CS440/ECE448 Lecture 33: The Future of Work

Mark Hasegawa-Johnson

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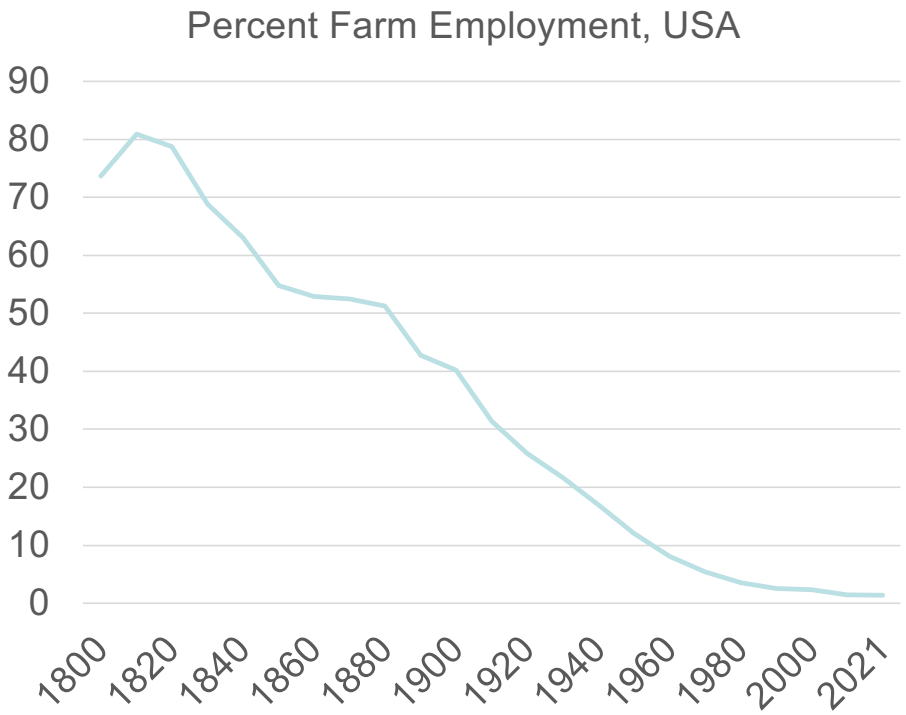
Outline

- The history of work
- AI-Human collaboration and the future of work
- Income inequality
- FlexTime and Universal basic income
- Say’s Law

Percentage of the labor market employed on farms, USA, 1800-2025

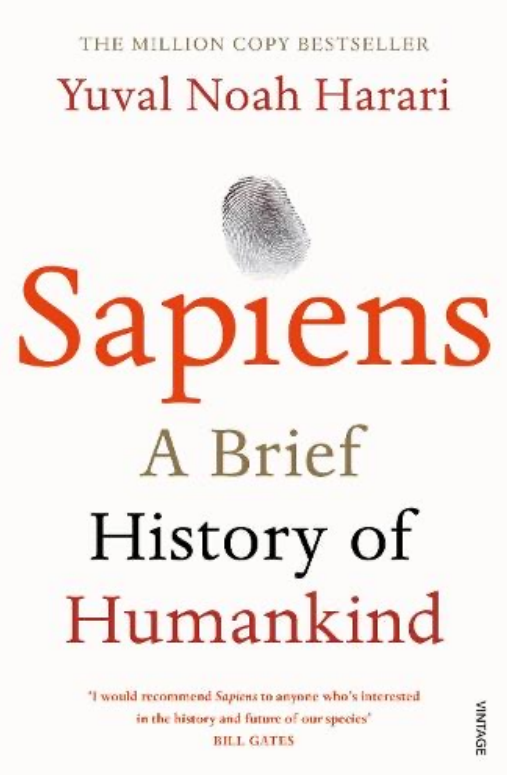
- From 9000BCE until 1880, more than half of all people worked on farms
- In 2025, 1.4% of people in the USA work in farming, forestry, or mining



Stanley Lebergott, "Labor Force and Employment, 1800-1960," 1966

A brief history of humankind

- **<u>100,000–10,000ya: Hunters & Gatherers</u>**
  - If hungry: go to nearest bush, pick fruit
  - World population: 10,000
- **<u>10,000–100ya: Farmers</u>**
  - If hungry: plant, water, weed, harvest, store, cook
  - World population: 10,000,000
- **<u>100ya – now: Employers & Employees</u>**
  - If hungry: work, earn money, buy food
  - World population: 10,000,000,000



Brief history of work

- “Work” meaning “employment” is a recent invention: about 150 years old
- It need not be what it currently is.

