

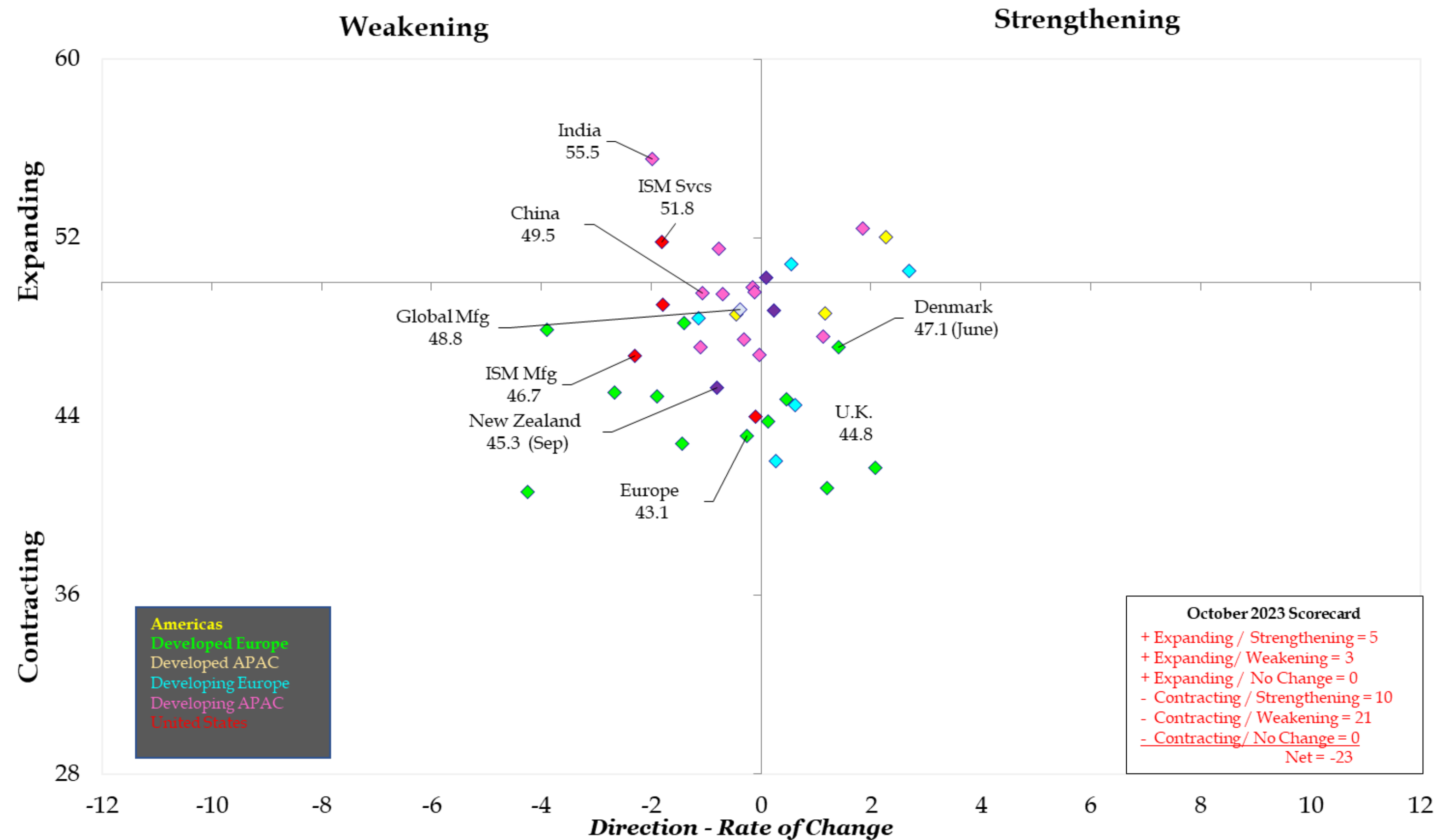
# Economic & Market Outlook: It All Depends On Your Time Horizon

