

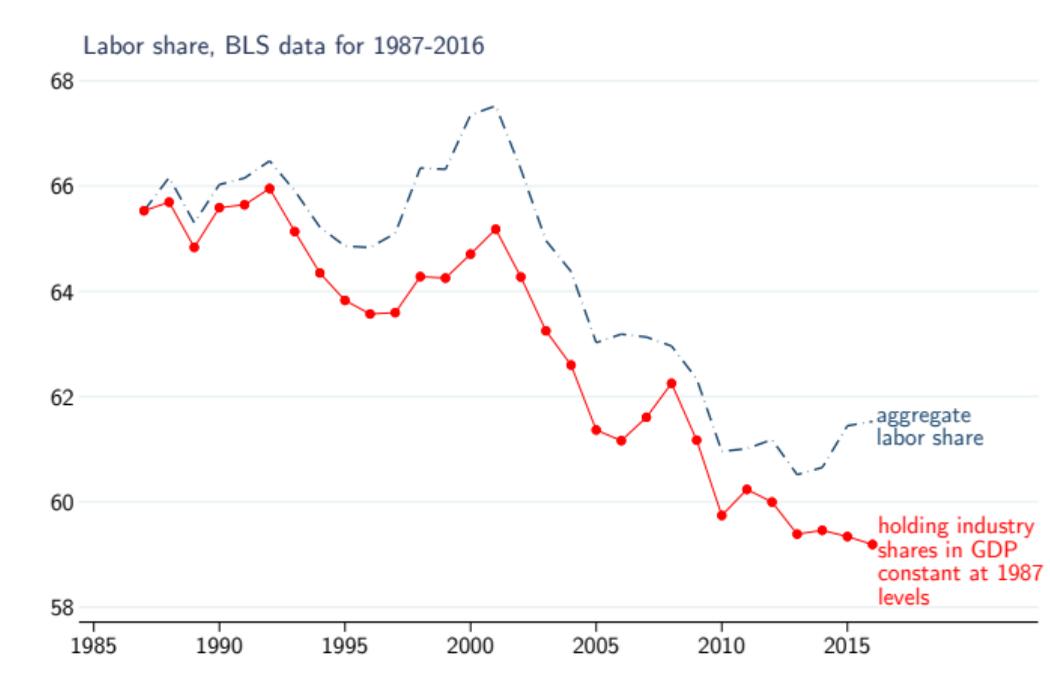
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# Automation and the Inappropriateness of Technology

Daron Acemoglu

January 2022

# Shifts Against Labor

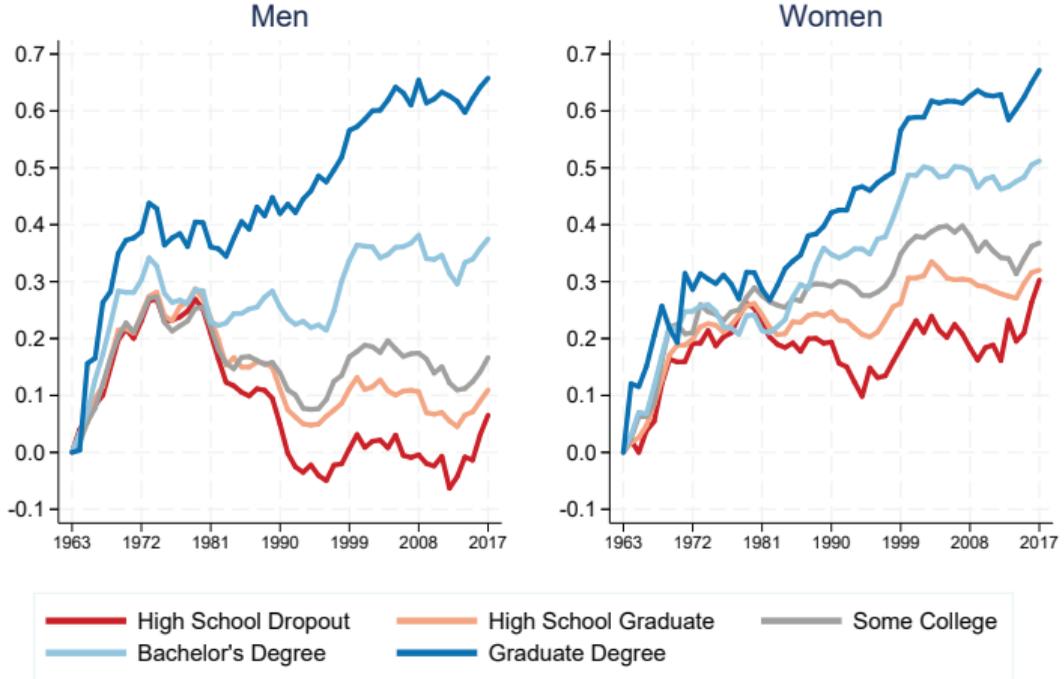


- ▶ Declining labor share in the US; similar in other economies, including in Latin America.
- ▶ Capital deepening? Markups? Monopsony?
- ▶ Seems much more connected to [automation](#).

# Some Consequences: Wages

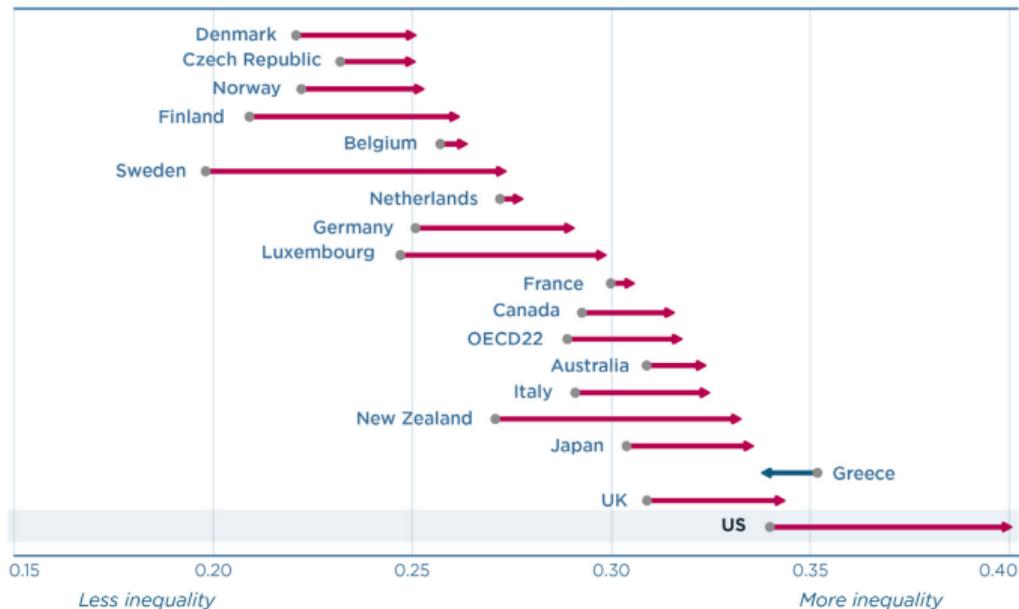
▶ Labor market trends over the last several decades look nothing like a tide lifting all boats.

