Automation and the Inappropriateness of Technology

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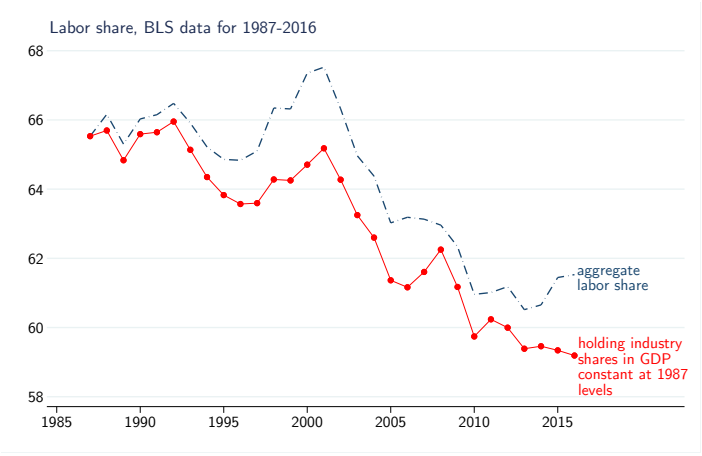
October 2021

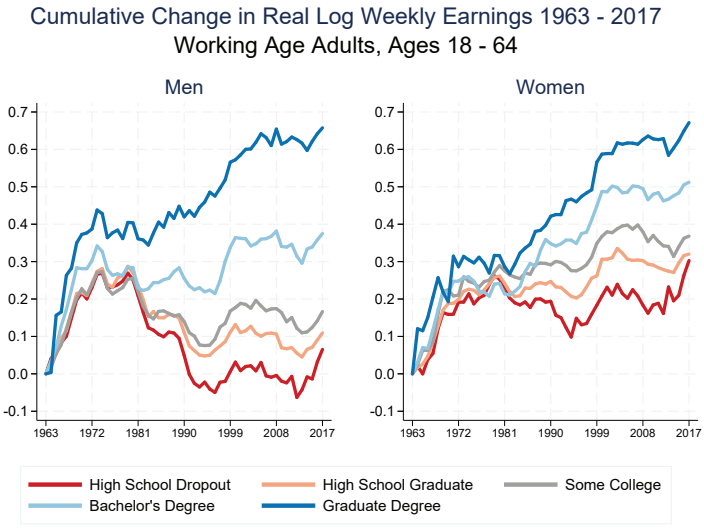
Shifts Against Labor



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

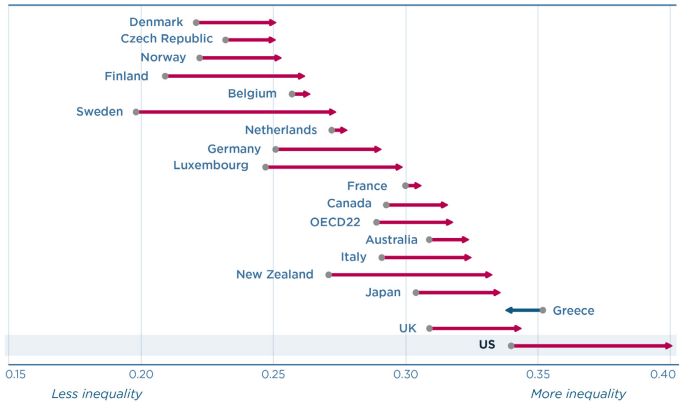
Some Consequences: Wages

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



Rise in Inequality Is Not Just a US Phenomenon

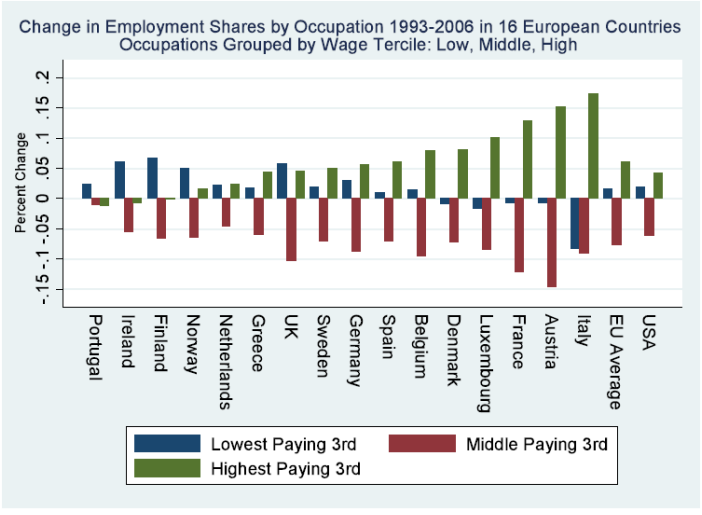
Figure 1: Change in Gini coefficient, 1985 to 2013