**Linda A. Duessel, CFA®, CPA, CFP®**  
Senior Equity Strategist  
Senior Vice President

November 2023

# Can the globe skirt a recession?

Global Economy Scorecard as of October 2023

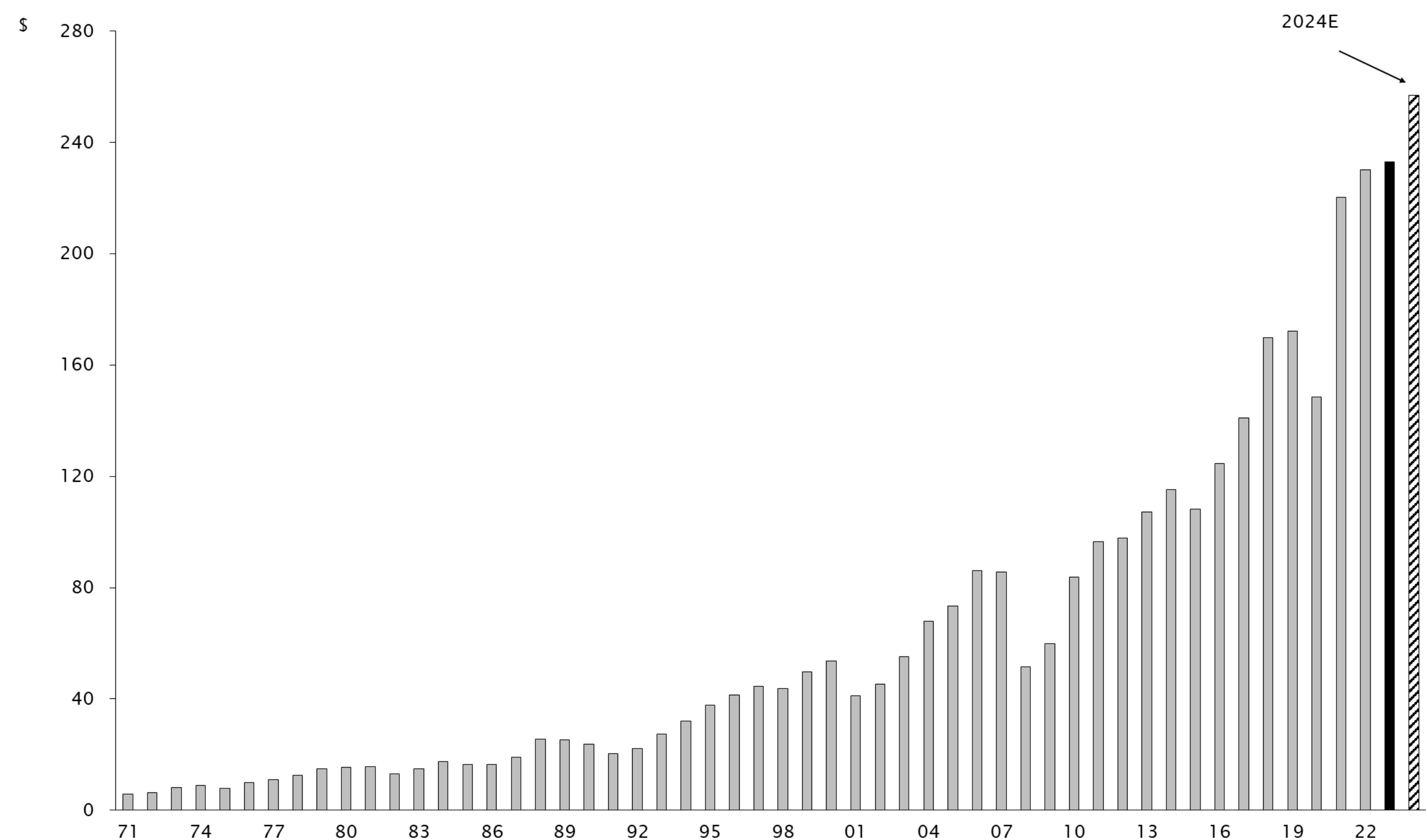


Source: Strategas Research Partners. Data as of October 31, 2023



