The AI Awakening: What Does It Mean for the Economy?

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We’ve crossed a key threshold

ImageNet Visual Recognition Challenge
We’ve crossed a key threshold

ImageNet Visual Recognition Challenge

Accuracy of ML system

source: The AI Index
Most of the recent progress in machine learning involves mapping from a set of inputs to a set of outputs.

**Problem solving**

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Policy challenges
Policy challenges

1. Understanding the modern productivity paradox

2. The transformation of work
Where’s the AI productivity boom?
Productivity growth has slowed everywhere
  • We are more than one decade into a slowdown in the U.S. and OECD countries

United States:
  • 1995-2004: 2.8% per year
  • 2005-2019: 1.3% per year

OECD: 29 of 30 countries saw similar-sized slowdowns after 2004
Mismasurement
Reality better than measured
Free goods: Many digital goods and services

Explosion of free digital goods

Information goods as a share of GDP
Brynjolfsson, Collis & Eggers (PNAS 2019) propose an approach to directly estimate consumer welfare by running massive online choice experiments.

1. We run incentive compatible discrete choice experiments
   • “Incentive compatible” => participants risk losing access to the good
   • Recruit a representative sample of the US internet population via online survey panel
   • Use data to estimate the consumer valuation of Facebook

2. Quantify the adjustment term to real GDP growth (GDP-B) for the contribution of Facebook

3. Run additional incentive compatible discrete choice experiments to estimate the consumer valuation of several popular digital goods
   • Instagram, Snapchat, Skype, WhatsApp, digital Maps, LinkedIn, Twitter, and Facebook
   • Conducted in a lab in the Netherlands

4. Explore the welfare gains from new goods: case study of smartphone cameras
Alternative explanations for the paradox

1. Mismeasurement
   Reality better than measured

2. Implementation and restructuring lags
   Technology requires complementary innovation
Computerization > Computers

Technology (10%)

Complementary Skills and Processes (90%)

The Productivity J-Curve

Growth Accounting

• With unmeasured intangible capital, growth accounting equation becomes:

\[ g_Y = \left( \frac{pF_K K}{Y} \right) \left( \frac{\dot{K}}{K} \right) + \left( \frac{pF_N N}{Y} \right) \left( \frac{\dot{N}}{N} \right) + \left( 1 - \frac{\lambda}{z} \right) \left( \frac{zI}{Y} \right) \left( \frac{\dot{I}}{I} \right) + \left( \frac{F_t}{F} \right) \]

• Key component is the ratio of the shadow price of investment to the purchase price of capital (details in appendix)

• Physical / marketed component may be small relative to the required investments in org change, training, etc.

Policy challenges

1. Understanding the modern productivity paradox

2. The transformation of work
How does technology affect wages?

1. Substitution
How does technology affect wages?

1. Substitution
2. Complementarities
3. Demand elasticity
4. Income elasticity
5. Supply elasticity
6. New tasks via invention and transformation

Source: Brynjolfsson and Mitchell “What can Machines Learn?” Science, 2017
Which tasks will be done by machine learning?

ML is far from AGI

We create a “Suitability for Machine Learning” (SML) rubric to assess tasks

- We apply it to 2,059 Detailed Work Activities in O*NET, 18,112 occupation-specific tasks, and 950 occupations (weighted by task importance)
- Questions are rated on five-point scale from “strongly disagree” to “strongly agree”
- Each DWA is scored by 10 different people
Sample Tasks (out of 27 tasks):

1. Provide advice on types or quantities of radiology equipment needed to maintain facilities.
2. Perform interventional procedures such as image-guided biopsy, percutaneous transluminal angioplasty, transhepatic biliary drainage, or nephrostomy catheter placement.
3. Administer or maintain conscious sedation during and after procedures.
4. Interpret images using computer-aided detection or diagnosis systems.
5. Develop treatment plans for radiology patients.
6. Treat malignant internal or external growths by exposure to radiation from radiographs (x-rays), high energy sources, or natural or synthetic radioisotopes.
7. Conduct physical examinations to inform decisions about appropriate procedures.
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Total wage value of high SML, high measurability activities is $713 Billion in the United States

Method: Take the task weights supplied by O*NET and multiply them by the occupational wage.

• This is the wage attributable to the task
• Calculate the average wage attributable to the task over occupations
• Sum the wage bill attributable to the task over all occupations
  • This is the total wage bill in a given task (or activity)

Also calculate the high SML wage value, job-specific wage value

• High SML, High Measurability wage value: wage attributable to SML Tasks that are >90th Percentile and >4 Measurability
  • This total is $713 billion
• Job-specific low SML wage proportion: (Value of low SML Activity in Job / Value of those Activities in overall economy)
Good News, but Also Challenges

Digital progress makes the economic pie bigger. But there is no economic law that everyone, or even most people, will benefit.
ML will affect all groups, but especially lower wage workers

Regression of SML on Wages
Slope: -0.0034, t-stat: 18.5
Regions vary in ML exposure

SML Standardized Score by Metro Area
The New Grand Challenge

- Digital technologies will continue to accelerate
- Our skills, organizations and institutions are lagging
- Business as usual won’t solve this problem

How can we reinvent our economy and society to keep up with accelerating technology?

- New Metrics
- New Skills
- New Business Processes
- New Institutions
To Learn More:

AI & Future of Work Resources:  
https://digitaleconomylab.stanford.edu/AIfowResources

Measuring the Economy:  
https://www.measuringtheeconomy.org/

Stanford Digital Economy Lab:  
https://digitaleconomy.stanford.edu/

Erik Brynjolfsson:  
https://www.brynjolfsson.com/