

Will Automation *Displace* Workers?

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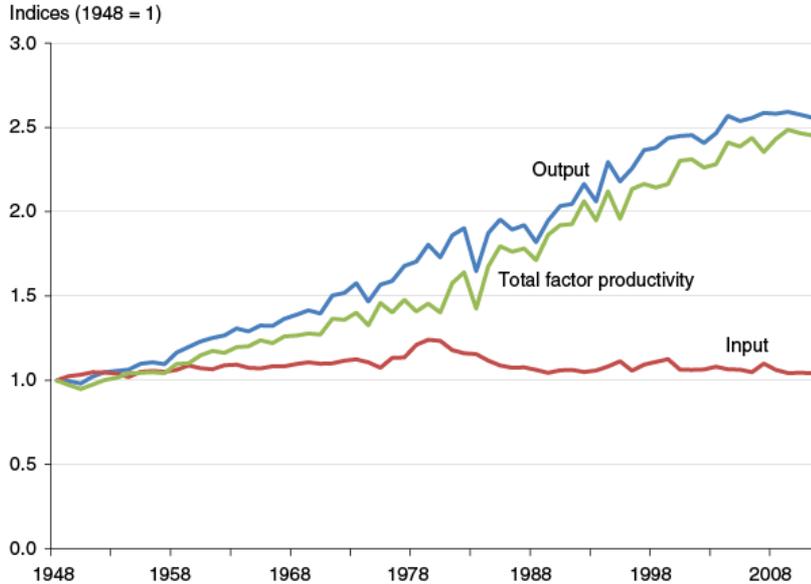
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Automation: Routine replacing technological change?

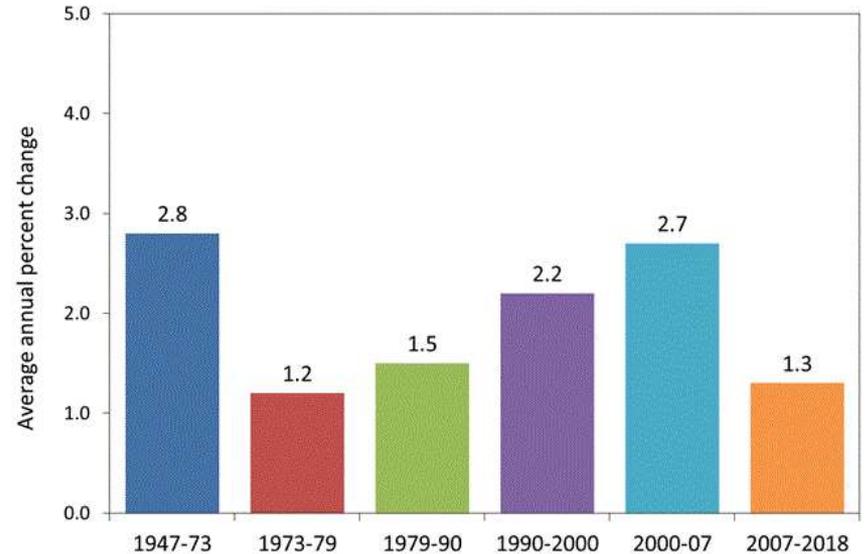
... or complement to skilled workers?

Agricultural productivity growth has accounted for most of the output growth between 1948 and 2011



Source: USDA, Economic Research Service productivity accounts.