# The earnings have been extraordinary

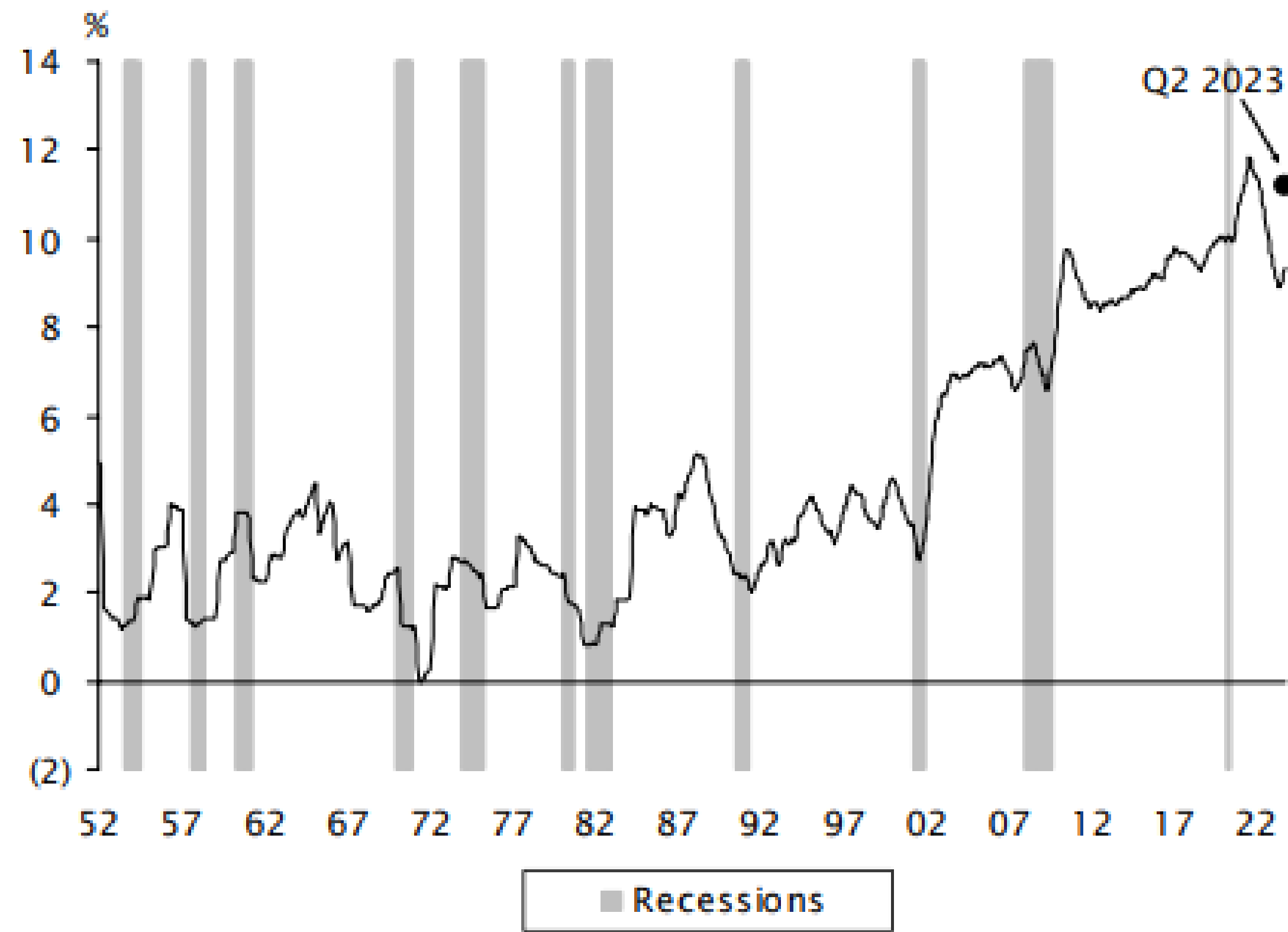
The S&P 500 Earnings Per Share \*  
1971 Through 2024E



Source: Empirical Research Partners Analysis and Estimates, November 16, 2023  
\*-Based on a roll-up of analyst estimates. Note: Shaded bars represent recessions.