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Mina Lee, Percy Liang and Qian Yang, “Co-Author: Designing a Human-AI Collaborative Writing Dataset for Exploring Language Model Capabilities,” CHI 2022

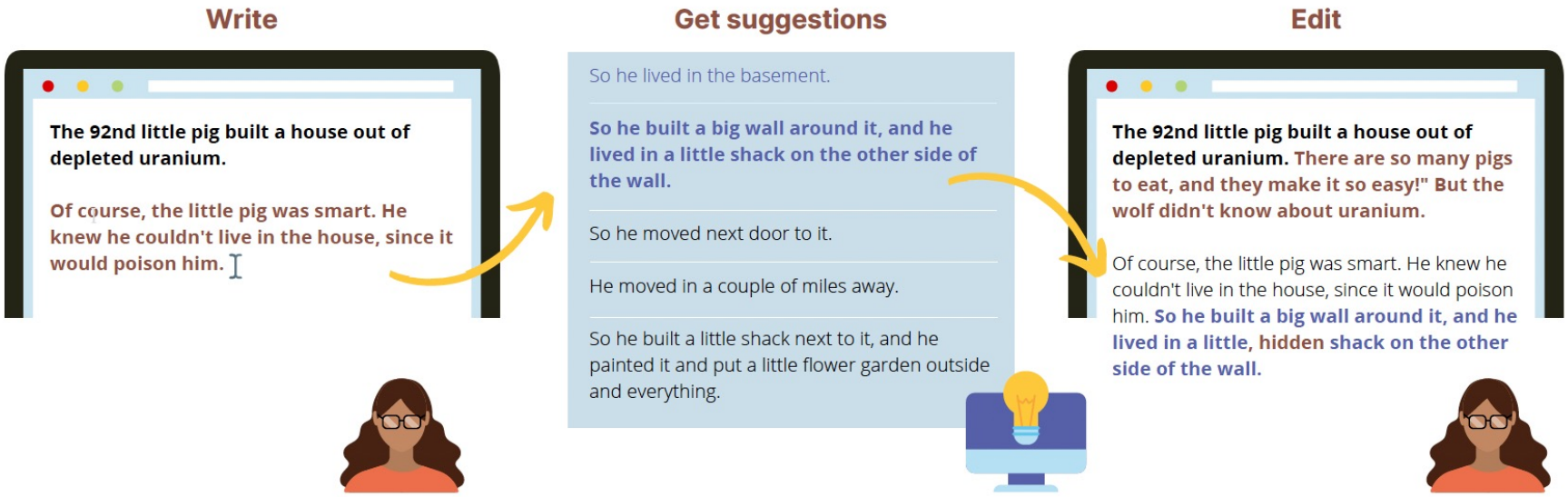

Figure 1: We present CoAuthor, a dataset designed for revealing GPT-3’s generative capabilities for interactive writing. It contains rich interactions between 63 writers and 4 instances of GPT-3 across 1445 writing sessions. Each session starts with a prompt (black text). Writers then freely write (brown), request suggestions from GPT-3 (blue), accept or dismiss suggestions, and edit accepted suggestions or previous texts in any order they choose.

EDUCATION AND SKILLS

4 ways to enhance human-AI collaboration in the workplace

Jan 13, 2025

When is collaboration useful?

If human > AI, then collab is better than either alone.

- Human can tell when the AI's contribution is useful
- Example: most creative tasks, but not all

If AI > human, then AI > collab.