Cumulative Change in Real Log Weekly Earnings 1963 - 2017  
Working Age Adults, Ages 18 - 64



# Rise in Inequality Is Not Just a US Phenomenon

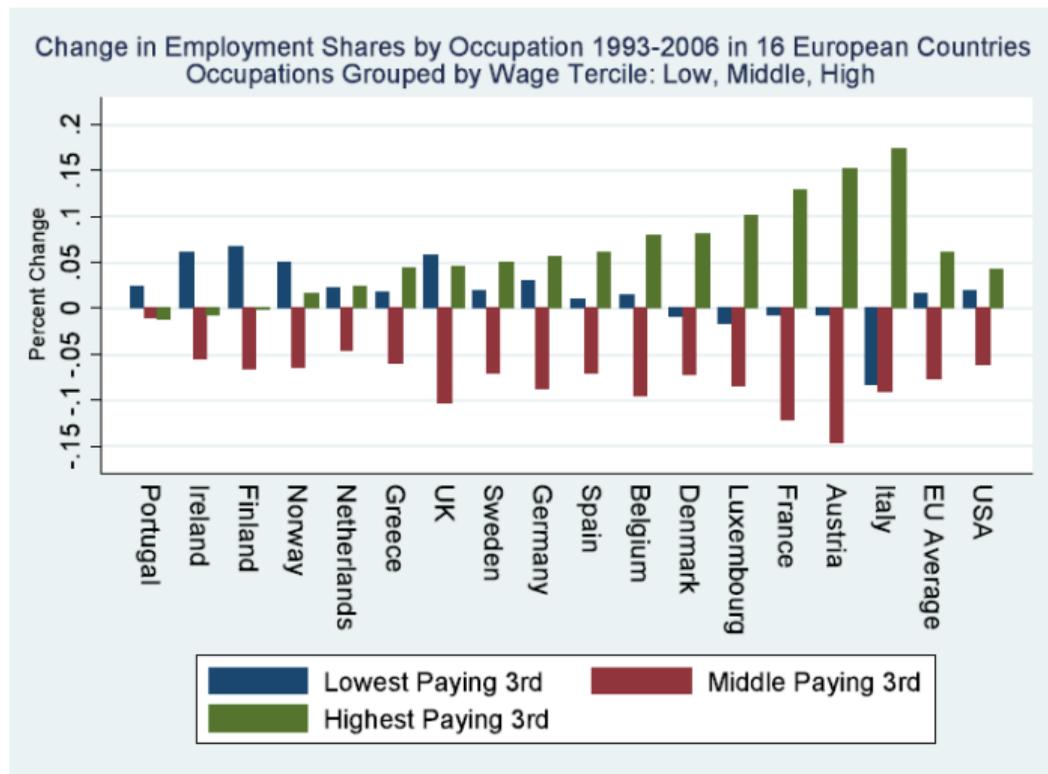
Figure 1: Change in Gini coefficient, 1985 to 2013



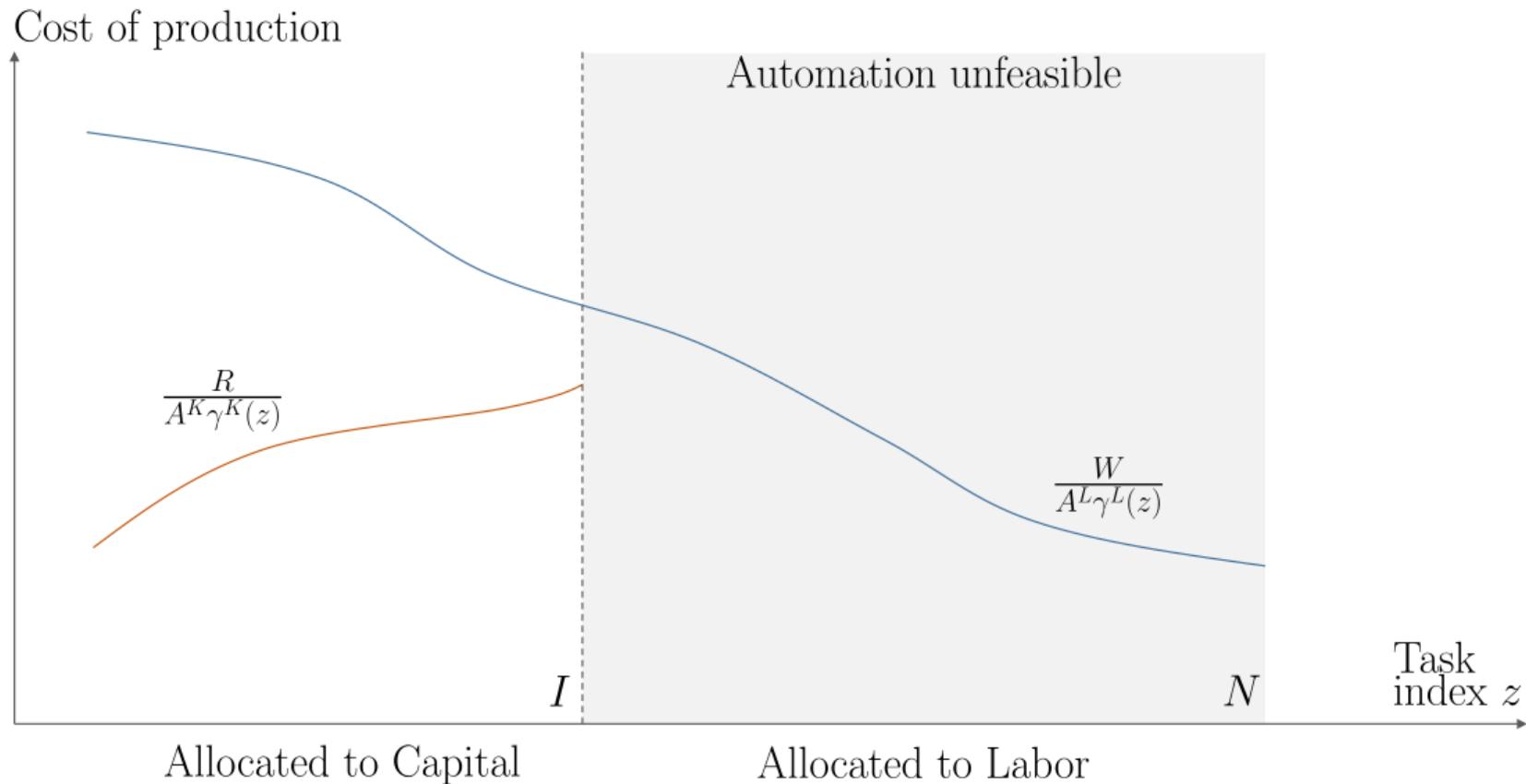
**Note:** 1985 data refer to 1985 or closest available year. 2013 data refer to 2013 or nearest available year. The Gini coefficient measures how equally income is distributed across a population, from 0 (perfectly equal) to 1 (all income to one person).

**Source:** Organization for Economic Cooperation and Development (OECD), "In It Together: Why Less Inequality Benefits All."