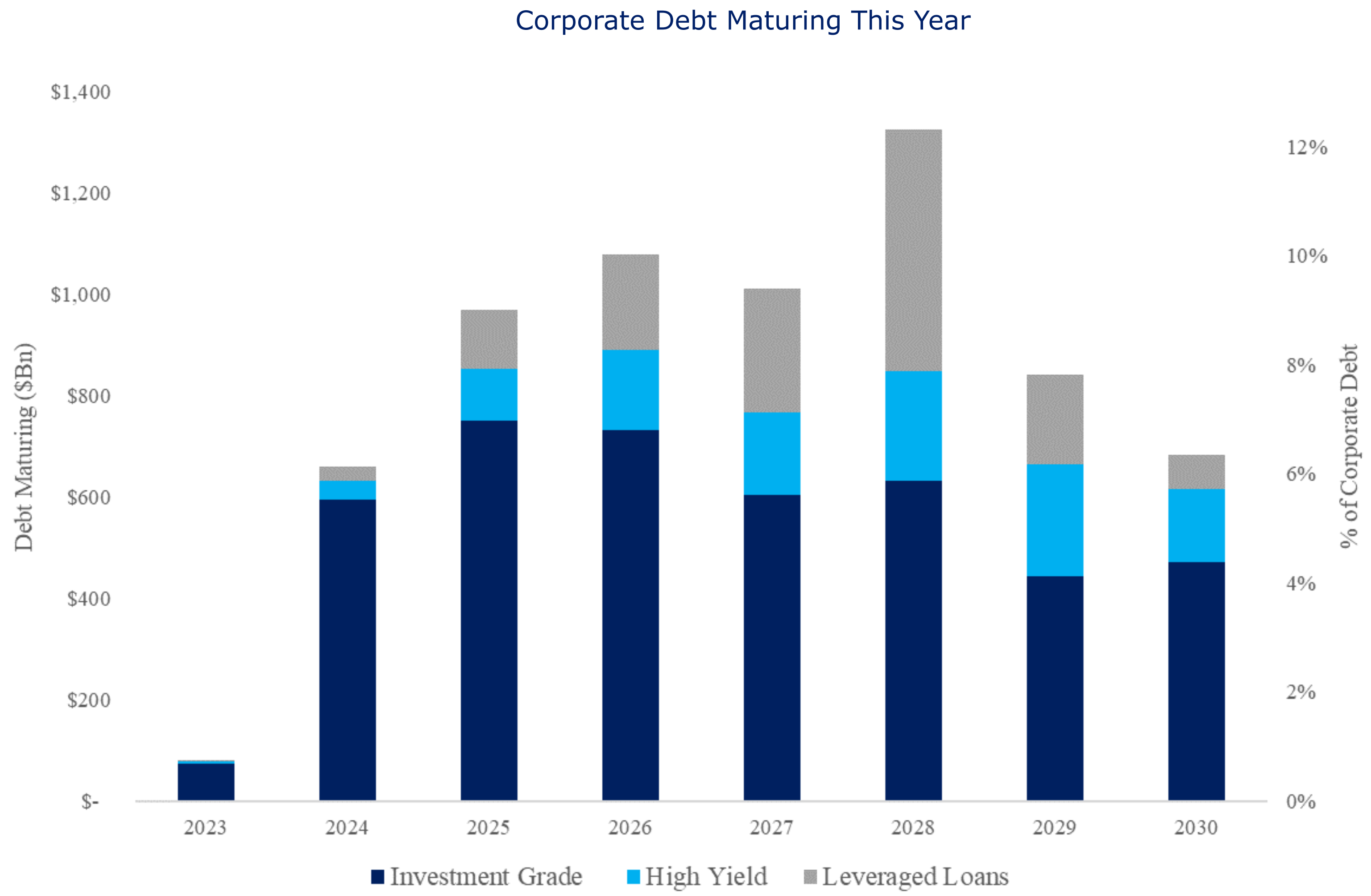
# Profit margins have held up

The Core of The Large-Cap Market\* Free Cash Flow Margins  
1952 Through September 2023



Source: Corporate Reports, National Bureau on Economic Research, Empirical Research Partners Analysis. October 10, 2023. Data through September 30, 2023.  
\*Excludes financials, REITs, utilities and energy; based on trailing four-quarter data.

