LARGE LANGUAGE MODELS AND LABOR MARKETS

AN ECONOMIC PERSPECTIVE

INTRODUCTIONS

WHO AM I?

- I'm Prof. Engle. I joined the economics department last fall!
- I did my undergrad at Davidson College, where I studied Classics and Mathematics, while also taking lots of Economics and Music courses.

WHO ARE YOU?

- Please share your name and a little bit about your interest in this class and what you hope to learn!

WHAT IS LABOR ECONOMICS?

Labor economists study questions like (but not limited to!):

- How do educational opportunities influence occupational choice and wages?
- What is the best way to design unemployment insurance?
- Which policies show the most promise for reducing labor market disparities?

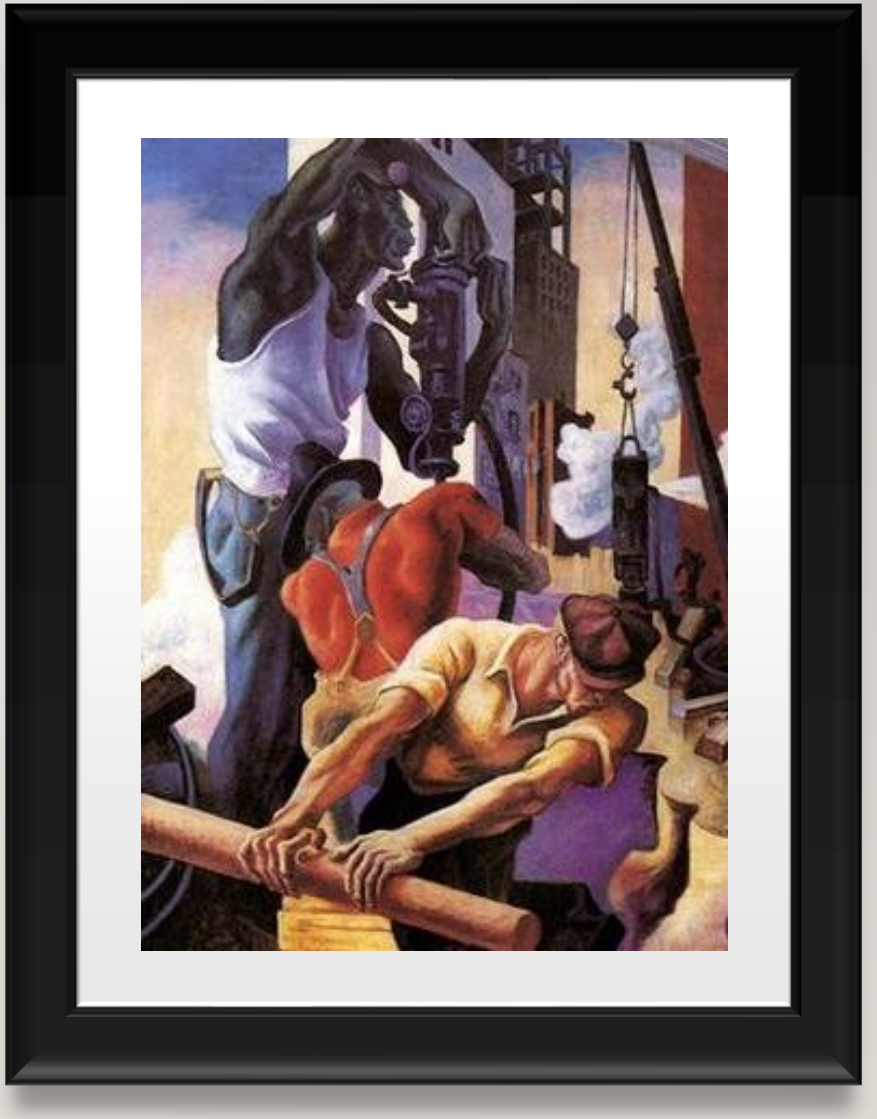


Image: Thomas Hart Benton, *City Building*

MY QUESTION FOR TODAY

- How might LLMs affect the labor market?
  - Do LLMs destroy jobs?
  - Do LLMs create jobs?
  - Whose jobs might be created or destroyed?
- Economics is not the only discipline that can address these questions! I'll be providing one lens through which to see these questions, which will have its own strengths and weaknesses. One beauty of the liberal arts is the opportunity to bring these many perspectives into conversation with one another.

DO LLMS DESTROY JOBS?