- Human contributes badly-motivated biases
- Example: many decision tasks, but not all

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When combinations of humans and AI are useful: A systematic review and meta-analysis

Michelle Vaccaro, Abdullah Almaatouq & Thomas Malone ✉

Nature Human Behaviour **8**, 2293–2303 (2024) | Cite this article

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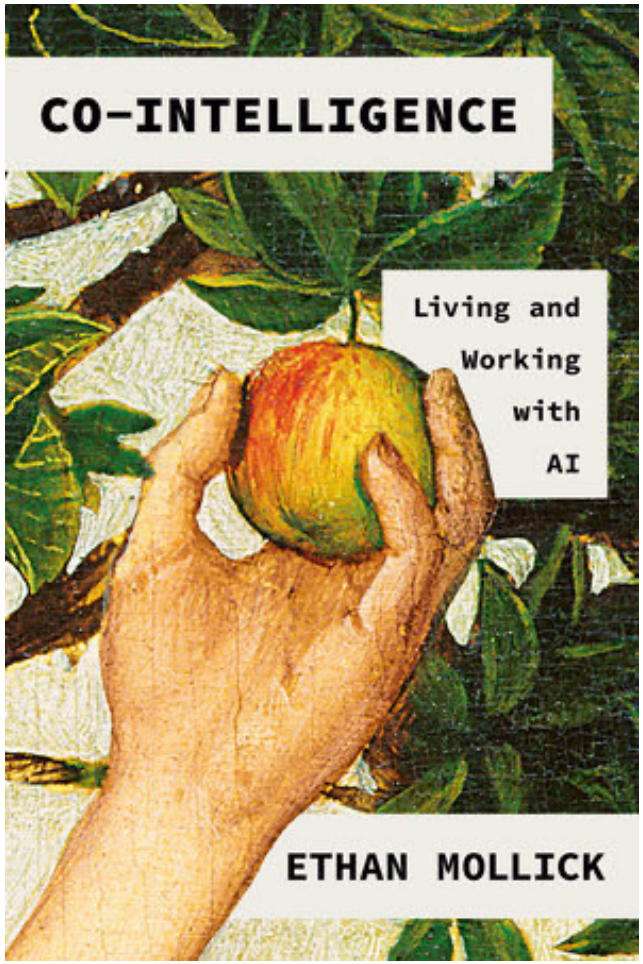
Abstract

Inspired by the increasing use of artificial intelligence (AI) to augment humans, researchers have studied human–AI systems involving different tasks, systems and populations. Despite such a large body of work, we lack a broad conceptual understanding of when combinations of humans and AI are better than either alone. Here we addressed this question by conducting a preregistered systematic review and meta-analysis of 106 experimental studies reporting 370 effect sizes. We searched an interdisciplinary set of databases (the Association for Computing Machinery Digital Library, the Web of Science and the Association for Information Systems eLibrary) for studies published between 1 January 2020 and 30 June 2023. Each study was required to include an original human-participants experiment that evaluated the performance of humans alone, AI alone and human–AI combinations. First, we found that, on average, human–AI combinations

When is collaboration useful?

In many tasks,

- Expert human > Expert+AI
- Average human < Average human+AI



How can expertise be learned?

- If ordinary humans don't outperform AI, how can expertise be learned?
- A possible strategy: Pair programming as a kind of two-way apprenticeship?

https://commons.wikimedia.org/wiki/File:Apprenticeship.jpg

https://commons.wikimedia.org/wiki/File:Wocintech_(microsoft)_-_61_(25926639341).jpg

