AI Will Cause Jobs to Evolve: Will You Be Able to Evolve With It?
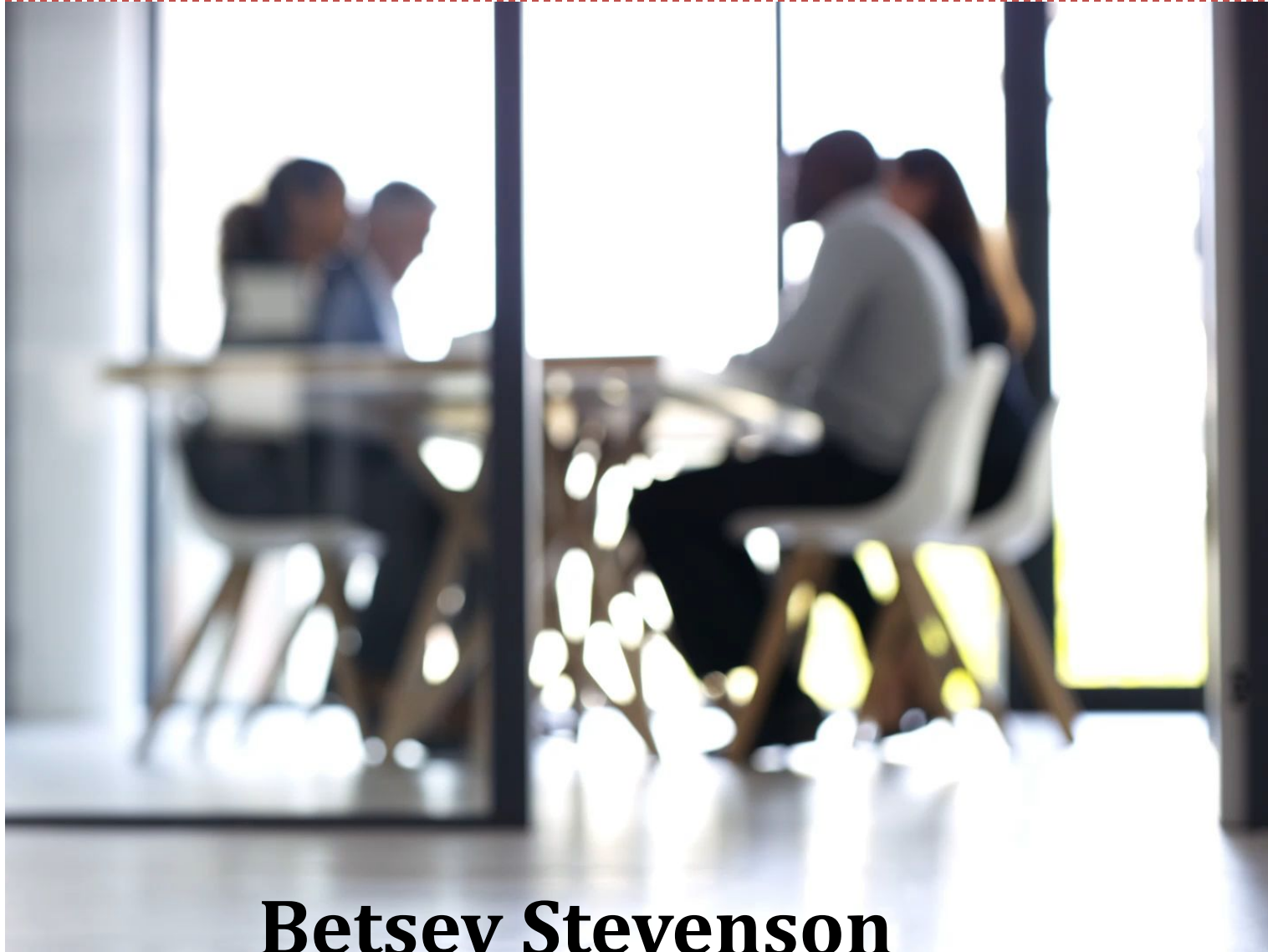
Betsey Stevenson

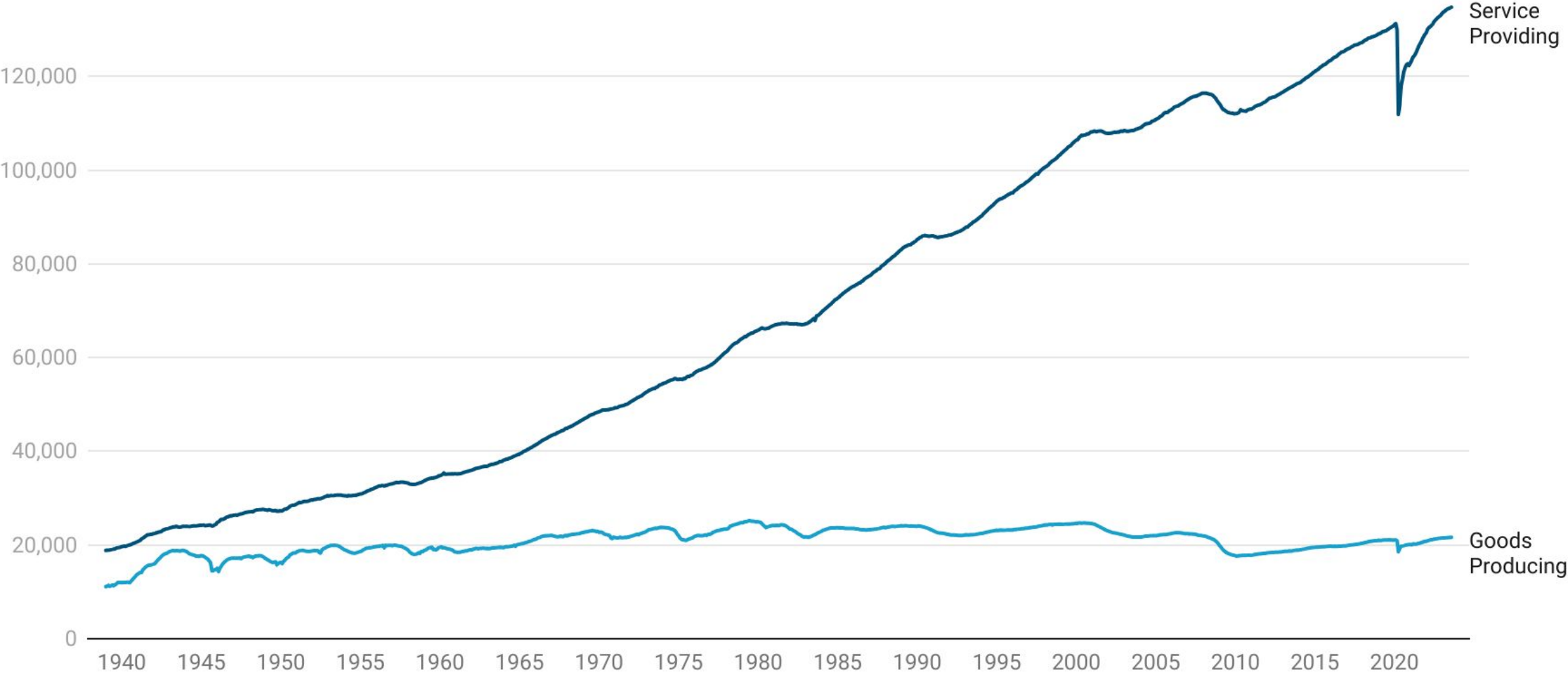**Professor of Economics and Public Policy, University of Michigan**

Two Competing Extreme Visions

1. Doomsday: Machines destroy our lives

2. Utopia: Machines allow a quality of life previously only had by the very elite

The United States Doesn't Make Stuff Anymore

Thousands of jobs

- Service Providing
- Goods Producing

Created with Datawrapper

Two Competing Ideas

1. Technology displaces workers through technological unemployment because fewer people are needed to produce the same amount of stuff and the demand for stuff doesn't increase enough to offset the displacement

2. Automation creates productivity gains that lead to price decreases which increase market demand and the scale of production sufficiently to offset the displacement

*On a small scale:* Do productivity gains offset displacement within a firm?

On a medium scale: Do productivity gains offset displacement within an industry? Or within a small geographical region?

On a large scale: Do productivity gains offset displacement within a country?

On an even larger scale: Do productivity gains offset displacement on a global scale?