Production; substitutes and complements; tasks; and screenwriters

HOLLYWOOD SCREENWRITERS' GUILD STRIKE

Image: New York Times

A DAY IN THE LIFE: JOB TASKS AND LLMS

- Group 1: Journalist
- Group 2: Software Developer
- Group 3: Paralegal
- Group 4: Teacher
- Group 5: Real Estate Agent
- Group 6: Medical Billing Specialist

- Create a list of tasks in this profession. Try to capture all parts of the day-to-day work of the job! Use search tools as needed.
- Is each task:
  - Hard for LLMs to replace?
  - Easy for LLMs to replace?
  - Improved by LLMs?
  - Unrelated to LLMs?

DO LLMS CREATE JOBS?

Opportunity cost; creative destruction; and horses

A BRIEF HISTORY OF ECONOMIC THOUGHT

Thomas Malthus (1766-1834)

- The "Malthusian trap" – people produce more food, improving standards of living, but then produce more people, returning standards of living to where they were or even making them worse
- Hypothesized that technology can therefore never produce meaningful changes in the standard of living

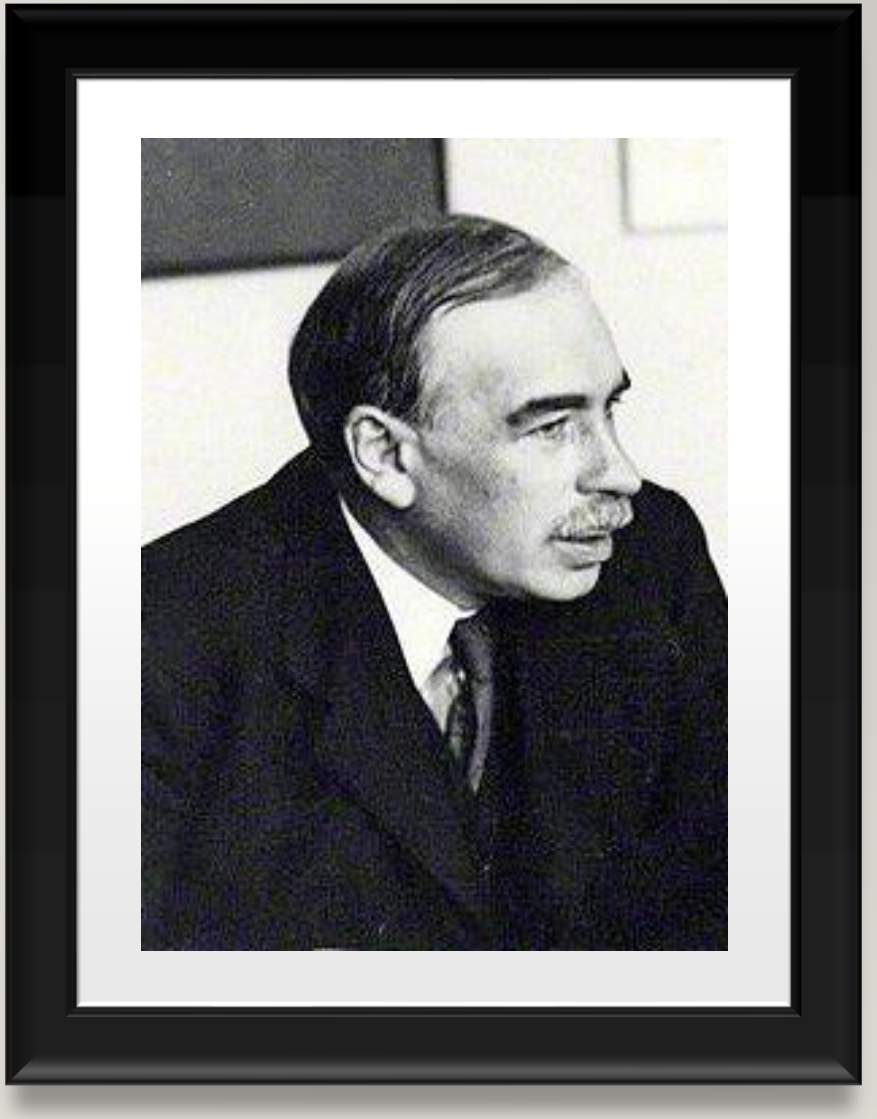
Image: Wikimedia Commons

A BRIEF HISTORY OF ECONOMIC THOUGHT

John Maynard Keynes (1883-1946)

- "Technological unemployment" – technology will allow us to produce everything we need with mostly capital and very little labor
- Hypothesized that labor-saving technology would remove the need for work almost entirely

Image: Wikimedia Commons



A BRIEF HISTORY OF ECONOMIC THOUGHT

Joseph Schumpeter (1883-1950)