# Disappearance of Middle-Class Jobs: Not Just a US Phenomenon

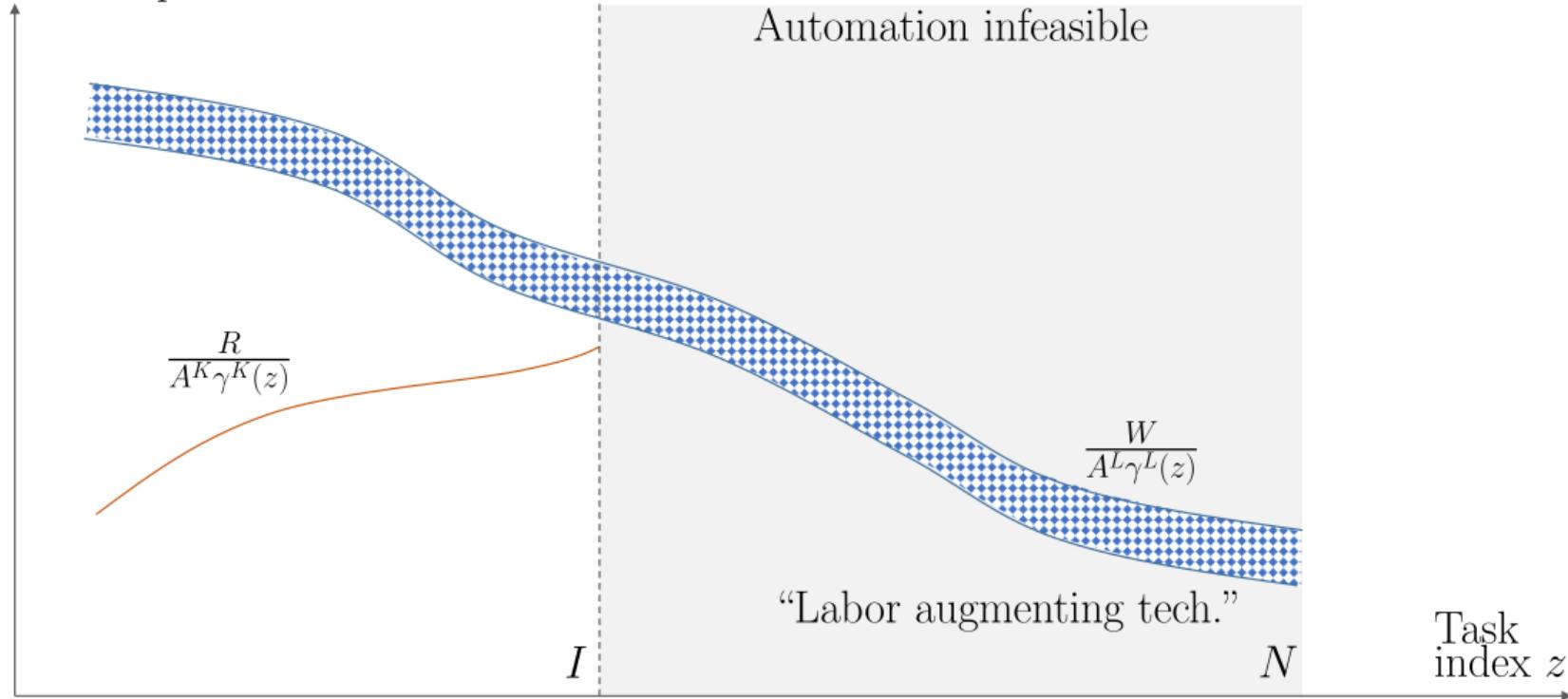


# How to Think About All of This? Allocation of Tasks to Factors

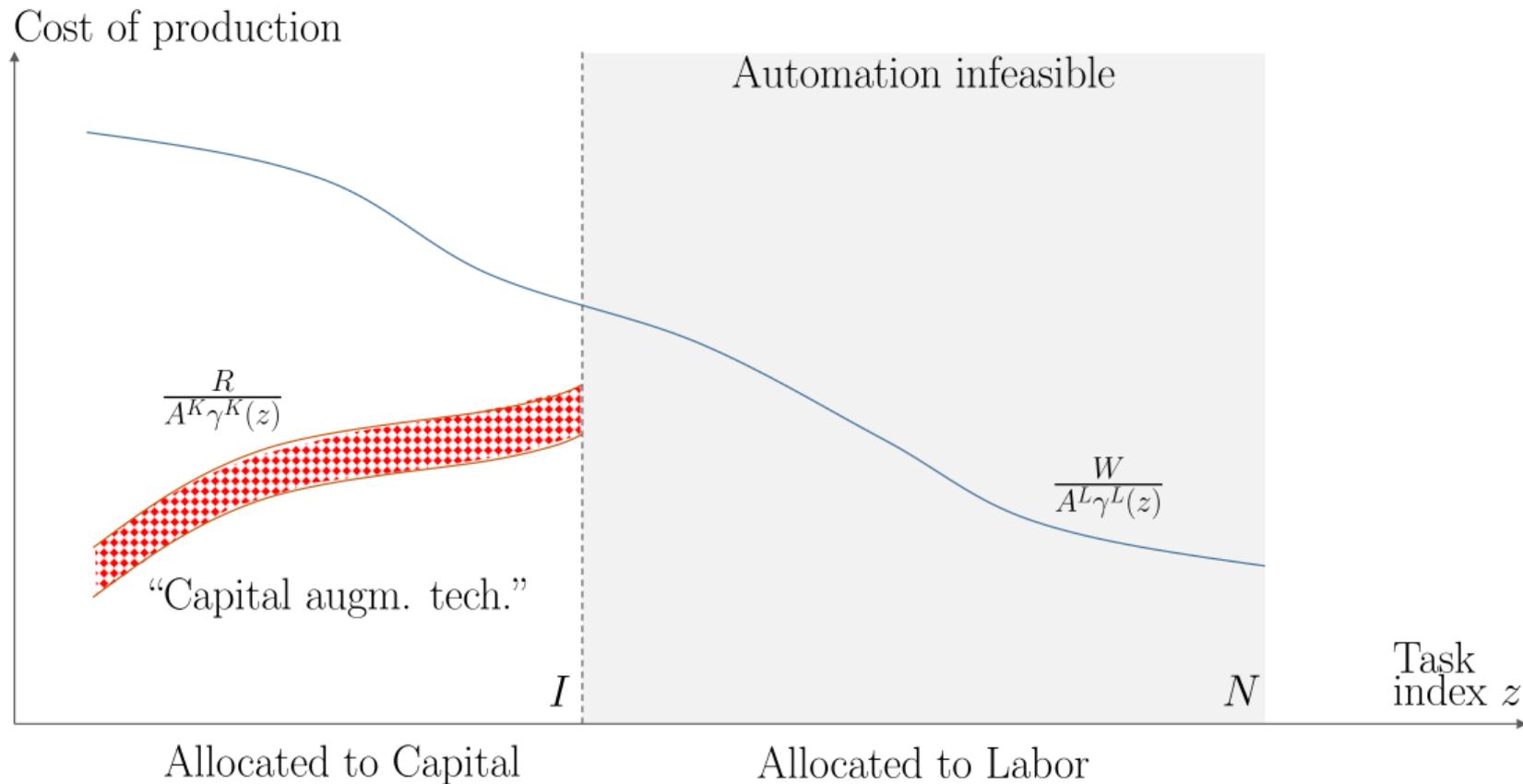


# Labor-Augmenting Technological Change

Cost of production

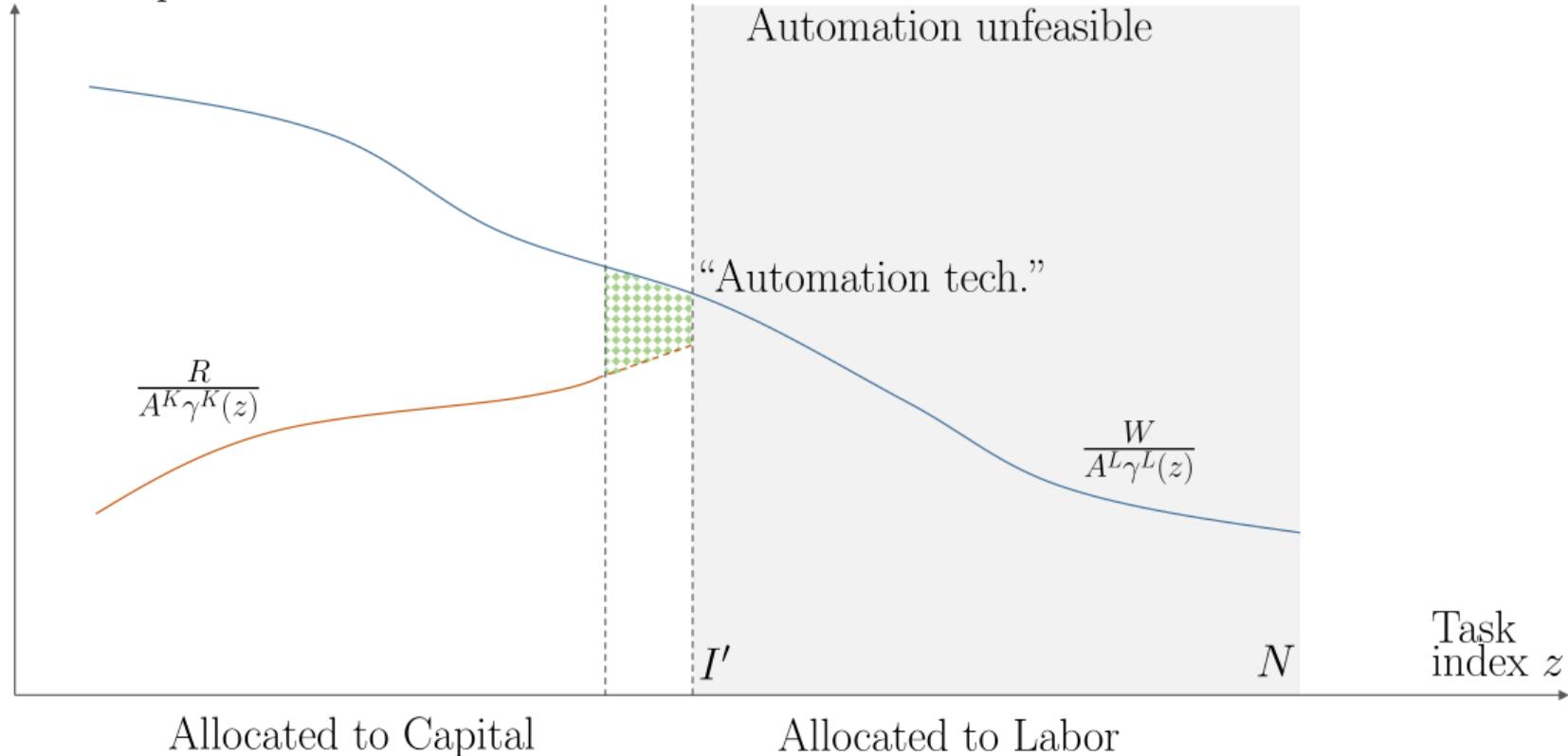


# Capital-Augmenting Technological Change

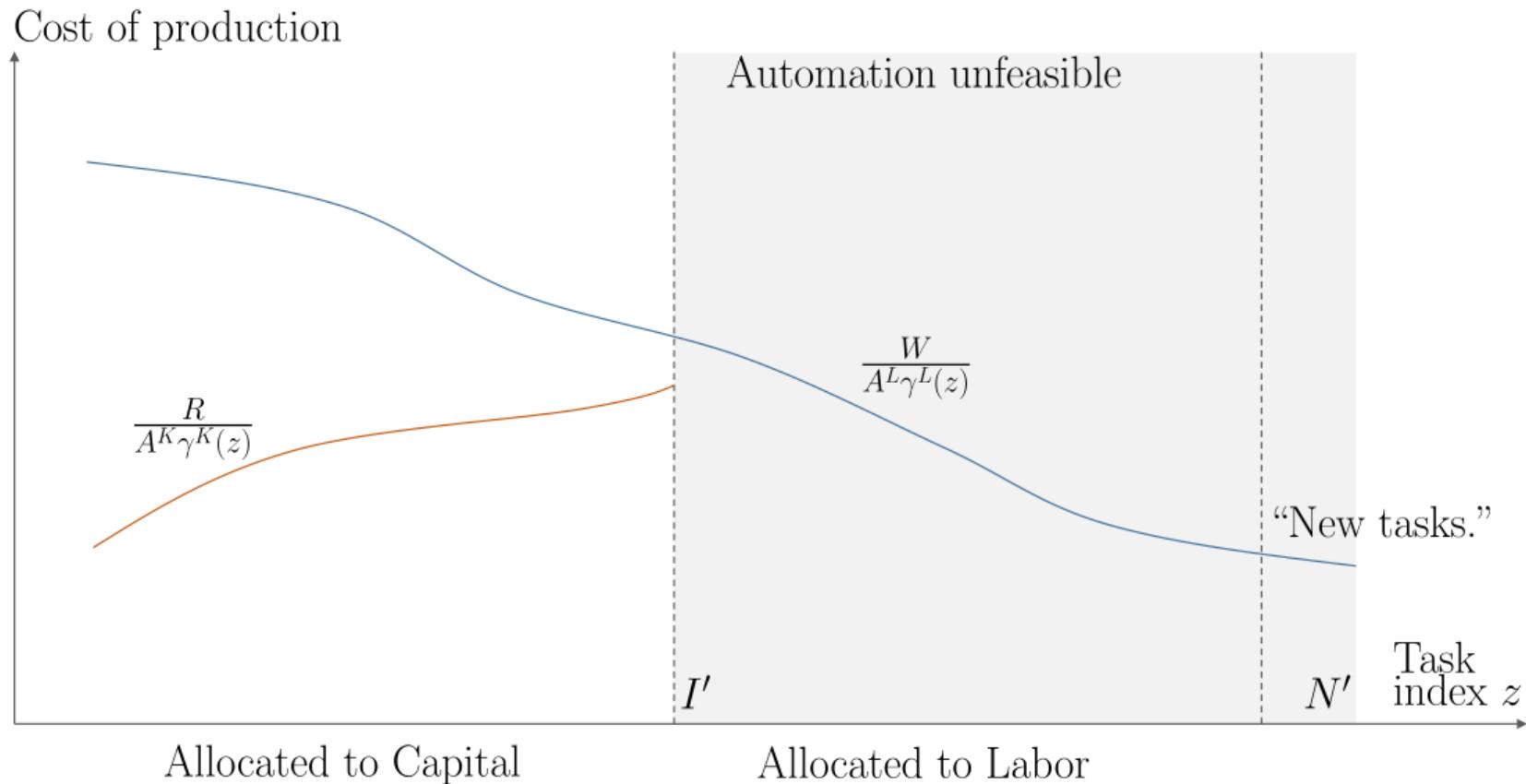


# Automation

Cost of production



# Very Different Implications from New Tasks



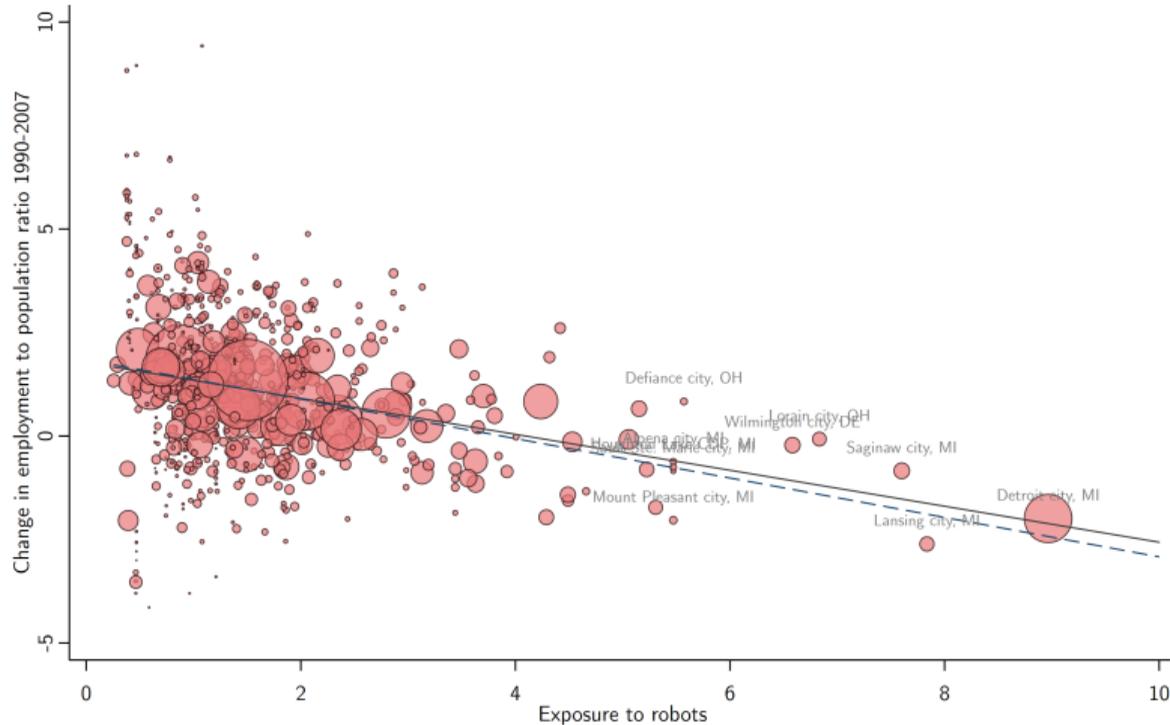