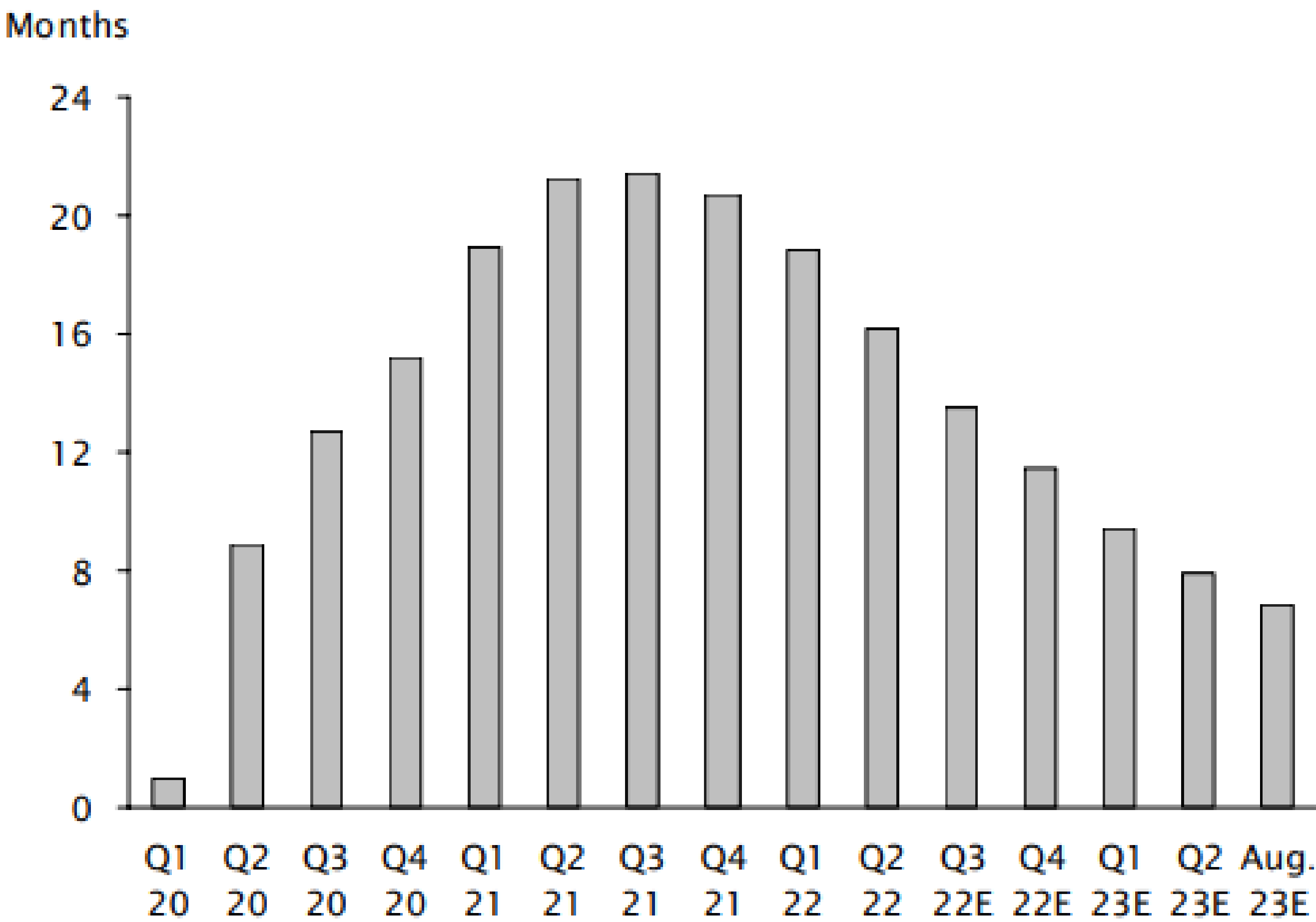
# Corporate debt is manageable, for now



Source: Bloomberg, Federated Hermes Multi-Asset Team as of October 31, 2023