- "Creative destruction" – technology and competition destroying some jobs makes way for other jobs and innovations that can't be foreseen
- Hypothesized that … it's difficult to hypothesize

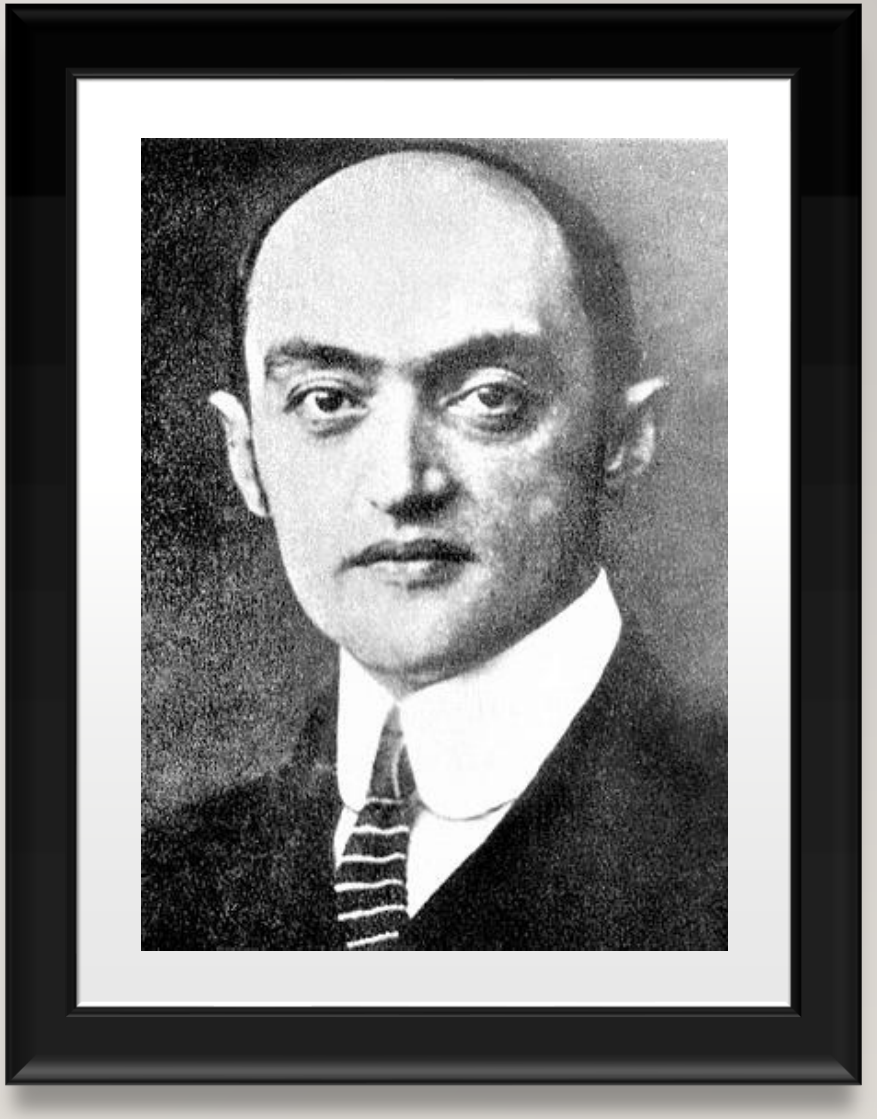


Image: Wikimedia Commons

OPPORTUNITY COST

- The cost of an activity is the value of what you aren't doing instead.
  - What aren't you doing because you're in class right now?
  - What would you be doing if you weren't a Mac student?
- While the production activities (i.e., jobs) people are engaged in right now are valuable, that doesn't mean there aren't other valuable things they could be doing!
- Innovation may come along with the opportunity to do something else.