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).

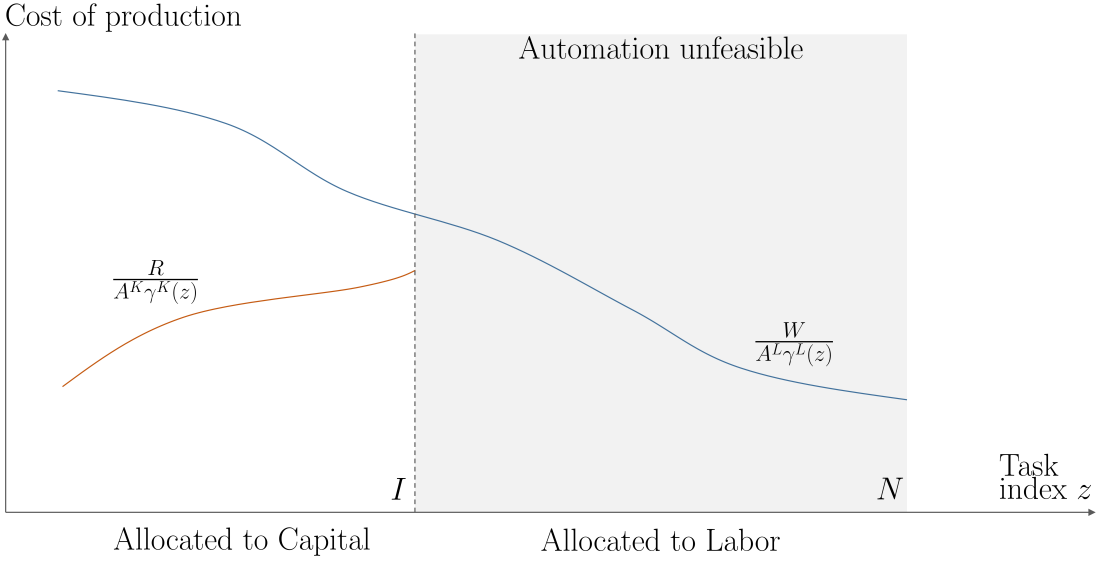
Source: Organization for Economic Cooperation and Development (OECD), "In It Together: Why Less Inequality Benefits All."

