The New (More) Inappropriate Technology

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Inappropriate Technology

- As aptly noted by Frances Stewart, the hope that advanced nations' technology creates a productivity bandwagon for developing nations was always on somewhat shaky grounds.
- A key reason is that the West's technology tends to evolve in a way that is appropriate for its conditions, which are not the ones that prevail in the developing world.
- This is evident in the context of agricultural technologies (such as seeds and pesticides) that deal with problems specific to a given geography.
- It is also clear for capital intensity of production: while the West is capital-rich, many developing nations are capital-poor.
- So technologies that improve productivity heavily relying on capital investments would be of little use, and may even be counterproductive in developing nations (Stewart; Atkinson and Stiglitz; Basu and Weil).
- The same may be even more so when it comes to the skill-intensity of new technologies (Acemoglu and Zilibotti).

The New Inappropriateness

- Global technology's inappropriateness to the developing world will depend on a few critical factors:
  1. How easy it is to direct technology towards the needs of the West (and some powerful companies in the West).
  2. Whether there are other trends pushing technology in a direction biased against developing nations.
  3. How different developed and developing nations are in terms of their factor endowments and other environmental conditions.
- All three of these considerations are now pushing in the direction of more inappropriate technology.
  - **New research infrastructure:** new technologies (such as GM crops) and big data have increased the ability of firms to direct technology to specifically bias direction.
  - Other social and economic changes in the US have pushed new production technologies in a more anti-labor direction, which is currently being exacerbated with AI.
  - Finally, some of the gaps between developed and developing nations, especially in terms of the now relevant skill endowments, have increased.

Evidence from Moscana and Sastry (2021): Different Needs

African Maize Stalk Borer
Busseola fusca

Affected crops: Maize; Sorghum; Rice; Sugarcane

Western Corn Rootworm
Diabrotica virgifera virgifera

Affected crops: Maize; Millet; Pumpkins; Sunflower; Soybeans

Rice Blast Disease
Magnaporthe oryzae

Affected crops: Barley; Rice; Wheat

Witches' Broom Disease
Moniliophthora perniciosa

Affected crops: Cocoa

Ringspot Virus

Affected crops: Cucumbers; Melons; Papayas; Peas; Pumpkins

Desert Locust
Schistocerca gregaria

Affected crops: Barley; Cassava; Castor; Cotton; Dates; Pigeon Peas; Sesame; Sorghum; Wheat; Maize; Sugarcane

Evidence from Moscana and Sastry: Effects of GM

***Prominent solution:* *Bt* (GM) Corn, genetically modified to produce "cry toxins"**

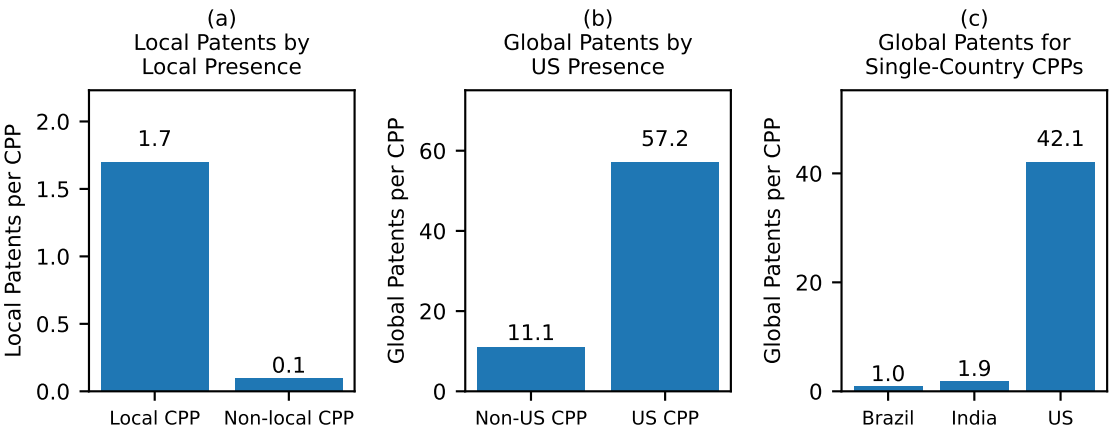
What does this matter?* *Cry toxins are "insect-type-specific"

