Will Automation *Displace* Workers?

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Automation: Routine replacing technological change?
… or complement to skilled workers?
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?


Tasks that are difficult to automate

Routine tasks that are procedural and rule-based and are readily automated

New technologies complement skills, increasing relative productivity

Employment share by skill level

- Low-Skill Occupations
- Middle-Skill Occupations
- High-Skill Occupations

Displacement Effect vs. Productivity Effect

Low-Skill Automation
• More tasks can be performed by capital

Displacement Effect
• Takes away tasks of directly affect workers

Productivity Effect
• Workers can perform more complex tasks, with better yield, lower cost

Final Demand Effects
• Consume more
• Absorb it with more complexity

Examples
• Ford’s original mass production system
• iPhone production with <1 mm pitch BGA ICs

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

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Visual Inspection
↓
Automated Optical Inspection (AOI)
↓
AI-assisted AOI
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“*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?

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

Neck
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?