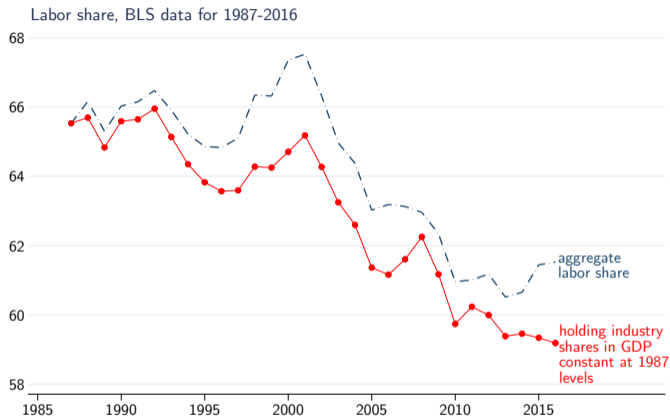


Automation and the Future of Work

Daron Acemoglu

February 2021

Shifts Against Labor

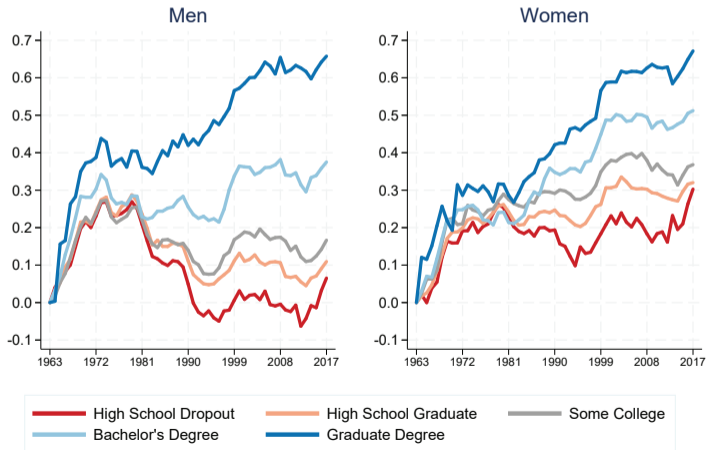


- ▶ Declining labor share in the US; similar in other economies, including in Latin America.
- ▶ Capital deepening? Intangible capital? Markups? Monopsony?
- ▶ We argue: much more connected to the changing **task content of production**.

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



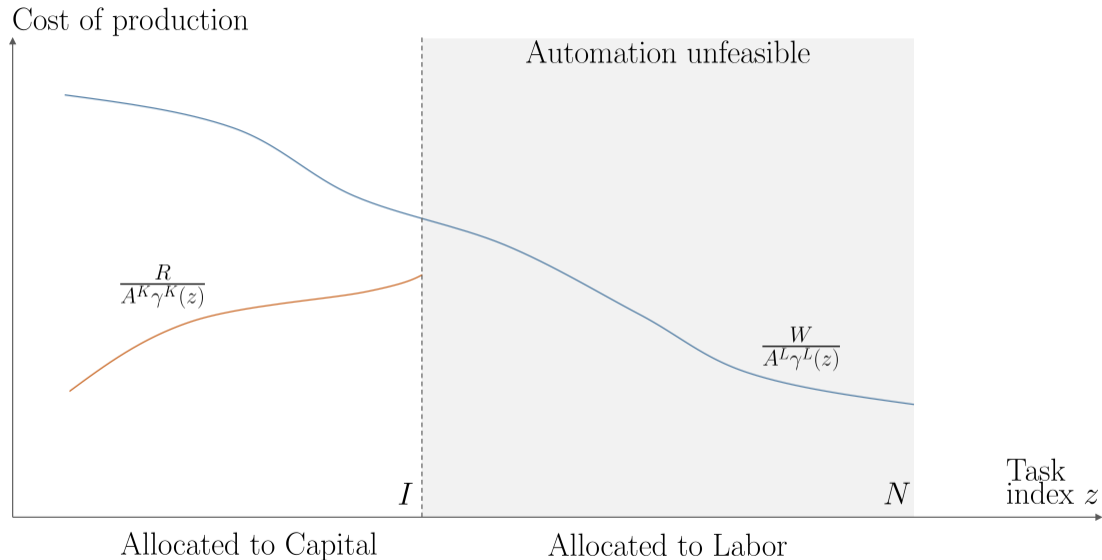
The Need to Think in Terms of Tasks

- ▶ Tasks and automation at the center of technological change throughout the last 200 years.
 1. horse-powered reapers, harvesters, and threshing machines replaced manual labor
 2. machine tools replaced labor-intensive artisan techniques
 3. industrial robotics automated welding, machining, assembly, and packaging
 4. software automated routine tasks performed by white-collar workers
- ▶ Hard to map to canonical production function factor-augmenting technologies:

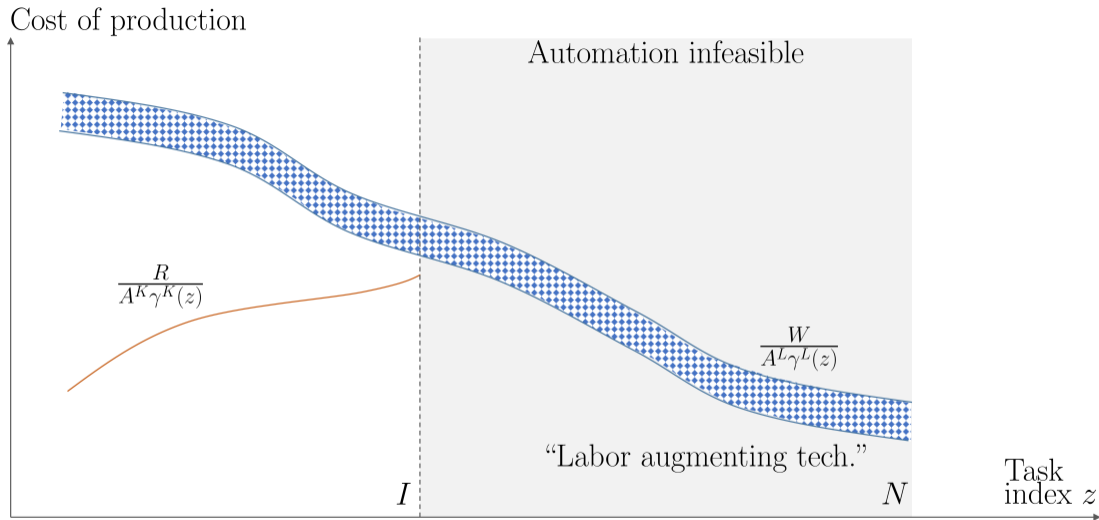
$$Y = F(A_L L, A_K K).$$

- ▶ In this formulation, allocation of tasks to factors remain unchanged, and
- ▶ technological change makes capital (or labor) **uniformly** more productive in all tasks.

