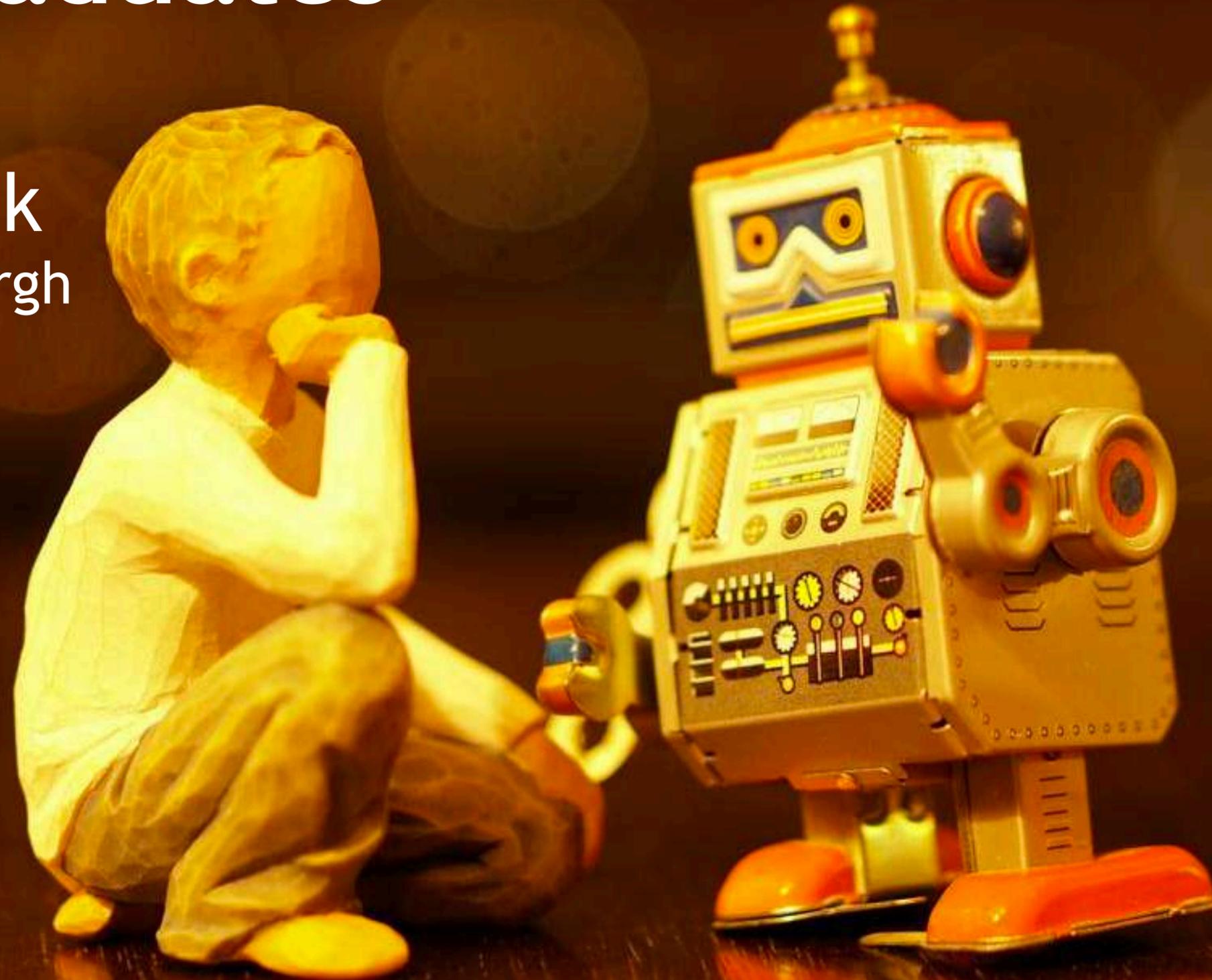


AI's Impact on the Early-Careers of College Graduates

Morgan R. Frank
University of Pittsburgh



Automation! Ahh, scary!

FORTUNE

Anthropic CEO warns AI could eliminate half of all entry-level white-collar jobs

BY CHRIS MORRIS
CONTRIBUTING WRITER

May 28, 2025 at 11:27 AM EDT



Anthropic CEO Dario Amodei is warning that AI could be a job killer.

FABRICE COFFRINI/AFP VIA GETTY IMAGES

Automation! Ahh, scary!

Finance & economics | Boy cries wolf

Why AI hasn't taken your job

And any jobs-pocalypse seems a long way off



PHOTOGRAPH: GETTY IMAGES

May 26th 2025 | SAN FRANCISCO

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FORTUNE

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1/20/2023

The AI Threat for Coding Jobs Is Becoming Clearer

Satya Nadella, chief executive officer of Microsoft Corp., speaks during an event commemorating the 50th anniversary of the company at Microsoft headquarters in Redmond, Washington, US, on Friday, April 4, 2025. *Photographer: David Ryder/Bloomberg*

By [Walter Frick](#)
May 18, 2025 at 3:00 AM CDT

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Newsletters

The Atlantic

How ChatGPT Will Destabilize White-Collar Work

No technology in modern memory has caused mass job loss among highly educated workers. Will generative AI be an exception?



3/18/2023

The New York Times

Goodbye, \$165,000 Tech Jobs. Student Coders Seek Work at Chipotle.

As companies like Amazon and Microsoft lay off workers and embrace A.I. coding tools, computer science graduates say they're struggling to land tech jobs.

By [Natasha Singer](#)
Natasha Singer covers tech companies and their social impacts.
Published Aug. 10, 2025 Updated Aug. 14, 2025

A photograph of a young woman with dark hair, wearing a white t-shirt and a dark skirt, standing in front of a brick building with arched windows and a set of stairs.

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ChatGPT is the Myspace of AI: It's fun, but it's far from taking your white-collar job

Automation! Ahh, scary!

So should we be worried?

A decade of studies estimate AI exposure.

Can we resolve this uncertainty?

The problem:

We lack data on job loss, and

We need data on careers.

The AI Threat for Coding Jobs Is Becoming Clearer

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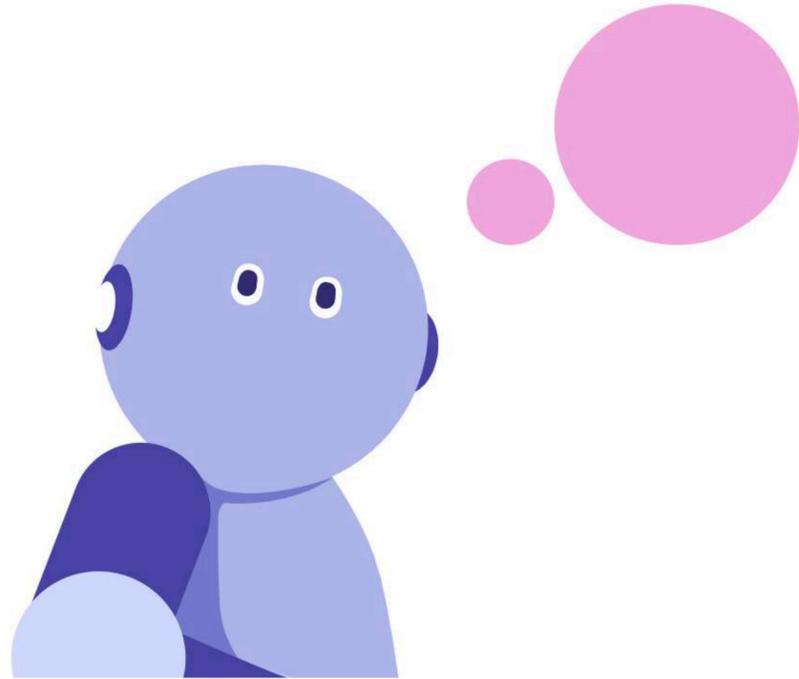
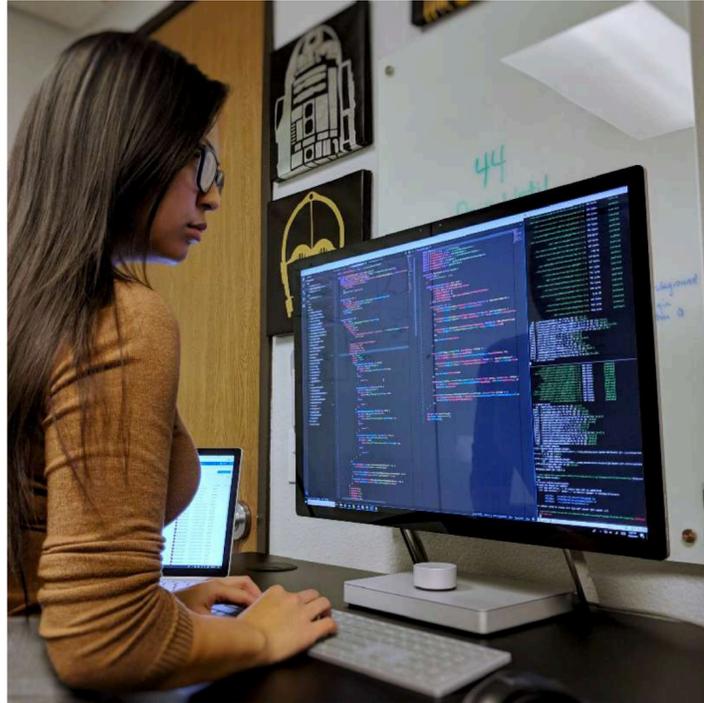
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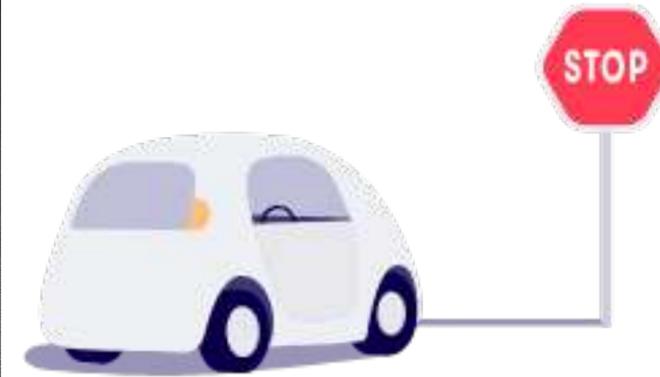
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ChatGPT is fun, but it's far from taking your white-collar job

The traditional perspective: Skill biased technological change



Programmers & Machine Learning



Truck Drivers & Autonomous Vehicles

What is “AI exposure” today?

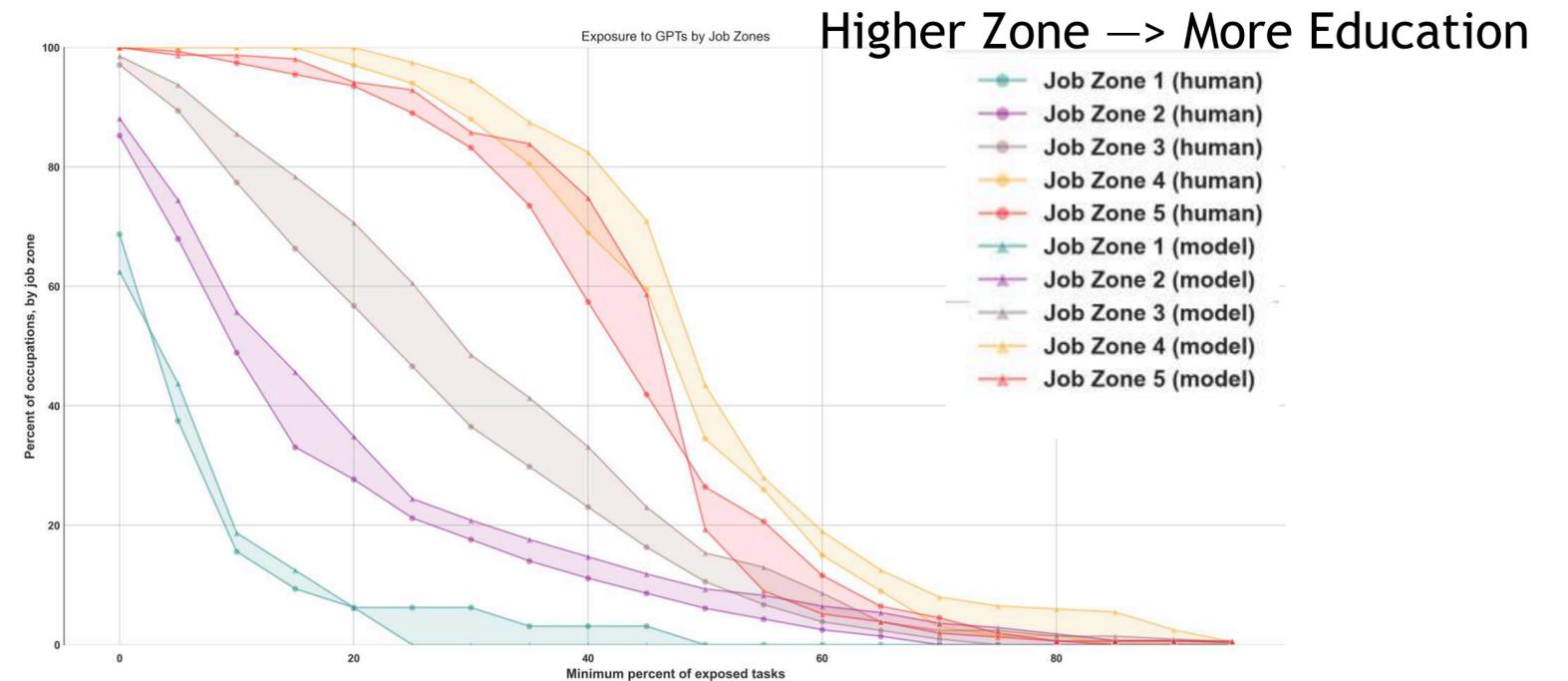
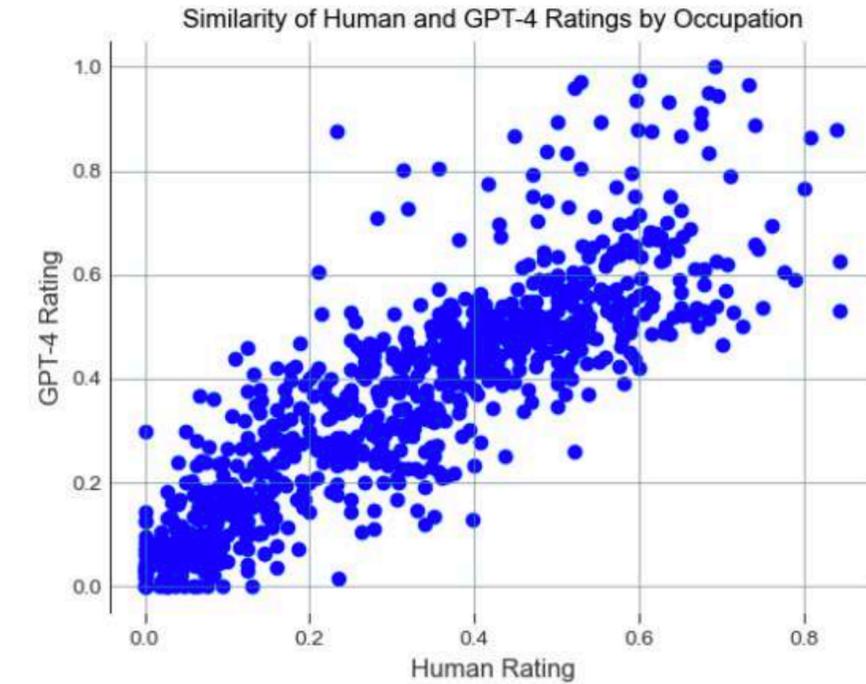
OpenAI + Daniel Rock (Wharton School, Penn) focusing on LLMs

