasks.
3 Interfacing with stakeholders.
4 Performing physical activities and operating machinery in unpredictable environments.
5 Performing physical activities and operating machinery in predictable environments.
NOTE: Numbers may not sum due to rounding.

SOURCE: US Bureau of Labor Statistics; McKinsey Global Institute analysis

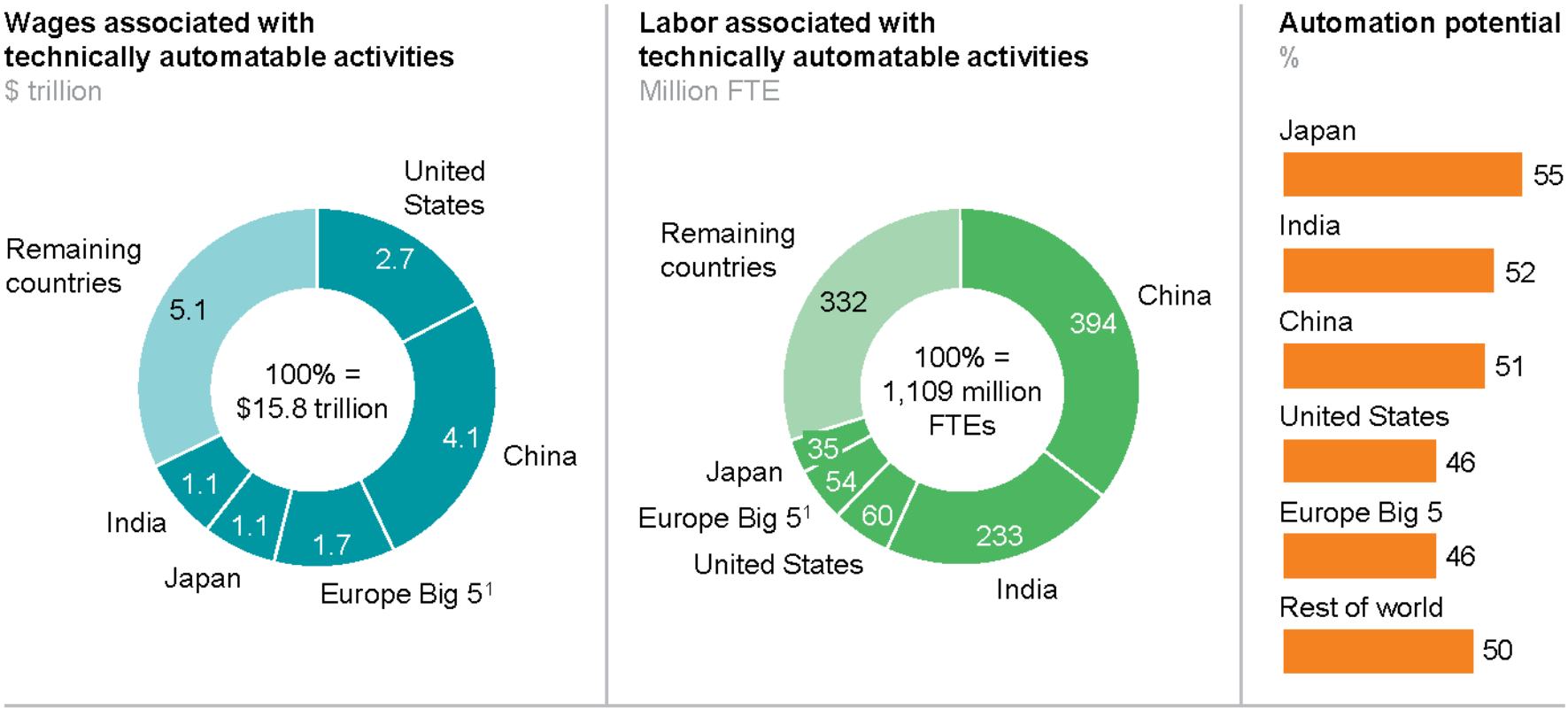
The technical automation potential of the global economy is significant, although there is some variation among countries

Employee weighted overall % of activities that can be automated by adapting currently demonstrated technologies



Technical automation potential is concentrated in countries with the largest populations and/or high wages

Potential impact due to automation, adapting currently demonstrated technology (46 countries)



1 Pakistan, Bangladesh, Vietnam, and Iran are largest countries by population not included.
2 France, Germany, Italy, Spain, and the United Kingdom.
NOTE: Numbers may not sum due to rounding.