## Robots and Jobs: Local Labor Market Effects

- ▶ Let's look at the equilibrium effects of automation in a little more detail, focusing on local labor markets affected by robots.
- ▶ Zero in on labor markets where the distribution of industry employment makes adoption of robots more likely — according to “exposure to robots” measure in Acemoglu and Restrepo (JPE, 2020).
- ▶ Loosely speaking, exposure to robots is given by a Bartik measure of baseline industrial structure interacted with the penetration of robots into that industry in countries that are more advanced than the US in robot adoption:

$$\begin{aligned}\text{exposure to robots}_c &= \sum_i \text{robot penetration industry}_i \times \text{baseline industry share}_{ic} \\ &= \sum_{i \in \mathcal{I}} \overline{APR}_i \times \ell_{zi}^{1970},\end{aligned}$$

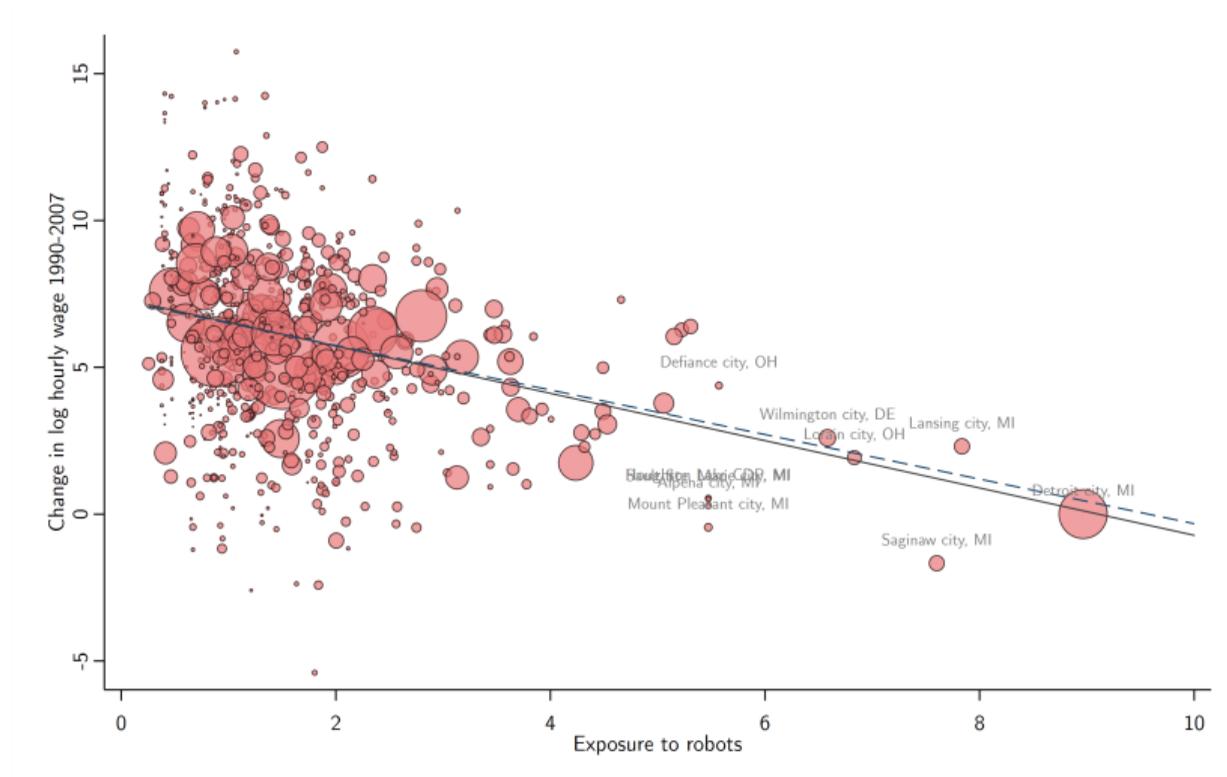
- ▶ Then see how this affects employment and wages.

# Exposure to Robots and Local Employment



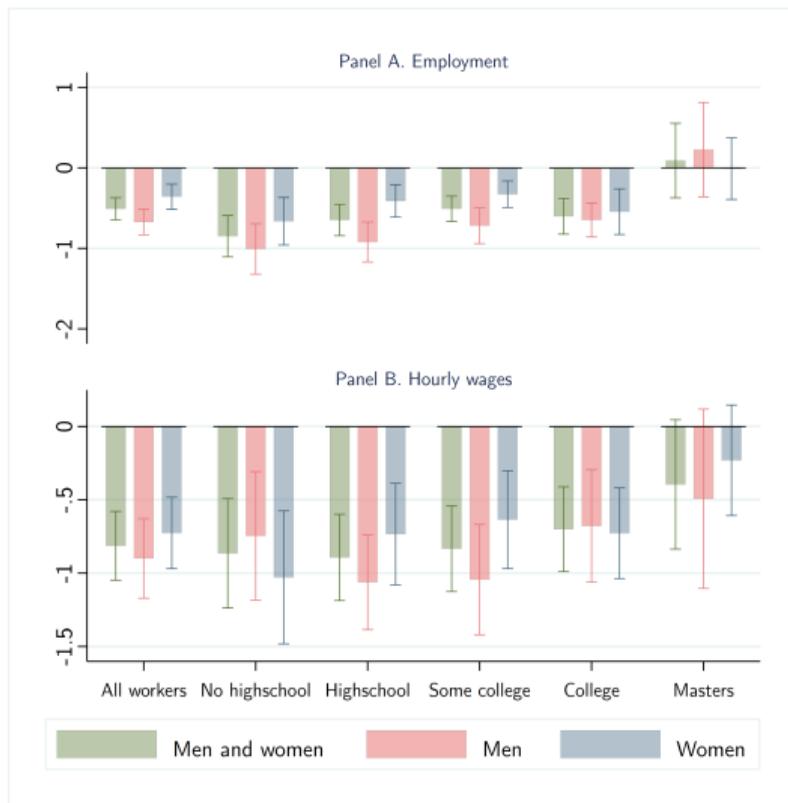
- ▶ Dashed line excludes the most exposed areas; thus the relationship is unchanged without the key parts of the industrial heartland.