Published in *Science*, a top research journal

Estimate automation exposure by workplace activity → job title

Ask Turkers to assess 2,000 detailed workplace activities

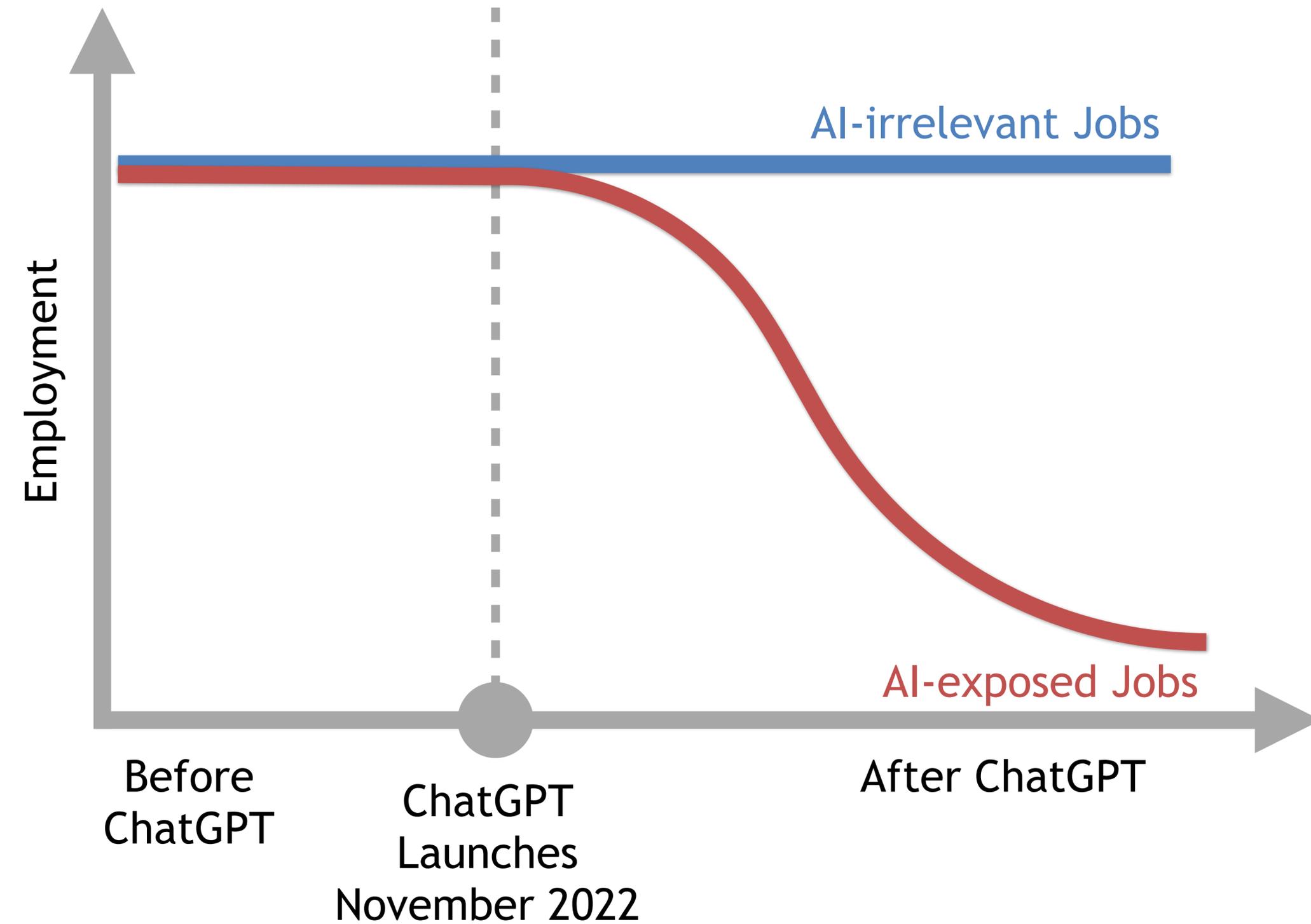
Ask ChatGPT to self-assess



Higher Zone → More Education

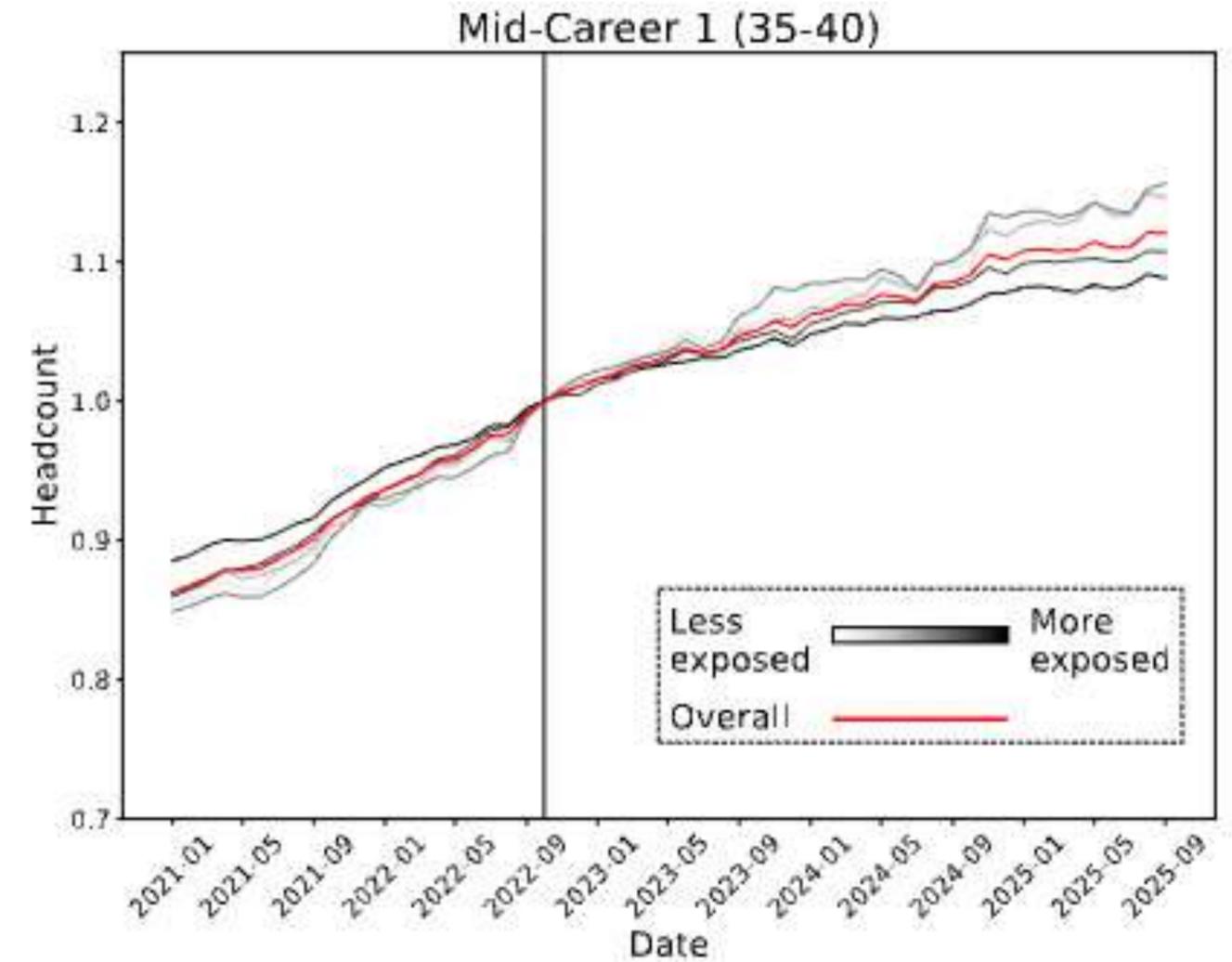
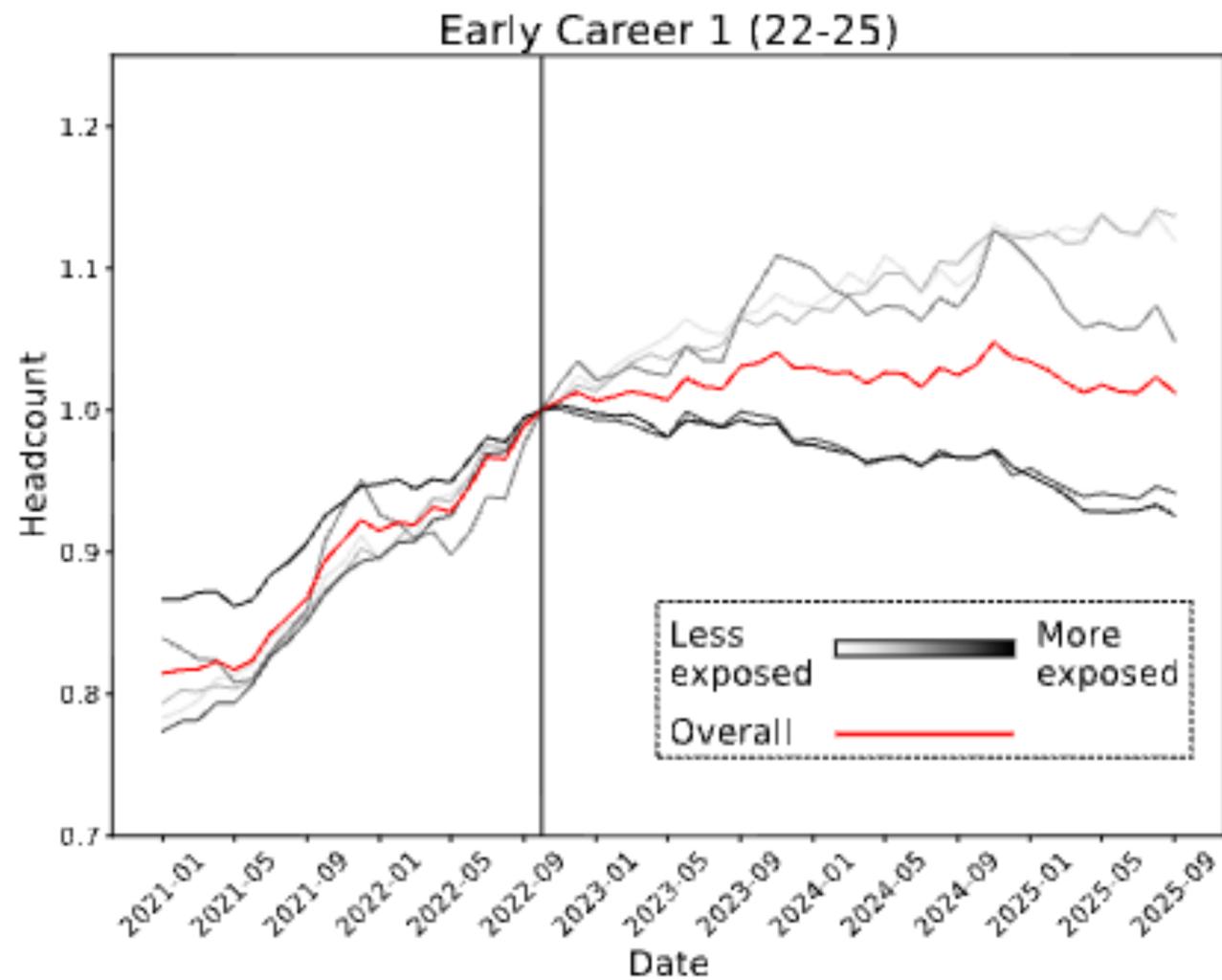
Eloundou, Tyna, et al. "GPTs are GPTs: Labor market impact potential of LLMs." *Science* 384.6702 (2024): 1306-1308.