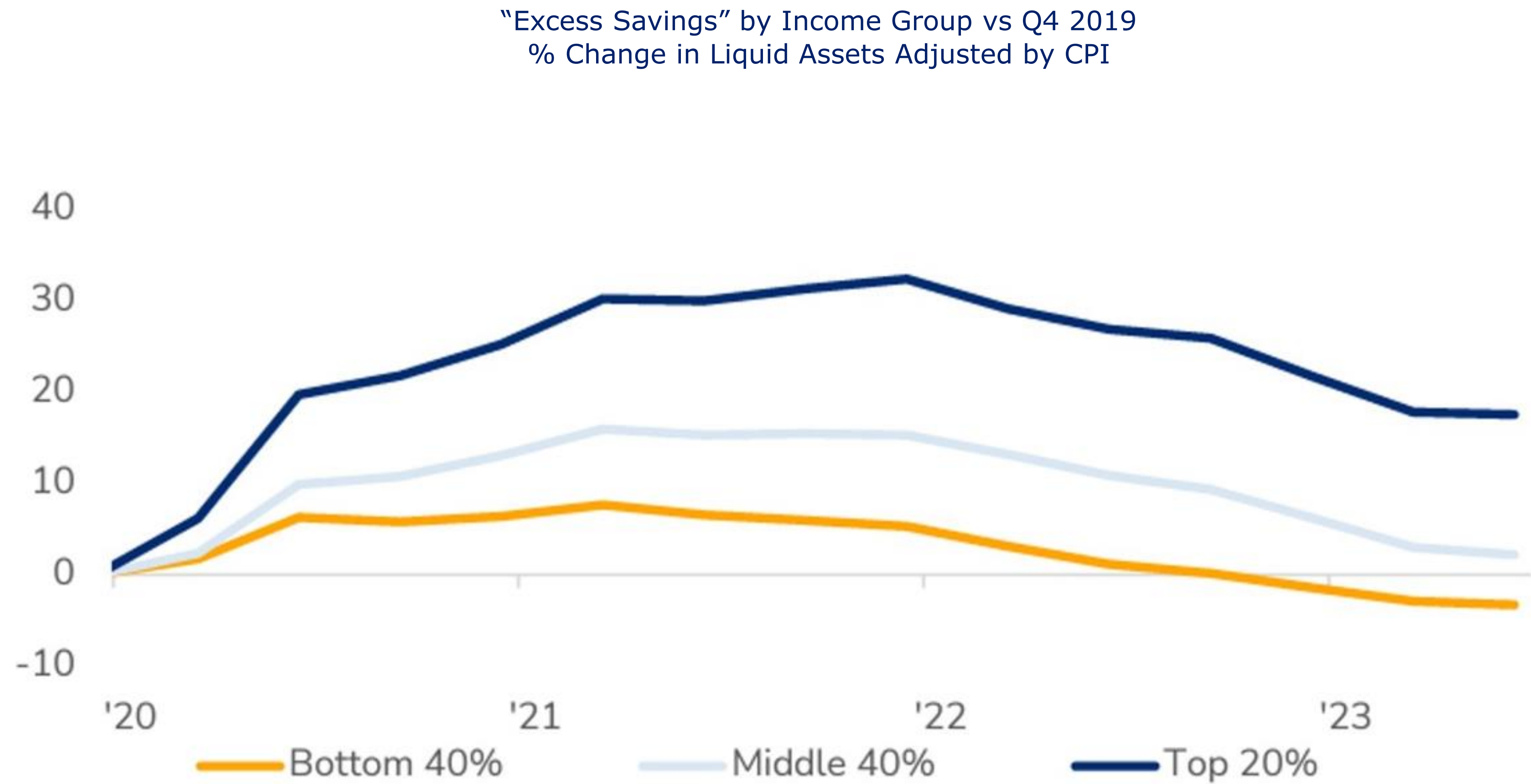
# Easy come, easy go

U.S. Consumers Cumulative “Excess” Savings Measured in Months of Typical Savings  
Q1 2020 Through August 2023E