European Maize Borer
Dominant threat: **US, Europe**
Biotech patents: **5,007**
Effective GM Variety ✓

Maize Rootworm
Dominant threat: **US**
Biotech patents: **327**
Effective GM Variety ✓

Maize Stalk Borer
Dominant threat: **sub-Saharan Africa**
Biotech patents: **5**
Effective GM Variety ✗

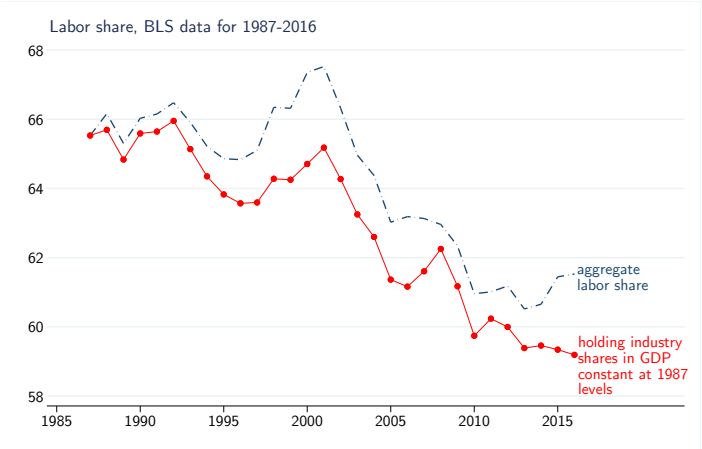
Evidence from Moscana and Sastry: Different Innovations



Big Data

- Big data is intensifying these trends.
- Massive data collection is common by many large companies, which then becomes an input into their innovative activities.
- One example is continuous use of A/B testing of new products and services.
- Big data processed by some fairly rudimentary AI technologies (such as machine learning) create opportunities for more finely directed technological change.
- Combined with other automation trends, risk that AI can be the "mother of all inappropriate technologies".

Trends Towards Inappropriate Technologies: Shifts Against Labor



- Declining labor share in the US; similar in other economies, including in Latin America.
- Acemoglu and Restrepo (2019; 2021): this is mainly connected to automation.

Particularly Shifts Against Low-Skilled Labor

- Acemoglu and Restrepo (2021): These trends are related to automation displacing low-skilled workers from routine jobs.
- Automation explains about 50-70% of changes in the US wage structure, 1980-2016.

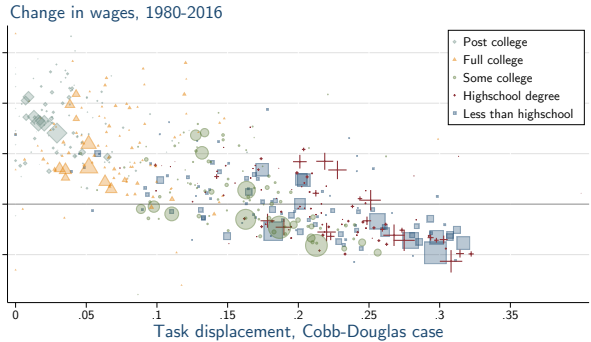
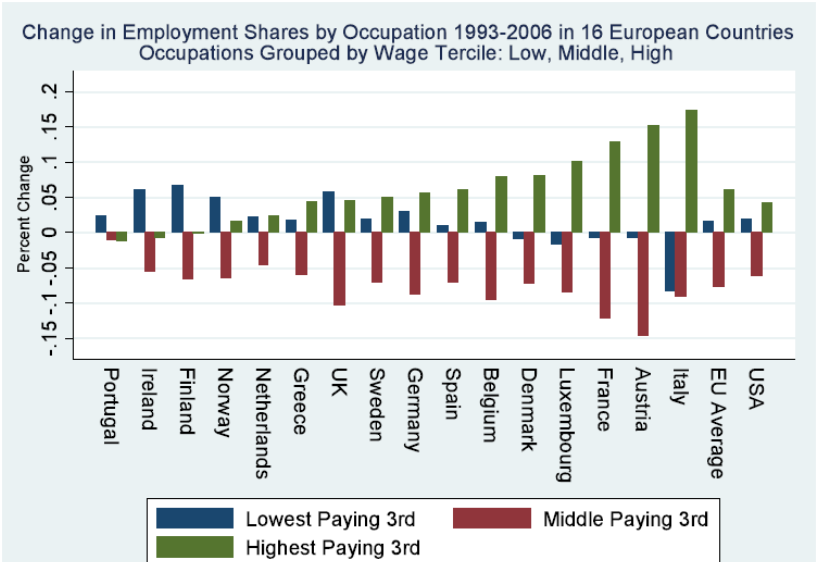


Figure: Reduced-form relation between task displacement and change in wages, 1980–2016.