SOURCE: Oxford Economic Forecasts; Emsi database; US Bureau of Labor Statistics; McKinsey Global Institute analysis

Is this time different?

- Clash between optimists and pessimists
- Lack of imagination
  - The lesson of Blade runner, the movie…
  - US agriculture: 41% workforce in 1900, 2% in 2000
- Cost effectiveness
  - No guarantee that firms would choose to automate; it would depend on the costs of substituting machines for labor and how much wages change in response to this threat (Acemoglu and Restrepo, 2017)
  - Indeed, McKinsey (2017) depicts two scenarios: Early vs Late adoption
  - The Lesson of Kodak…

Is this time different? (contd.)

- Partial vs general equilibrium
  - "Technological change (along with other forms of economic change) is an important determinant of the precise places, industries, and people affected by unemployment. But the general level of demand for goods and services is by far the most important factor determining how many are affected, how long they stay unemployed, and how hard it is for new entrants to the labor market to find jobs. **The basic fact is that technology eliminates jobs, not work**" (Bowen 1966)
  - The labor market impacts of new technologies depend not only on where they hit, but also on the adjustment in other parts of the economy. Other sectors and occupations might expand to absorb the labor force made redundant by the automated tasks
  - And productivity improvements due to new machines may even expand employment in affected industries. How?

A tale of complementarieties

- Many, perhaps most, workplace technologies are designed to save labor. **But machines both substitute for and complement human labor**. Focusing only on what is lost misses a central economic mechanism by which automation affects the demand for labor and the equilibrium outcome in the labor market
- Basic fact: Tasks that cannot be substituted by automation are generally complemented by it
- **O-ring theory** of production (Kremer, 1993)
- The lesson of ATMs…
- Workers are more likely to benefit directly from automation if they supply tasks that are complemented by automation, but not if they primarily (or exclusively) supply tasks that are substituted