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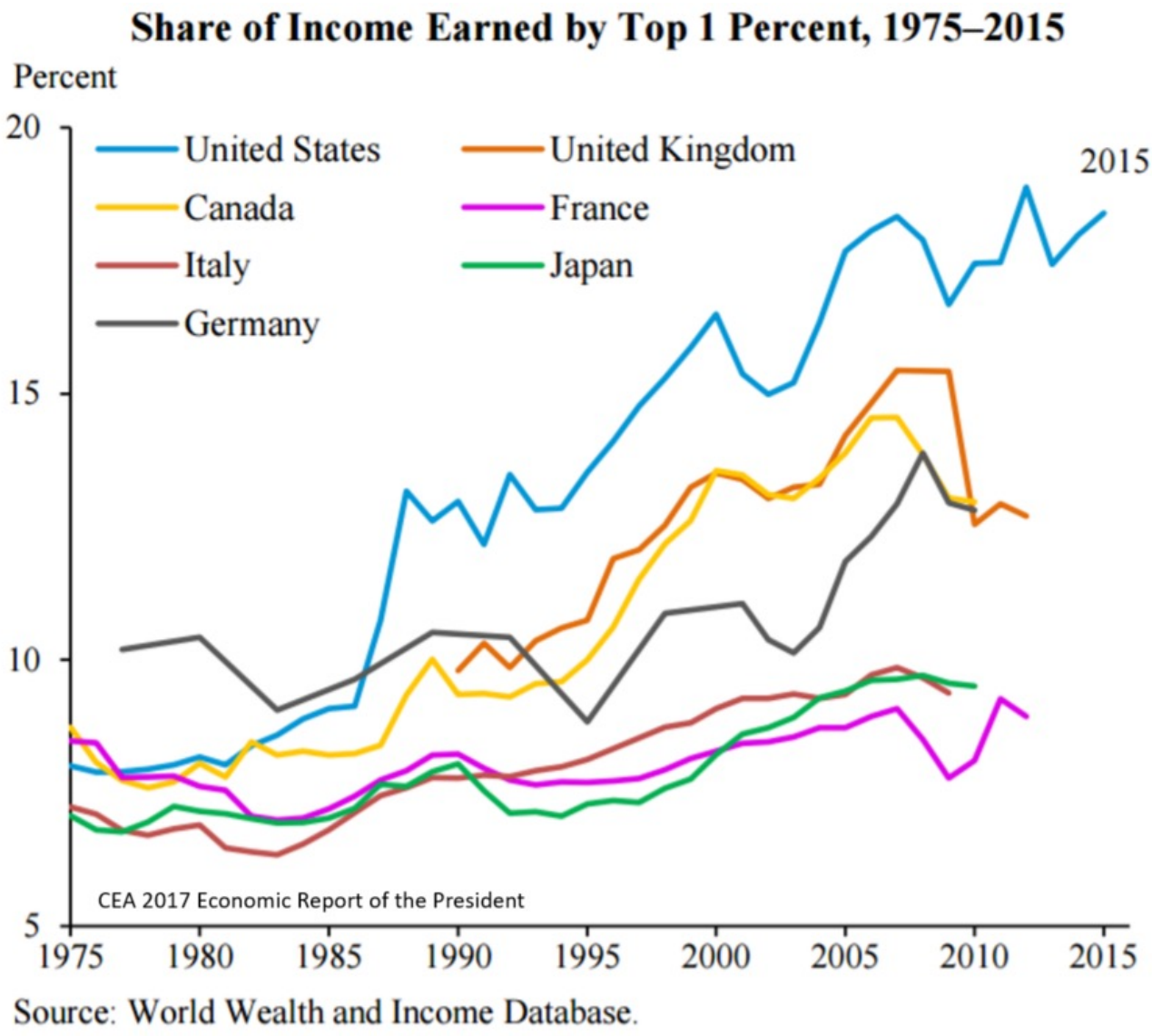
Income Inequality



Some advantages and disadvantages of income inequality

- Advantages:
  - Income concentrated in the hands of the most creative individuals tends to encourage economic growth
  - A rational agent takes risk only if (probability of success)X(possible gain)>1, so income inequality encourages people to take risks
- Disadvantages:
  - Income concentrated in the hands of non-creative individuals stifles growth
  - Inequality decreases trust in society
  - Inequality increases crime
  - Inequality is correlated with the probability of violent revolution

Relationship of AI to income inequality

- “Artificial Intelligence Has Caused A 50% To 70% Decrease In Wages—Creating Income Inequality And Threatening Millions Of Jobs.”
  - Jack Kelly, Forbes, June 2021
- “AI can reduce economic inequalities by helping small businesses compete with larger ones.”
  - Quantilus Innovation, December 2022

Call for action: Benchmarks for AI-human collaboration

“When you look at AI research, and you look at the benchmarks that are used pretty much universally, they’re all tied to matching or comparing to human performance. Benchmarks are super important to AI developers—especially for young scientists, who are entering *en masse* into AI and asking, ‘What should I work on?’”

- Katya Klinova, Technology Review, April 2022

“But benchmarks for the performance of human-machine collaborations are lacking.”

- David Rotman, Technology Review, April 2022

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Flextime—the New Work Schedule?