Productivity change in the nonfarm business sector, 1947-2018

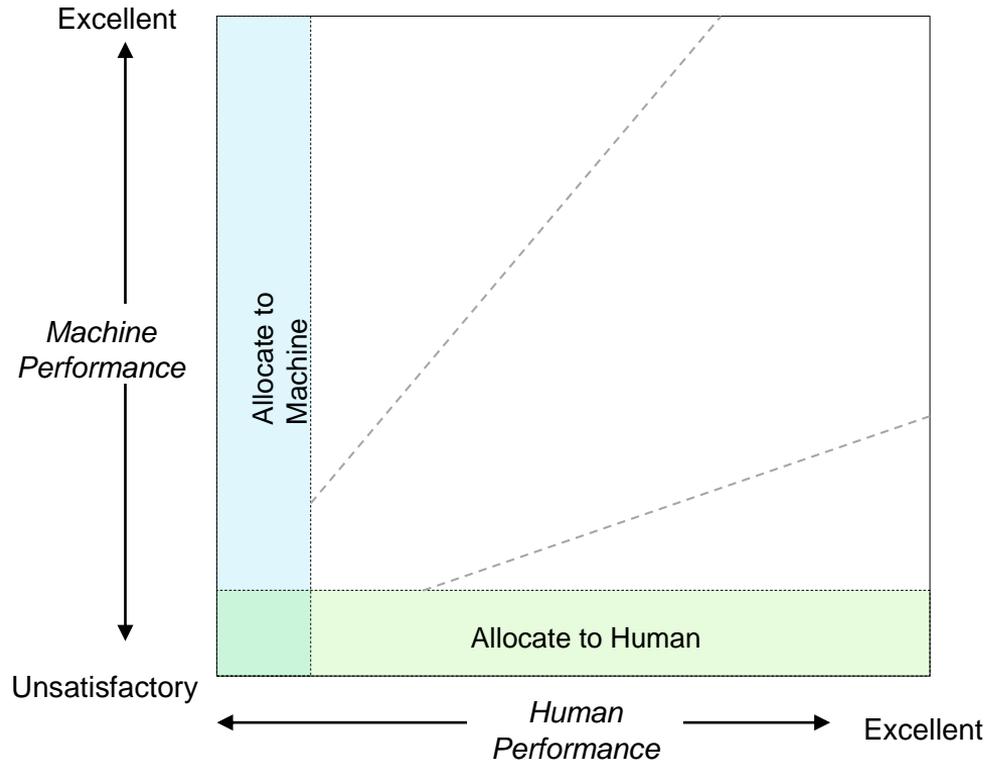


Source: U.S. Bureau of Labor Statistics

Automation = mechanization in agriculture led to a clear displacement of workers

The question now is what happens in the nonfarm sector

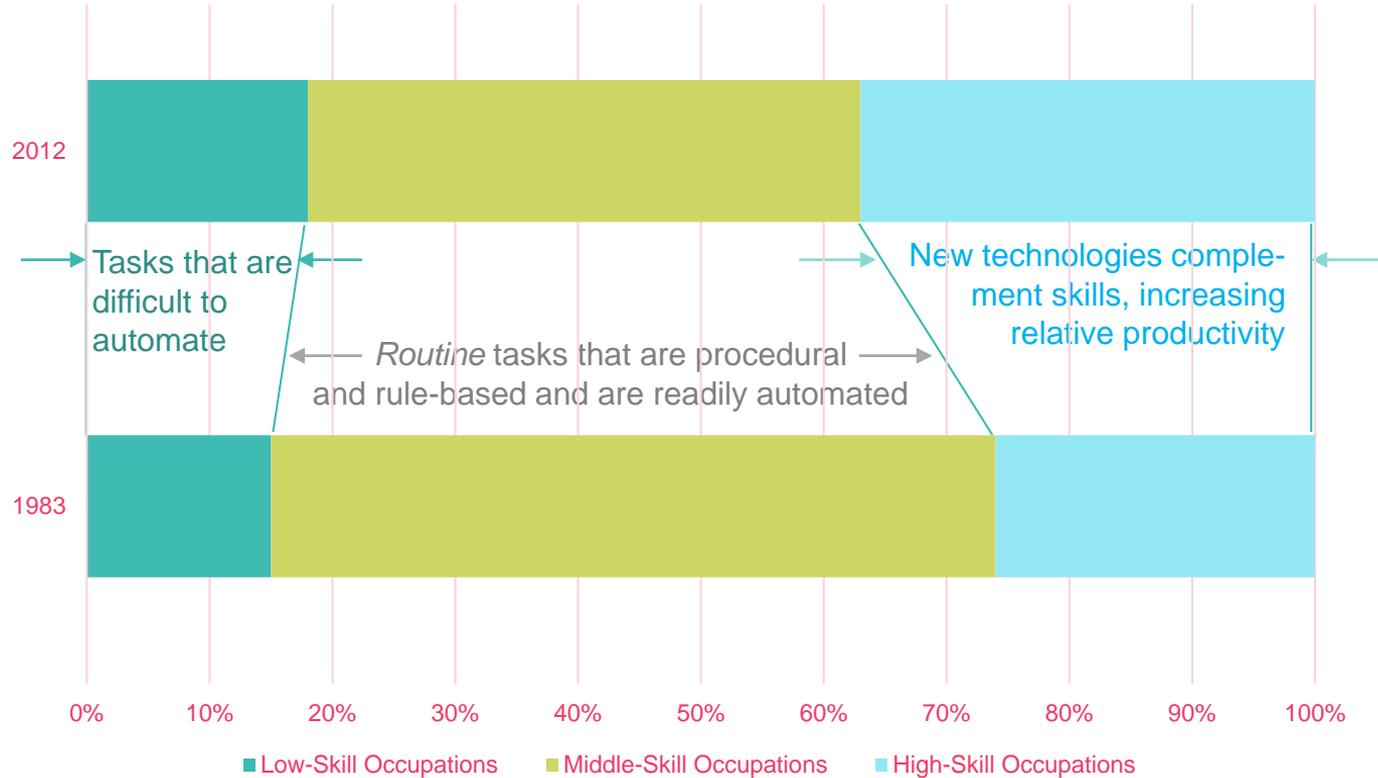
Is this task allocation shifting?