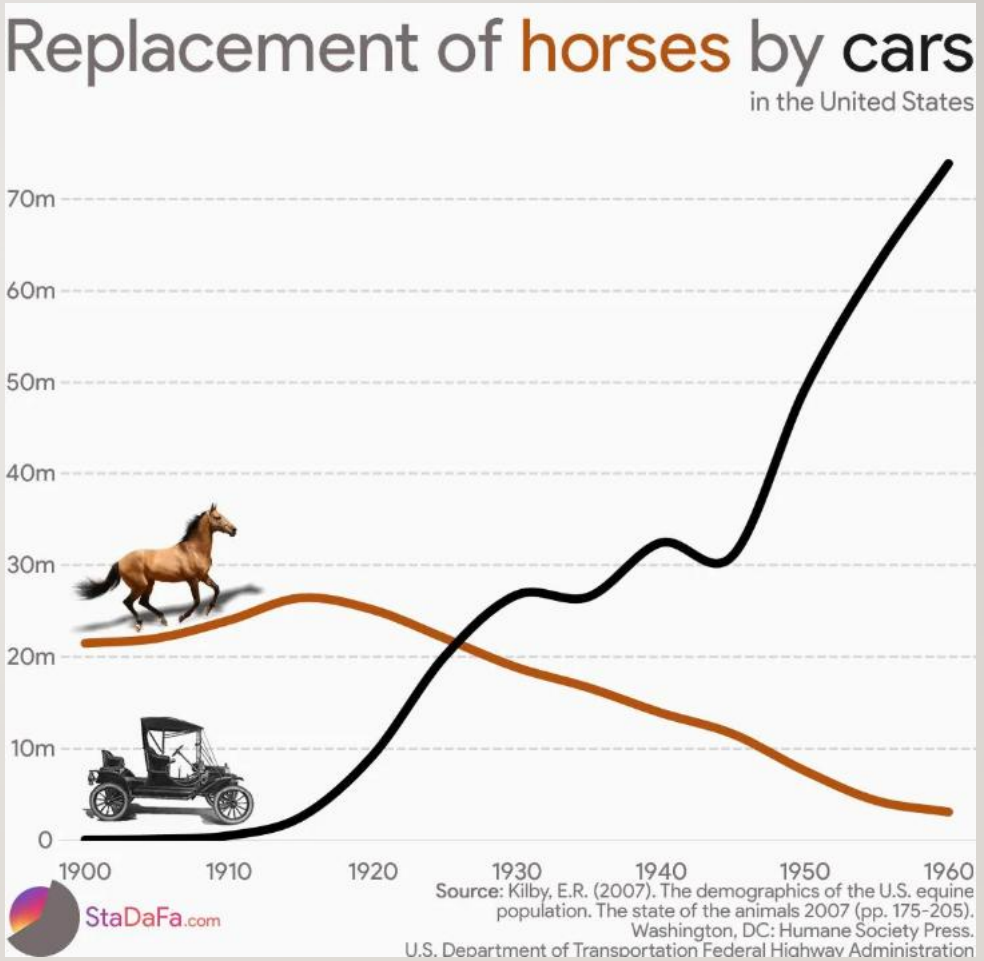
WHAT IS THE DIFFERENCE?

VS.

VS.

HORSE VS. CAR

Once horses cease to be the dominant mode of transportation, there's not a lot else for them to do.



TELLERS VS. ATMS

As ATMs rise, tellers switch into "relationship banking" roles; banks can expand their offerings to customers now that they can take advantage of tellers' specialized knowledge rather than having them count money all the time.

Source: Bessen (2015)