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

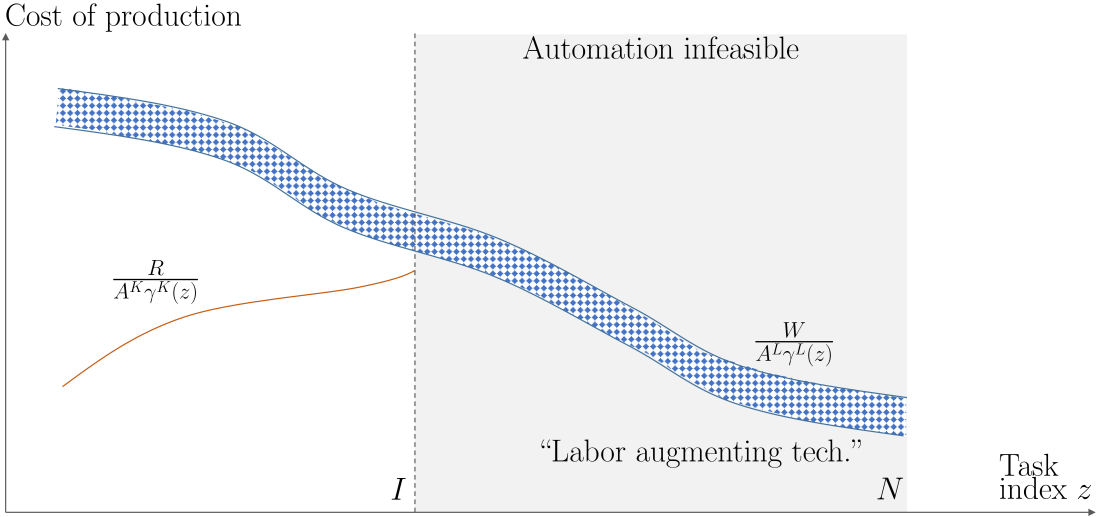


- Acemoglu and Autor, 2011.

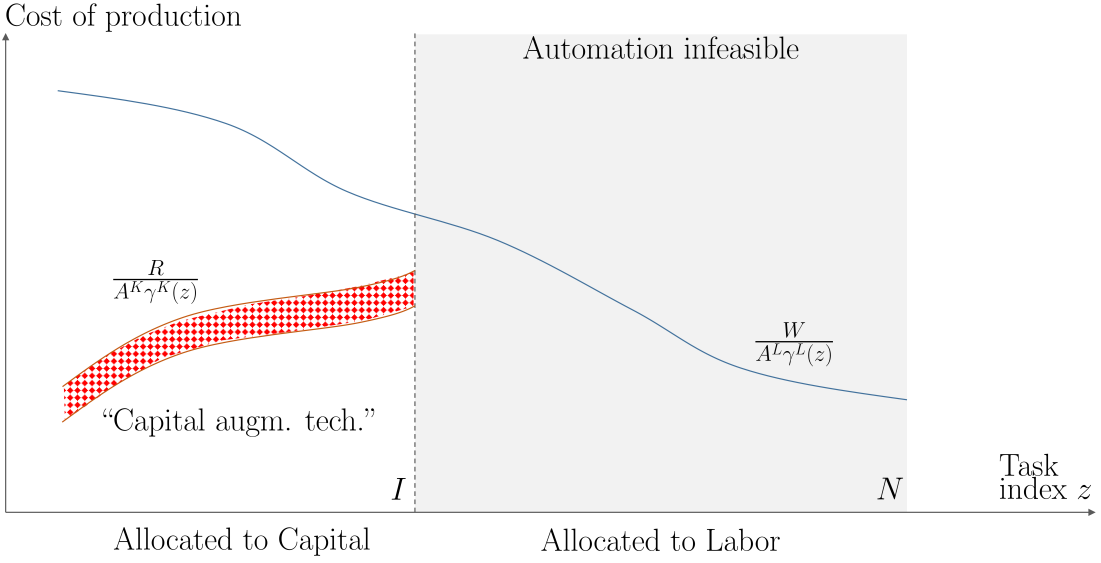
How to Think About All of This? Allocation of Tasks to Factors