Allocation of Tasks to Factors

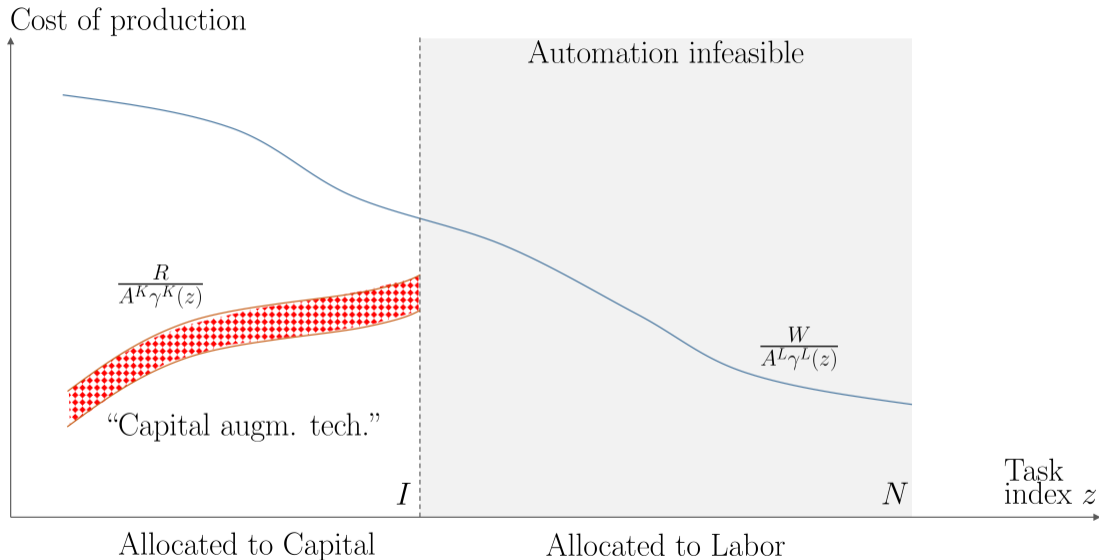


Labor-Augmenting Technological Change



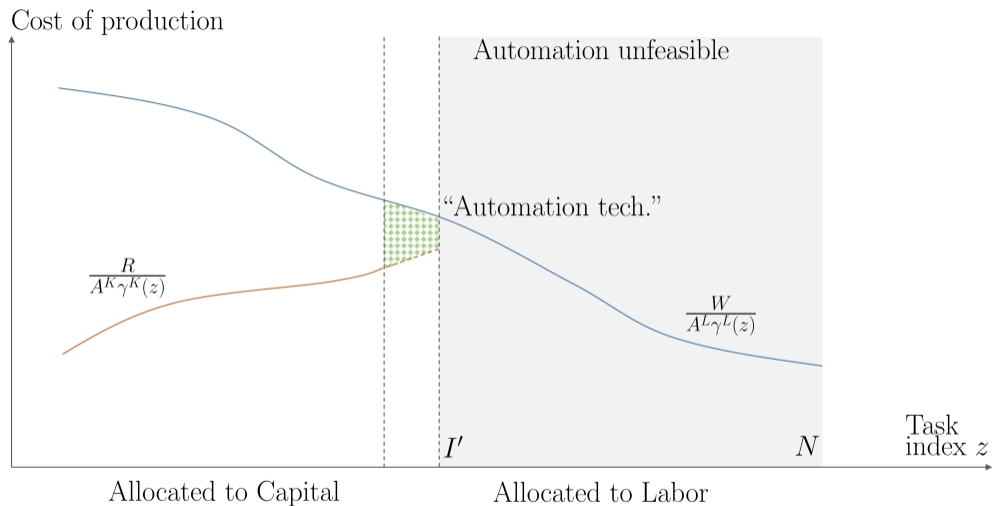
- ▶ Large productivity effects and no changes in the task content of production.

Capital-Augmenting Technological Change



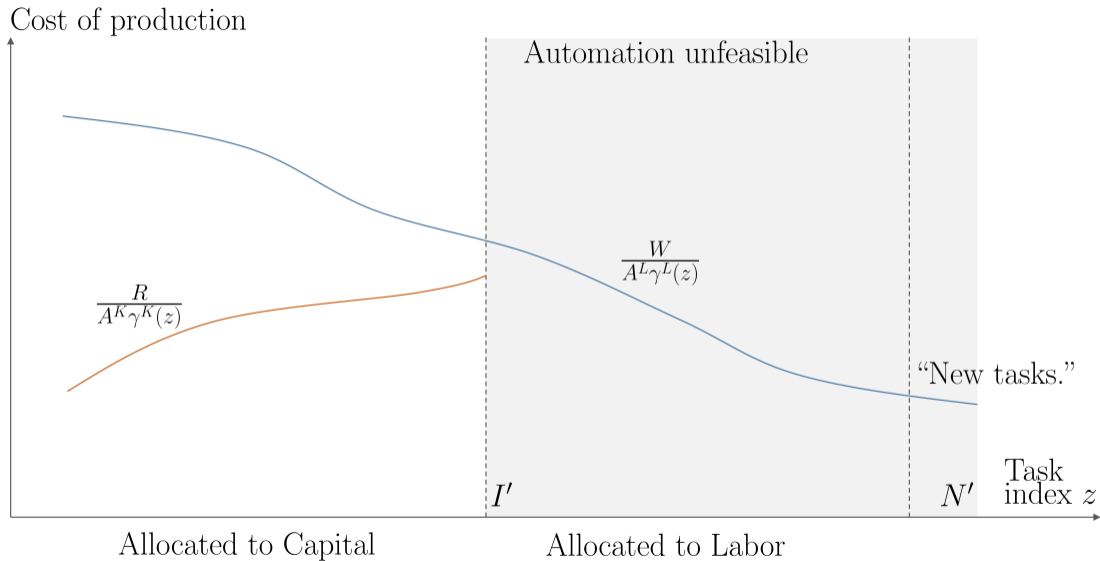
- ▶ Again large productivity effects and no changes in task content.