Agriculture's share of world employment fell from 40% to 27% between 2000 and 2019

GLOBAL WORKFORCE EMPLOYED IN AGRICULTURE

1 050 MILLION — 2000 — 40%
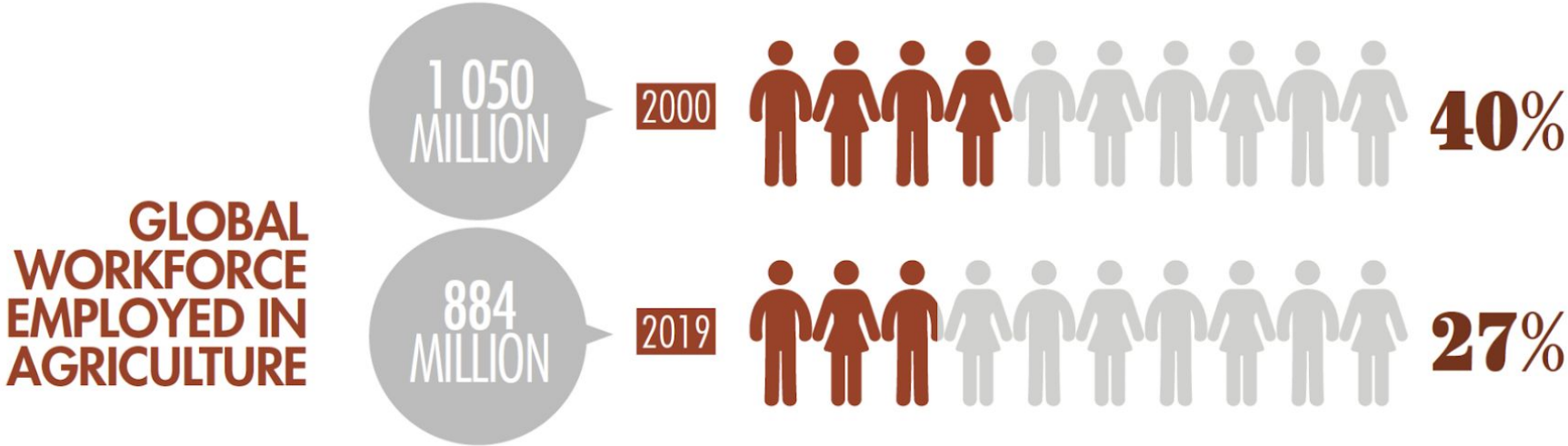
884 MILLION — 2019 — 27%

Agriculture employed 884 million people in 2019, or 27% of the global workforce, compared with 1 050 million (or 40%) in 2000.

Source: Migration Dialogue UC Davis using Data from FAO. 2020. Statistical Yearbook. World Food and Agriculture.

Microeconomics of AI

- How will AI change work?

3 business case studies and an Insight into Innovation

Access to an AI coding assistant led coders to complete their tasks **56% faster**

Coders were tasked with implementing an HTTP server using Javascript. The control group used their typical workflow. The randomly-assigned treatment group were also given access to an AI coding assistant.

Average time to complete the coding task
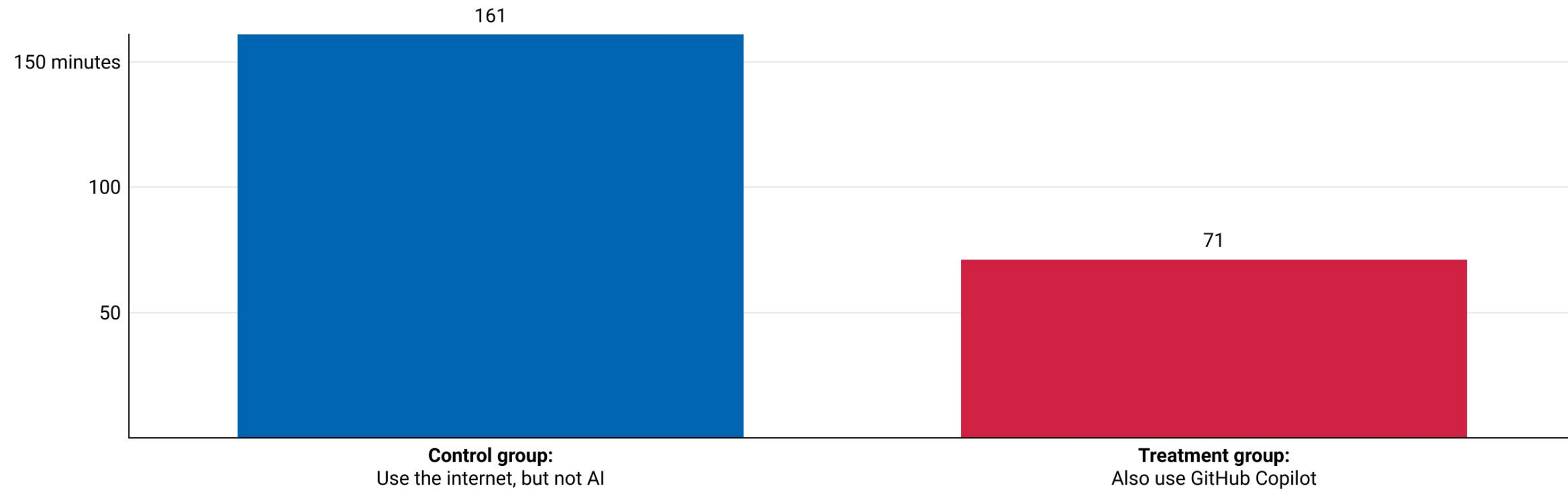
n=95 freelance coders recruited from Upwork.

Chart: Betsey Stevenson • Source: Peng, Kalliamovokou, Cihon, and Demierer (2023), The impact of AI on developer productivity: Evidence from Github Copilot"

Betsey Stevenson

ChatGPT led office workers to do professional writing tasks **40% faster**

White collar workers were assigned tasks such as writing press releases, short reports, analysis plans, and delicate emails, and they were paid for producing quality work. The randomly-assigned treatment group was instructed to sign up ChatGPT 3.5, while the control group was not.

Average time to complete the writing task
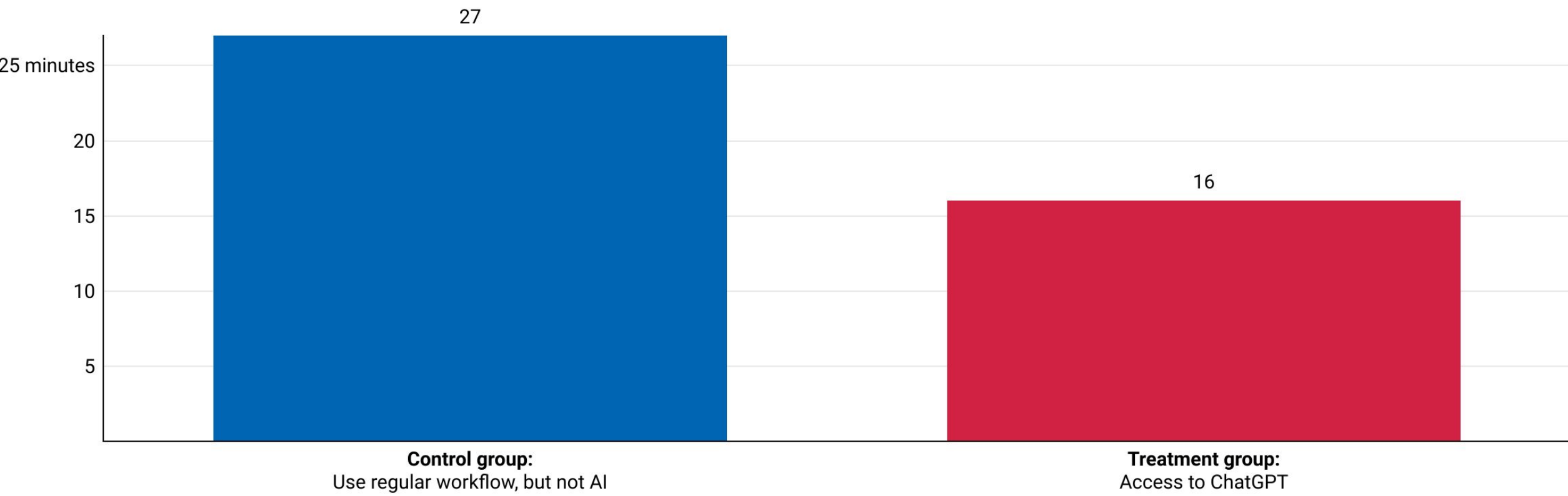
n=453 college-educated professionals recruited through Prolific.