Using the Suddenness of Generative AI



- ChatGPT came first and grew fast
- Within 2 months:
 - gained 100 million users
 - 13 million unique users per day
- **AI-exposure:** the share of workplace activities that can be automated by AI (actually, LLMs)

Using the Suddenness of Generative AI



Brynjolfsson, Erik, Bharat Chandar, and Ruyu Chen. "Canaries in the coal mine? six facts about the recent employment effects of artificial intelligence." Stanford Digital Economy Lab. Published August (2025).

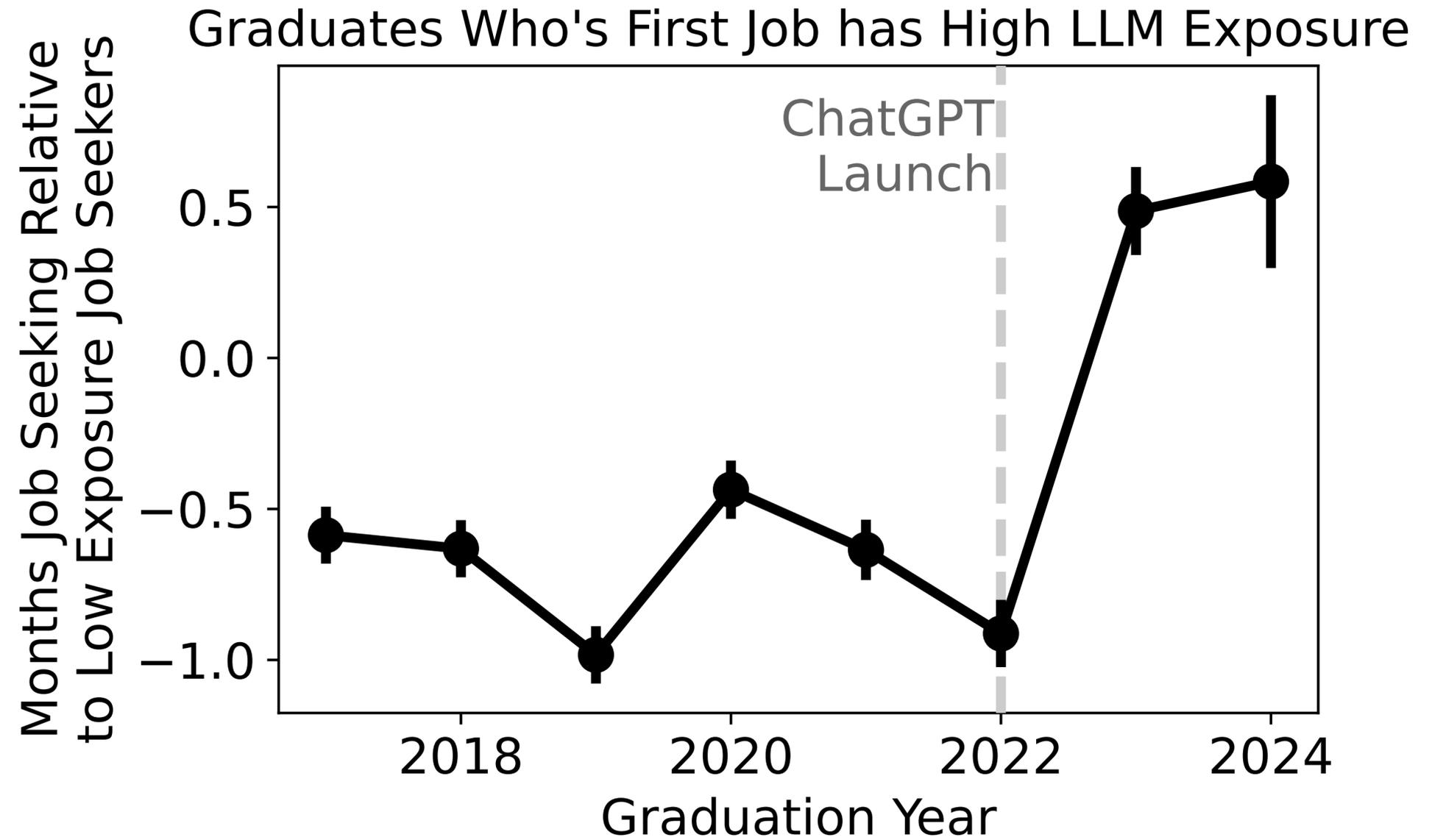


Longer job searches for recent college graduates

Millions of LinkedIn profiles including education and career history

Examine the time to first job after graduation

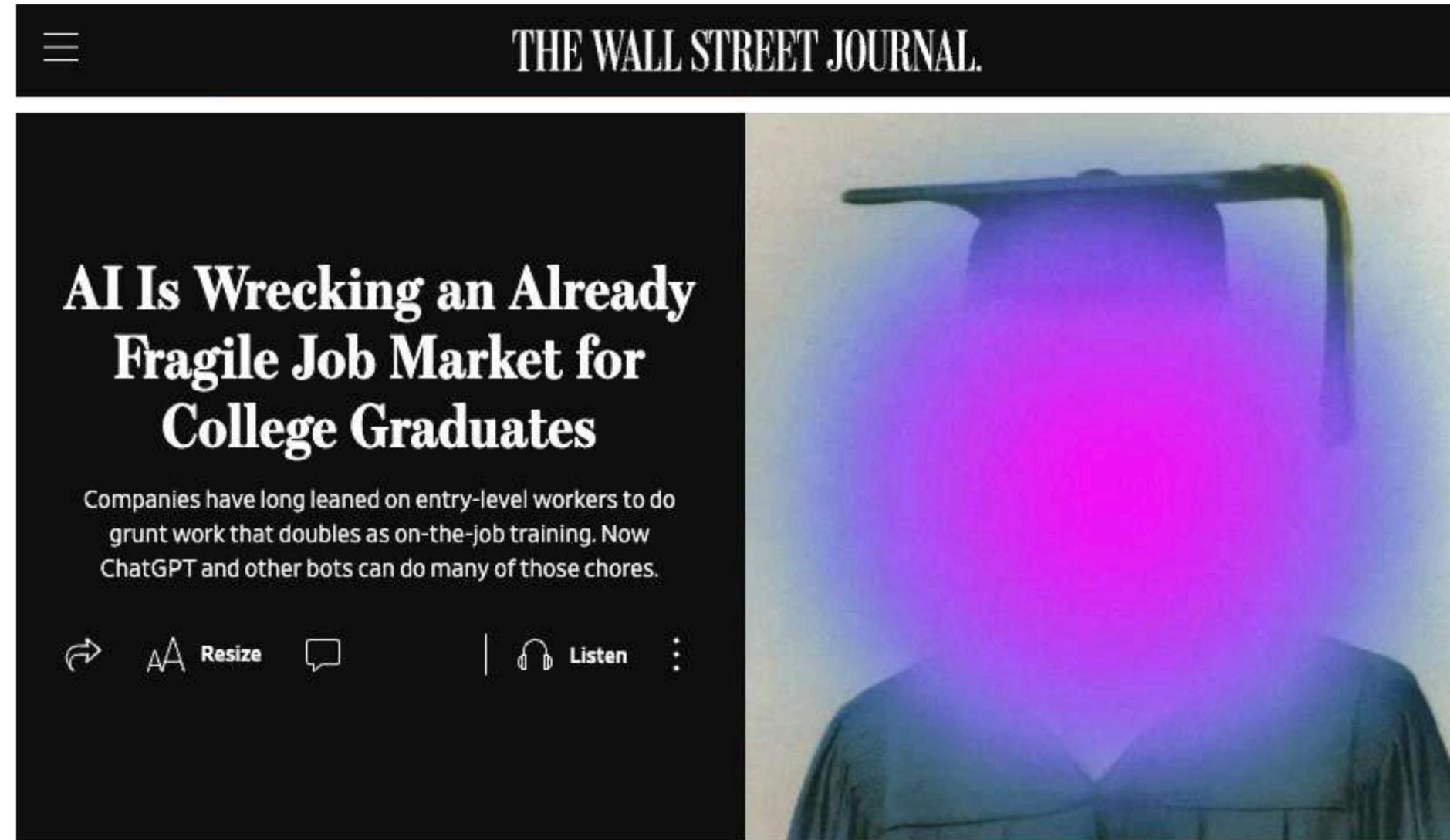
Compare AI-exposed job starters to peers in the same graduation cohort



How can universities prepare students?

If AI is eliminating jobs:

- should we continue to teach programming, writing, information synthesis?
- Are these skills no longer relevant in the workforce?
- Or, does teaching them produce AI super-users?



ALEXANDRA CITRIN-SAFADI/WSJ

By [Lindsay Ellis](#) [Follow](#) and [Katherine Bindley](#) [Follow](#) | Graphics by [Rosie Ettenheim](#)

[Follow](#)

Updated July 29, 2025 5:17 pm ET

Research Questions

1. Has unemployment for AI-exposed workers increased aligned with the launch of ChatGPT?
2. Do college graduates perform poorly aligned with the launch of ChatGPT?
3. Should universities continue to teach AI-related skills?

AI exposure and unemployment risk

The old way:

Does employment for “exposed” occupations decrease?