Automation



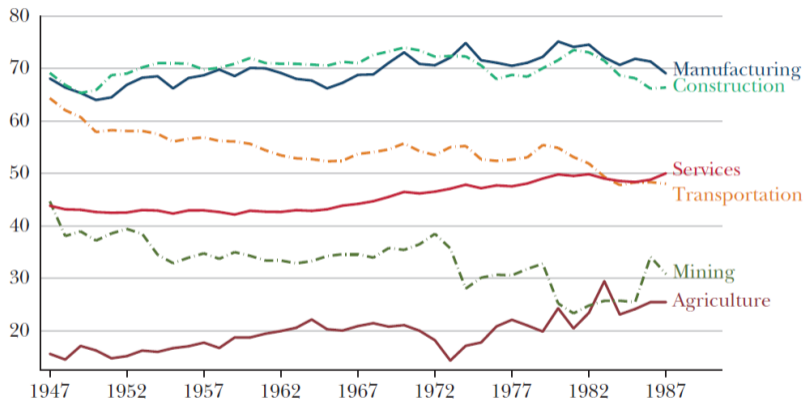
- ▶ Now the task content of production changes and potentially with small productivity effects. But also the labor share declines and real wages of affected workers may fall.

So Why Hasn't the Labor Share Fallen? New Tasks



Where Does the Labor Share Decline Comes from? 1947-1987

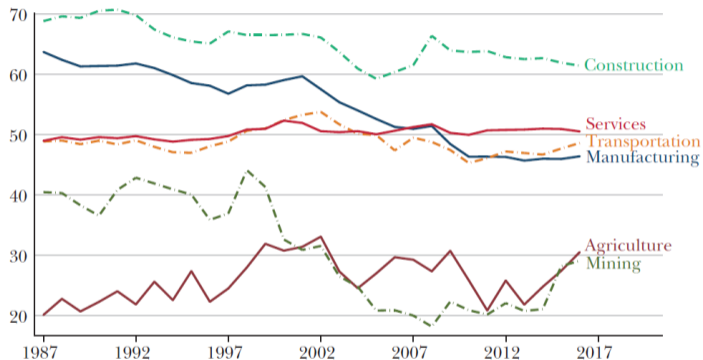
A: Labor Share within Each Industry, 1947-1987



- ▶ Important to look at labor share in value added (not sales, since the share of intermediates in sales is increasing over time).

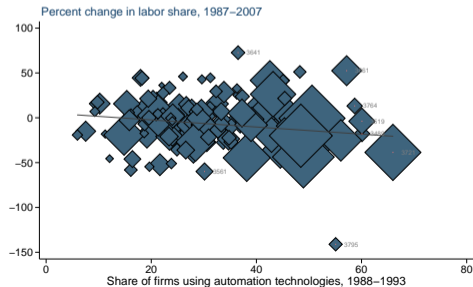
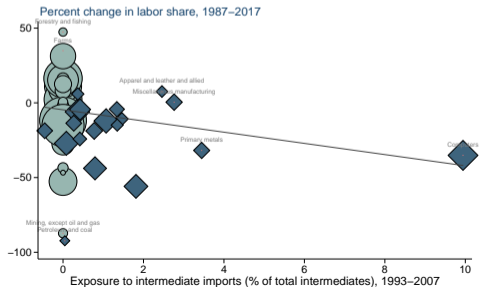
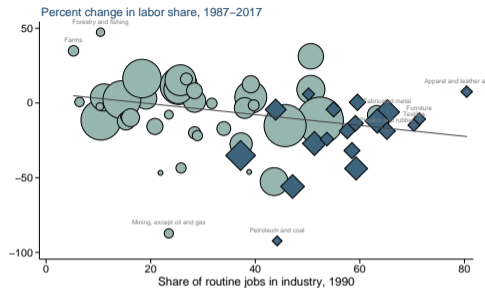
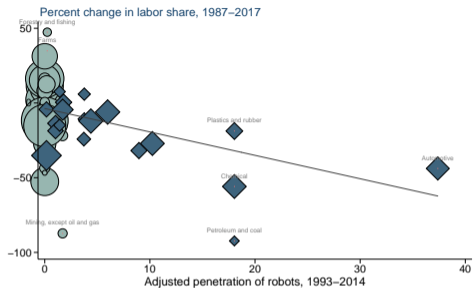
Where Does the Labor Share Decline Comes from? 1987-2017