A tale of elasticities

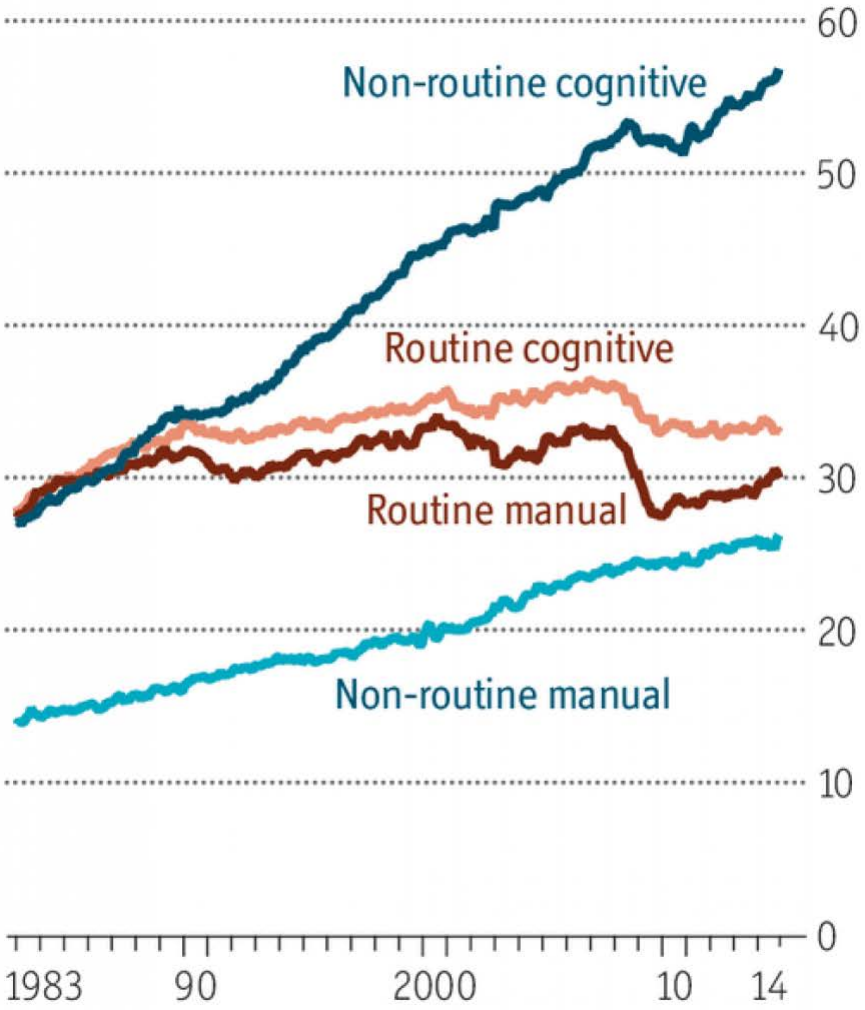
- The **elasticity of labor supply** can mitigate wage gains
- The **income elasticity of demand** can either dampen or amplify the gains from automation
- Back-of-the-envelope example (Autor, 2015): An average US worker in 2015 wishing to live at the income level of an average worker in 1915 could roughly achieve this goal by working about 17 weeks per year
- Most citizens would not consider this tradeoff between hours and income desirable, however, suggesting that consumption demands have risen along with productivity
- Historically, we have experienced more leisure, but also more consumption of new goods and services

Labor market polarization

- Even if automation does not reduce the quantity of jobs, it may greatly affect the qualities of jobs available
- Useful classification:
  - Jobs related to routine tasks
  - Jobs related to “abstract” non-routine tasks
  - Jobs related to “manual” non-routine tasks
- What’s the effect of automation on the employment levels of these jobs?
- What’s the effect of automation on their wages?