Shift in human – machine comparative advantage?

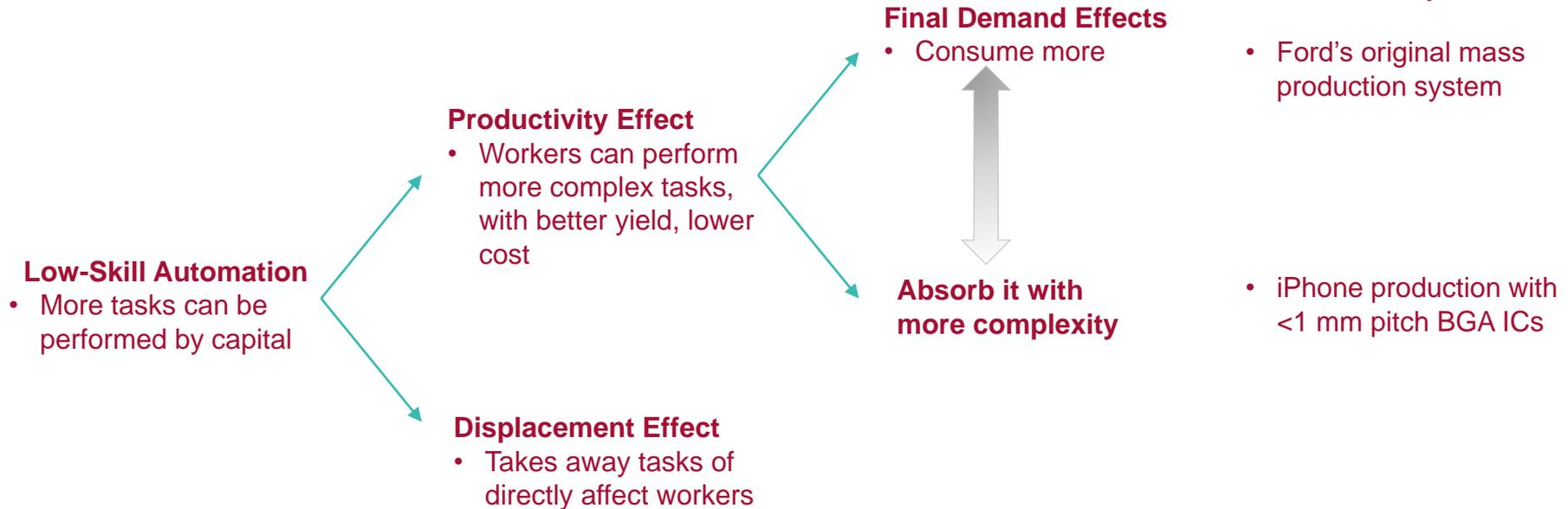
- Because of improved machine performance thanks to the embodiment of more advanced capabilities?

Employment share by skill level



Tüzemen, Didem, and Jonathan Willis. "The vanishing middle: Job polarization and workers' response to the decline in middle-skill jobs." *Economic Review-Federal Reserve Bank of Kansas City* (2013): 5.