A: Labor Share within Each Industry, 1987-2017

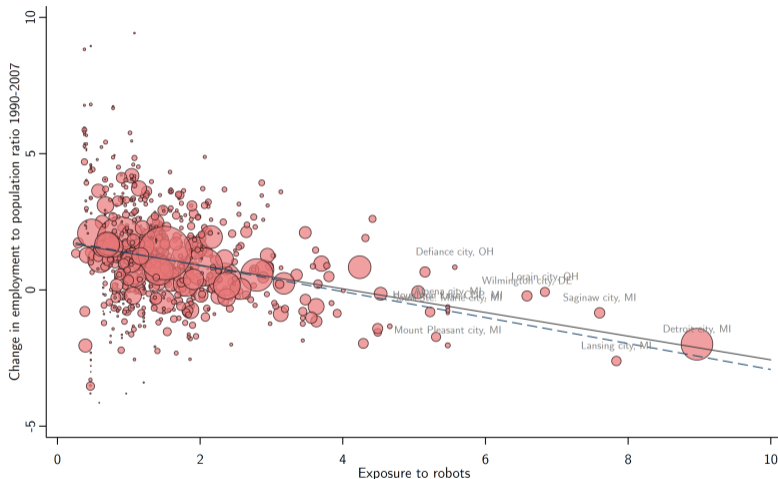


- ▶ Some declines in labor share in wholesale and retail during this time period.
- ▶ But the decline in the labor share is mostly a manufacturing phenomenon.

Automation and the Labor Share: Industry Evidence

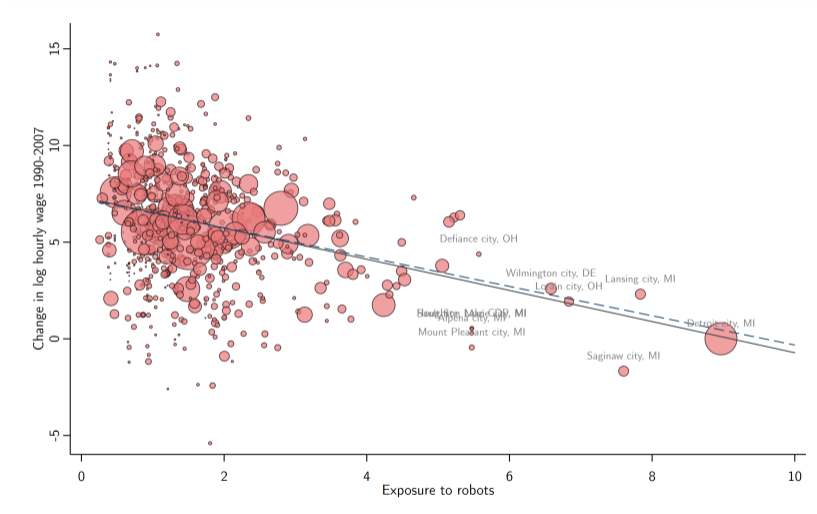


Robots and Jobs: Local Labor Market Effects from Exposure to Robots



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

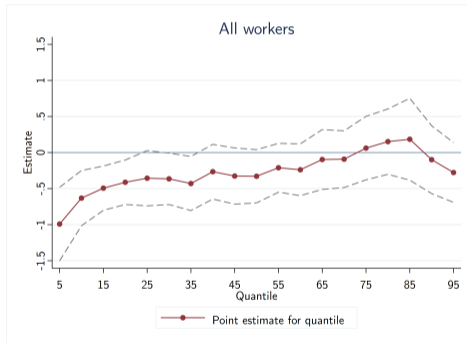
Exposure to Robots and Local Wages



► Dashed line excludes the most exposed areas.

Inequality

- ▶ Changes in task content affect different types of workers differently, and thus also have first-order effects on inequality.
- ▶ We can see this from the local effects of robots.



- ▶ In more recent work, Pascual Restrepo and I show that more than 50% of US wage structure changes is accounted for by task displacement driven by automation.
- ▶ In contrast, skill-biased technical change explains no more than 10%.