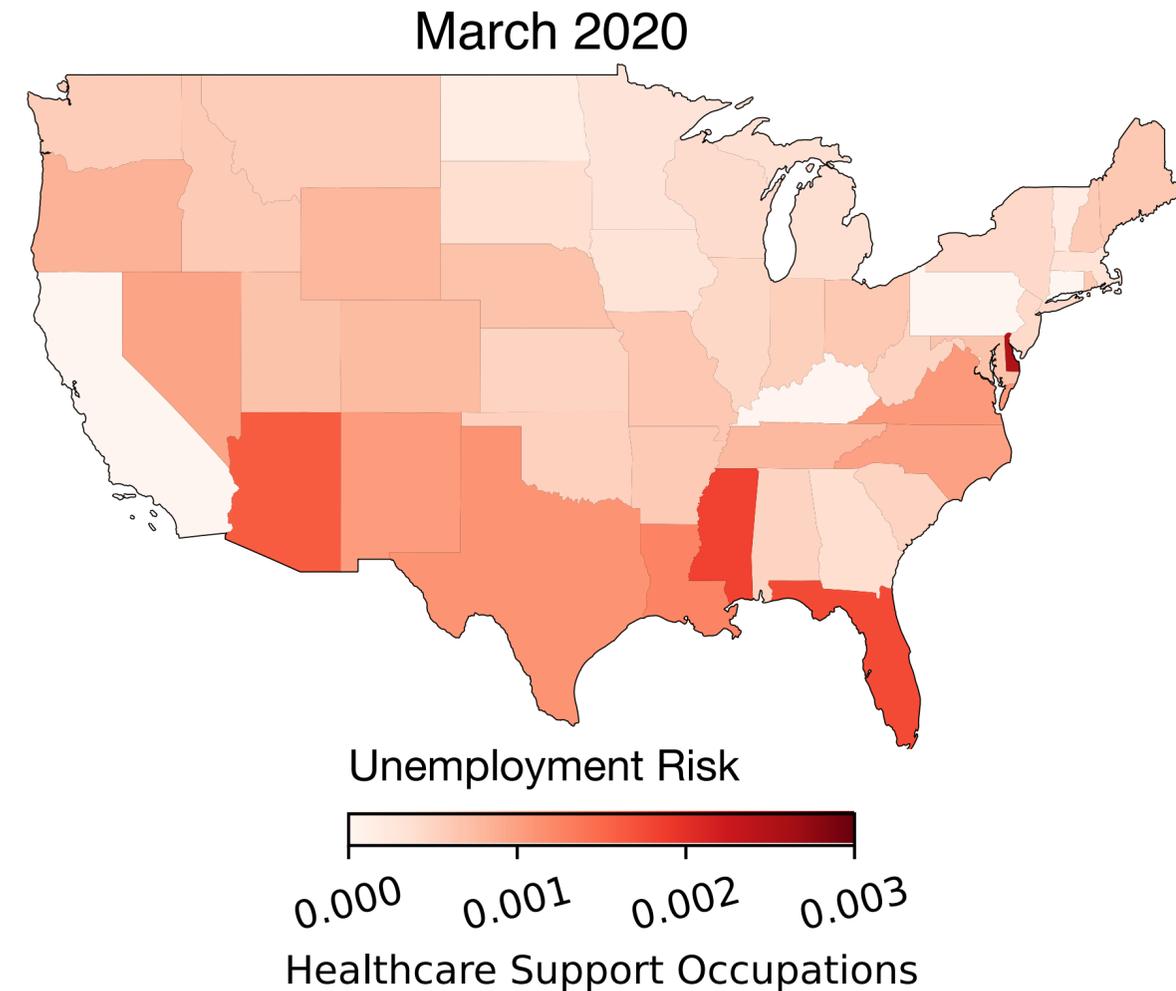
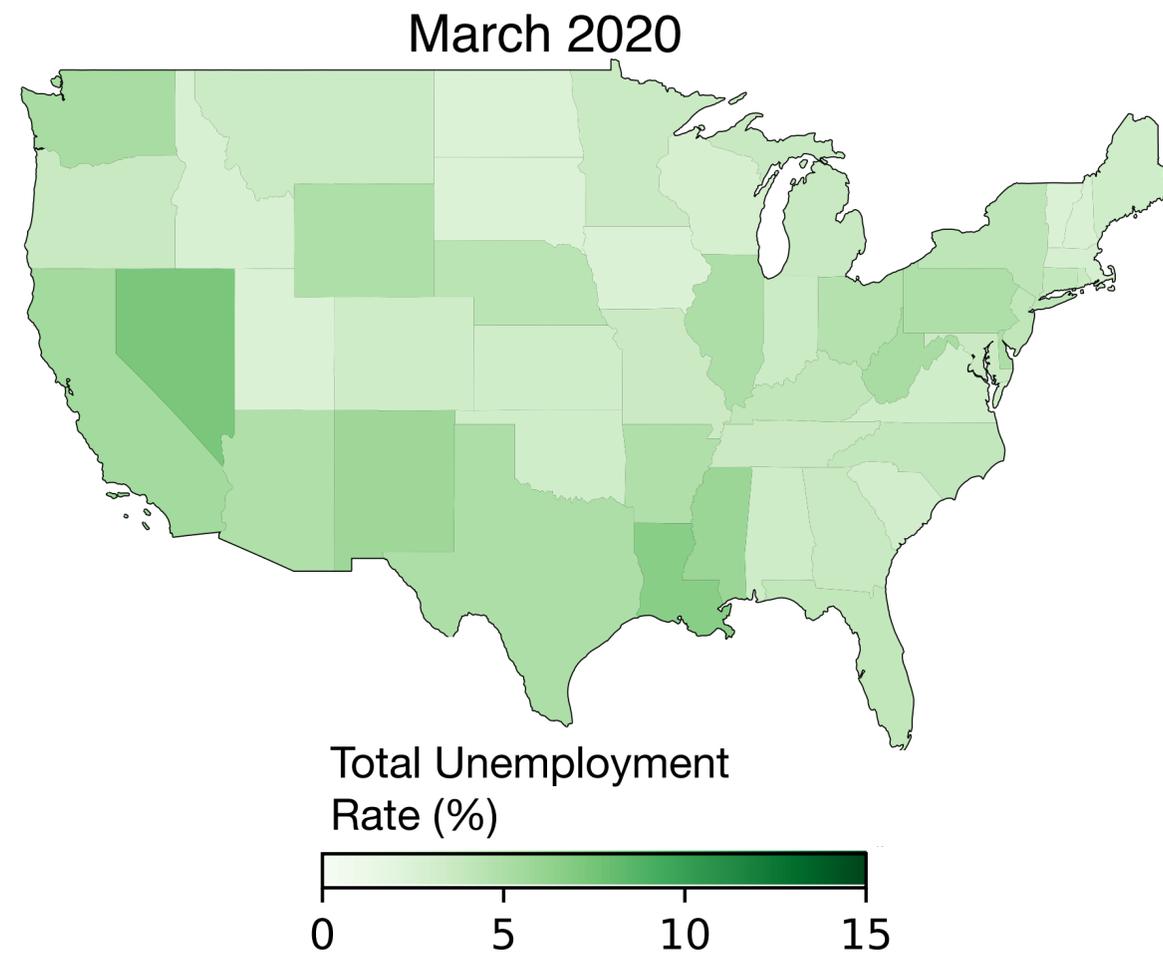
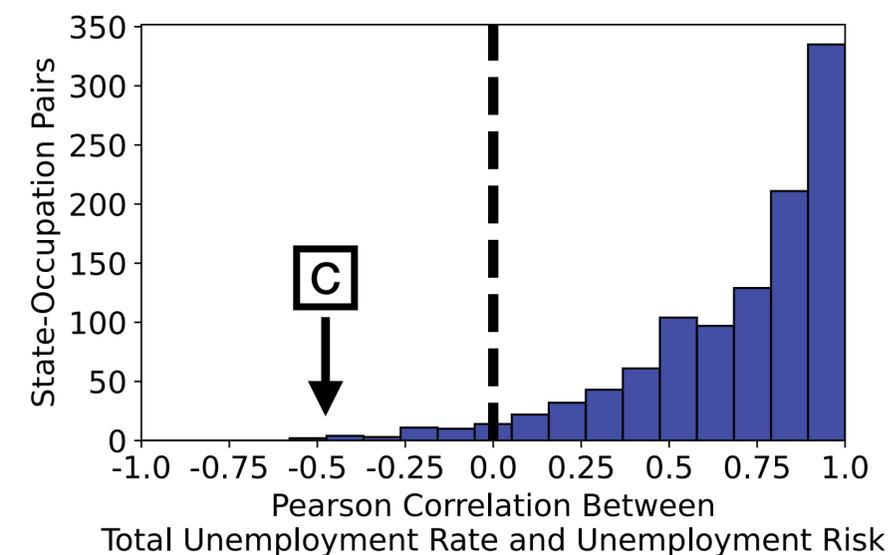
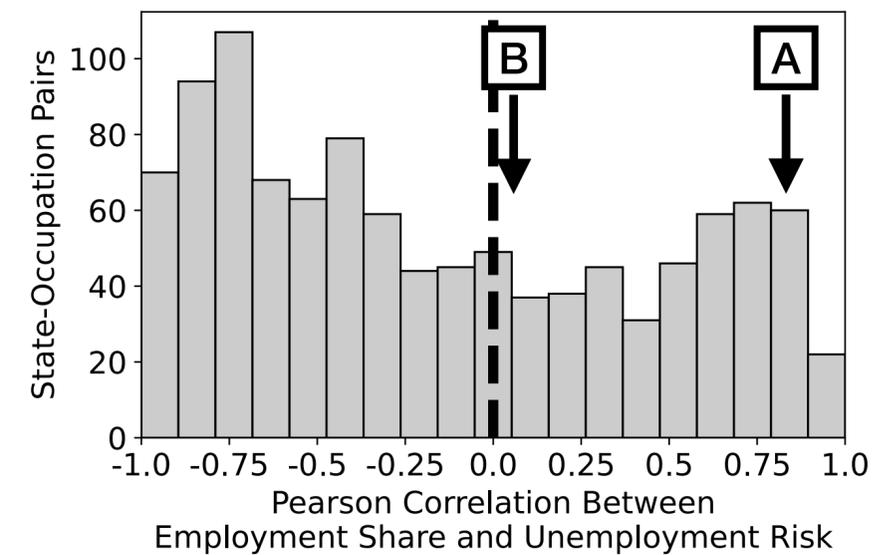
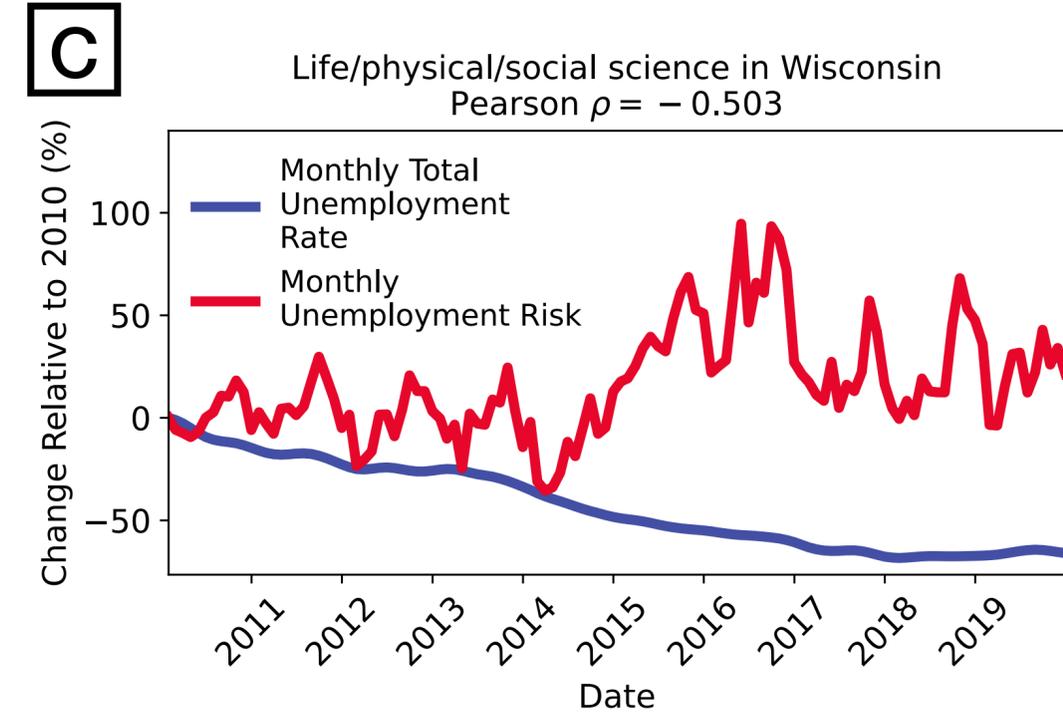
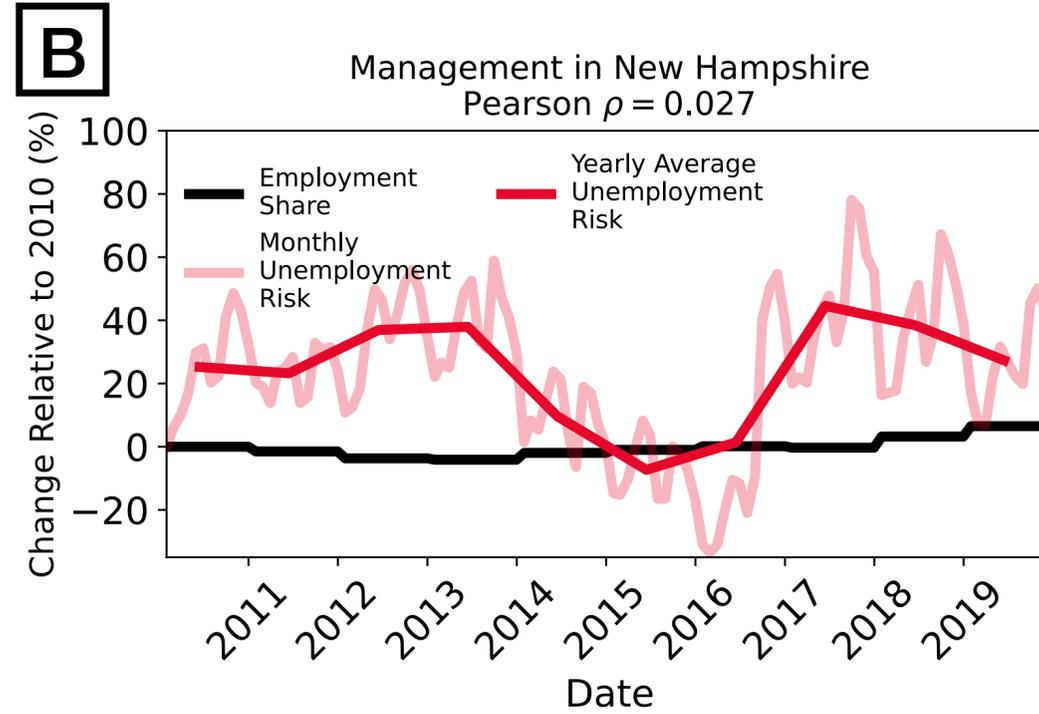
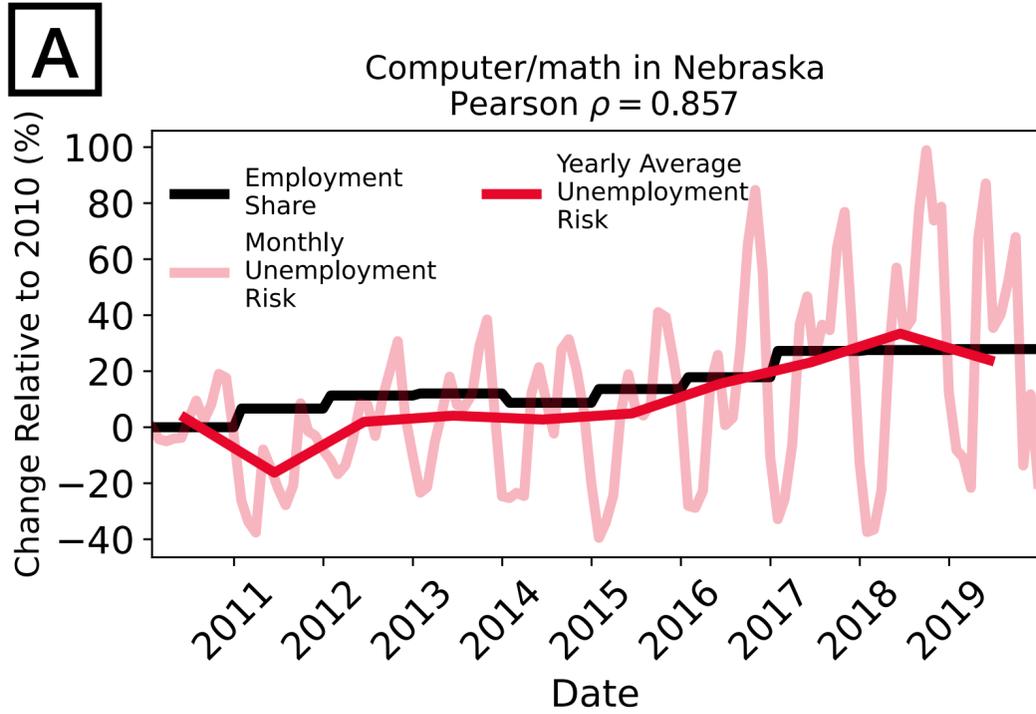
A new perspective:

Incorporate data from each US state’s unemployment insurance program including the **most recent occupation** of every unemployment recipient in the US each month.