Displacement Effect vs. Productivity Effect



Acemoglu, Daron, and Pascual Restrepo. "Low-skill and high-skill automation." *Journal of Human Capital* 12, no. 2 (2018): 204-232.

Productivity effect

- Technology has enabled direct input from worker to ERP systems, billing systems
- Displacement effect in the middle skills area?



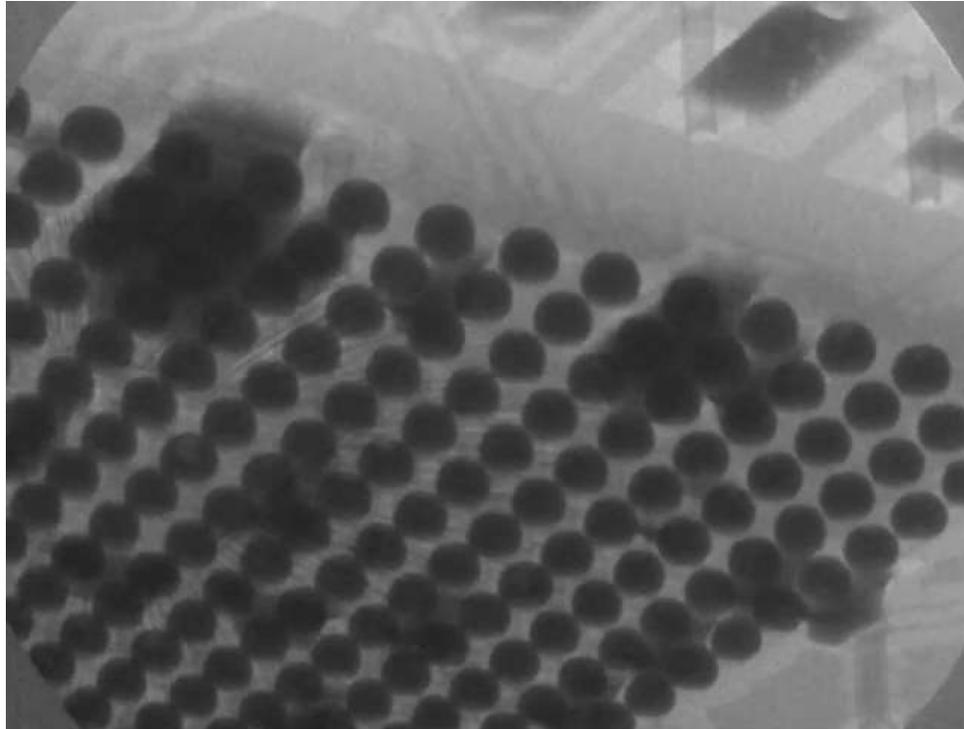
More demand elsewhere in the value chain?



- Daron Acemoğlu's novel labor-generating tasks?

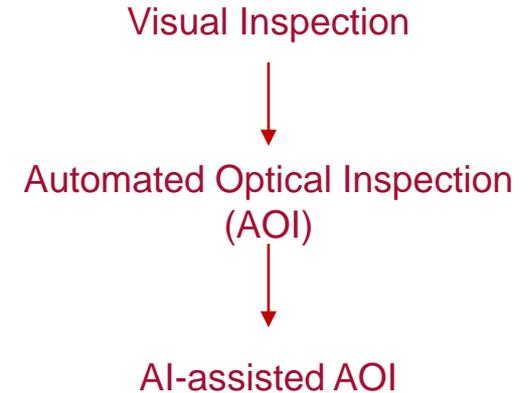
More complex tasks

Technology increases our leverage



Electronics Assembly (Low-skill)