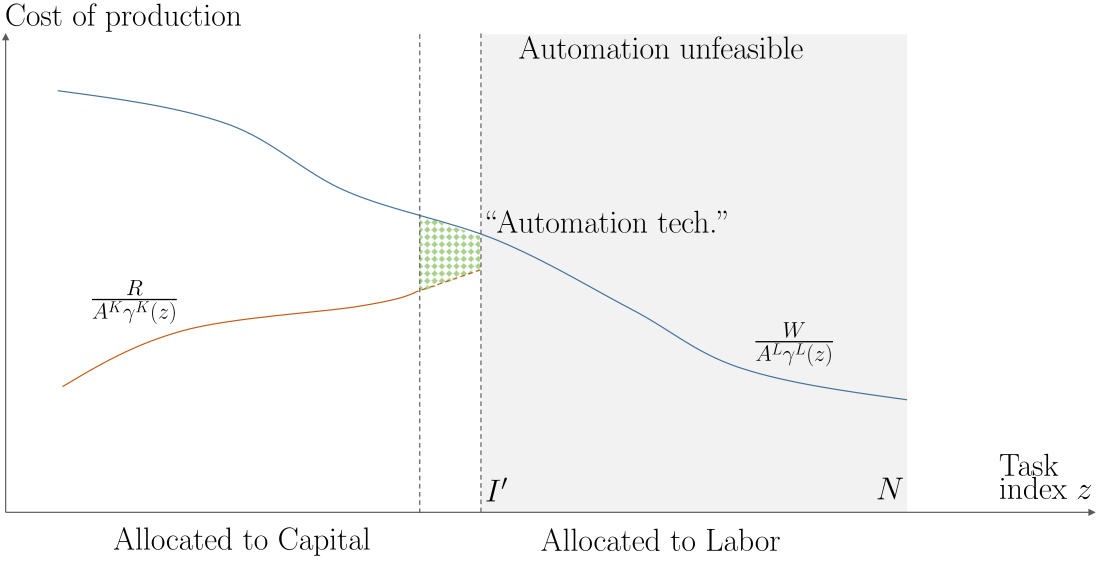
Labor-Augmenting Technological Change



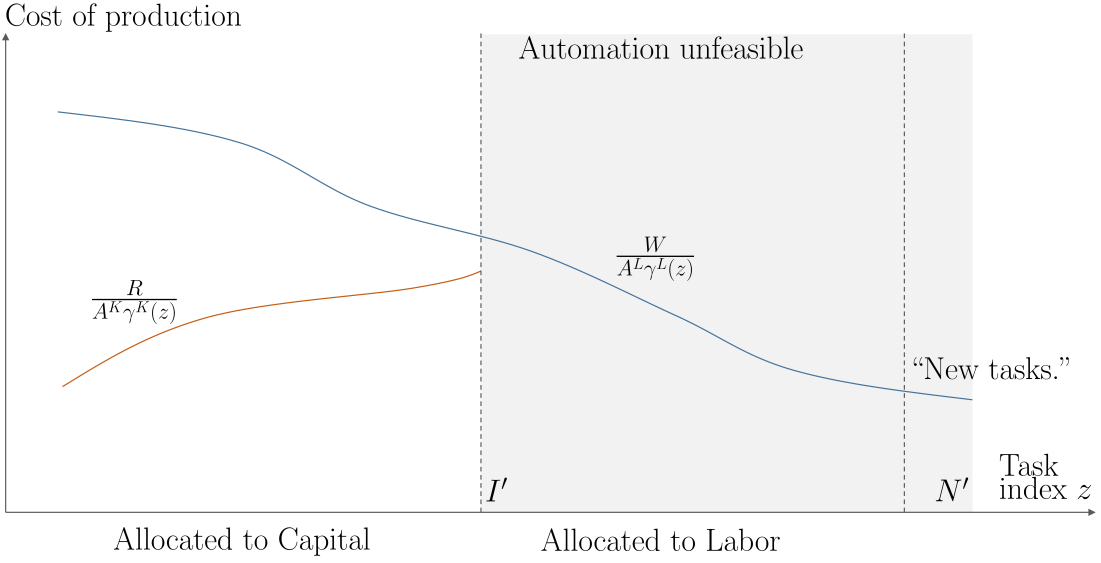
Capital-Augmenting Technological Change



Automation


Cost of production
Automation unfeasible
"Automation tech."
$\frac{R}{A^K\gamma^K(z)}$
$\frac{W}{A^L\gamma^L(z)}$
I'
N
Task index z
Allocated to Capital
Allocated to Labor

Very Different Implications from New Tasks



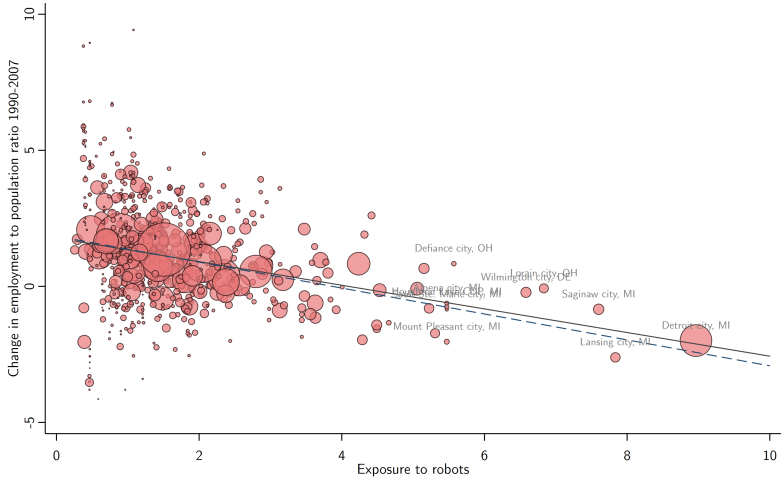
Robots and Jobs: Local Labor Market Effects