With this, we calculate **Unemployment Risk**:

the probability of receiving unemployment given a worker’s occupation, state, and month.

$$p(u | j, s, t) = \frac{n(j | u, s, t)}{n(j | u, s, t) + n(j | emp, s, t)}$$



<https://sites.pitt.edu/~mrfrank/uiRiskDemo/>

Unemployment risk for AI-exposed workers

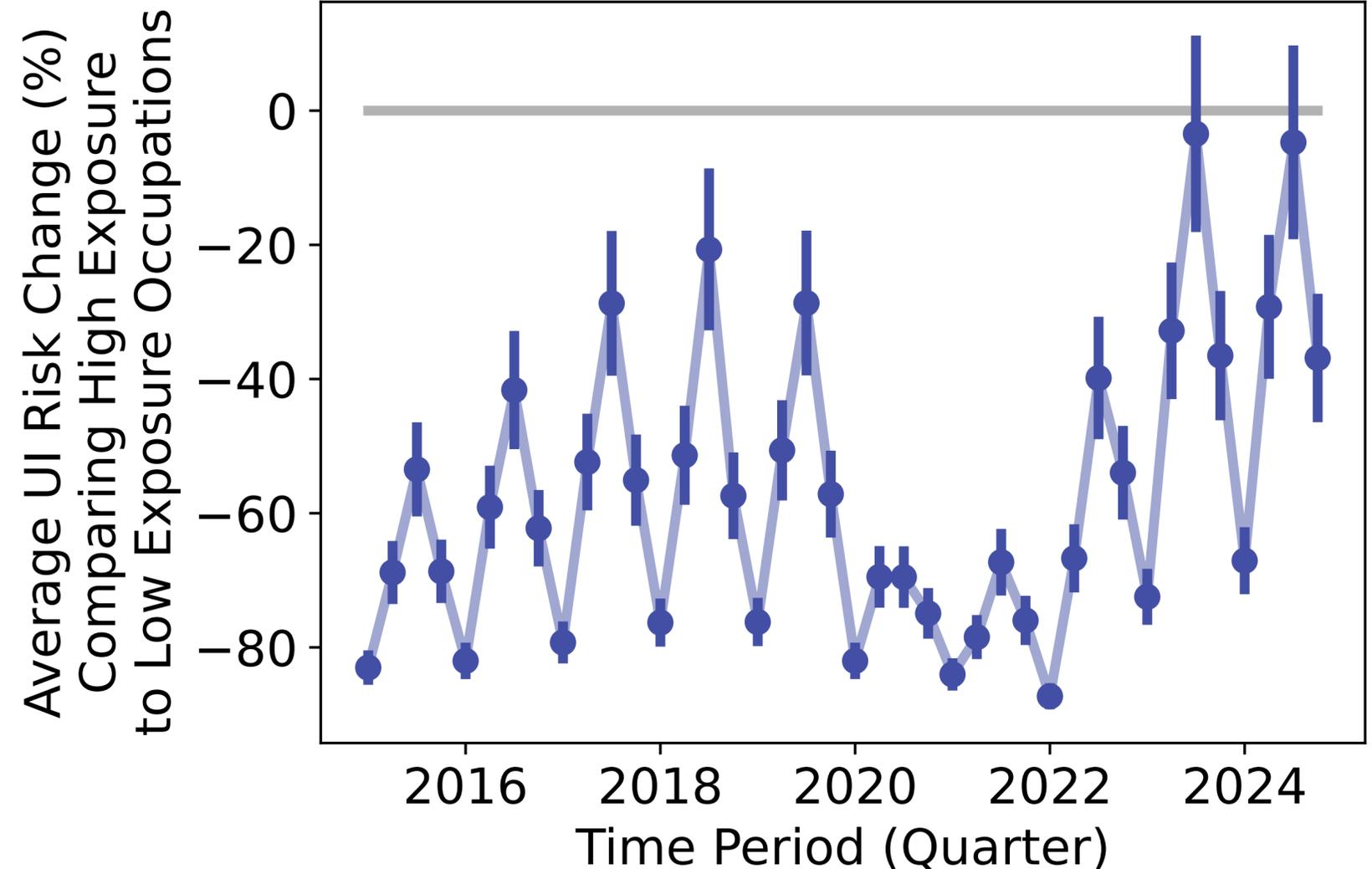
How does the UI risk for AI-exposed occupations compare to other occupations?

Before the pandemic, high-exposure jobs had lower ui risk

This difference was more pronounced during the COVID years

But, since 2022, the relative difference has deteriorated.

There are some quarters with no difference



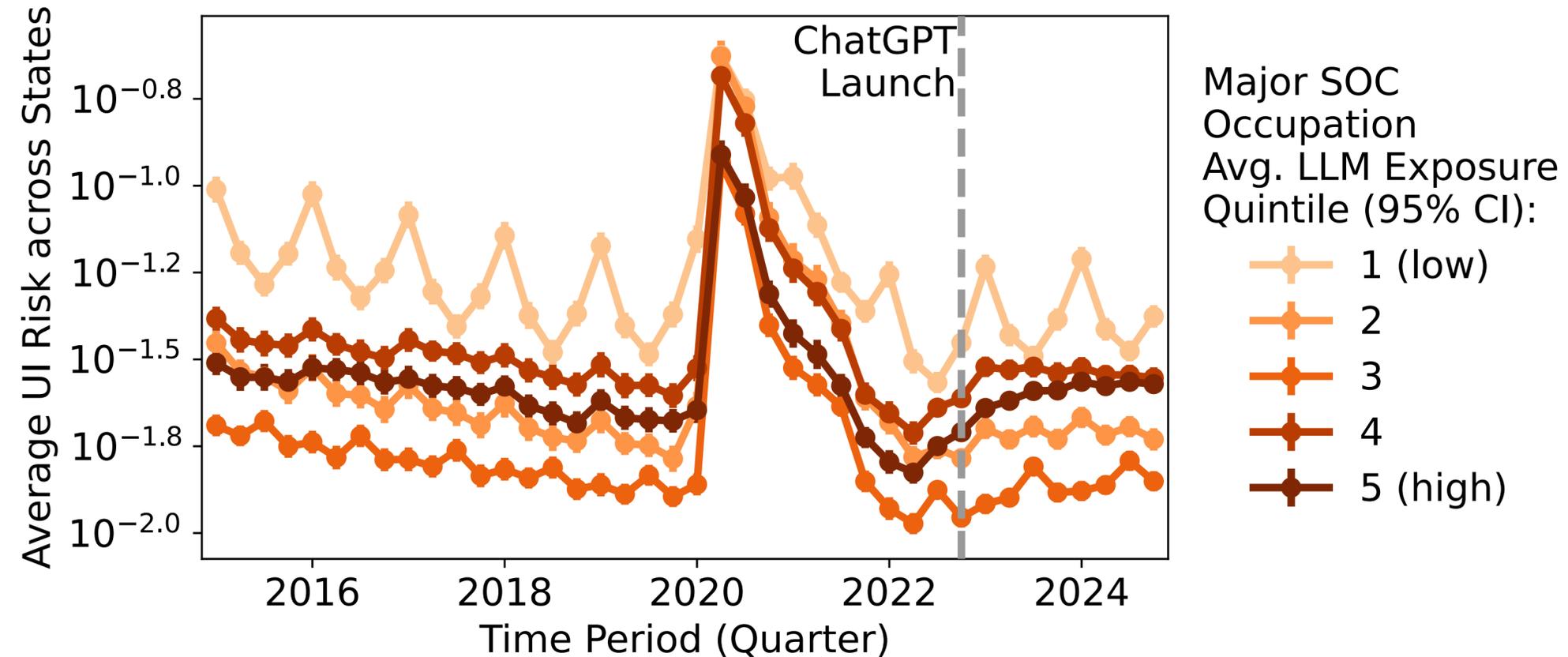
Unemployment risk for AI-exposed workers

We gathered monthly data from each US state's unemployment insurance program

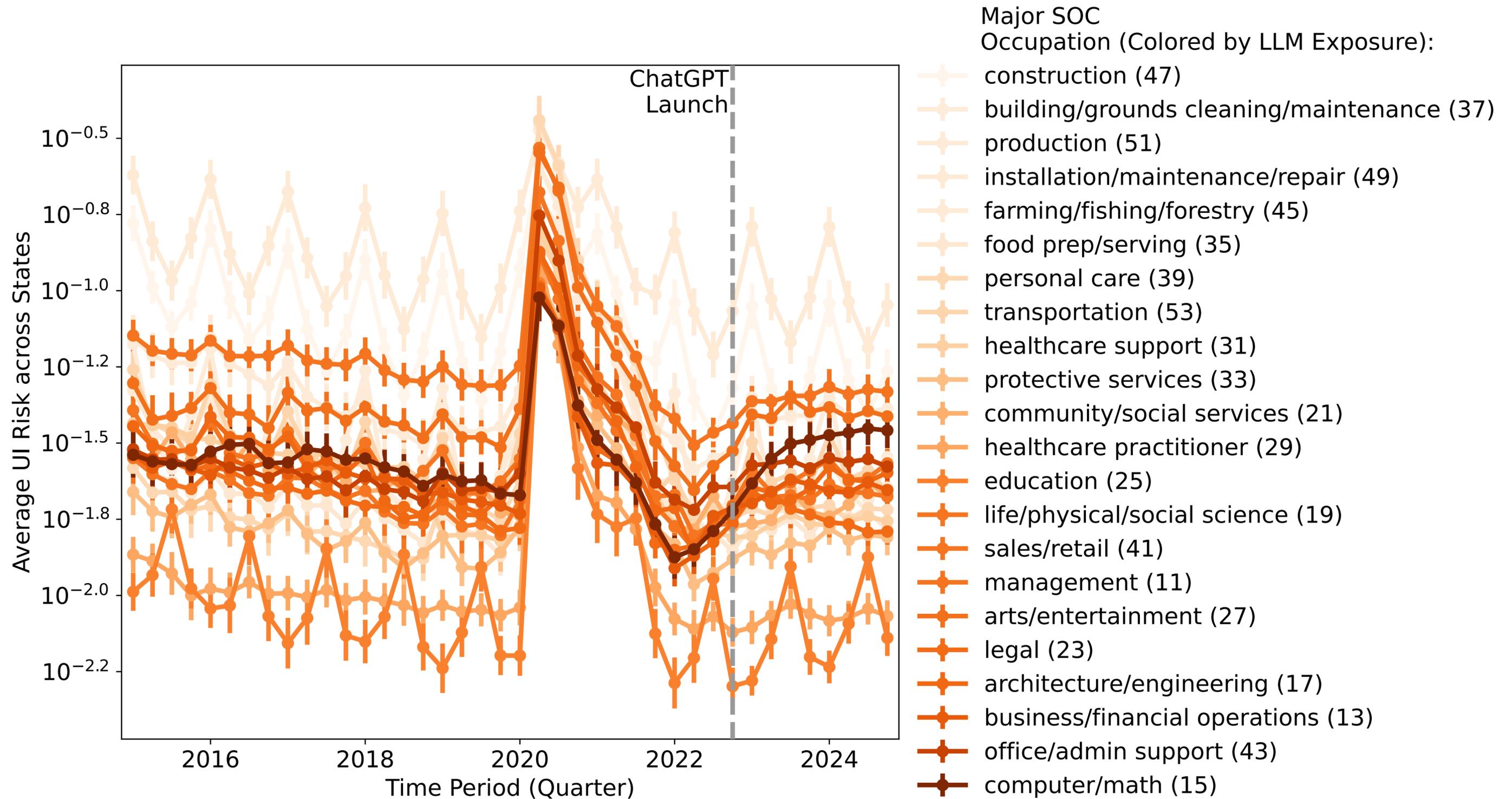
We calculated *unemployment risk*: the likelihood of claiming unemployment given occupation, month, and state

Separate UI risk by AI-automation risk (i.e., *exposure*)