# Exposure to Robots and Local Wages



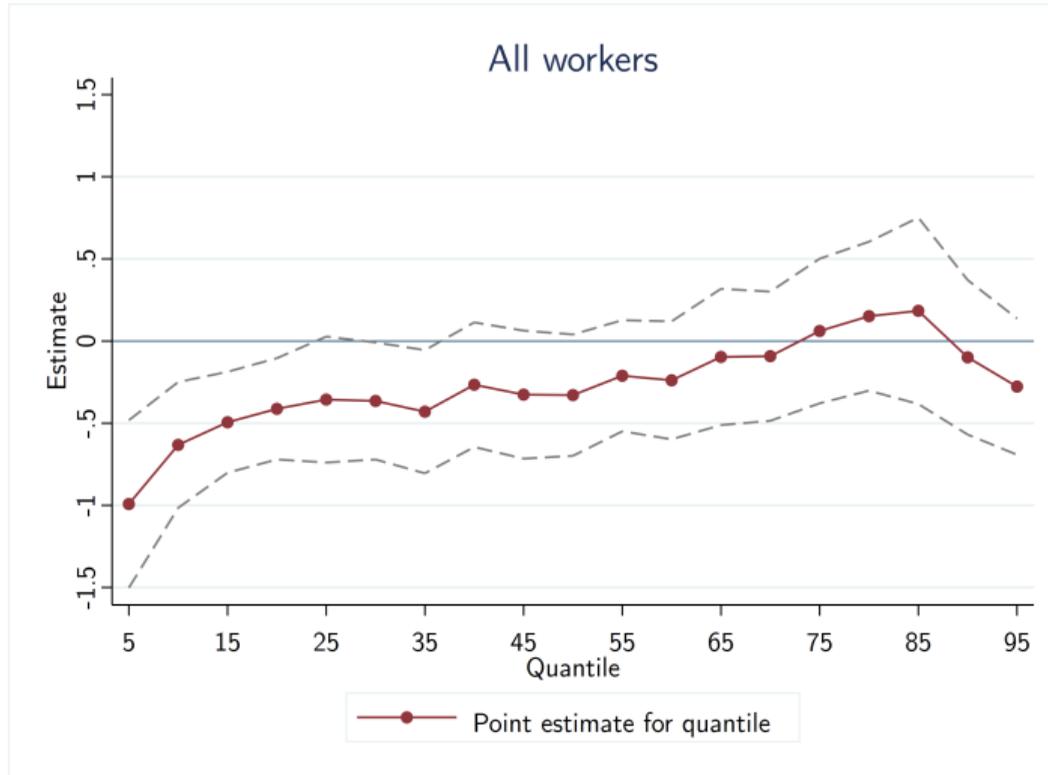
► Dashed line excludes the most exposed areas.

# Inequality: Effects on Different Skill Groups



► Larger effects on workers with less than college.

# Inequality: Effects on the Distribution of Wages



- ▶ Negative effects concentrate in the bottom seven deciles.

# Automation and Inequality

- ▶ In fact, the effects of automation on inequality are much greater than suggested by this evidence.
- ▶ Acemoglu and Restrepo (2021): 50-70 % of changes in the US wage structure between 1980 and 2016 are due to automation — experienced by groups specialized in routine tasks in industries undergoing automation.
- ▶ In the data the effects of automation are very different from those of other technological changes and overall capital deepening.

## Task Displacement and Inequality

- ▶ A summary: **task displacement** = Bartik measure of change in industry labor share times exposure of a demographic group to routine occupations in that industry.
- ▶ Changes in wage structure driven by wage declines of demographic groups experiencing **task displacement**.

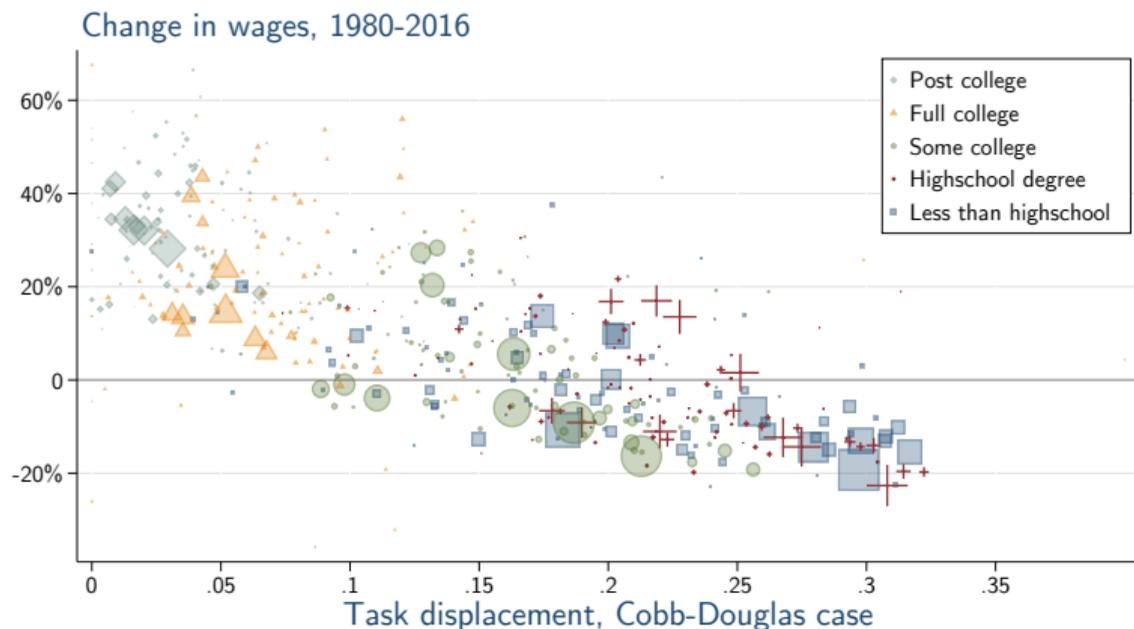


Figure: Reduced-form relation between task displacement and change in wages, 1980–2016.

# Why This Impact of Automation? Why Now? Displacement and Reinstatement, 1947-1987

- ▶ Change in task content = displacement + reinstatement.
- ▶ Empirical counterparts of automation and new tasks.

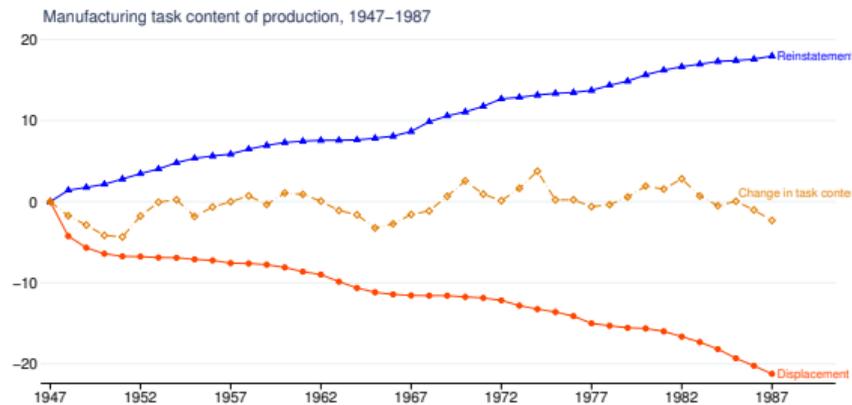
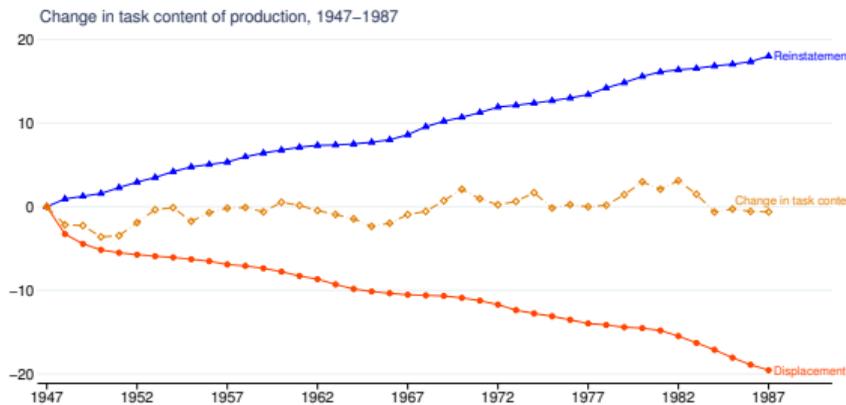


Figure: Estimates of the displacement and reinstatement effects, 1947-1987.