- Denser packaging, more complex chips with fine pitch interconnect



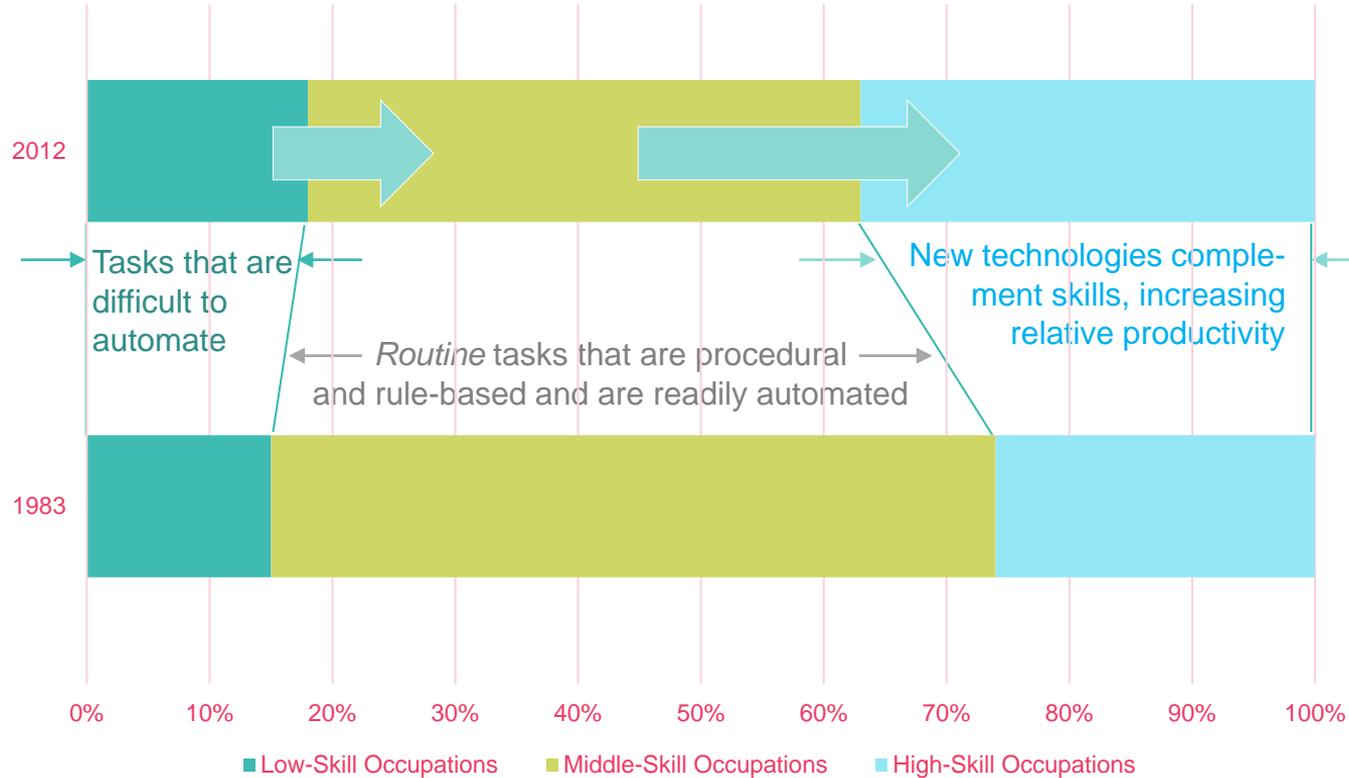
“Enabling Technology”

Rising abstraction is enabling productivity leaps



- Videogames and touch-screen interfaces on phones have decreased training barriers
- Complex tasks are much more accessible
 - Gamification

Encroachment?



Is part of the productivity effect enabling low-skill encroachment on middle-skills, or middle on high?

Tüzemen, Didem, and Jonathan Willis. "The vanishing middle: Job polarization and workers' response to the decline in middle-skill jobs." *Economic Review-Federal Reserve Bank of Kansas City* (2013): 5.

Employment augmenting but labor share displacing?

Automation → Replacing Technology

- Direct effect is reduced labor inputs
 - Indirect effect is offsetting gains in downstream segments
- + Aggregate growth in real value-added and final demand



Autor, David, and Anna Salomons. "Is Automation Labor Share-Displacing? Productivity Growth, Employment, and the Labor Share." *Brookings Papers on Economic Activity* 2018, no. 1 (2018): 1-87.