Chart: Betsey Stevenson • Source: Now and Zhang (2023), "Experimental evidence on the productivity effects of generative artificial intelligence"

Betsey Stevenson

AI assistant led online customer service staff to resolve issues **14% faster**

In the treatment group, technical support staff were provided with an AI assistant that provides suggested responses (which they could use or ignore). Workers in the control group were those who were yet to receive access to this tool.

Average time to close a customer support ticket
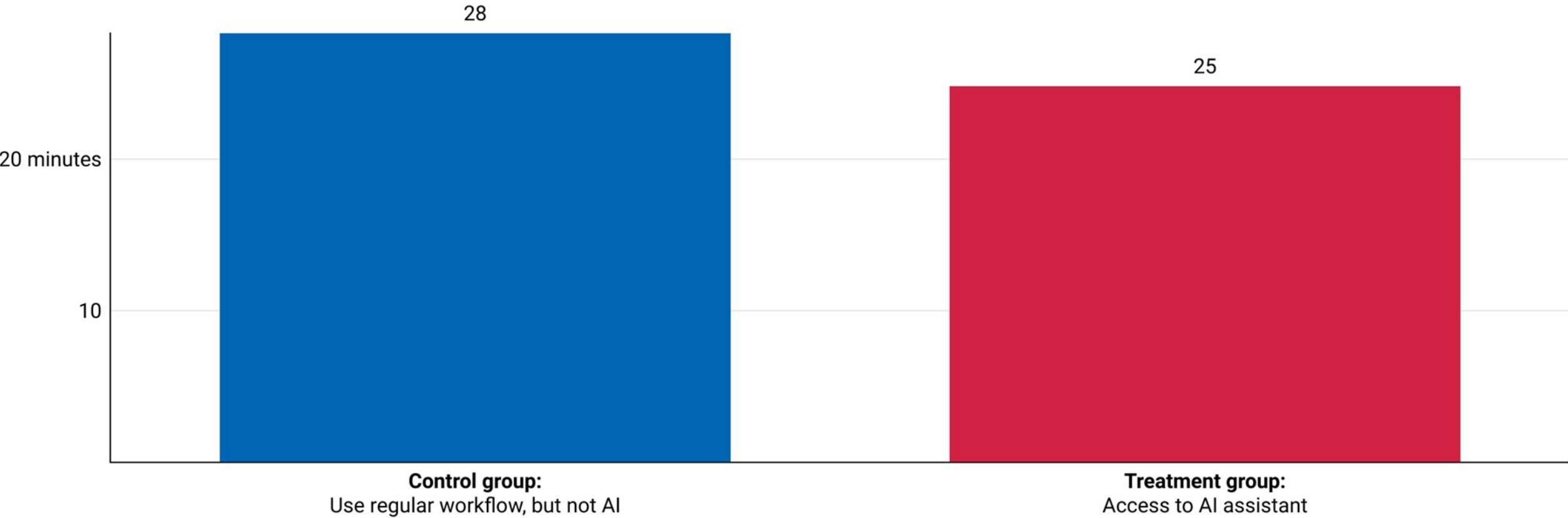
28

25

20 minutes

10

Control group:
Use regular workflow, but not AI

Treatment group:
Access to AI assistant

Generative AI can come up with innovative ideas

ARTIFICIAL INTELLIGENCE

M.B.A. Students vs. AI: Who Comes Up With More Innovative Ideas?

We put humans and AI to the test. The results weren't even close.

By Christian Terwiesch and Karl Ulrich

Sept. 9, 2023 9:00 am ET

Task: *Create an idea for a new physical product for the college student market that would be likely to retail for less than $50*

Purchase intent for each idea

Mean: 0.404
Std: 0.112

Mean: 0.468
Std: 0.108

Mean: 0.493
Std: 0.12
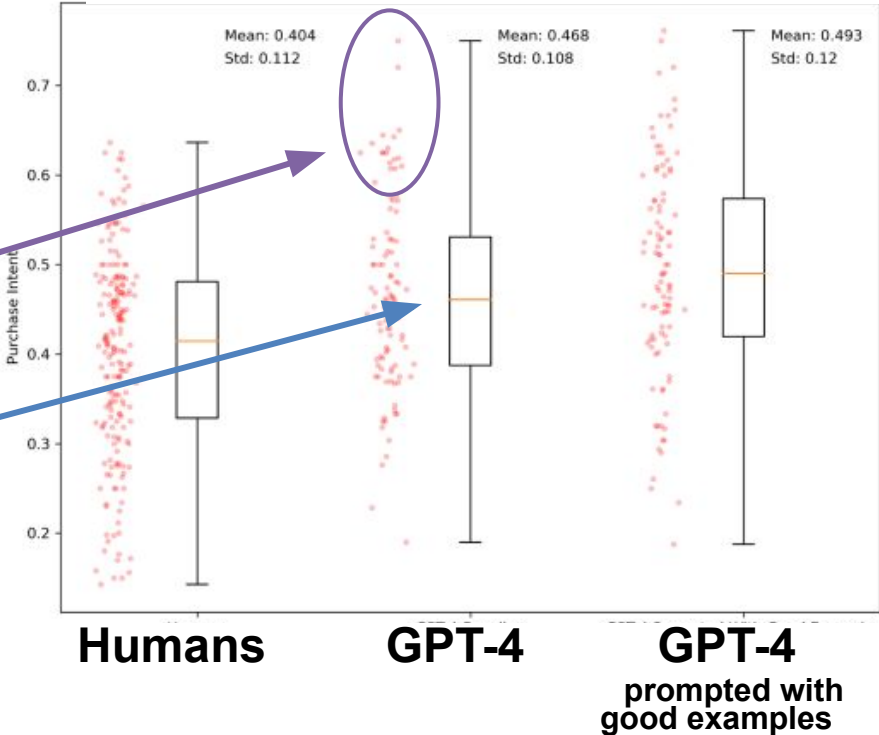
Best ideas are better

Average idea is better

Humans   **GPT-4**   **GPT-4**
prompted with good examples

What's different about the labor market effects of AI?

"Unlike most advances in automation in the past, it is a machine of the mind affecting cognitive work."

Source: Baily, Brynjolfsson, and Korinek (2023), "Machines of mind: The case for an AI-powered productivity boom"

Betsey Stevenson

Economists Believe in the Potential for Large Gains

Question B: Rising use of robots and artificial intelligence in advanced countries is likely to create benefits large enough that they could be used to compensate those workers who are substantially negatively affected for their lost wages.

Responses
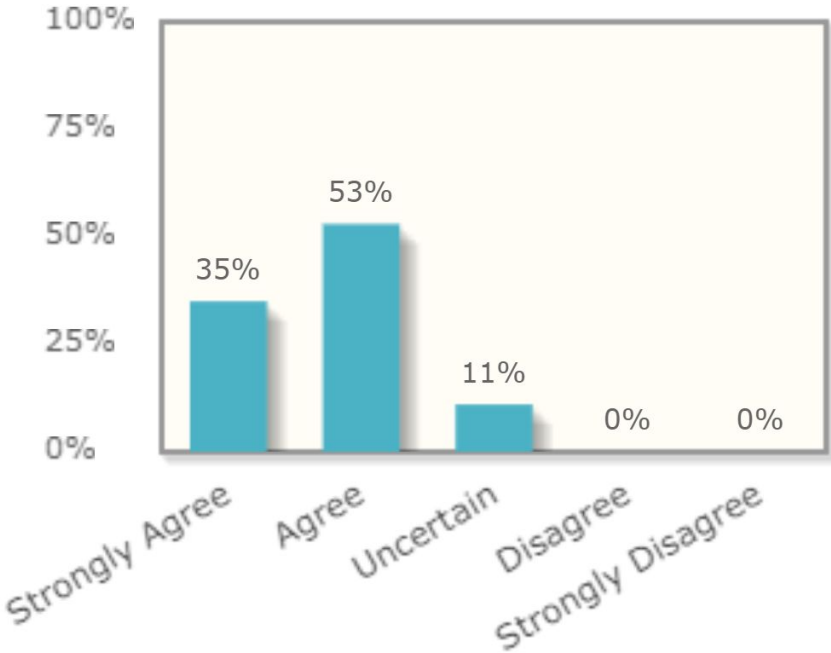
© 2019. Initiative on Global Markets.