Understanding Labor Demand: Displacement and Reinstatement, 1947-1987

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

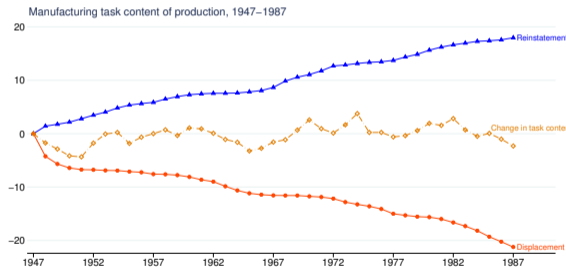
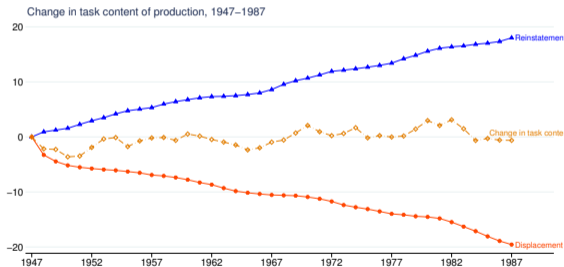


Figure: Estimates of the displacement and reinstatement effects, 1947-1987.

Understanding Labor Demand: Displacement and Reinstatement, 1987-2017

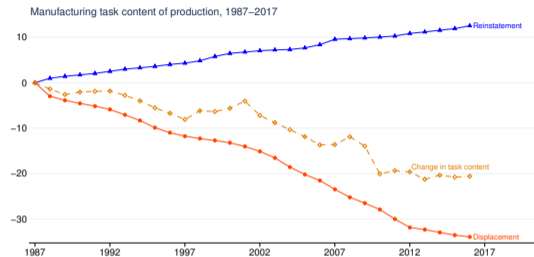
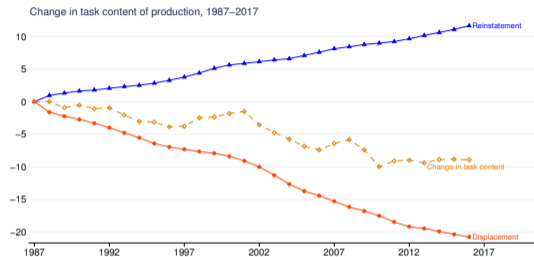
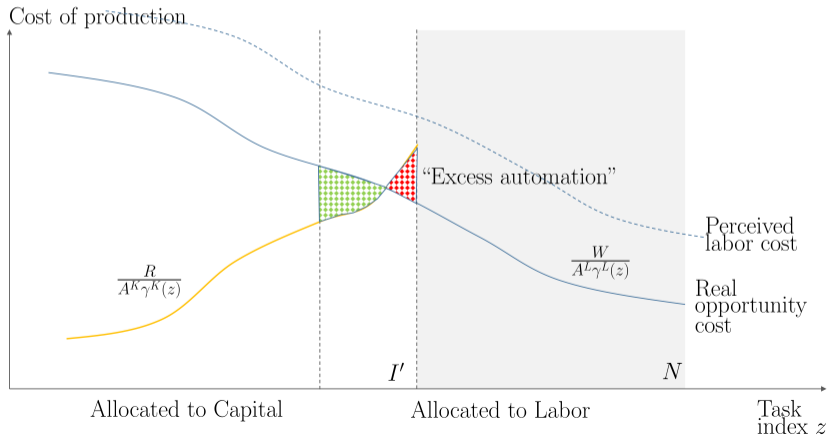


Figure: Estimates of the displacement and reinstatement effects, 1987-2017.

- ▶ 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.

Double Whammy: So-so Automation

- ▶ Recall that — via **productivity effect** — automation may generate benefits for labor.
- ▶ However, when policies or distorted visions encourage **excessive automation**, we end up with **so-so automation technologies** — hence plenty of labor displacement, but not much productivity gains (impact on TFP may even be negative).



Conclusion: Implications for the Future of Work

- ▶ But there are really two faces of automation.
- ▶ **Good automation** — high-productivity automation technology going hand-in-hand with new tasks — can contribute to productivity and labor demand.
- ▶ But **bad** or **so-so automation** reduces employment growth and worsens the distribution of income — esp. when there is **excessive automation** due to policy or vision distortions.
- ▶ The problem is even worse when automation is 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.
- ▶ In fact, even more severe problems for emerging economies, such as those of Latin America, because their comparative advantage is still in labor-intensive industries and technologies — automation is an **“inappropriate technology”** for the developing world.
- ▶ 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”.
- ▶ But good automation, particularly when combined with rapid creation of new tasks for workers, can be powerful engine of growth and prosperity. **Which future will it be?**