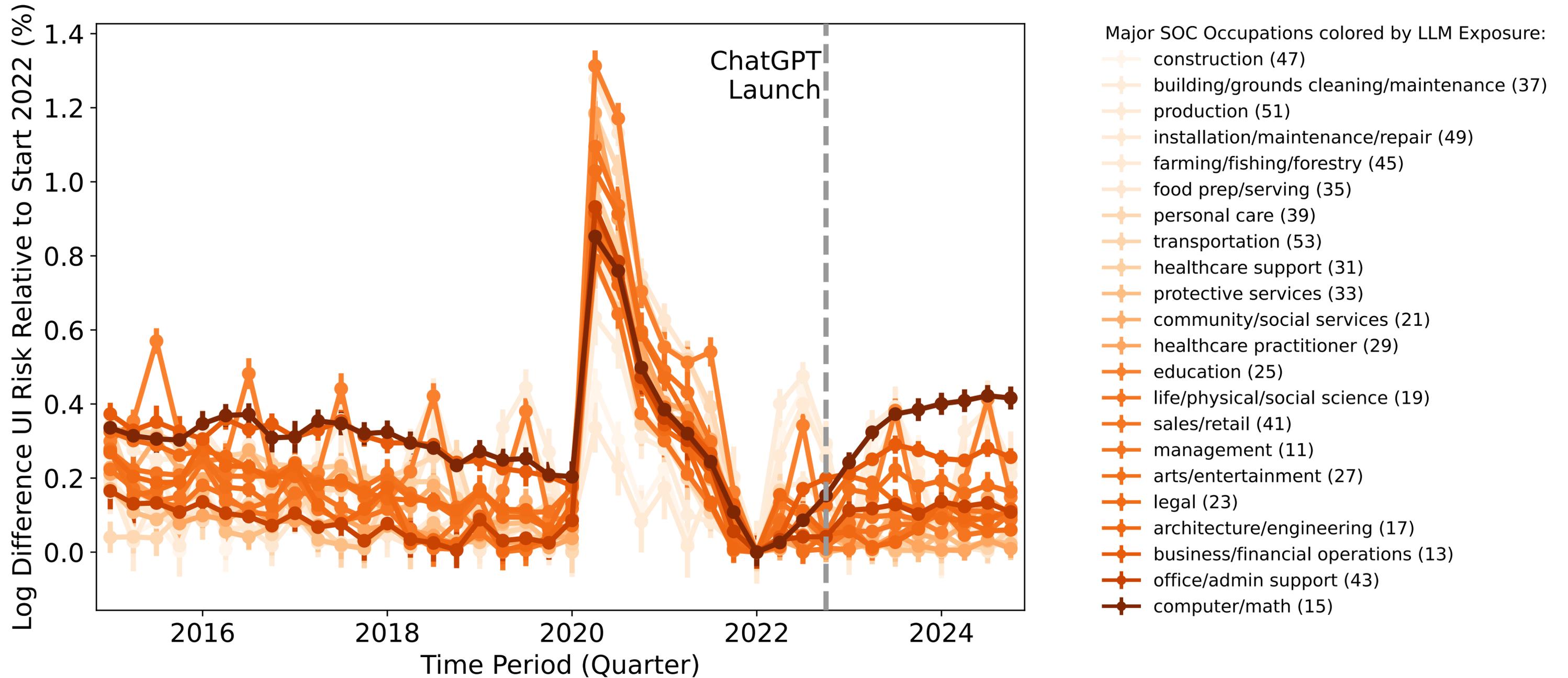
High-exposure occupations have rising UI risk around the launch of ChatGPT, but the rise starts first quarter 2022.



Unemployment risk for AI-exposed workers



Unemployment risk for AI-exposed workers



Research Questions

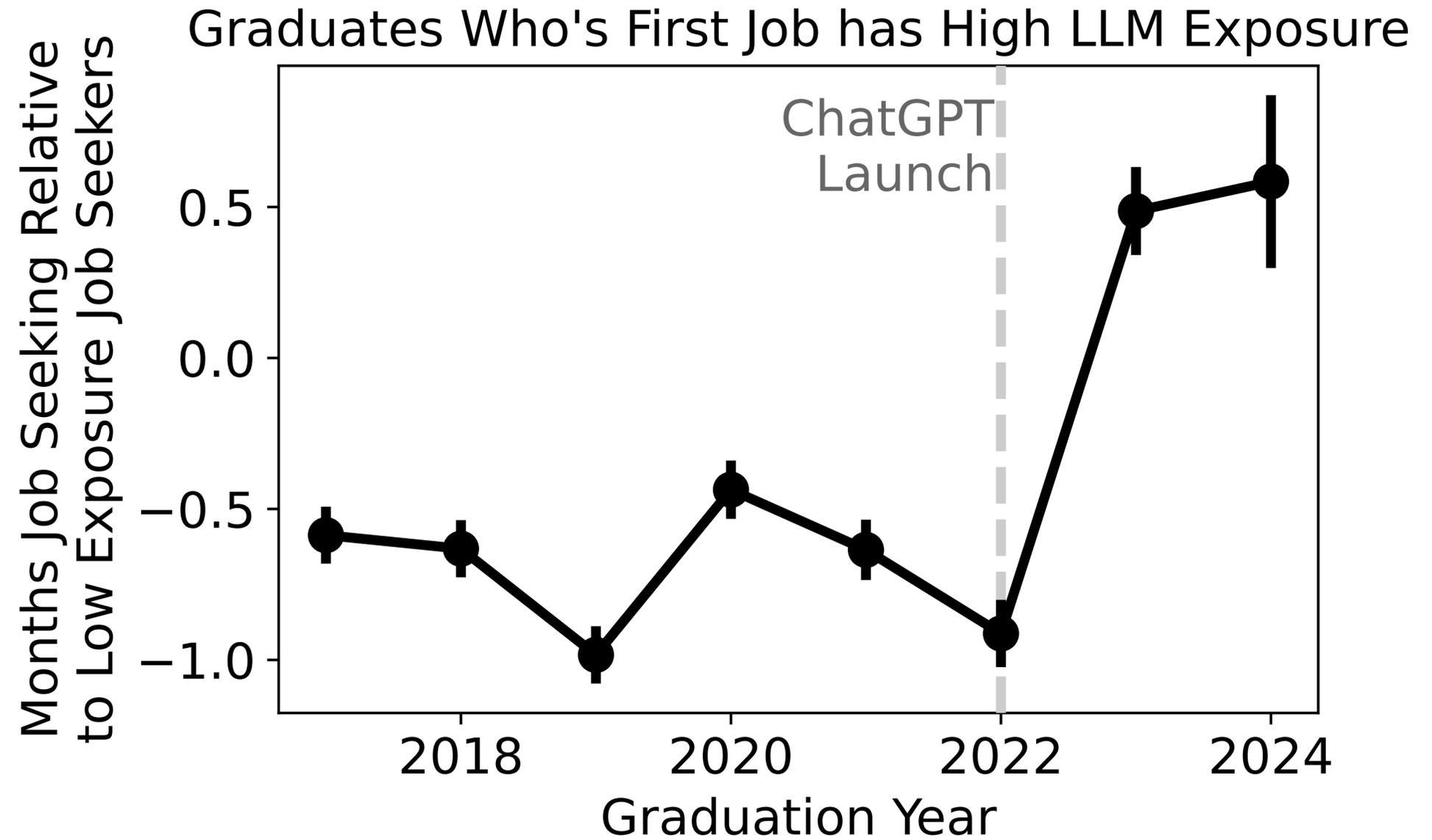
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3. Should universities continue to teach AI-related skills?

Longer job searches for recent college graduates

Millions of LinkedIn profiles including education and career history

Examine the time to first job after graduation

Compare AI-exposed job starters to peers in the same graduation cohort



Longer job searches for recent college graduates... because of AI?

Look to user profiles from LinkedIn courtesy of Revelio Labs containing:

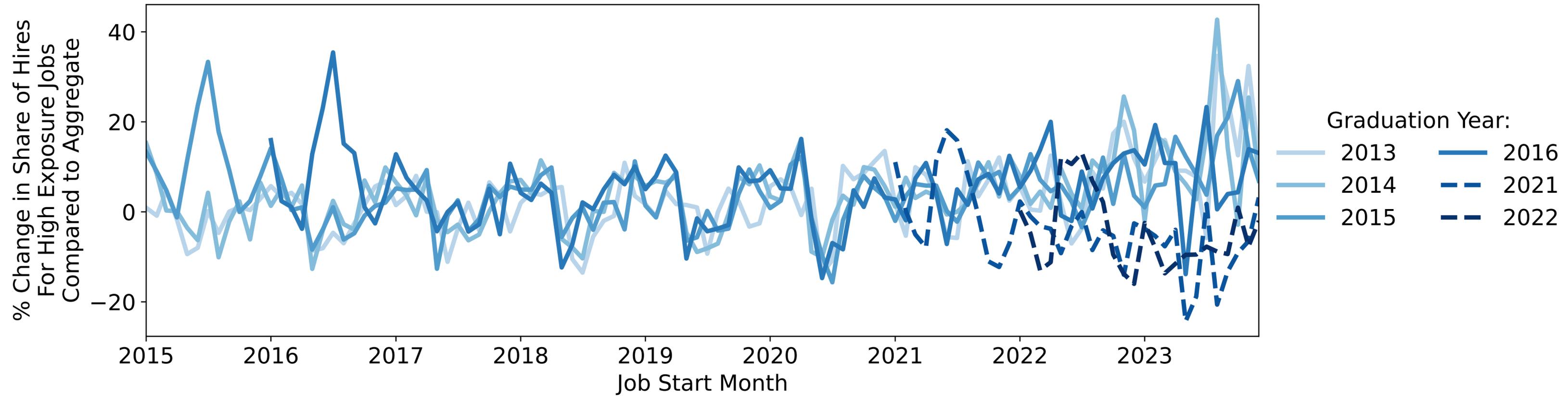
- Education Info: graduation year, field of study, degree granting university
- Work History: career timeline, job titles, employer, location, estimated salary

Do recent graduation cohorts perform worse at securing AI-exposed jobs?

$$jobGap_{month, llm} = 100 \cdot \frac{p(grad | month, llm) - p(grad | month)}{p(grad | month)}$$

- $p(grad | month)$ is the share of jobs started in *month* by graduates of the class of year *grad*
- $p(grad | month, llm)$ is the share of *llm* exposed jobs (by decile)

Exploring graduate job seeking times

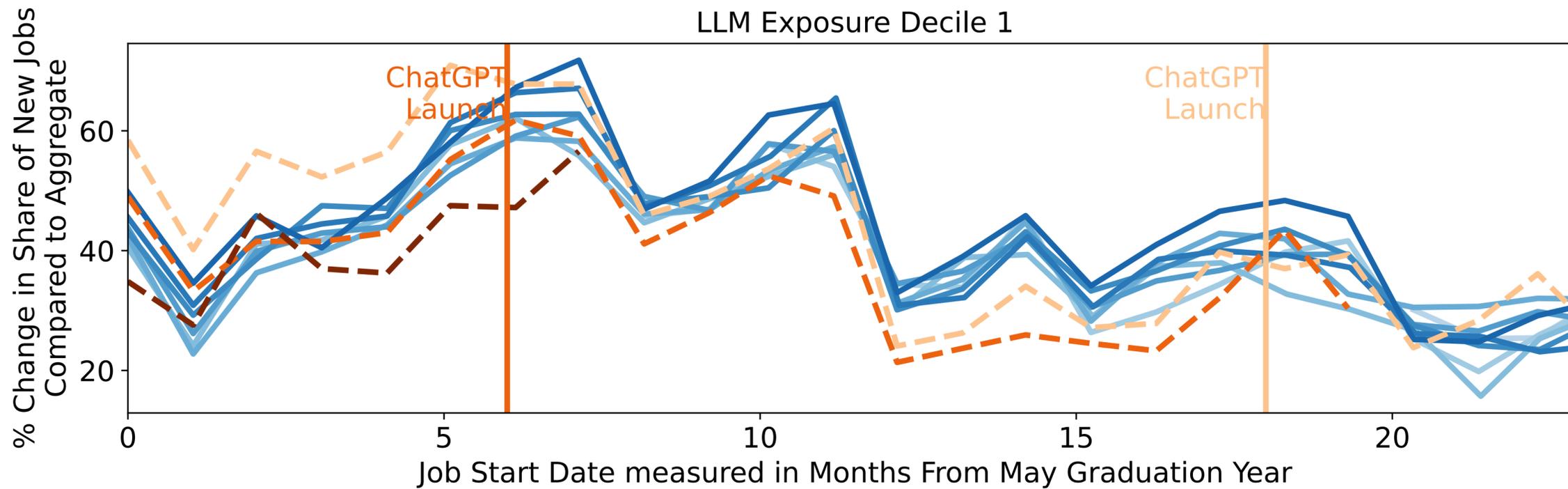
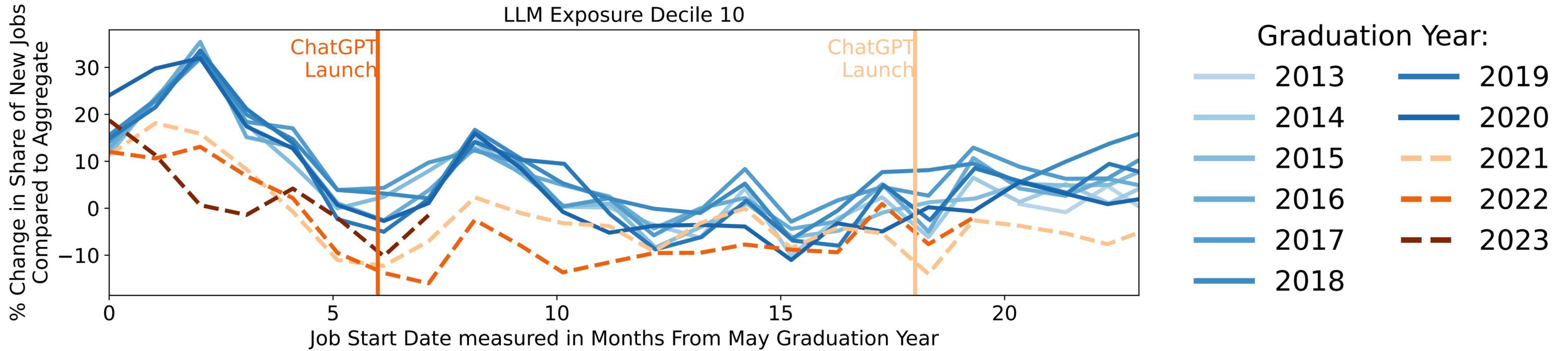


Here, focus on just a few graduation cohorts and high-exposure jobs (decile=10).