Source: IGM Economic Experts Panel
www.igmchicago.org/igm-economic-experts-panel

Responses weighted by each expert's confidence

© 2019. Initiative on Global Markets.

Source: IGM Economic Experts Panel
www.igmchicago.org/igm-economic-experts-panel

But They Are Uncertain about Who Will Get Hurt

Use of artificial intelligence over the next ten years will have a negative impact on the earnings potential of substantial numbers of high-skilled workers in advanced countries.

Responses
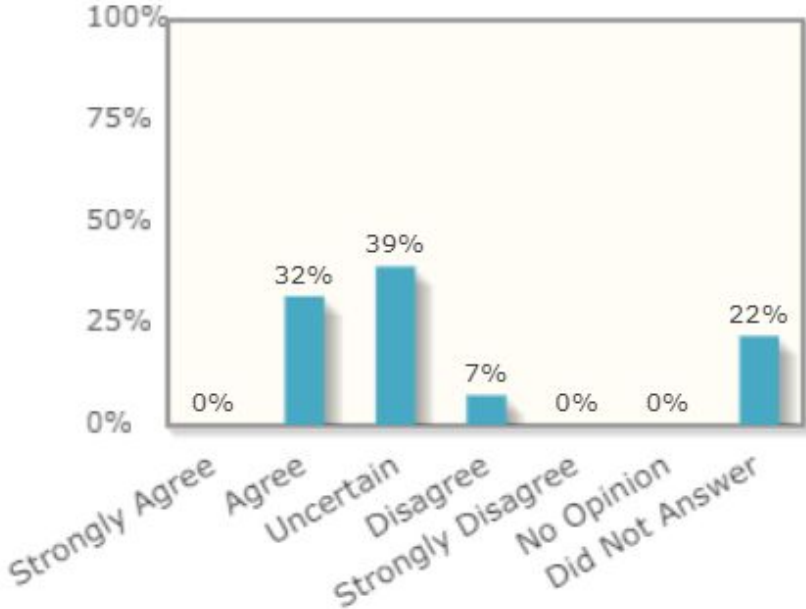
Responses weighted by each expert's confidence

© 2023. Kent A. Clark Center for Global Markets.

Source: Clark Center Economic Experts Panel
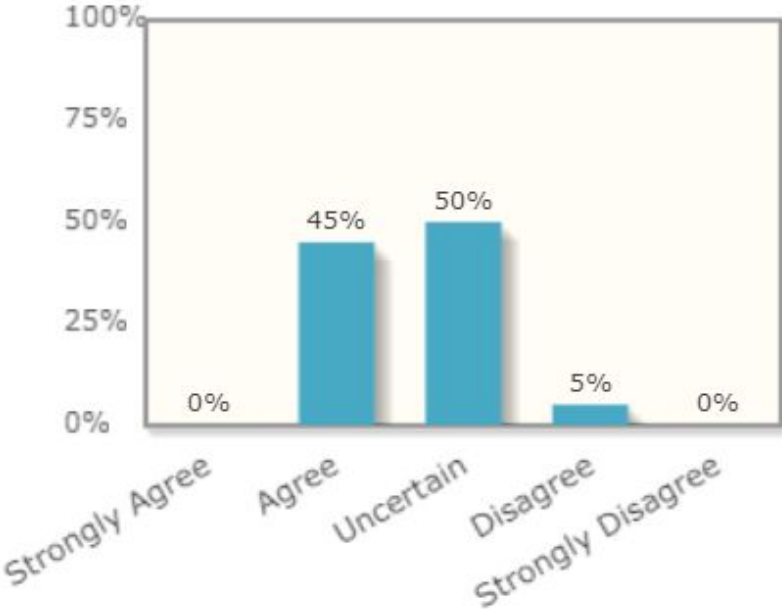
Methodology

© 2023. Kent A. Clark Center for Global Markets.

Source: Clark Center Economic Experts Panel

Methodology

And What It Will Mean for Inequality

Use of artificial intelligence over the next ten years is likely to have a measurable impact in increasing income inequality.

Responses

Responses weighted by each expert's confidence

© 2023. Kent A. Clark Center for Global Markets.

Source: Clark Center Economic Experts Panel

© 2023. Kent A. Clark Center for Global Markets.

Source: Clark Center Economic Experts Panel

Which jobs are vulnerable to being automated by AI?

80% of (US) workers have
>10% of their tasks affected

50% of (US) workers have
>50% of their tasks affected

Jobs where
0%
of tasks can
be automated

Jobs where
100%
of tasks can
be automated

Athletes
Cooks
Dishwashers
Floor layers
Meatpackers
Tire repairs
Tradesmen's
helpers

Copy editors
Financial
analysts
Survey
researchers
Tax preparers
Translators
Web designers

AI will have uneven effects across sectors

Share of work tasks that could be automated by AI
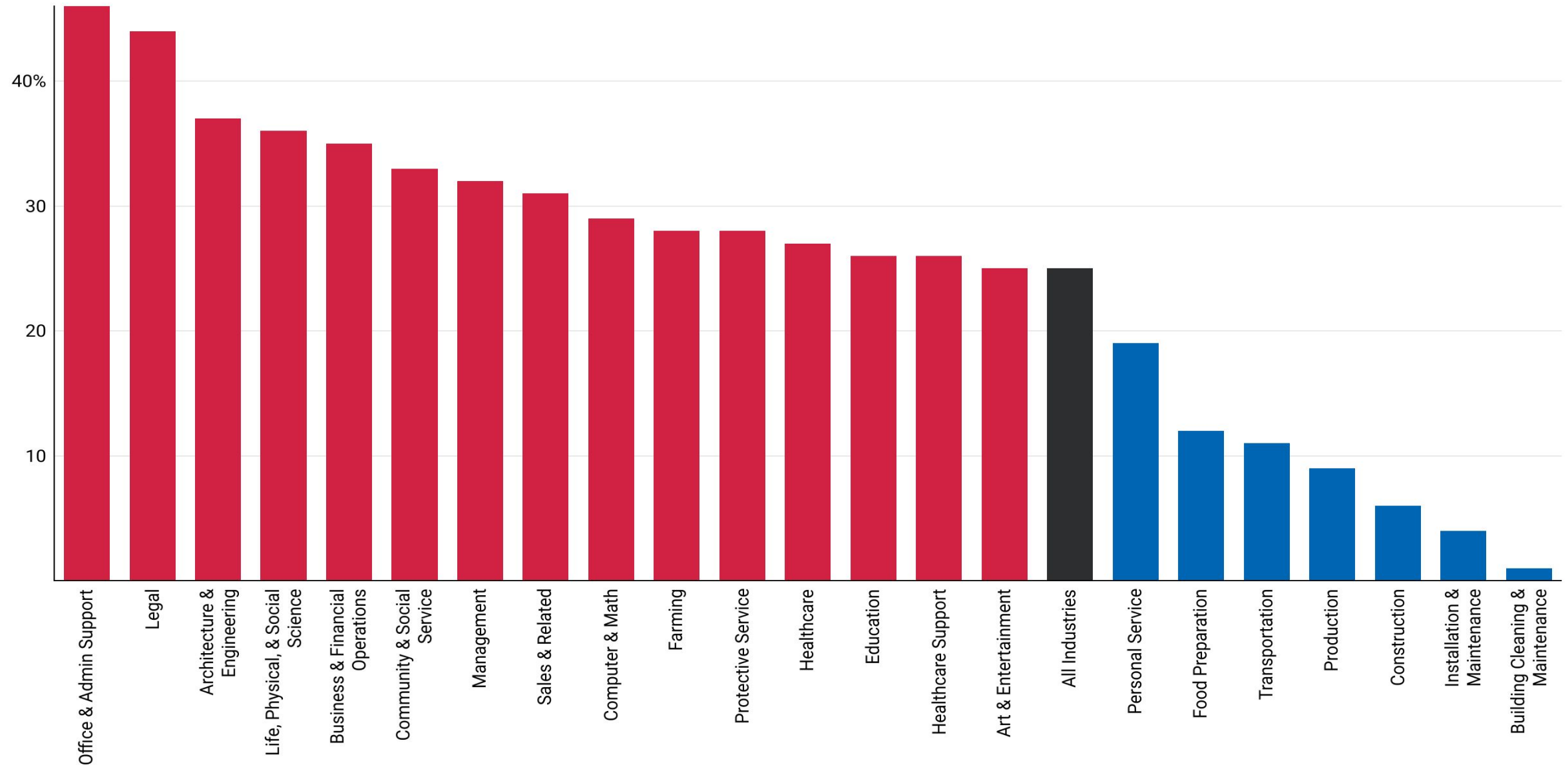
Chart: Betsey Stevenson • Source: Goldman Sachs, "The Potentially Large Effects of Artificial Intelligence on Economic Growth"

Microeconomics of AI

- How will AI change work?