*By Edgar T. Busch**

In this article the author discusses flextime, an alternative to today's working conditions. Flextime is a developing trend and one which is being tried in some work—most notably in West Germany. [Reprinted from the December 1973 issue of the U.S. Army Audit Agency Pamphlet.]

The CPA Journal 44:57, 1974,
https://www.proquest.com/docview/214923720

4-Day Week

“Netherlands is among the nations with the shortest work weeks, according to *CNN Money*. Netherlands has an average of 29 working hours per week and an average annual income amounting to $47,000.” – https://nltimes.nl/2013/07/11/worlds-shortest-work-weeks

Universal basic income

- In “Utopia,” Thomas More’s imaginary country, theft is abolished by giving every citizen enough to eat.
- Philosophers including Thomas Paine and Bertrand Russell wrote about UBI.
- William Beveridge was perhaps the first economist to support it; it then became popular in the United States during discussions of Lyndon Johnson’s “New Deal”

Utopia by Thomas More. Transferred from it.wikipedia by User:Marcok., Public Domain, https://commons.wikimedia.org/w/index.php?curid=3893696

Experimental tests of UBI and related ideas

https://en.wikipedia.org/wiki/Universal_basic_income

- **Health**: Residents receiving UBI are 27% less likely to get sick.
- **Work**: Residents receiving negative income tax are slightly disincentivized to work, e.g., one study showed that those receiving negative income tax worked 5% fewer hours.

- "Negative income tax" = a type of unemployment insurance, i.e., paid only to people without income.

Try the quiz!

Try the quiz!

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The Luddites

- The Luddites were craftsman weavers who lost work because of new weaving factories.
- They organized a secret army to smash factory looms.

https://commons.wikimedia.org/wiki/File:Blue_Plaque_for_Westhoughton_Mill.JPG

Say's Law

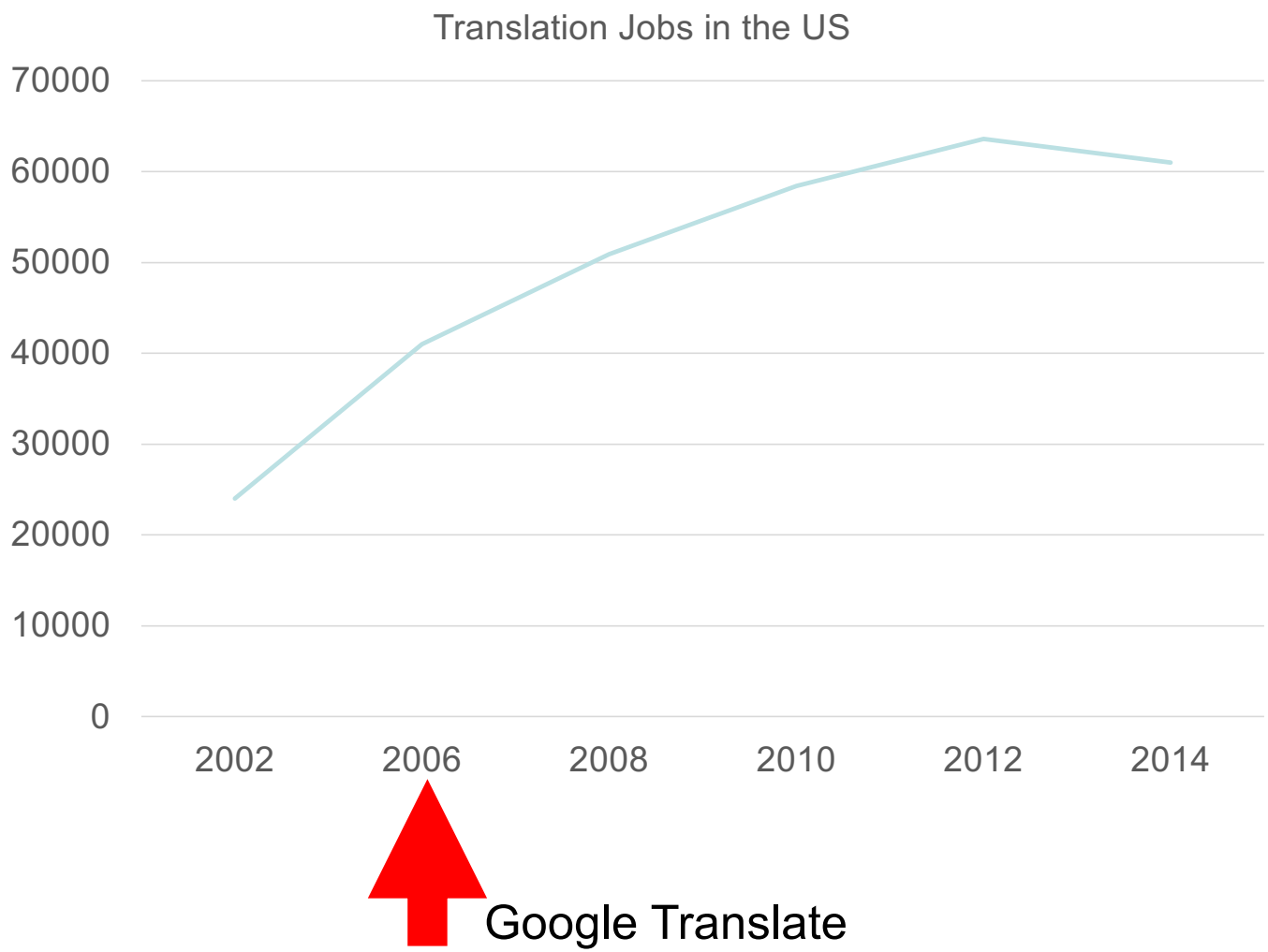
A product is no sooner created, than it, from that instant, affords a market for other products to the full extent of its own value. – Jean-Baptiste Say, 1834