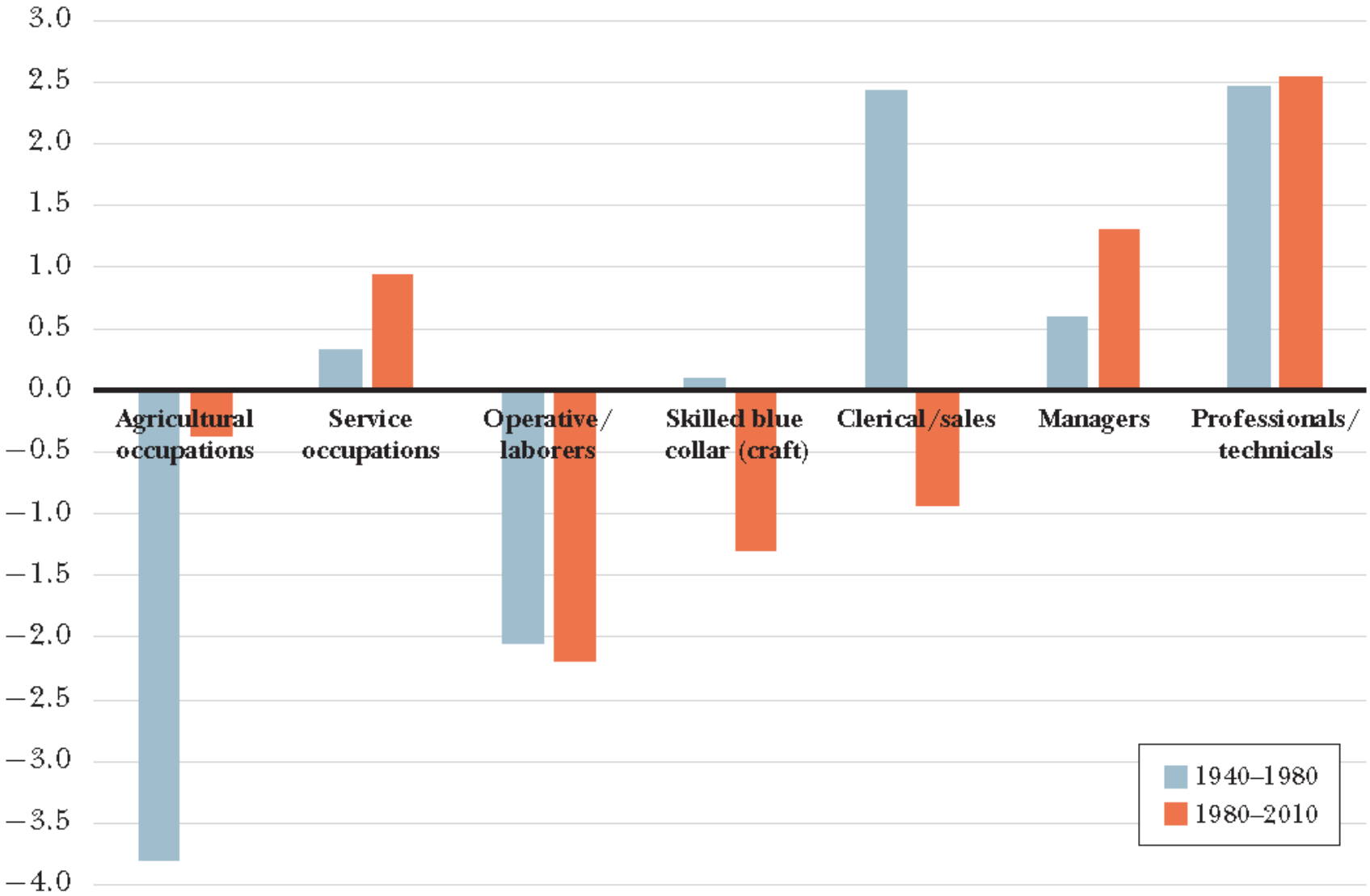
Think

United States employment, by type of work, m

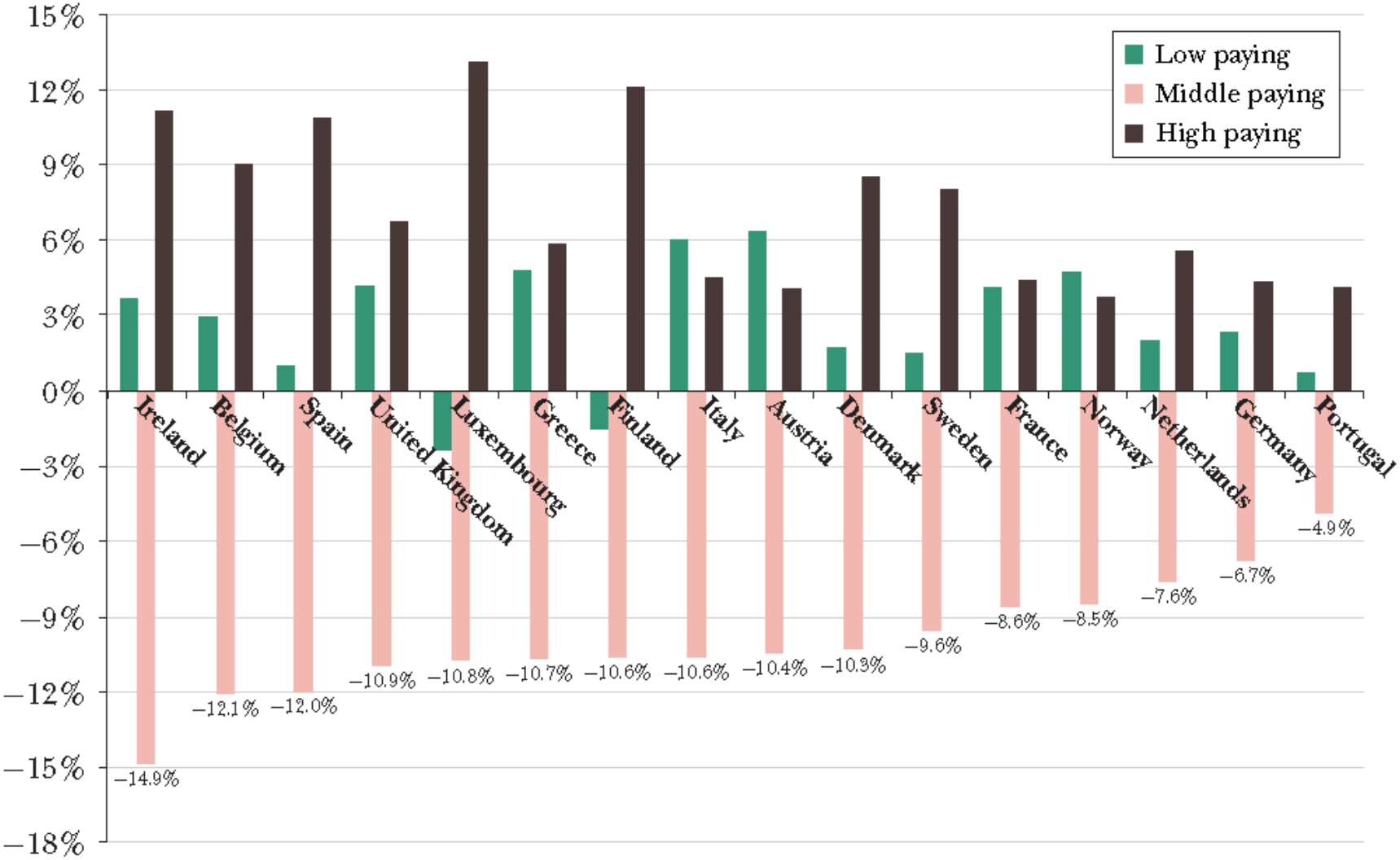


Sources: US Population Survey; Federal Reserve Bank of St. Louis

Average Change per Decade in US Occupational Employment Shares for Two Periods: 1940–1980 and 1980–2010