Macroeconomics of AI

- Add it up (and maybe multiply)

Political economy of AI

- Dividing the pie

Me-conomics of AI

- How **you** can adapt

Betsey Stevenson

A task-based view

AI could transform 20% of all tasks

= AI affects a large share of the economy (but not all)

A task-based view

$$\boxed{\text{AI could transform 20\% of all tasks}} \times \boxed{\text{Only 23\% of these tasks can be cost-effectively automated}} = 20\% \times 23\% = 4.6\%$$

of tasks will be done by AI

A task-based view

AI could transform 20% of all tasks	$\times$	Only 23% of these tasks can be cost-effectively automated	$\times$	Automating a task yields a 27% labor saving

$$= 20\% \times 23\% \times 27\% = 1.2\%$$

reduction in labor costs

A task-based view

Productivity boost
(doing more with less)

AI could transform 20% of all tasks	$\times$	Only 23% of these tasks can be cost-effectively automated	$\times$	Automating a task yields a 27% labor saving	$\times$	Labor accounts for only 53% of costs

$$= 20\% \times 23\% \times 27\% \% \times 53\% = 0.66\%$$

reduction in production costs

Economists also call this a rise in **total factor productivity**

Source: Acemoglu (2024), "The Simple Macroeconomics of AI"

A task-based view

Productivity boost
(doing more with less)

| AI could transform 20% of all tasks | × | Only 23% of these tasks can be cost-effectively automated | × | Automating a task yields a 27% labor saving | × | Labor accounts for only 53% of factor costs |

+ | Proportionate 0.66% increase in capital investments | × | Capital : Output ratio is 0.73 |

$= 0.66\% + 0.66\% \times 0.73 =$

1.1%
rise in GDP
over the next decade

"Capital deepening"
(investments in AI)

Betsey Stevenson

Let's get more optimistic

Different approach (not a big deal)

The price of AI is falling dramatically

Some case studies yield better outcomes

AI could transform **25%** ~~20%~~ of all tasks

×

~~Only 23%~~ **All** of these tasks can be cost-effectively automated

×

Automating a task yields a ~~27%~~ **36%** labor saving

×

Labor accounts for only 53% of costs

= 4.7%

rise in productivity

+

Proportionate 4.7% ~~0.66%~~ increase in capital investments

×

Capital : Output ratio is 0.73

= 4.7% + 4.7%×0.73 = 8%

rise in GDP over the next decade

Source: Goldman Sachs (2024), "Addressing the AI growth debate"

What's missing?

Tech revolutions reallocate workers to new and productive jobs

Some occupations shrank
Share of employment, 1940 and 2020

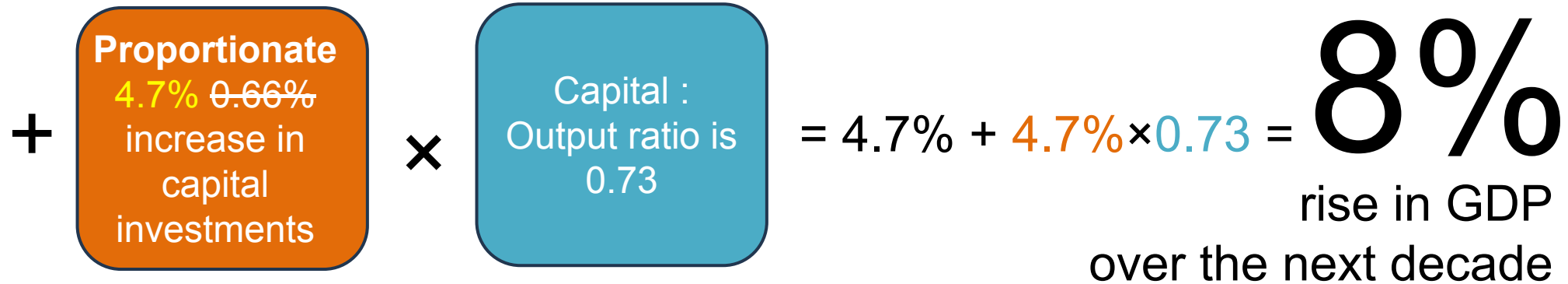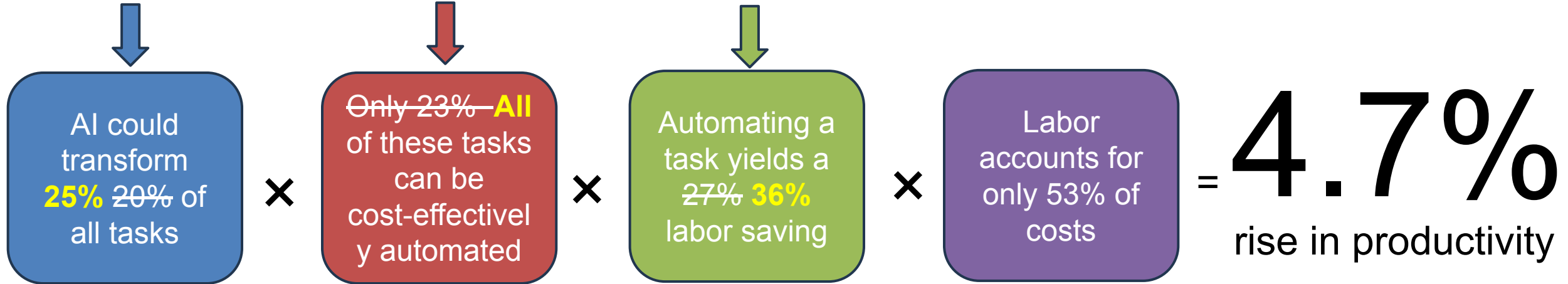|	0%	5%	10%
Farmers (owners and tenants)			
Operative and kindred workers			
Laborers			
Salesmen and sales clerks			
Farm laborers, wage workers			
Private household workers			
Farm laborers, unpaid family workers			
Bookkeepers			
Mine operatives and laborers			
Deliverymen and routemen			

Some occupations grew
Share of employment, 1940 and 2020

	0%	5%	10%
Managers, officials, and proprietors			
Clerical and kindred workers			
Professional, technical and kindred workers			
Teachers			
Cooks, except private household			
Nurses, professional			
Attendants, hospital and other institution			
Janitors and sextons			
Musicians and music teachers			
Attendants, professional and personal service			
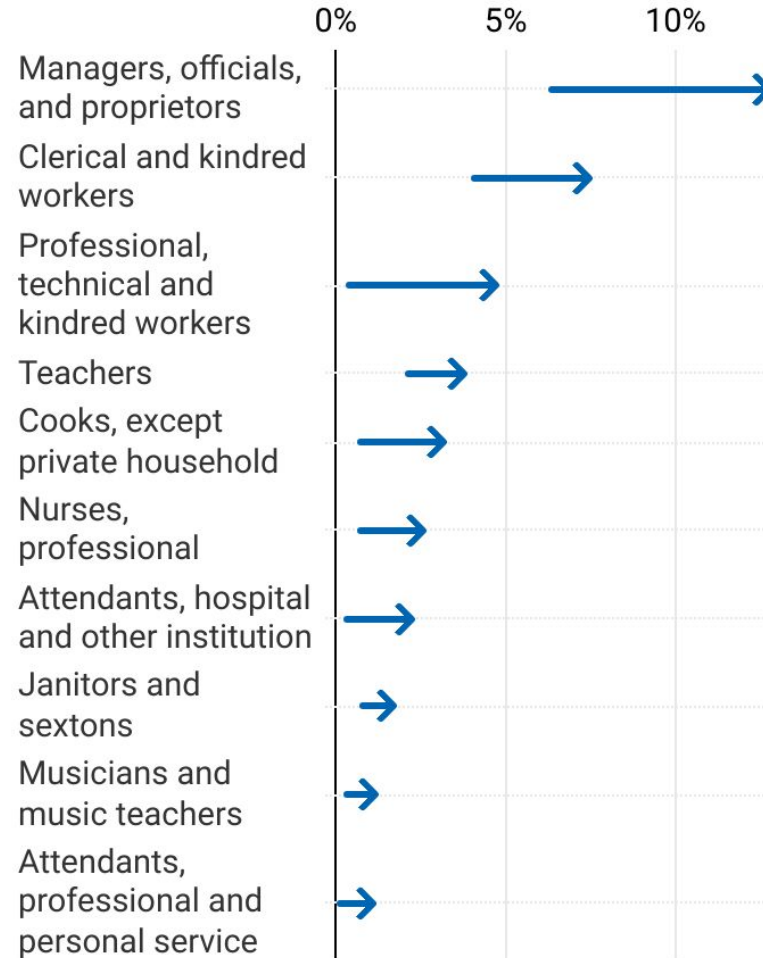
New occupations emerged
Share of employment, 1940 and 2020