https://commons.wikimedia.org/wiki/File:Jean-baptiste_Say.jpg

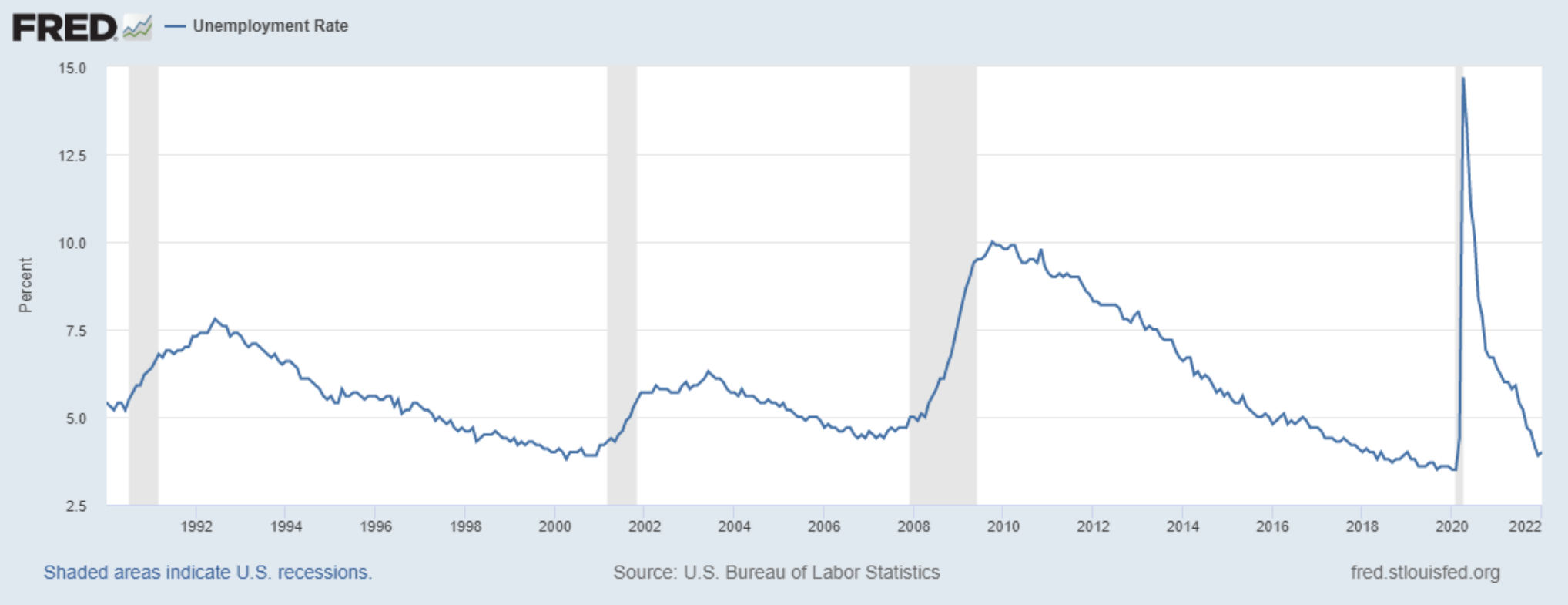
Technological Unemployment vs. Say's Law