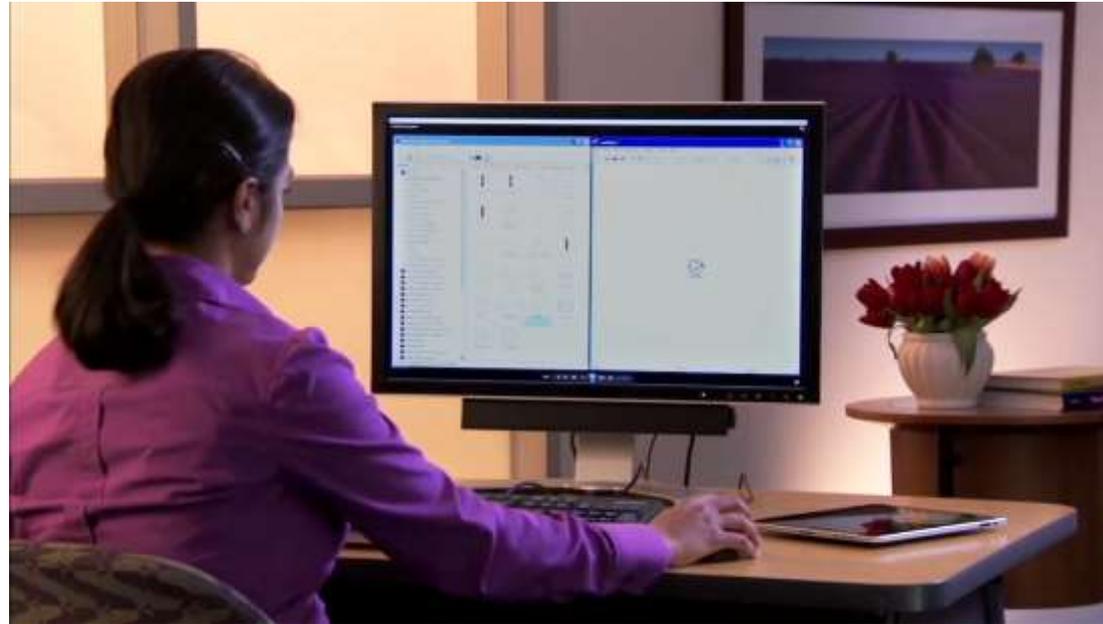
待裁剪区

检验区

Raising the Level of Abstraction

One of the stories in high-skill automation

- Much more capabilities to designers, system architects
- Should make skill-based technological change more accessible to people on all skill levels