	0%	1%	2%
Cashiers			
Medical and dental-technicians			
Accountants and auditors			
Personnel and labor relations workers			
Taxicab drivers and chauffeurs			
Engineers			
Recreation and group workers			
Bus drivers			
Economists			
Excavating, grading, and road machinery operators			
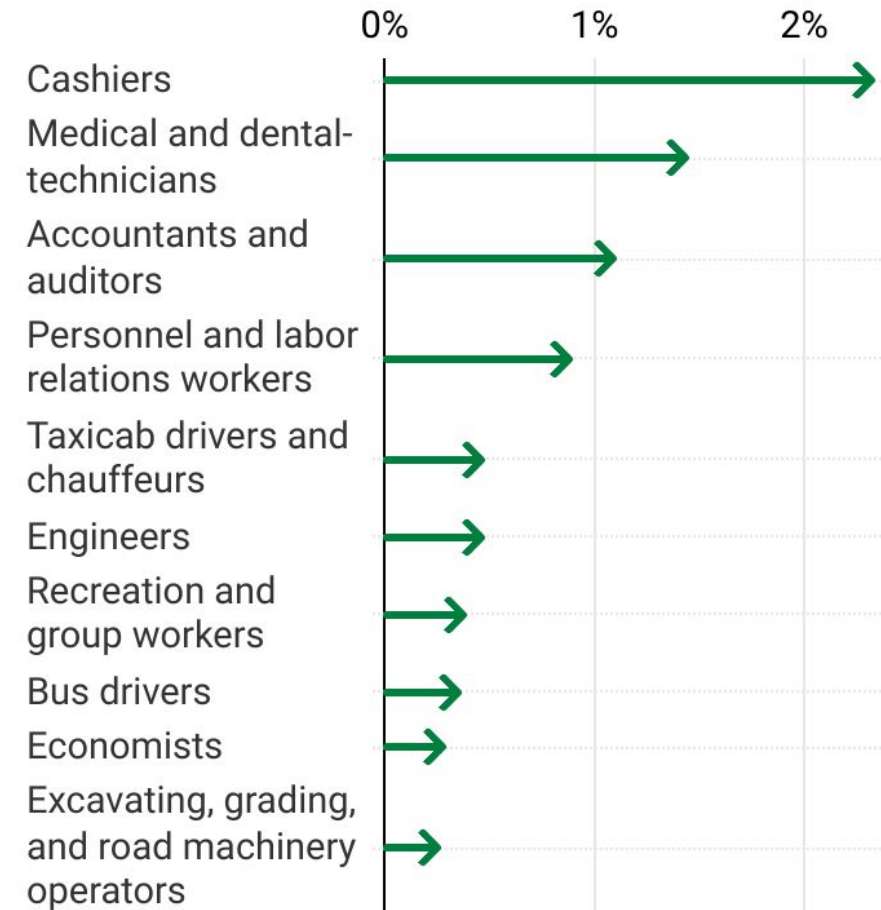
If AI could raise the productivity of <mark>innovators</mark> by 20%, it could raise output growth from a **2% baseline** to **2.4% with AI**, and a small change in growth compounds into big gains

Output, relative to 2024

Legend:
- If AI boosts innovation is 30% higher than Baseline
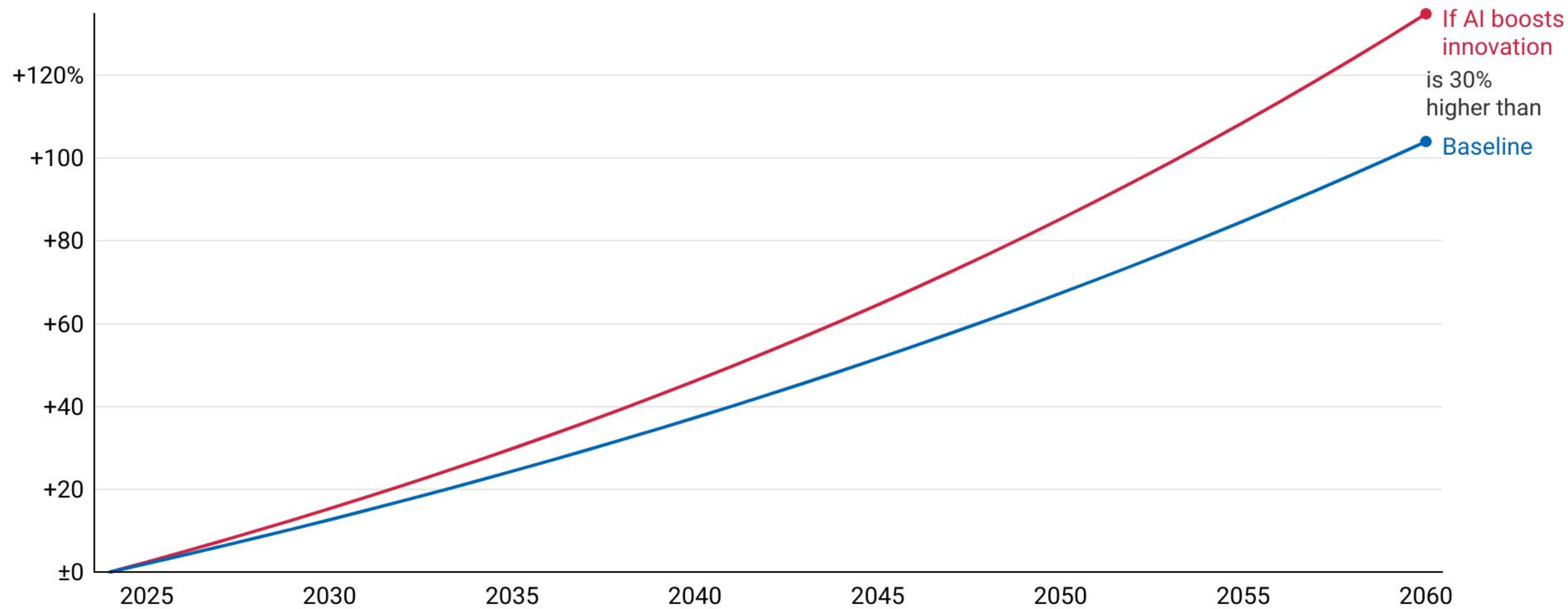
Estimated effects of AI on the level of US GDP in ten years time