- Underscoring the role of directed technological change, the effects of automation technologies are very different from those of other technological changes.

Similar Trends in Other Industrialized Nations: Disappearance of Routine, Middle-Skill Jobs



Why? The Direction of Technological Change: Displacement and Reinstatement, 1947-1987

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

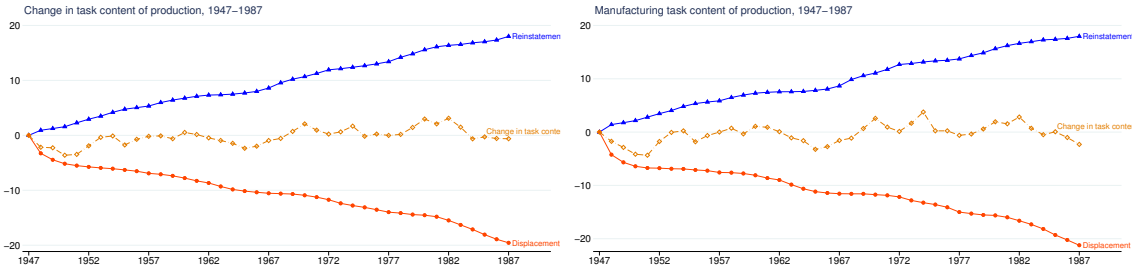
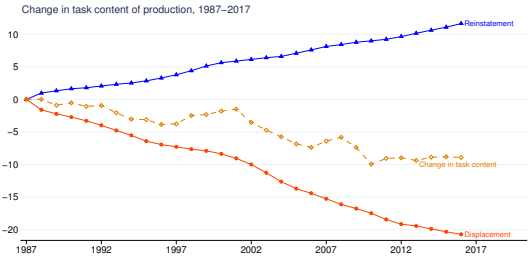


Figure: Estimates of the displacement and reinstatement effects, 1947-1987.

Why? The Direction of Technological Change: Displacement and Reinstatement, 1987-2017



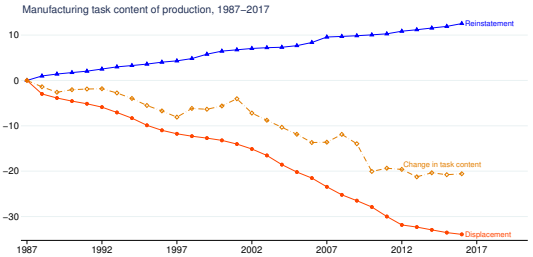
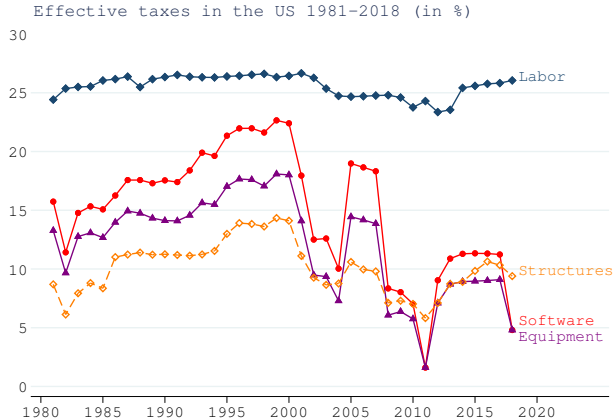


Figure: Estimates of the displacement and reinstatement effects, 1987-2017.

- 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. All of this multiplied with AI.