- Technological unemployment results when a new machine puts people out of work.
- Say's Law introduced the idea that the efficiency of the new machine creates the opportunity for new products that will employ people in new jobs.

- `Labor-saving' technologies can, in some cases, result in a significant increase in the number of available jobs.
- Example: Google Translate.
- Data from Tamara Cabrera, "The Translating and Interpreting Industry in the United States," 2014



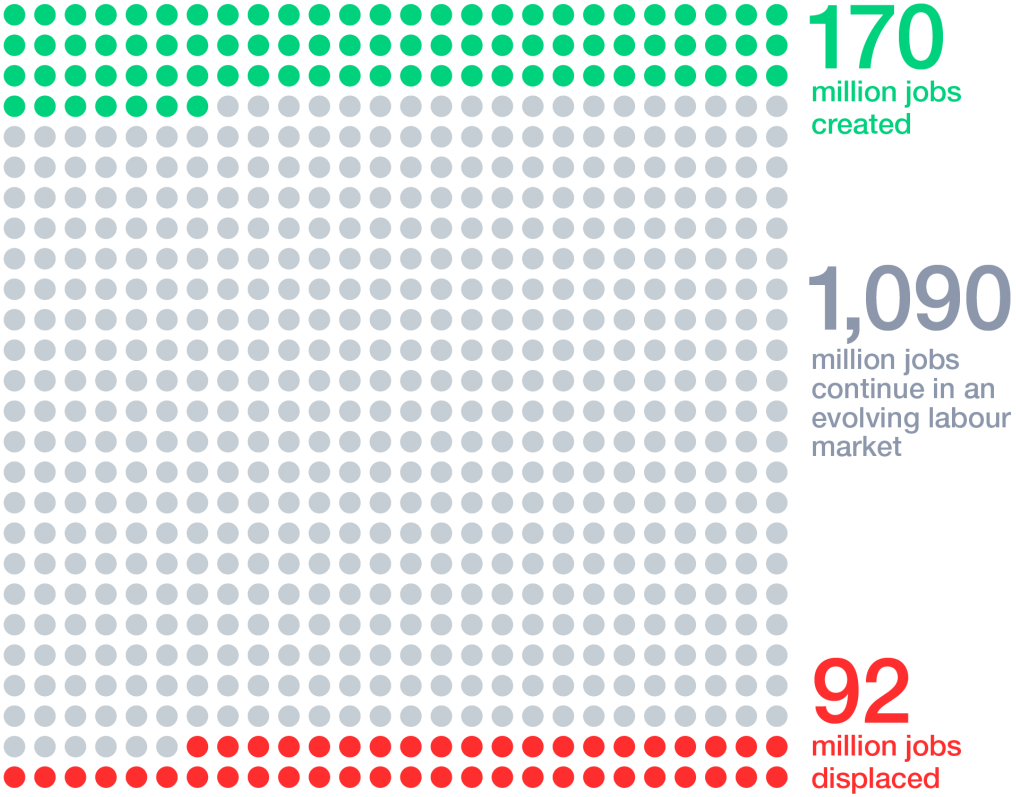
The cost of Say's law: The economic cycle



US Unemployment rate, January 1990 to December 2022. Public domain image, https://fred.stlouisfed.org/graph/?g=FfBh

Future of Jobs Report 2025

Total job growth and loss



Source: World Economic Forum. (2025). *Future of Jobs Report 2025*.

What new jobs will be created?

WEF predicts increased employment by 2030 in these occupations:

1. Farmers
2. Delivery drivers
3. Software developers
4. Builders
5. Salespeople
6. Food processing
7. Nursing & social work