Central estimate, by forecaster

Average: 12%

Forecaster	Estimate
Acemoglu	1%
JP Morgan	9%
Accenture	11%
McKinsey	14%
Goldman Sachs	15%
PwC	21%
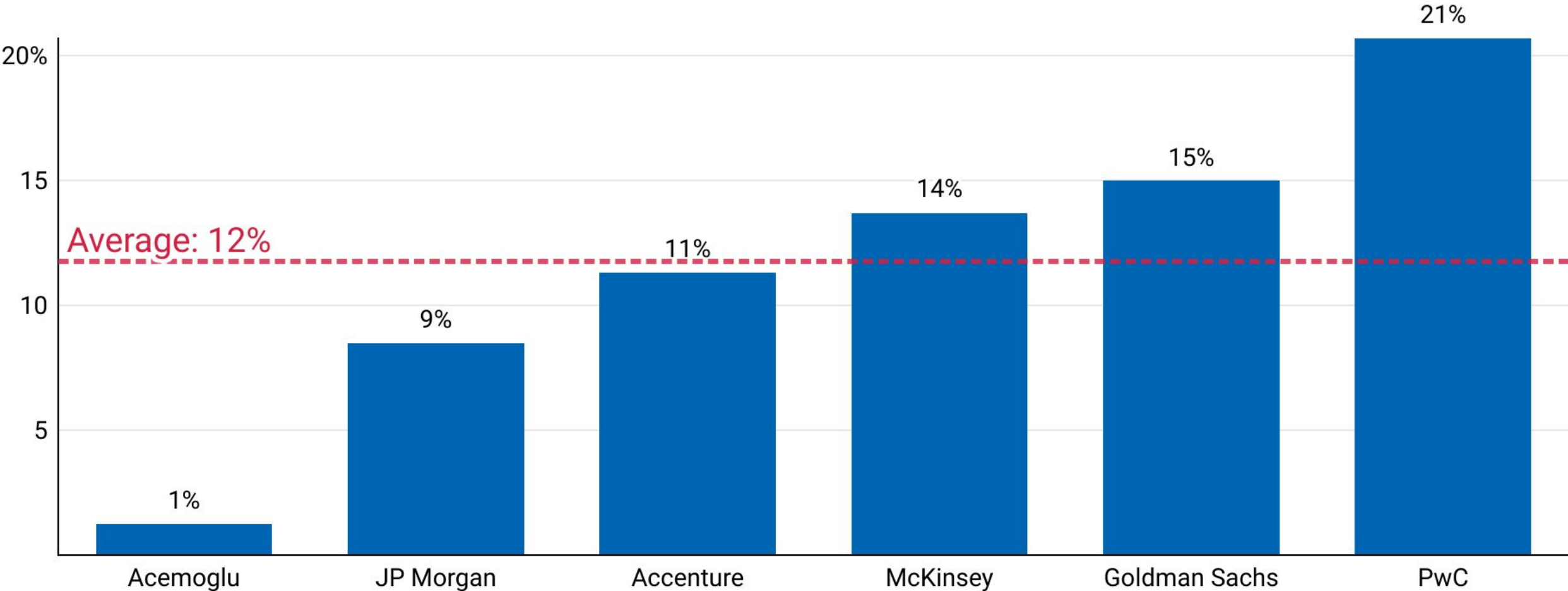
Chart: @JustinWolfers • Source: JP Morgan

How transformative will AI be in our lifetimes?

Economists

Technologists

Just another
innovation

Utterly
transformative

Major innovations often don't deliver productivity growth until work has been reorganized around them

Numbers of years between invention and the boost to productivity

"Engels pause"
Half-century of capital accumulation and wage stagnation to kick off the industrial revolution

Factory layouts needed to change to reap benefits

Solow paradox:
One "can see the computer age everywhere but in the productivity statistics"

A big unknown
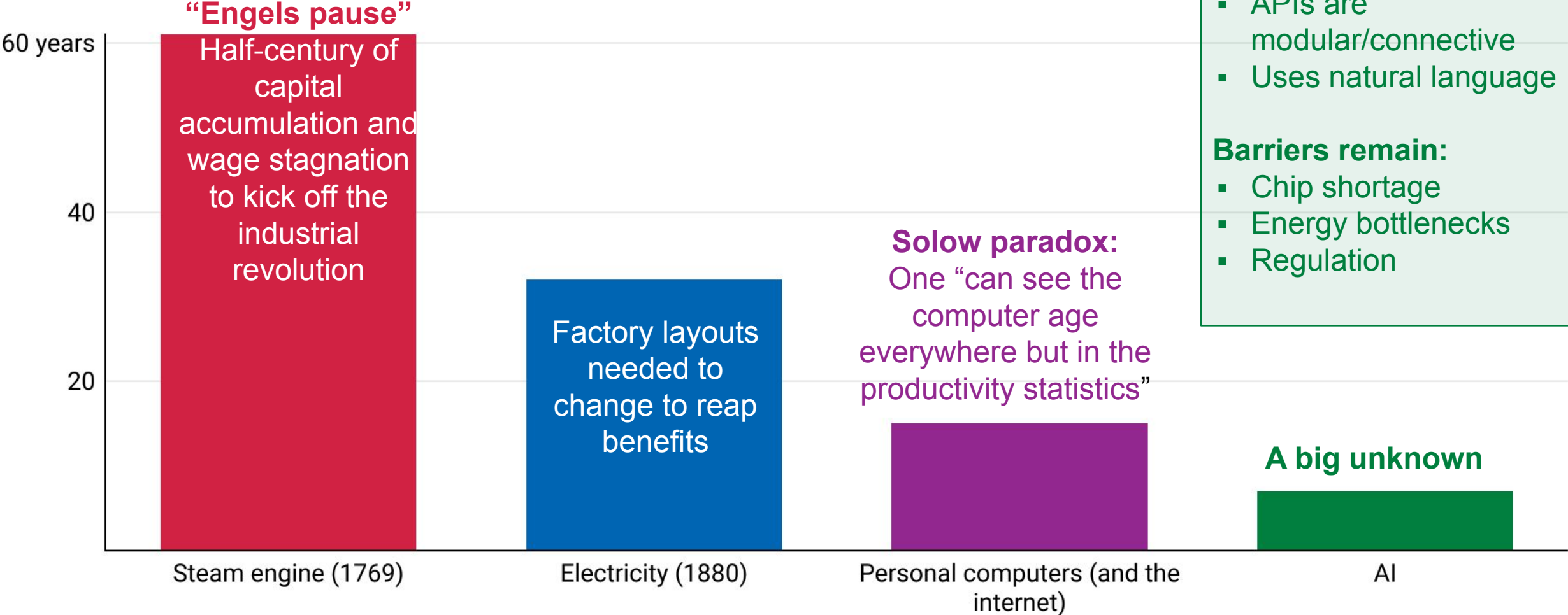
Adopting AI simpler:
- Software is not physical
- APIs are modular/connective
- Uses natural language

Barriers remain:
- Chip shortage
- Energy bottlenecks
- Regulation

60 years
40
20

Steam engine (1769)
Electricity (1880)
Personal computers (and the internet)
AI

Betsey Stevenson

Remarkably few U.S. businesses have adopted AI

Share of businesses, Late 2023

Have adopted AI (3.9%)

Plan to adopt within six months (2.6%)
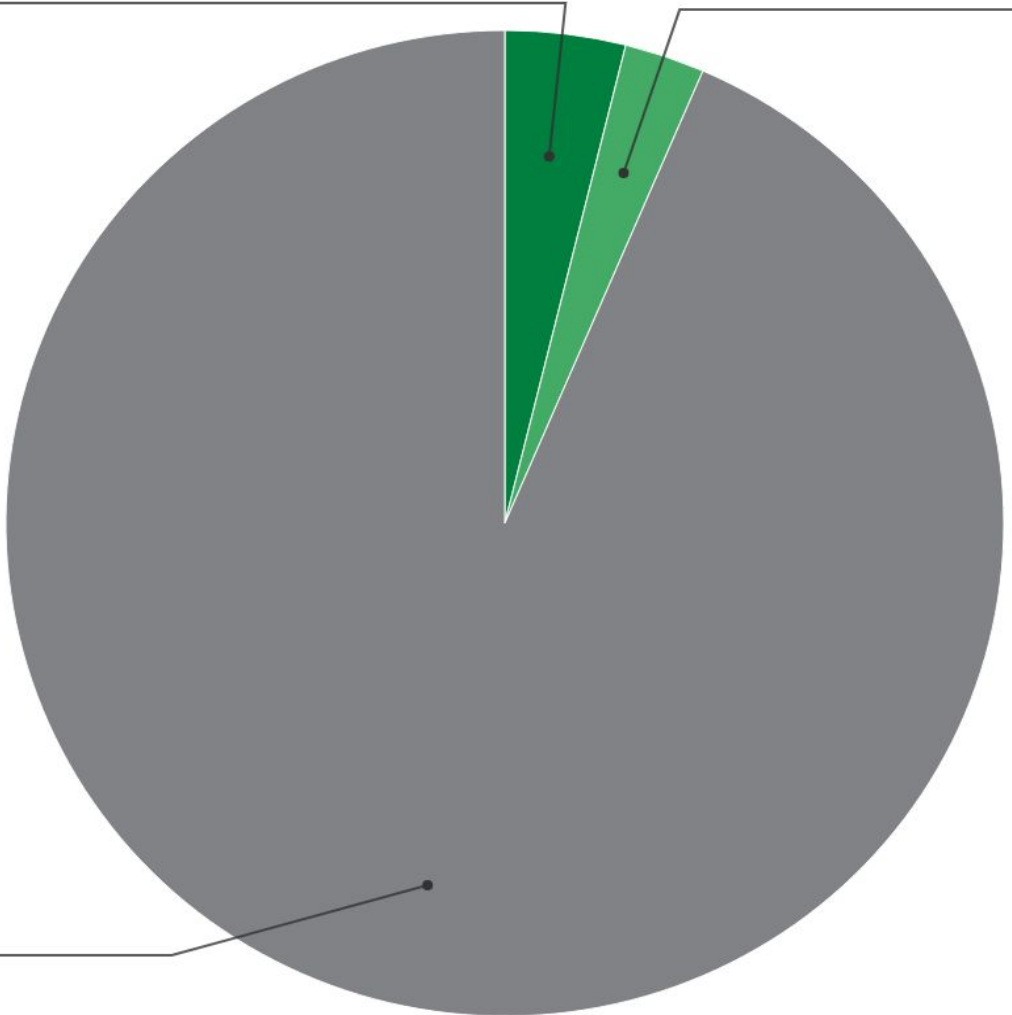
Haven't adopted AI (93.5%)

Microeconomics of AI

- How will AI change work?