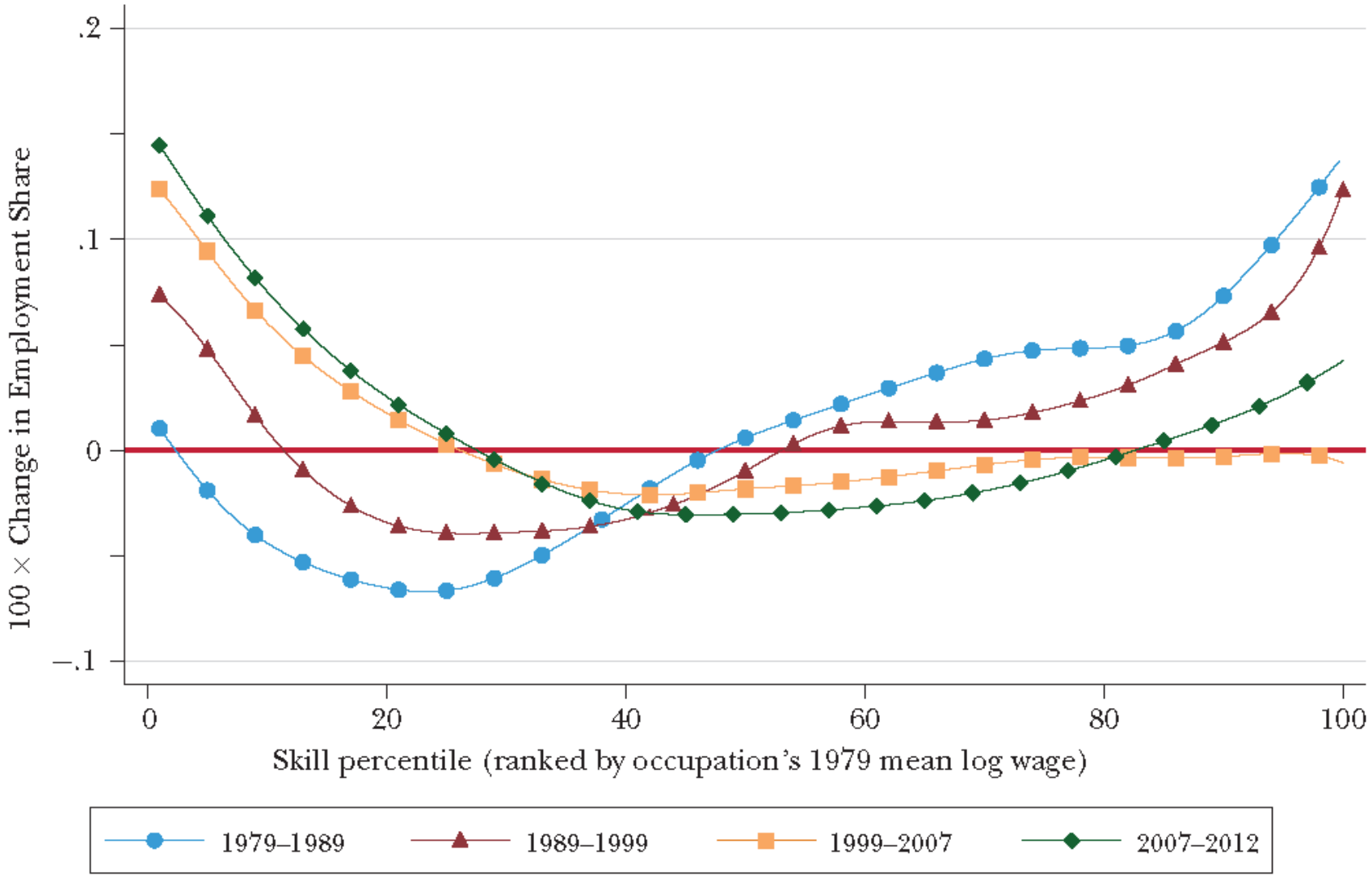


Change in Occupational Employment Shares in Low, Middle, and High-Wage Occupations in 16 EU Countries, 1993–2010



Source: Goos, Manning, and Salomons (2014, table 2).