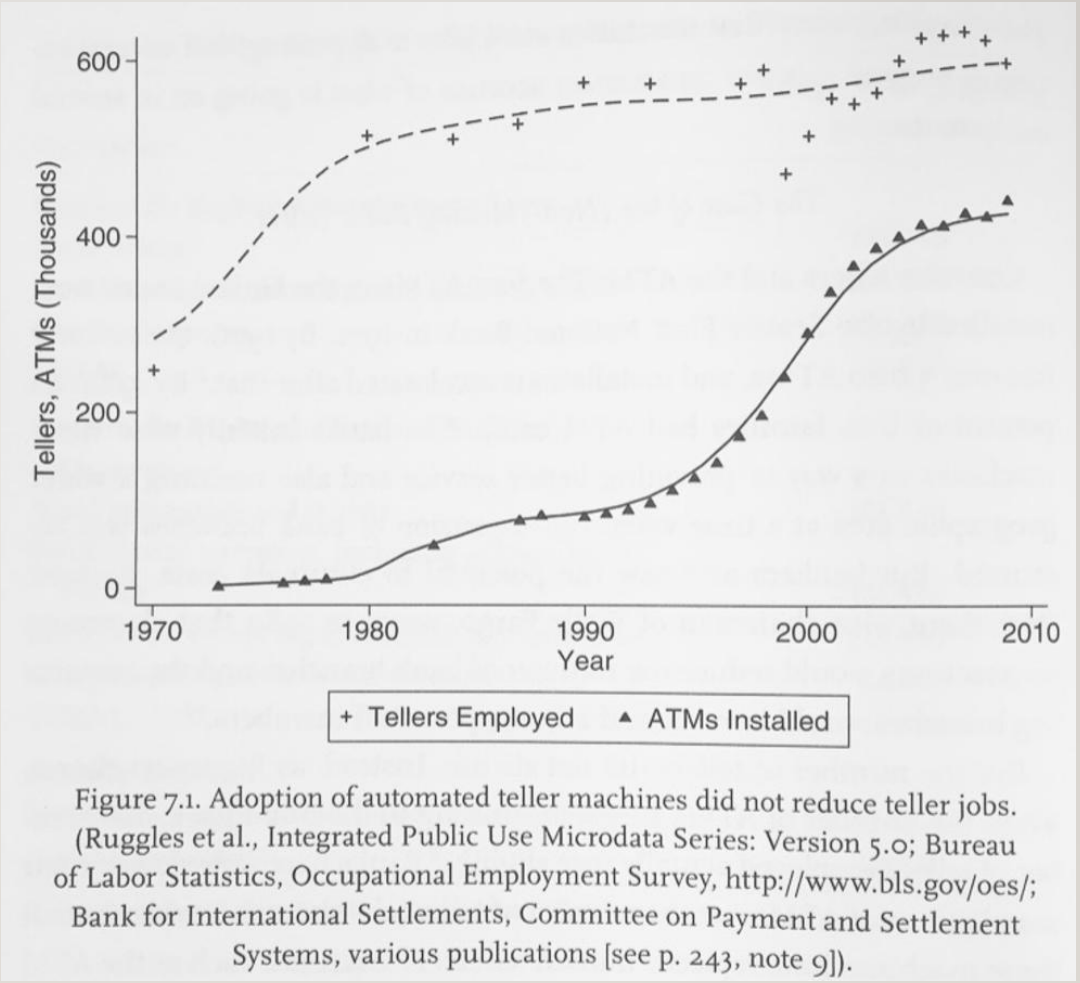


Figure 7.1. Adoption of automated teller machines did not reduce teller jobs. (Ruggles et al., Integrated Public Use Microdata Series: Version 5.0; Bureau of Labor Statistics, Occupational Employment Survey, http://www.bls.gov/oes/; Bank for International Settlements, Committee on Payment and Settlement Systems, various publications [see p. 243, note 9]).

A NEW DAY IN THE LIFE: JOB TASKS AND LLMS

- Group 1: Journalist
- Group 2: Software Developer
- Group 3: Paralegal
- Group 4: Teacher
- Group 5: Real Estate Agent
- Group 6: Medical Billing Specialist

- For your group's job, consider which tasks are likely to become more or less important, or how LLMs might be integrated into the work. What would a day in the life look like now?

WHOSE JOBS ARE CREATED OR DESTROYED?

Skill-biased technological change; employment and wage polarization; and a paradox

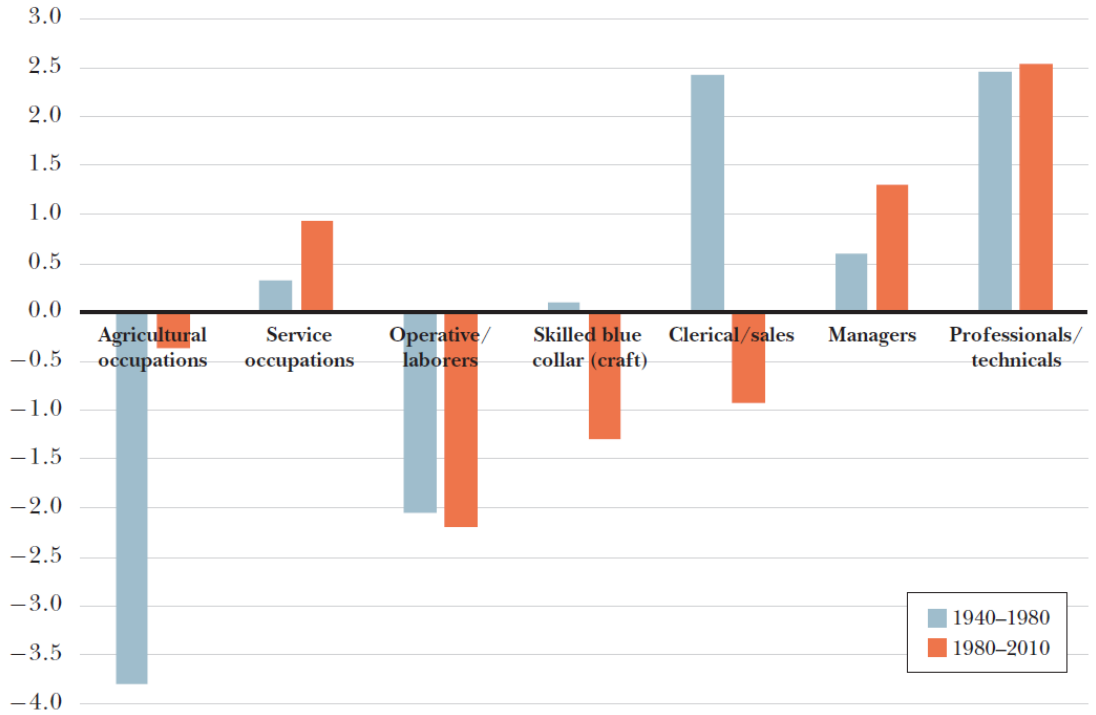
WHICH OCCUPATIONS HAVE BEEN GROWING? SHRINKING?