Macroeconomics of AI

- Add it up (and maybe multiply)

Political economy of AI

- Dividing the pie

Me-conomics of AI

- How **you** can adapt

Understanding the disruption as an **ownership** problem

❑ Imagine that **you** own a robot that can do all of your work for you

   ▢ Are you better off?   **Yes**

   ▢ Is your boss better off? **No**

❑ Imagine that **your employer** owns a robot that can do all of your work without you

   ▢ Are you better off?   **No**

   ▢ Is your boss better off? **Yes**

→ We don't have a **robot problem** (or an AI problem)
…but we do have an **ownership problem**

Understanding the disruption as a **competition** problem

❑ Imagine that **Open AI, Google, Facebook, and many other competitors** each own competing AI models that can do all of your work

❑ Imagine that **a monopoly AI company** owns an AI model that that can do all of your work

   ❑ Are you better off?   **No**

   ❑ Is your boss better off?   **Yes**

   ❑ Are you better off?   **No**

   ❑ Is your boss better off?   **No**

   ❑ Is the monopolist better off?   **Yes**

→ We don't have a **robot problem** (or an AI problem)

…but we might have a **competition problem**

Microeconomics of AI

- How will AI change work?

Macroeconomics of AI

- Add it up (and maybe multiply)

Political economy of AI

- Dividing the pie

Me-conomics of AI

- How **you** can adapt

The three stages of the AI rollercoaster

1. This can do my job!

2. This can do my job!

The three stages of the AI rollercoaster

1. ***This*** can do my job!

2. This can do ***my*** job!

THEY TOOK MY JOB

3. Working together, this can **help** me do a ***better*** job

Substitute

← AI will **displace** some workers

versus

Complement

← AI will **augment** others

Understand the opportunity

From Computer code… ...to AI

❑ Explicit instructions transform inputs to outputs

  ☐ Task must written in code

→ Use for **codified** knowledge

❑ *Infer* instructions from examples

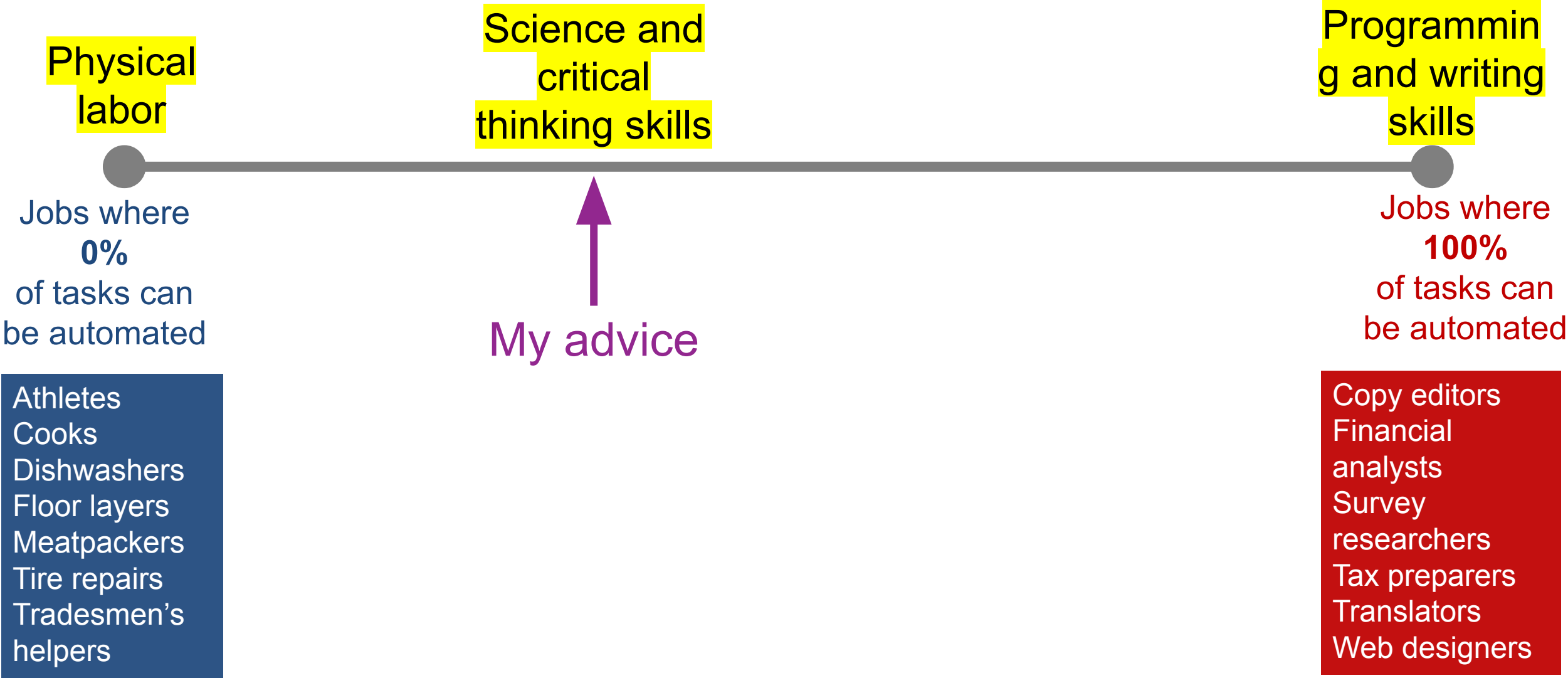 ☐ Can perform tasks even when no instructions exist

→ Use for **tacit** knowledge

  → Previously could only be gained through lived experience

AI will reduce the total number of jobs! Great!

"The mass of men lead lives of quiet desperation. What is called resignation is confirmed desperation.. unconscious despair is concealed even under what are called the games and amusements of mankind. There is no play in them, for this comes after work." Thoreau

Invest in new skills wisely

Physical labor

Science and critical thinking skills

Programming and writing skills

Jobs where **0%** of tasks can be automated

My advice

Jobs where **100%** of tasks can be automated

Athletes
Cooks
Dishwashers
Floor layers
Meatpackers
Tire repairs
Tradesmen's helpers

Copy editors
Financial analysts
Survey researchers
Tax preparers
Translators
Web designers

Instead of focusing on **shortcomings**, learn to help **AI succeed**

- AI **hallucinates**
  - Set "temperature" = 0
- Responses are **formulaic**
  - "Sharpen that response"; "write like Hemmingway"
- It makes simple **math errors**
  - "And check your answer in Python"
- AI lacks **creativity**
  - I'm not so sure
- Computers lack **empathy**
  - Good prompting can yield empathy
  - AI doesn't get tired and cranky

Expand your uses

- Everyday open an LLM in a spare tab, and make sure you try it for **at least one new task**

- Some examples
  - Edit your writing
  - Name your next company, design a logo, and come up with advertising slogans
  - Plan your next family holiday
  - Extract data from a chart
  - Learn a new language
  - Brainstorm new product ideas
  - Write your code
  - Write (or rewrite) your social media posts
  - Write your children a bedtime story
  - Read financial statements and predict future corporate earnings

Microeconomics of AI

- How will AI change work?

Macroeconomics of AI

- Add it up: How will it change the economy?

Political economy of AI

- Dividing the pie: What are the political divides?

Me-conomics of AI

- Bringing it back to you: How **you** can adapt