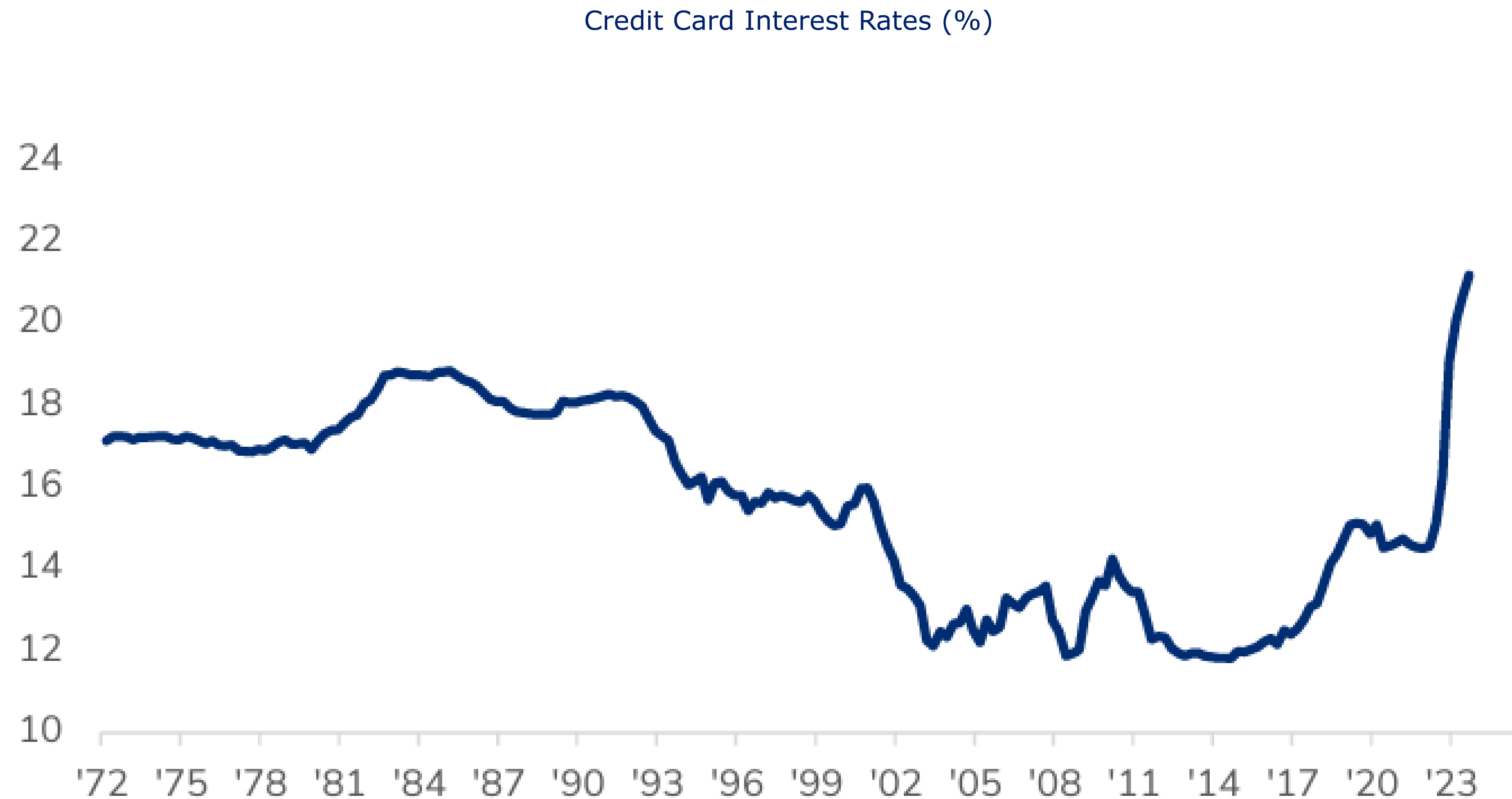
Source: Aladangady, A., Cho, D., Feiveson, L., and Eugenio Pinto, 2022. “Excess Savings During the COVID-19 Pandemic,” FEDS Notes, U.S. Department of Commerce, Empirical Research Partners Analysis and Estimates. October 10, 2023. Data through August 31, 2023

# Haves vs. have-nots



Source: Wolfe Research. Haver Analytics, November 6, 2023. Data as of June 30, 2023  
Note: From the Fed's Distributional Financial Accounts, includes deposits and money market shares by income group, deflated by headline CPI.