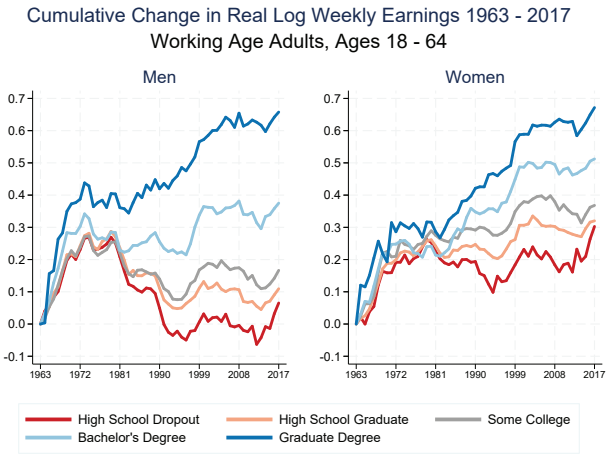
Why So Much Automation?

1. Global competition.
2. Business models and growing size of Big Tech.
3. Disappearance of worker power.
4. Subsidies to capital.



Diverging Conditions

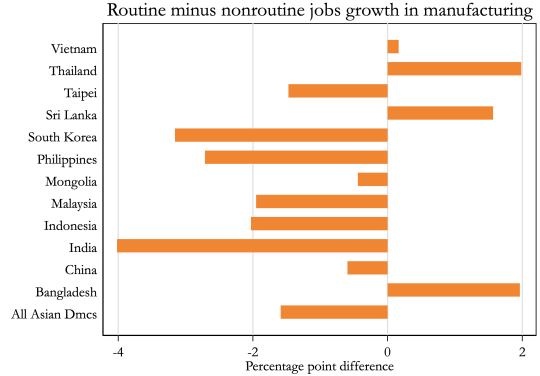
- Acemoglu-Zilibotti: differences in skill endowments in terms of college vs. noncollege.
- But big difference of technology bias is now between post-graduate and the rest:

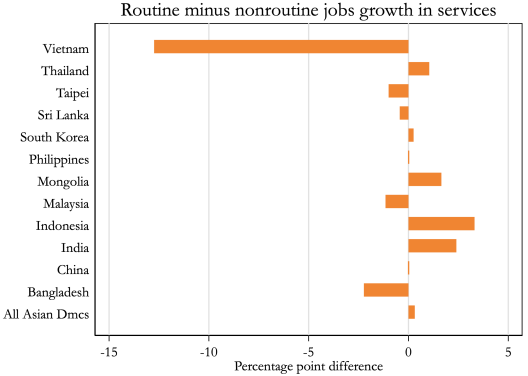


- A much larger gap between developing and developed nations in post-graduate skills.

Impact on the Developing World?

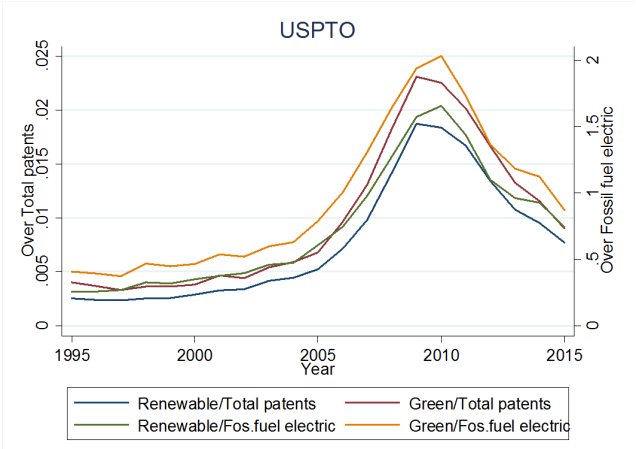
- Premature deindustrialization (Rodrik, 2015).
- The disappearance of routine jobs (data from the Asian Development Bank).





Redirecting Technological Change: Lessons from Renewable Energy

- Lessons from renewable energy: sizable redirection of technological change.



- Why the reversal? Perhaps in Q&A.

Redirecting Technological Change: How Was It Done?

- 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.

Redirecting Technological Change: Giving Voice to the Developing World

- Where will incentives for redirection come from?
- Partly from developed economy workers and civil society.
- Perspective of the developing world critical as well.
- For their voice to be heard, developing economies need to prioritize this issue and organize, perhaps using existing international institutions, such as the United Nations.
- But the developing world also needs to play a leadership role in research, as was the case during the Green Revolution.