Technological change from 1940-2010 was large "skill-biased" – it tended to be a complement to more educated workers and a substitute to less educated workers.

Source: Autor (2015)

Figure 1

Average Change per Decade in US Occupational Employment Shares for Two Periods: 1940–1980 and 1980–2010



Source: Based on Katz and Margo (2014), table 1.6, panel A, which is based upon the 1920 through 2000 Census of population IPUMS and 2010 American Community Survey.

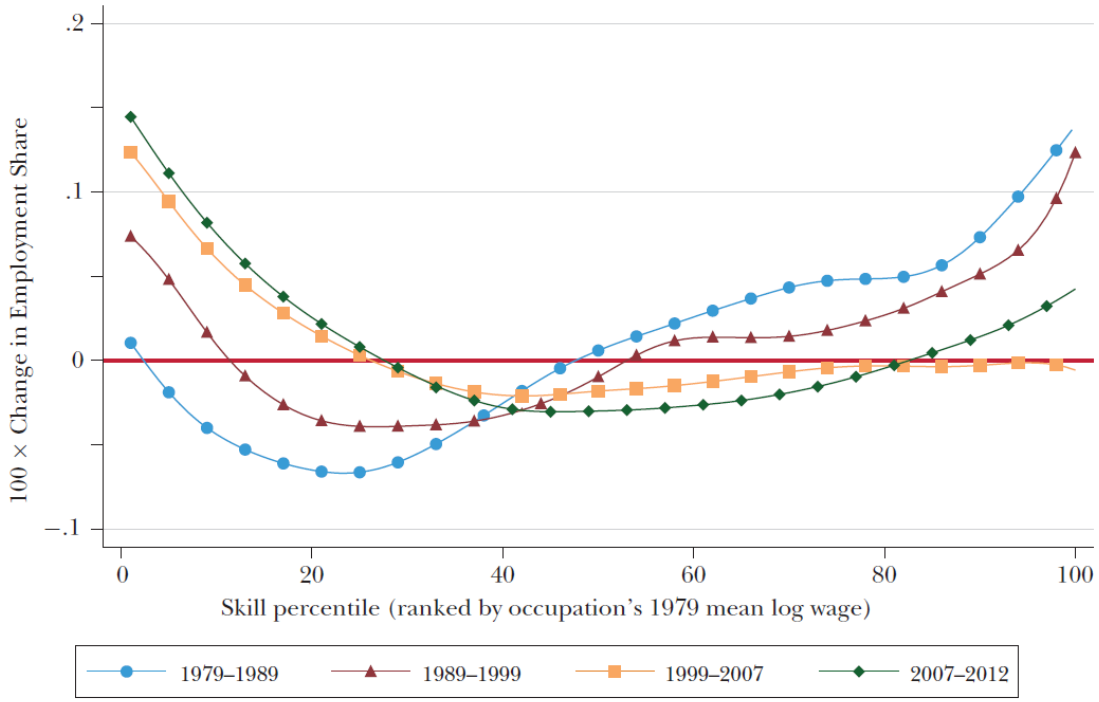
Notes: Observed long changes in US occupational employment shares over 1940–1980 and 1980–2010 are scaled by the number of intervening decades to yield average change per decade. Occupations are classified into occupational groups based on 1950 occupation codes using the consistent coding of occupations in all years into 1950 codes (the OCC1950 variable) in the IPUMS. Additional details are found in Katz and Margo (2014, p. 46).

POLARIZATION: LESS EMPLOYMENT IN MIDDLE-SKILL JOBS

More recent change has featured polarization – job growth is concentrated in high- and low-skill jobs, with declines in the middle.