- 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:

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

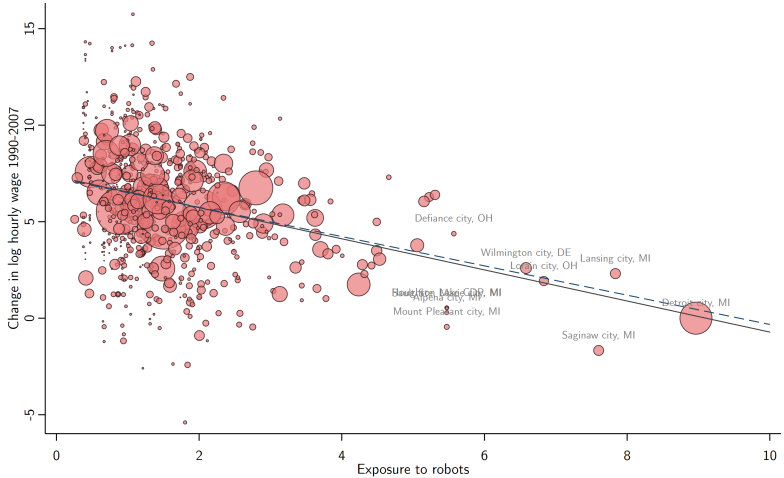
- Then see how this affects employment and wages.

Exposure to Robots and Local Employment



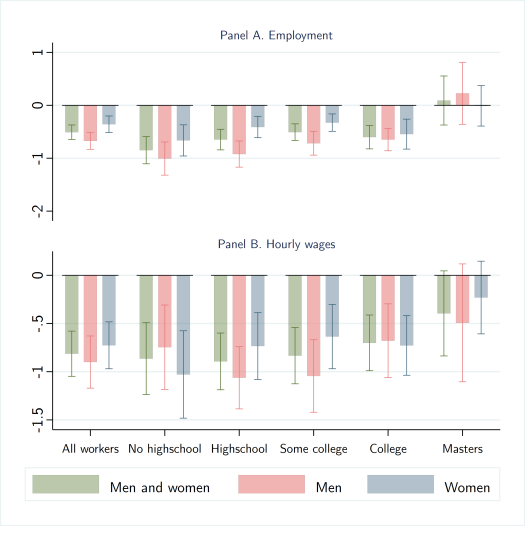
- Dashed line excludes the most exposed areas; thus the relationship is unchanged without the key parts of the industrial heartland.

Exposure to Robots and Local Wages



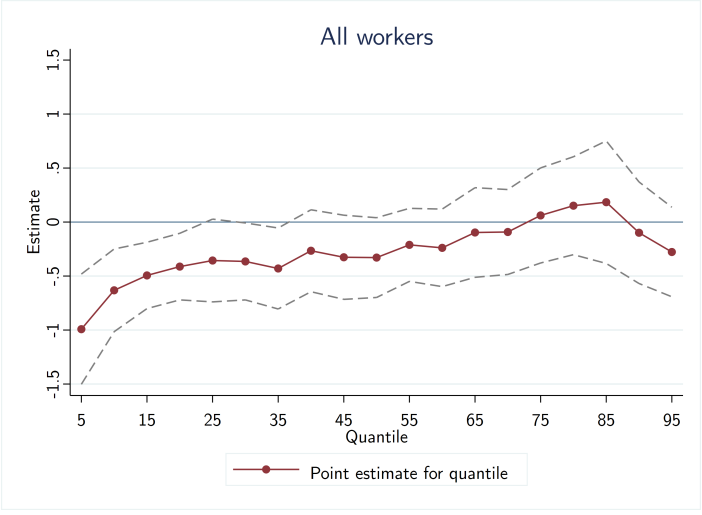
- Dashed line excludes the most exposed areas.

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.

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.