# Displacement and Reinstatement Today—1987-2017

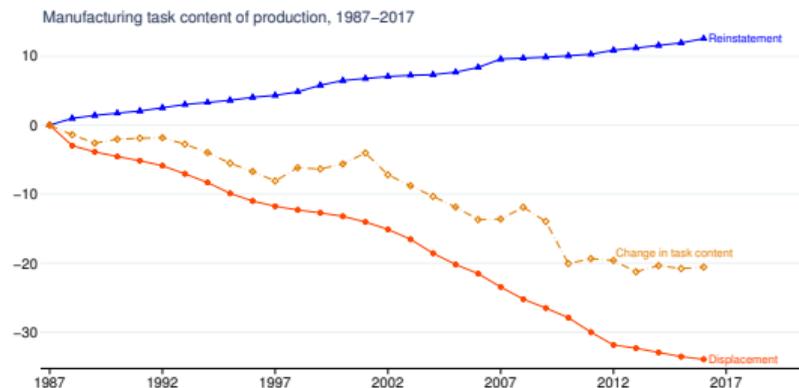
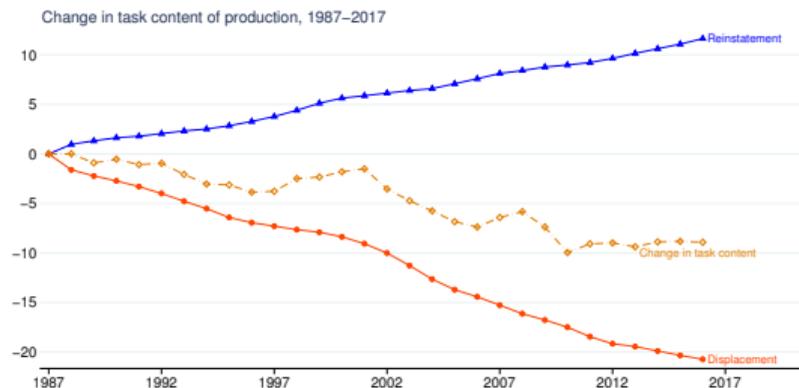
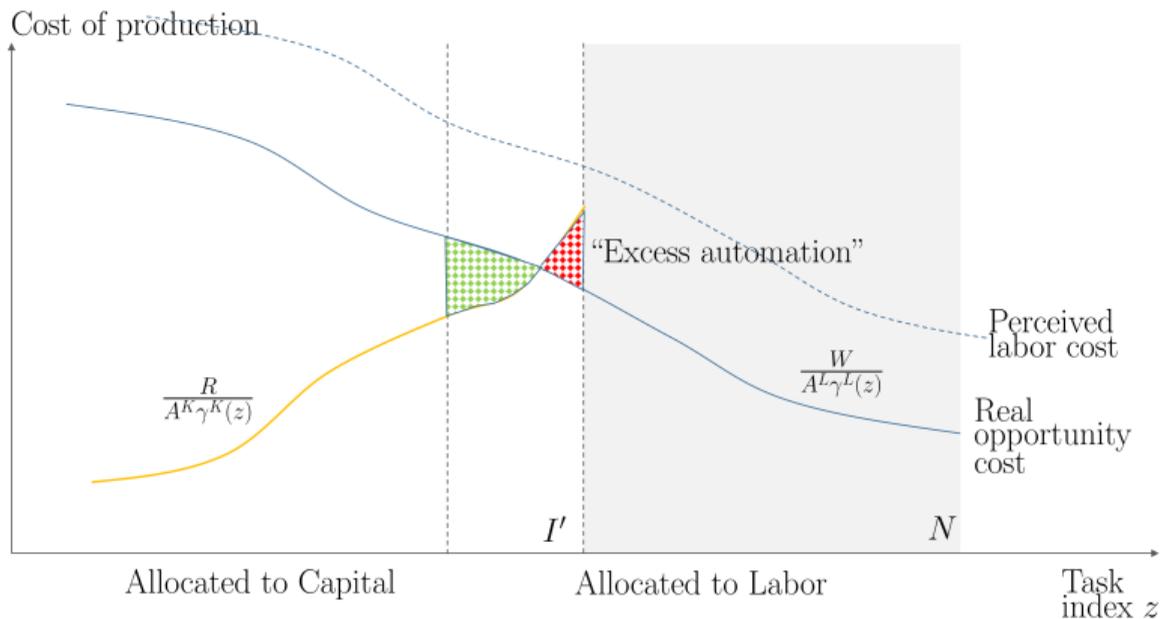


Figure: Estimates of the displacement and reinstatement effects, 1987-2017.

- ▶ Very different than during 1947-1987.
- ▶ Much faster **displacement** and much slower **reinstatement**.
- ▶ Changes in tasks content correlated with measures of **automation** and **new tasks** — consistent with theory. All of this multiplied with AI.

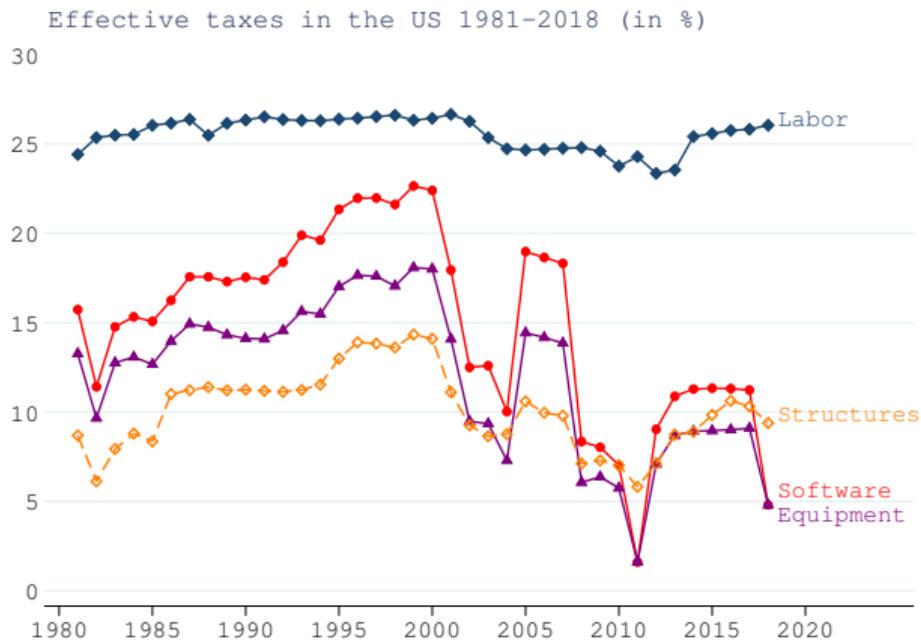
## Double Whammy: So-so Automation

- ▶ It is even worse than that.
- ▶ Circumstantial evidence suggesting that a lot of this automation is excessive and not productivity-enhancing.
- ▶ **Excessive automation**: so-so automation technologies — hence plenty of labor displacement, but not much productivity gains (impact on TFP may even be negative).