Figure 5

Smoothed Employment Changes by Occupational Skill Percentile, 1979–2012



Sources: Author, calculated using 1980, 1990, and 2000 Census Integrated Public Use Microdata Series (IPUMS) files; American Community Survey combined file 2006–2008, American Community Survey 2012.
Notes: The figure plots changes in employment shares by 1980 occupational skill percentile rank using a locally weighted smoothing regression (bandwidth 0.8 with 100 observations), where skill percentiles are measured as the employment-weighted percentile rank of an occupation's mean log wage in the Census IPUMS 1980 5 percent extract. Employment in each occupation is calculated using workers' hours of annual labor supply times the Census sampling weights. Consistent occupation codes for Census years 1980, 1990, and 2000, and 2008 are from Autor and Dorn (2013).

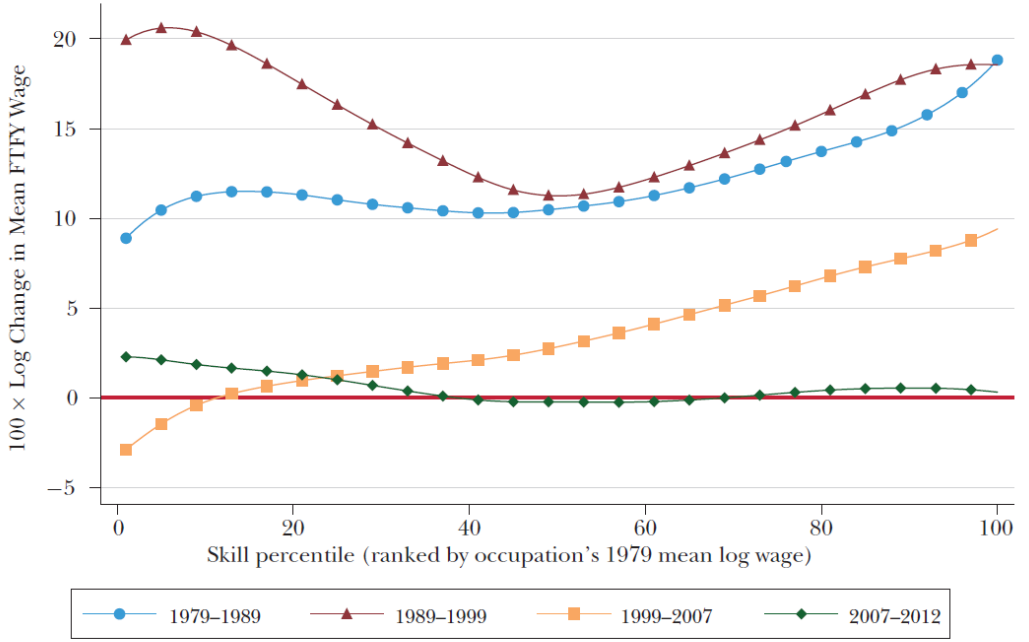
POLARIZATION: NOT JUST FOR EMPLOYMENT

Wages also rise, particularly at the top of the distribution; abstract tasks become more valuable (e.g. your decision as a CEO now affects much more production because of automation).

Figure 4

Changes in Mean Wages by Occupational Skill Percentile among Full-Time, Full-Year (FTFY) Workers, 1979–2012

(the y-axis plots 100 times log changes in employment, which is nearly equivalent to percentage points for small changes)



Sources: Author, calculated using 1980, 1990, and 2000 Census IPUMS files; American Community Survey combined file 2006–2008, American Community Survey 2012.

Notes: The figure plots changes in mean log wages over each period, by 1979 occupational skill percentile rank using a locally weighted smoothing regression (bandwidth 0.8 with 100 observations), where skill percentiles are measured as the employment-weighted percentile rank of an occupation's mean log wage in the Census IPUMS 1980 5 percent extract. The sample includes the working-age (1–64) civilian non-institutionalized population with 48+ annual weeks worked and 35+ usual weekly hours. Weekly wages are calculated as annual earnings divided by weeks worked.

POLANYI'S PARADOX

Michael Polanyi (1891-1976)

- Chemist/economist/philosopher/general polymath
- Polanyi's paradox: "we know more than we can tell"
  - A lot of things we do are beyond our own explicit understanding; we use tacit knowledge that we can't explain
  - So that will make it hard to program a machine to do things that should seem simple!