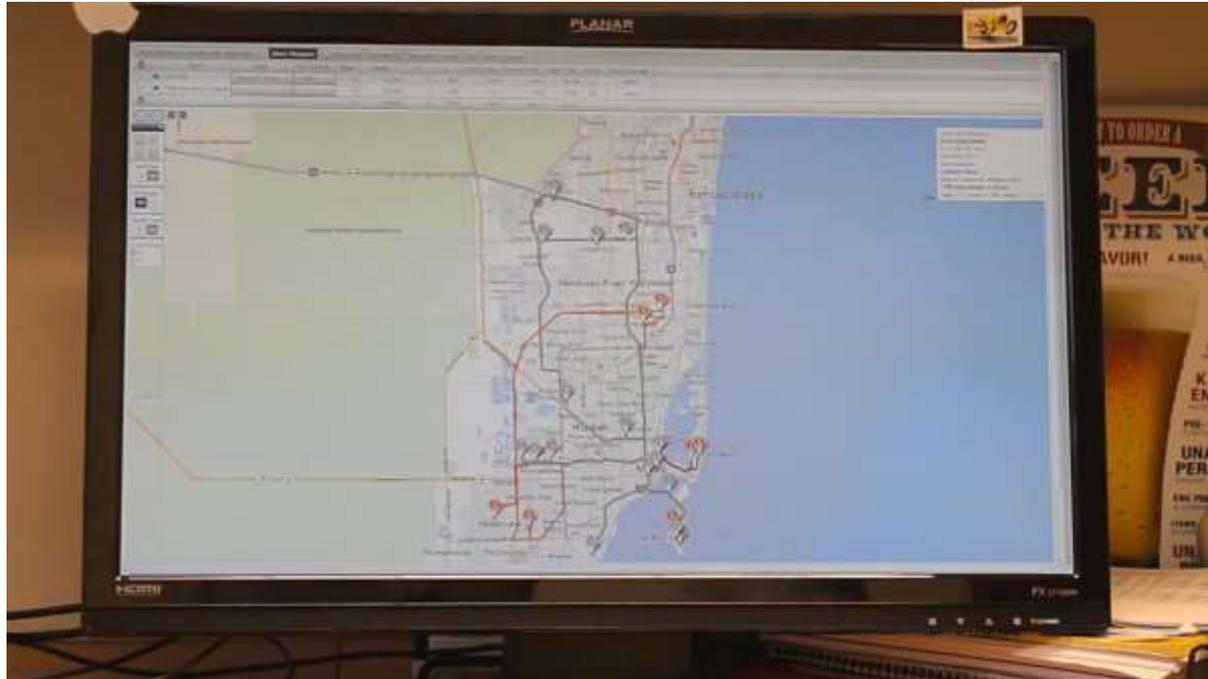


A more optimistic view ...

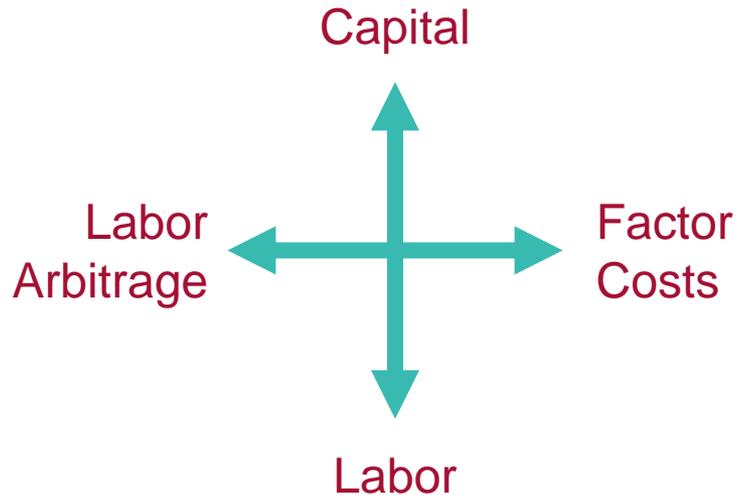
Productivity effect

- Absorbed by more demand, more complexity

Displacement effect is partly a move “up-market”



A complex dynamic



- Managerial assumptions on capital/labor substitution still (constantly) adjusting
- But many new technologies aren't really “substitutions” *per se*, as they represent something beyond human capabilities

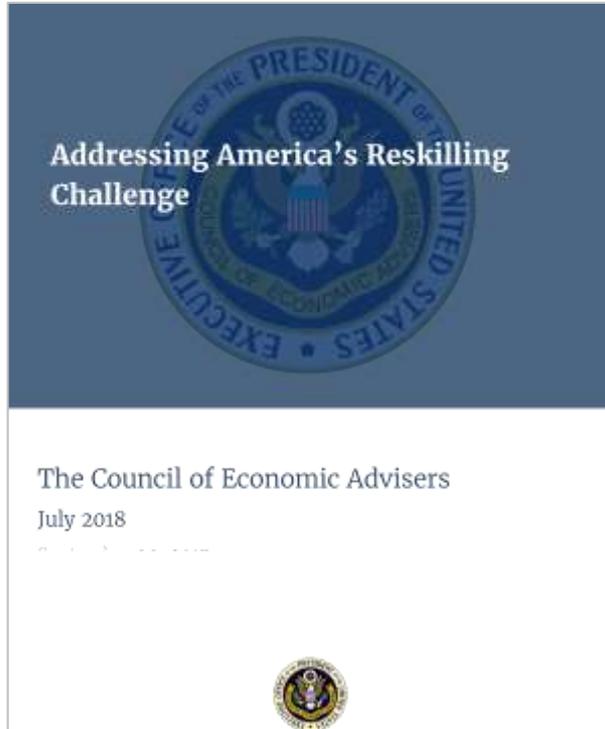
Rethinking Retraining

- Given the displacement effect, are we thinking the right way about retraining?
- Conventional wisdom on retraining older workers is they are too old or set in their ways to learn new things and update their skills



We tend to conflate proposals for retraining older workers with the ways in which we prepare high school graduates for direct entry into the workforce

Rethinking Retraining



- Investment in skill development in the United States is largely “front-loaded” during the first 25 years of life, after which public contributions to formal education are substantially smaller
- Is this really the best way to handle displacement?