For 2015 & 2016, early months are very similar with peaks in June of their graduation year

Performance in years after graduation follow a typical trend regardless of graduation year until the middle of 2020.

Recent graduates spend longer job seeking because of AI?



Research Questions

1. Has unemployment for AI-exposed workers increased aligned with the launch of ChatGPT?
 - Unemployment risk rose for AI-exposed workers starting in January 2022
2. Do college graduates perform poorly aligned with the launch of ChatGPT?
 - Graduates from 2021, 2022, & 2023 underperform compared to earlier classes starting months before ChatGPT's launch
3. Should universities continue to teach AI-related skills?



Should universities teach AI skills?

3 million course syllabi taught at nearly 3,000 U.S. higher education institutions from the Open Syllabus Project

Metadata includes syllabus year, field of study (FOS), university, and syllabus text omitting names. We group syllabi by graduation class, alma mater, and FOS.

We restrict to syllabi from before the COVID pandemic and before ChatGPT's launch.

For each, syllabus we identify the workplace skills (ie, O*NET Tasks) being taught and assess skills' exposure to automation from generative AI.

Combined with millions of LinkedIn profiles to see how graduates across fields and universities initially perform in the US job market.

Javadian Sabet, A., Bana, S. H., Yu, R., & Frank, M. R. (2024). Course-Skill Atlas: A national longitudinal dataset of skills taught in US higher education curricula. *Scientific Data*, 11(1), 1086.

Should universities teach AI skills?

Education exposure is associated with higher salaries and shorter job searches only after ChatGPT.

Graduates who start AI-exposed jobs earn slightly less and spend more time job seeking after ChatGPT...

... but graduates with AI-exposed education and jobs do better after ChatGPT.

Dependent Variable: Variable	Log Salary (Real 2015 \$)		Months to First Job	
	Model 1	Model 2	Model 3	Model 4
Job Opening Rate	0.028***	0.029***	0.473***	0.472***
Major SOC Log Annual Wage (2020)	0.726***	0.644***	-0.044***	-0.034***
Post ChatGPT Indicator (<i>gpt</i>)	0.034***	0.031***	2.341***	2.344***
Education Exposure (<i>edu</i>)	0.000	-0.000	0.000***	0.000***
<i>edu</i> × <i>gpt</i>	0.003*	0.001	-0.025***	-0.025***
LLM Exposure (<i>llm</i>)		0.564***		-0.096***
<i>gpt</i> × <i>llm</i>		-0.064***		0.034***
<i>edu</i> × <i>llm</i>		-0.019***		0.006***
<i>edu</i> × <i>llm</i> × <i>gpt</i>		0.012***		-0.009***
State FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Terminal Degree Type FE	Yes	Yes	Yes	Yes
Graduation Year FE	Yes	Yes	Yes	Yes
College Major FE	Yes	Yes	Yes	Yes
University FE	Yes	Yes	Yes	Yes
R^2	0.426	0.433	0.374	0.374
adj. R^2	0.425	0.433	0.373	0.373

$p_{val} < 0.1^*$, $p_{val} < 0.01^{**}$, $p_{val} < 0.001^{***}$

Variables centered and standardized (i.e., z-scores).

Restrict to each individual's first job within 3 years of terminal degree completion.

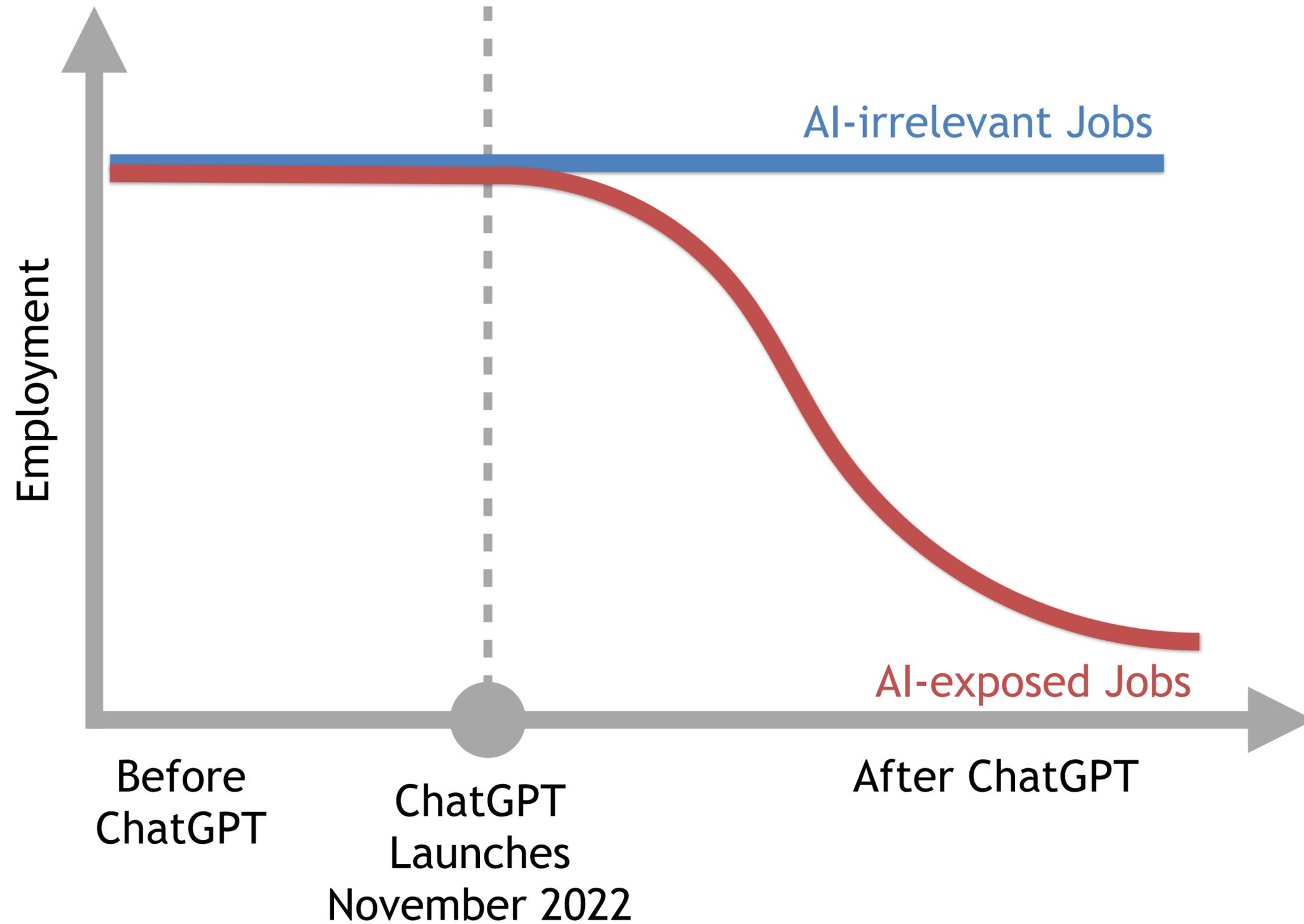
Number of Rows: 1,350,482

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 - Graduates from 2021, 2022, & 2023 underperform compared to earlier classes starting months before ChatGPT's launch
3. Should universities continue to teach AI-related skills?
 - Recent graduates who learn AI-related skills earn higher salaries and spend less time job seeking in the post-ChatGPT job market



If this is wrong, then what is right?

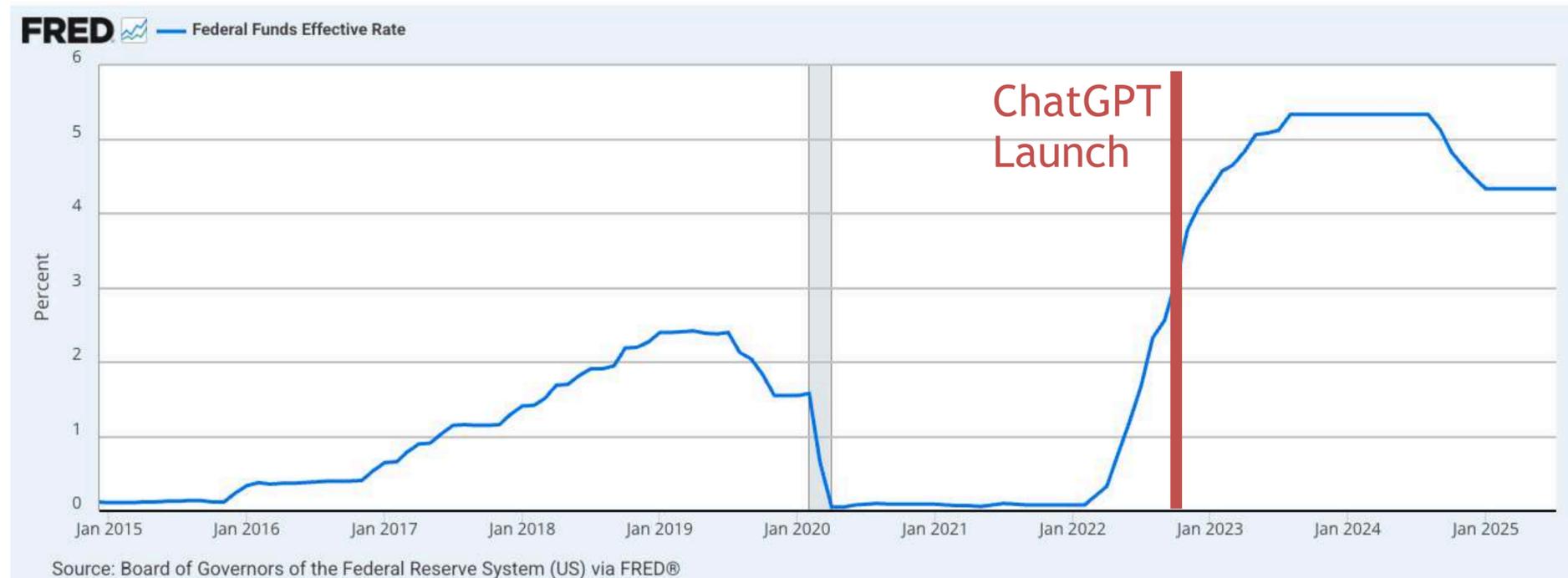
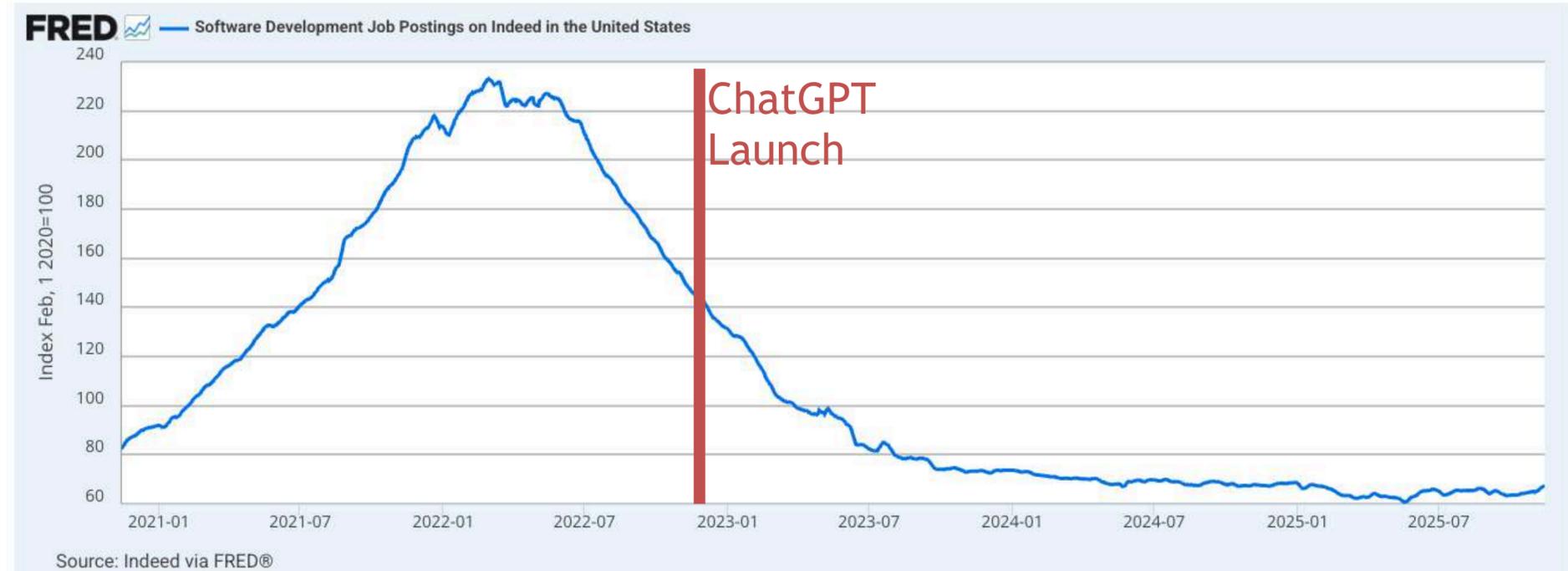


Is it *really* AI impacting jobs?

Other big things were happening in the economy at the same time as the launch of ChatGPT.