Source: Wikimedia Commons

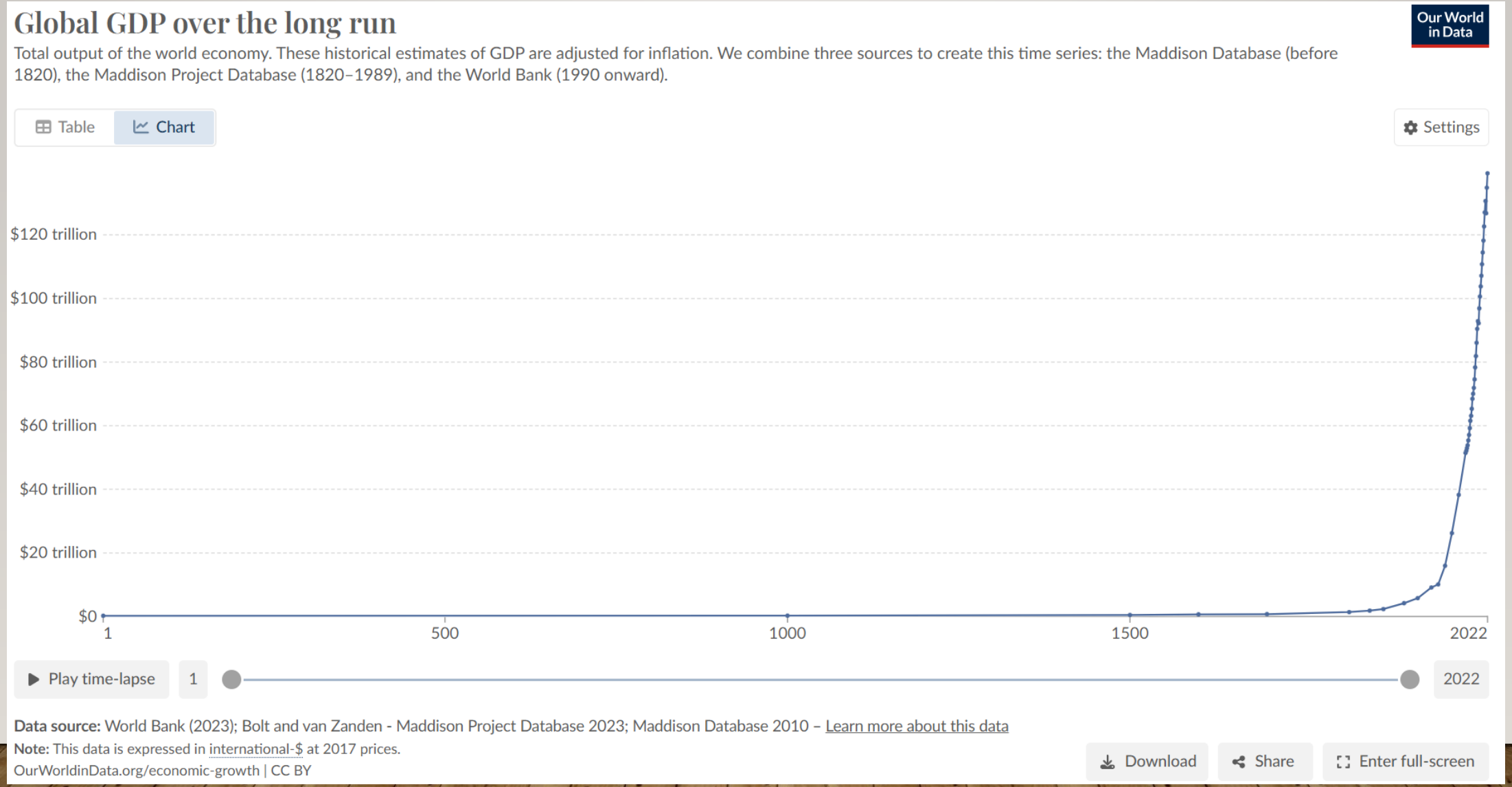
WHOSE JOBS AND WAGES WILL BE AFFECTED BY LLMS?

- With your neighbor, map out who benefits or loses from LLM adoption. Consider different:
  - Skill levels
  - Geographic locations
  - Industry sectors
  - Age groups
- What patterns do you notice? How are these the same as prior technological changes? How do they differ?

HOW ARE LLMS LIKE THESE PAST CHANGES? HOW ARE THEY DIFFERENT?

- Even if we think that LLMs are not going to end work as we know it, that doesn't mean they won't have profound impacts on the labor market.
  - The destruction of jobs
  - The change and creation of jobs
  - The change in the skills and training rewarded by the labor market
- Past changes provide some frameworks for thinking about how technological change affects the labor market, but just like Malthus and Keynes, we may find ourselves disproven by the data. And that's great! That's how our frameworks become more accurate.

ONE FINAL THOUGHT



DISCUSSION