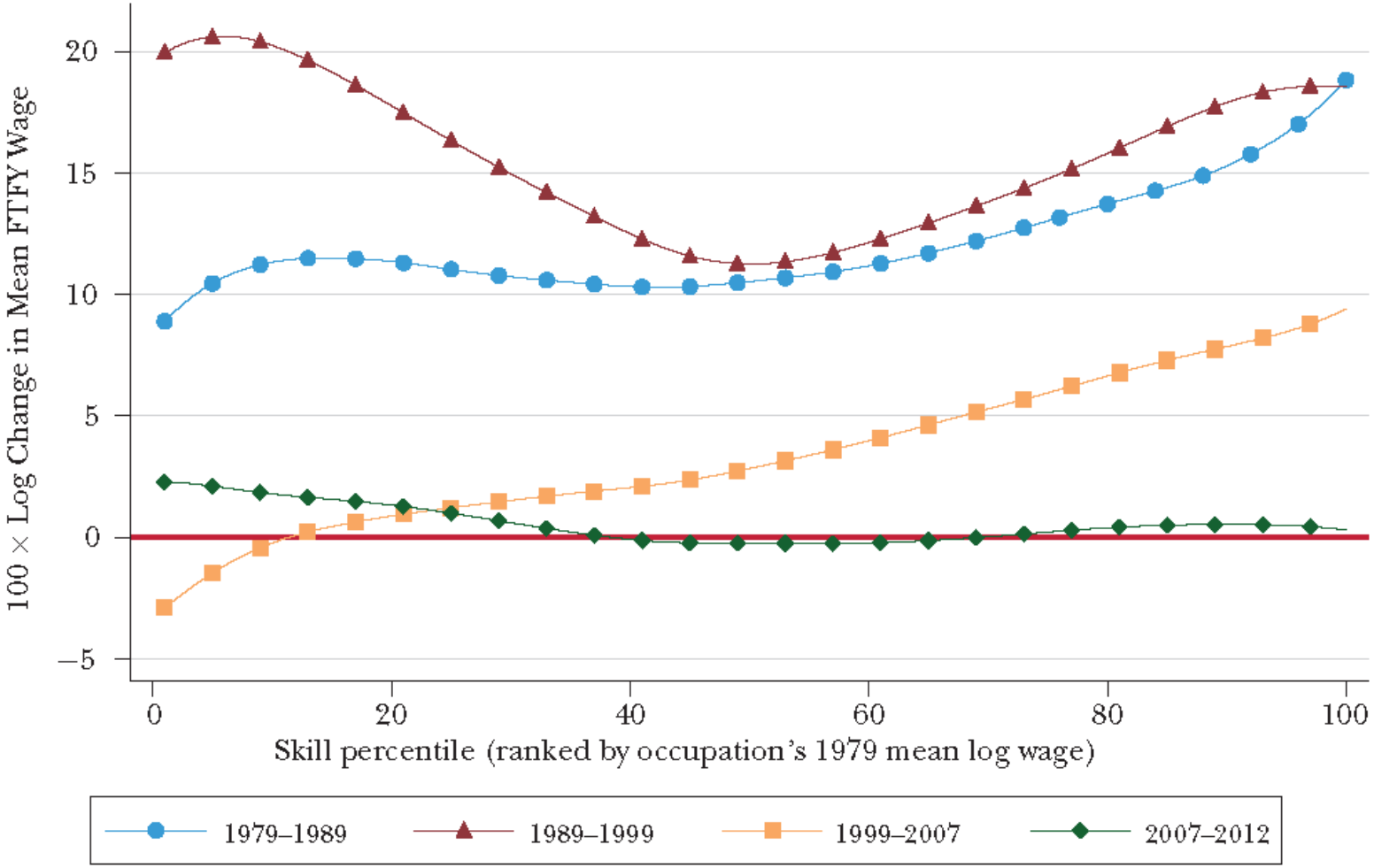
Smoothed Employment Changes by Occupational Skill Percentile, 1979–2012



Sources: Author, calculated using 1980, 1990, and 2000 Census Integrated Public Use Microdata Series (IPUMS) files; American Community Survey combined file 2006–2008, American Community Survey 2012.

Changes in Mean Wages by Occupational Skill Percentile among Full-Time, Full-Year (FTFY) Workers, 1979–2012

(the y-axis plots 100 times log changes in employment, which is nearly equivalent to percentage points for small changes)



Sources: Author, calculated using 1980, 1990, and 2000 Census IPUMS files; American Community Survey combined file 2006–2008, American Community Survey 2012.

Winners and losers

- *Change ain't easy*: Also in the past the road to riches was rockier than is often appreciated today
- Spatial dimension of adjustment costs and lack of geographical mobility
- Economic costs of labor mobility
- Social costs of labor mobility
- The decline of the middle class
- Cultural challenges ("strangers in their own land")
- Redistribution made more difficult by innovation and globalization

A tale of institutions

- Bowes Commission took the reality of technological disruption as severe enough that it recommended, as one newspaper (*The Herald Post* 1966) reported, “a guaranteed minimum income for each family; using the government as the employer of last resort for the hard core jobless; two years of free education in either community or vocational colleges; a fully administered federal employment service, and individual Federal Reserve Bank sponsorship in area economic development free from the Fed’s national headquarters.”
- The race between technology and education
- Online and adaptive learning
- From specialization to learning how to relearn

References

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