Example 1: The tech sector is correcting for over-hiring during the COVID pandemic economy

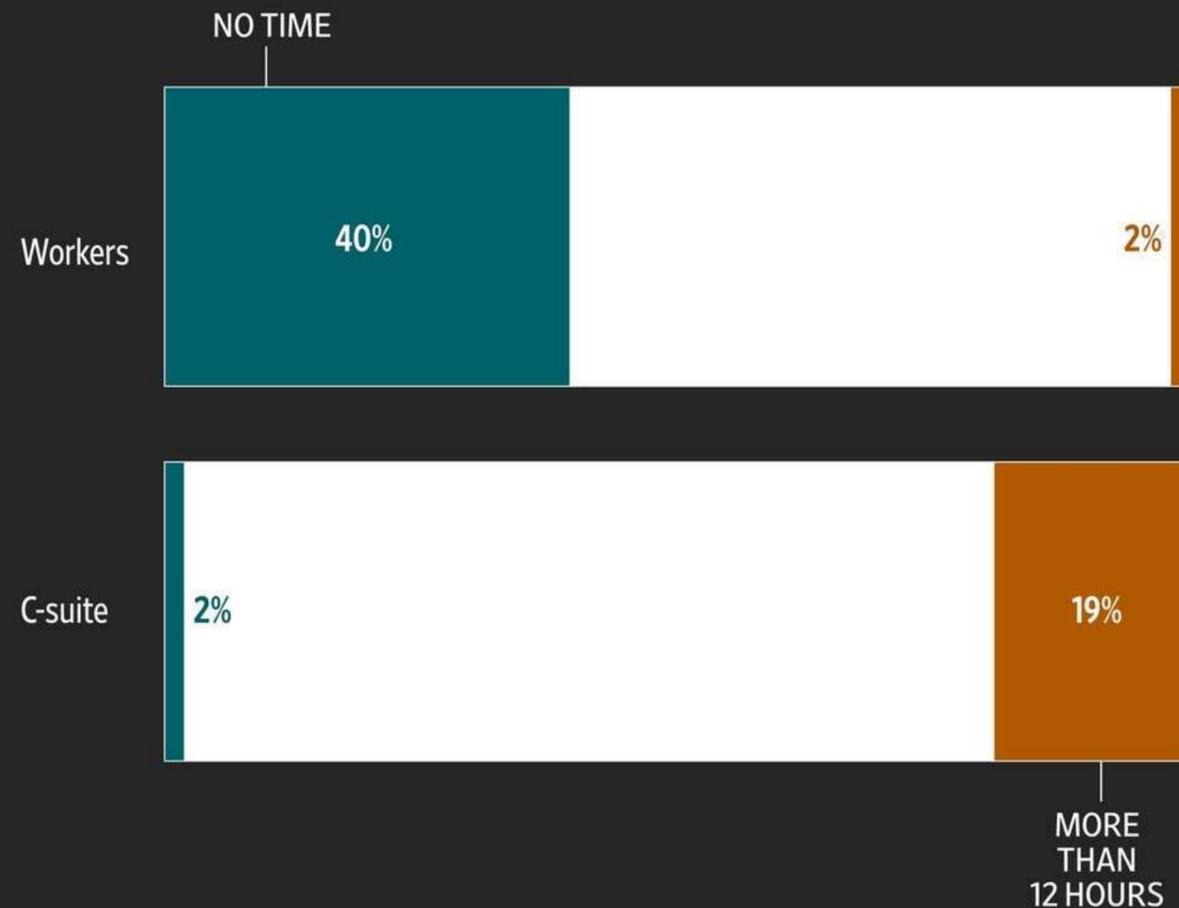
Example 2: Federal interest rates increased starting at the beginning of 2022



Who is steering public discourse?

CEOs say AI Is Boosting Efficiency. Employees Disagree.

How much time do you think you are saving each week by using AI?



Source: Section survey of 5,000 white-collar workers from companies with 1,000 or more people in the U.S., U.K. and Canada conducted Sept. 26-Nov. 3, 2025; margin of error: +/- 1.4 pct. pts.

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FORTUNE

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FABRICE COFFRINI/AFP VIA GETTY IMAGES

Conclusion

AI-exposed occupations have had a rough job market in recent years.

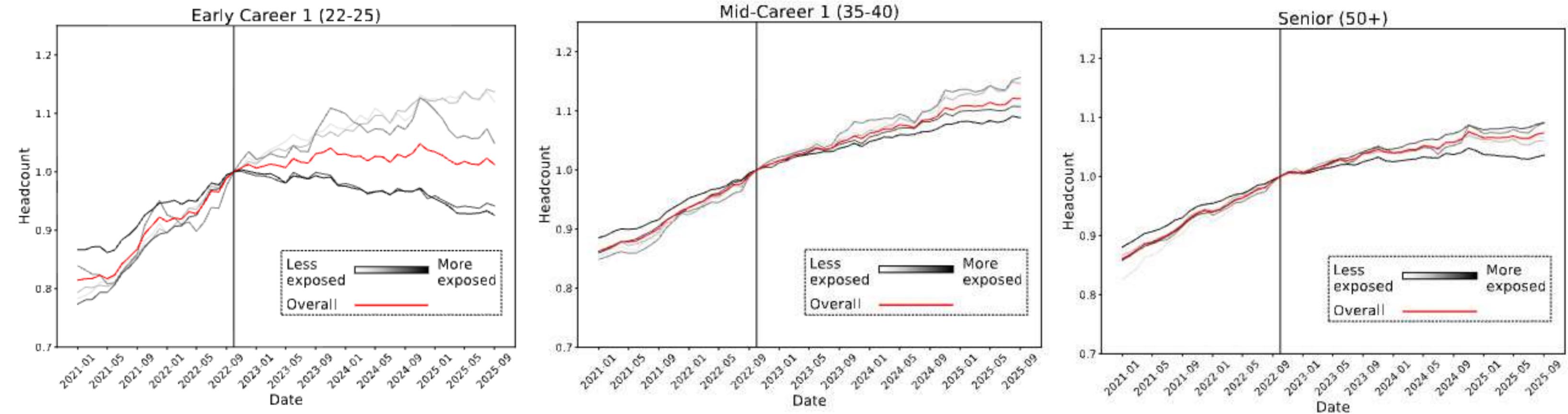
But the poor outcomes started well before the launch of ChatGPT.

Descriptive evidence suggests that students exposed to AI-related content during education are performing better than their peers, especially in the context of AI-related jobs.

Limitations:

- Unemployment data is problematic for California
 - no data for business/financial operations, management, education occupations
 - Does have data for computer/math occupations though!
- LinkedIn profiles may not represent the US workforce
 - white collar workers and recent college graduates are likely over-represented
 - ... but they are who we are most interested in
- Education exposure analysis is not causal
 - Selection into majors, university, job are not random

Using the Suddenness of Generative AI



Brynjolfsson, Erik, Bharat Chandar, and Ruyu Chen. "Canaries in the coal mine? six facts about the recent employment effects of artificial intelligence." Stanford Digital Economy Lab. Published August (2025).



Unemployment by occupation?

“Where can I find unemployment by occupation?”

“Morgan, that’s a silly question. By definition unemployed people have no occupation.”

- well-known Boston-area economist

The **Distribution of Characteristics of the Insured Unemployed** is a monthly report submitted by state Unemployment Insurance (UI) agencies to the Employment & Training Administration (ETA) of the United States Department of Labor.

Data captures the week including the 12th of the month in each state.

We use it to calculate unemployment risk:

$$p(\text{unemp} \mid \text{soc}, s, t) = \frac{4 \cdot n(\text{unemp} \mid \text{soc}, s, t)}{4 \cdot n(\text{unemp} \mid \text{soc}, s, t) + n(\text{emp} \mid \text{soc}, s, t)}$$

ETA 203 Report missing data (2019-2024)

Major Occupation Group	State									
	DE	CT	CA	NE	KY	NH	VT	AK	KS	SD
sales/retail (41)	3	0	0	0	0	0	33	0	0	0
protective services (33)	5	28	60	0	17	0	46	0	0	0
education (25)	5	7	60	0	10	0	43	0	0	0
office/admin support (43)	0	0	59	0	0	0	45	0	0	0
life/physical/social science (19)	0	23	60	0	1	0	46	0	0	0
production (51)	4	0	0	0	0	0	44	0	0	0
computer/math (15)	1	10	0	3	3	0	39	0	0	0
healthcare practitioner (29)	3	30	60	0	0	0	27	0	0	0
construction (47)	3	30	60	0	0	0	45	0	0	0
healthcare support (31)	2	15	60	0	1	0	19	0	0	0
transportation (53)	2	6	60	0	1	45	44	0	0	0
management (11)	0	30	60	0	0	0	45	0	0	0
architecture/engineering (17)	3	0	60	0	4	0	45	0	0	0
business/financial operations (13)	3	10	60	0	0	0	34	0	0	0
installation/maintenance/repair (49)	3	13	60	0	0	0	45	0	58	0
community/social services (21)	2	25	60	0	9	0	15	0	0	0
arts/entertainment (27)	1	10	60	0	0	0	30	0	0	0
personal care (39)	1	22	60	0	3	0	46	0	0	0
legal (23)	3	29	60	0	33	0	37	17	0	2
building/grounds cleaning/maintenance (37)	4	18	60	0	7	0	45	0	0	0
farming/fishing/forestry (45)	13	30	1	0	4	0	46	0	0	0
food prep/serving (35)	3	29	0	0	0	0	27	0	0	0

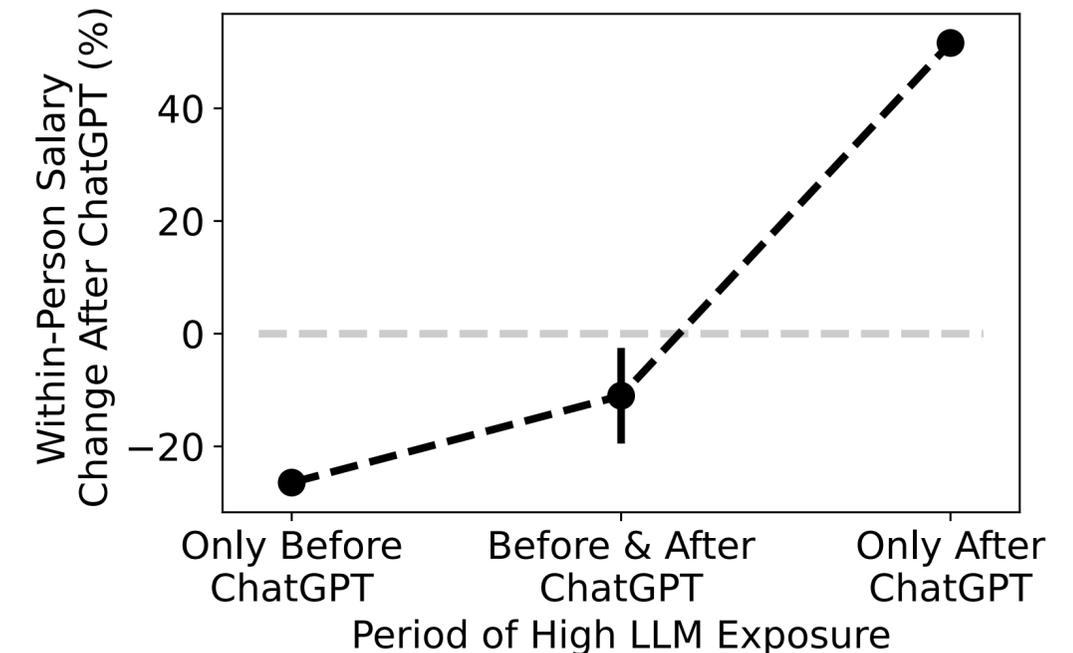
Are workers in the workforce adjusting to LLMs?

Before ChatGPT, AI-exposed occupations were high-earning and required college education.

What happens to individuals in these positions after LLMs?

Workers in exposed occupations before ChatGPT saw *decreased salaries* after the rise of LLMs.

Workers who started exposed jobs *only after ChatGPT* saw *increased salaries*.



Measuring Technology Exposure

Wave	Study	Year First Available	Description
1	Acemoglu & Autor	2011	Assess occupations on computer usage, routineness, and cognitive or manual requirements.
	O*NET Bachelors	2003	The fraction of workers in an occupation with a bachelor's degree.
2	Frey & Osborne	preprint 2013	Combined a subset of occupation skills with subjective assessments of fully automatable or non-automatable occupations.
	Arntz et al	2016	Considered a complete set of occupations' skills to assess automation risk in OECD countries.
	O*NET Degree of Automation	2016	The relative amounts of routine versus challenging work the worker will perform as part of a job.
3	Brynjolfsson et al	2018	Surveyed ML experts in order to assess occupations' task suitability for ML.
	Felten et al	2018	Crowdsource gig workers to establish connections between AI application capabilities and occupation abilities.
	Webb	2019	Uses NLP to compare technology patents to occupation tasks.

- **Wave 1:** Theory based
- **Wave 2:** Occupations are bundles of skills
- **Wave 3:** Quantify what technology can actually do
- Each study validates against education, employment, or wages



The future of employment: How susceptible are jobs to computerisation?

(Preprint 2013)

Out of Oxford University

Highly cited
(Google scholar: 16,212)

Estimate automation exposure by job title

Survey experts on “certainly” automatable occupations and assess 9 O*NET skills

“Because **creativity**, by definition, involves not only novelty but value, and because values are highly variable, it follows that many arguments about creativity are rooted in disagreements about value....In the absence of engineering solutions to overcome this problem, **it seems unlikely that occupations requiring a high degree of creative intelligence will be automated in the next decades.**”