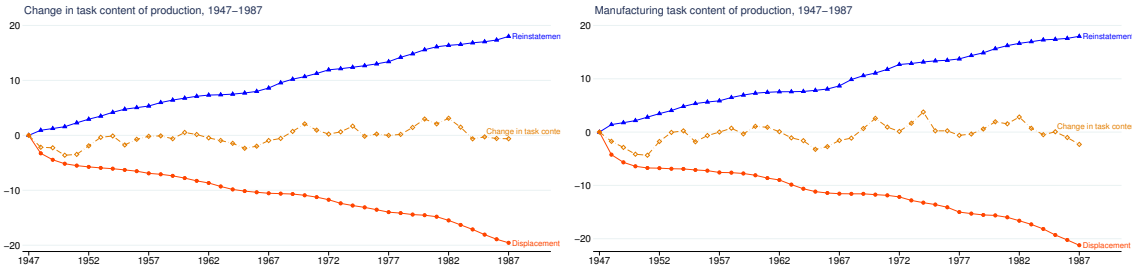
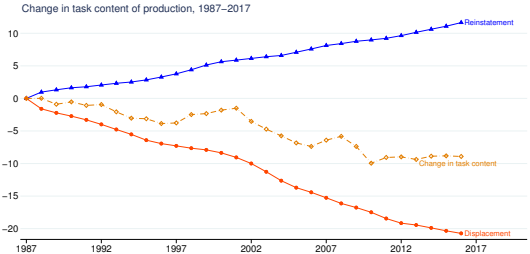


Figure: Estimates of the displacement and reinstatement effects, 1947-1987.

Displacement and Reinstatement Today—1987-2017



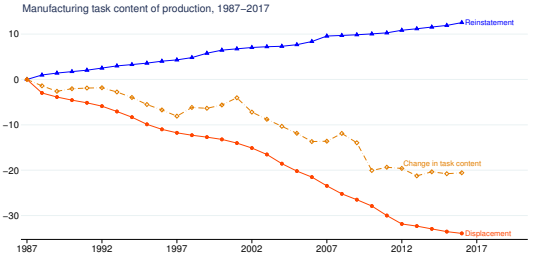
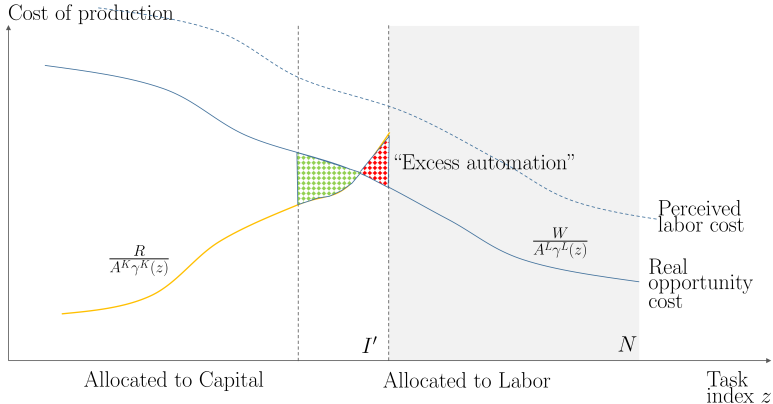


Figure: Estimates of the displacement and reinstatement effects, 1987-2017.

- 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.

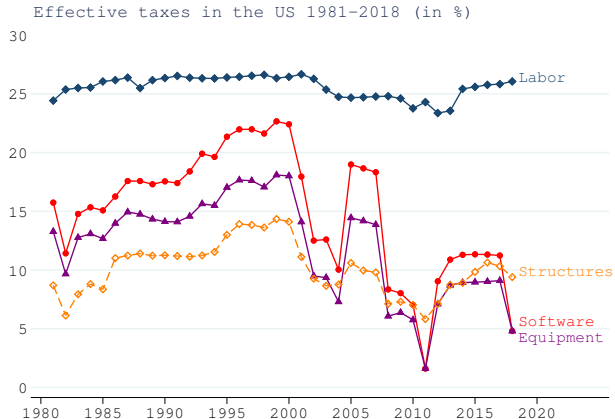
Double Whammy: So-so Automation

- 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?

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.