# Why Excessive Automation?

1. Global competition.
2. Business models and growing size of Big Tech.
3. Labor market institutions.
4. Subsidies to capital.



## Implications for the Developing World

- ▶ If there is indeed a much greater focus or even excessive bias towards automation, this has major implications for the developing world.
- ▶ Automation technologies will spread to the emerging world (and have already started doing so).
- ▶ Even more importantly, automation in the developed world will change the international division of labor: deindustrialization in the South from automation in the North.
- ▶ But automation technologies are **inappropriate technologies** for the developing world — they economize on the factors that are abundant in the developing world: labor, especially semi-skilled labor.
- ▶ They will increase inequality between the North and the South, as well as within the emerging world (Acemoglu and Zilibotti, 2001).
- ▶ Future of work in the developed world is thus intimately linked to future of growth in the developing world.
- ▶ **Problem:** Those suffering from excessive automation (workers in the developed and developing economies) have no voice on the direction of technology and future of work.
- ▶ **How can this change?**

# Implications for the Future of Work

- ▶ In fact, one can argue that automation technologies are not just inappropriate for the developing world, but for workers in the developed world.
- ▶ To the extent that these technologies reduce the labor share and economic opportunities for many worker groups, they would be failing to take advantage of the available human resources.
- ▶ The problem is even worse when automation is “so-so”, meaning that it is not greatly improving productivity either.
- ▶ Equally bad when not counterbalanced by **new tasks**.
- ▶ If the future is one of ceaseless automation and nothing else, then the future of work will not be bright. There would be lower and lower labor share across industries and in national income. And there would be no guarantee of sufficient job growth.
- ▶ Improving labor market institutions, by itself, cannot be the solution — if we push wages up, this will cause more automation, unless technology becomes more “human-friendly”.

# Do We Have Alternatives? Redirecting Technological Change

- ▶ Yes, the direction of technology is highly malleable. This is doubly so for AI.
- ▶ AI is a broad technological platform that can be used for many things, several of them human complementary—rather than excessively automating.
- ▶ How to do that?
- ▶ First, distortions encouraging excessive automation can be removed.
- ▶ Government support for “blue sky” research, which is arguably critical for new tasks, has declined. This is easy to correct, but what type of research to support?
- ▶ What if excessive automation is rooted in the business model/visions of leading players (e.g., Big Tech)? In the emphasis on cost-cutting of other large firms?
- ▶ This would make things more complicated. We would need:
  - ▶ Alternative visions.
  - ▶ Government leadership/regulation in the direction of technological change.
  - ▶ Societal pressure on companies.
  - ▶ Institutional changes.

## An Example of Alternative Model

- ▶ What will AI do to education?
- ▶ Most likely path: more and more AI technologies to replace teachers (first in grading, then in homework help, then in teaching, etc.).
- ▶ Is that the only path? Isaac Asimov:  
*Today, what people call learning is forced on you. Everyone is forced to learn the same thing on the same day at the same speed in class. But everyone is different. For some, class close too fast, for some too slow, for some in the wrong direction.*
- ▶ Asimov suggested using technology for individualized learning at home.
- ▶ But existing evidence suggests that learning without human direction is very difficult, especially for students who have already fallen behind.
- ▶ **Alternative:** AI to augment teachers, for example, to find out in real time which students are having what types of problems with different parts of the material.
- ▶ **But problem:** precisely because this will require more and more highly skilled and paid teachers, demand from cost-cutting educational institutions is not very high.
- ▶ **Even bigger problem:** this is not viewed as cool by AI researchers as replacing humans, because that's the one that has greater cachet as **“reaching human parity”**.

## How to Do It? Lessons from Renewable Energy

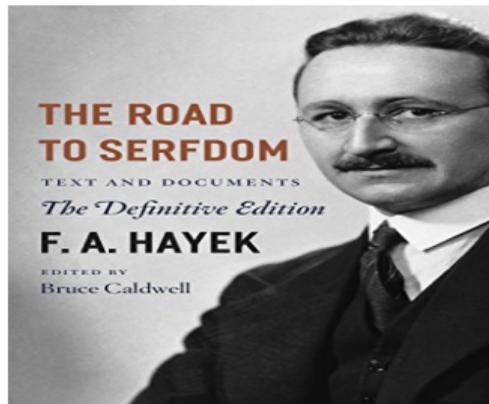
- ▶ Lessons from renewable energy: sizable redirection of technological change.
- ▶ What did it take?
- ▶ Subsidies to clean energy, but first based on a measurement framework (which we currently don't fully have in the area of excessive automation).
- ▶ Equally important was a change in social norms and societal pressure—awareness among consumers about climate change broad significant pressure from consumers and employees.
- ▶ This encouraged investment in renewable energy and started constraining/threatening the business model of Big Oil.
- ▶ In the area of technological change, we may also need a fundamental institutional overhaul.

## But What About the Political Economy?

- ▶ In terms of the framework James Robinson and I sketch out in Why Nations Fail, we are going through a **critical juncture**, when existing institutions are not up to task of dealing with new exigencies.
- ▶ In the age of AI, we need **regulation of technology**. But this cannot be done without a broader institutional framework.
- ▶ This is all the more so, because throughout history excessive control over technological change has been disastrous as well. So we have to find a middle ground.
- ▶ Worker rights and empowerment are part of it, but are not sufficient by themselves.
- ▶ This must also include limiting corporations power in collecting and exploiting data and a robust oversight structure for controlling governments' use of data for repression of society.

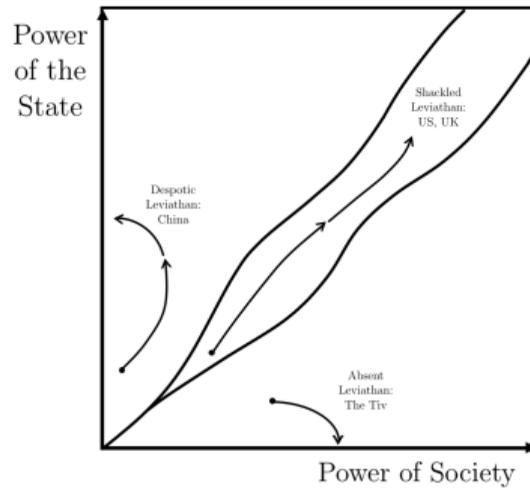
## Welfare State 3.0

- ▶ New responsibilities for the state for combating inequality, climate change, pandemics, security, and contributions to international development.
- ▶ Better regulation and social safety net for the disruption created by automation and inequality.
- ▶ And most importantly, something new from the state: [regulation of technology](#).
- ▶ Much greater burdens on the shoulders of the state, just like the Beveridge report articulated in 1942 for the UK.
- ▶ But what about keeping the state under control?
- ▶ This is what Hayek, then a recent émigré from Austria teaching at the LSE, worried about in 1942.



# Why Hayek Was Wrong? The Red Queen

- ▶ Hayek's concerns did not come to pass. Why not?
- ▶ Due to what James Robinson and I called the “Red Queen effect” in our new book, *The Narrow Corridor*.
- ▶ Society becomes stronger as the state shouldered more responsibilities.



- ▶ Can we prove Hayek wrong again?