# Credit card sticker shock

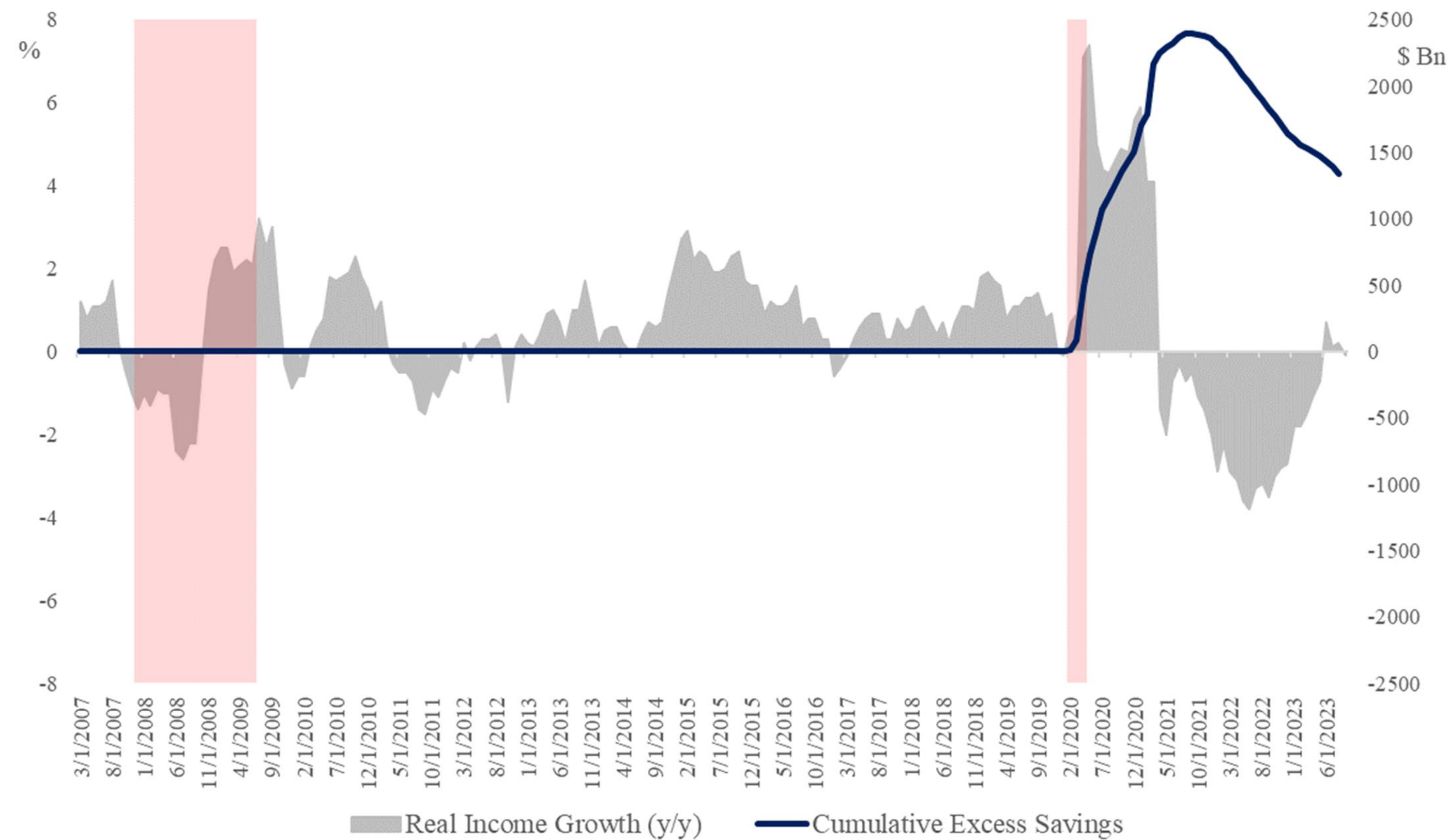


Source: Wolfe Research, FRB, Haver Analytics, November 9, 2023. Data as of September 30, 2023



# Just don't get fired

Real Income Growth Has Turned Positive, Which Could Slow/Reverse the Drawdown of Excess Pandemic Savings

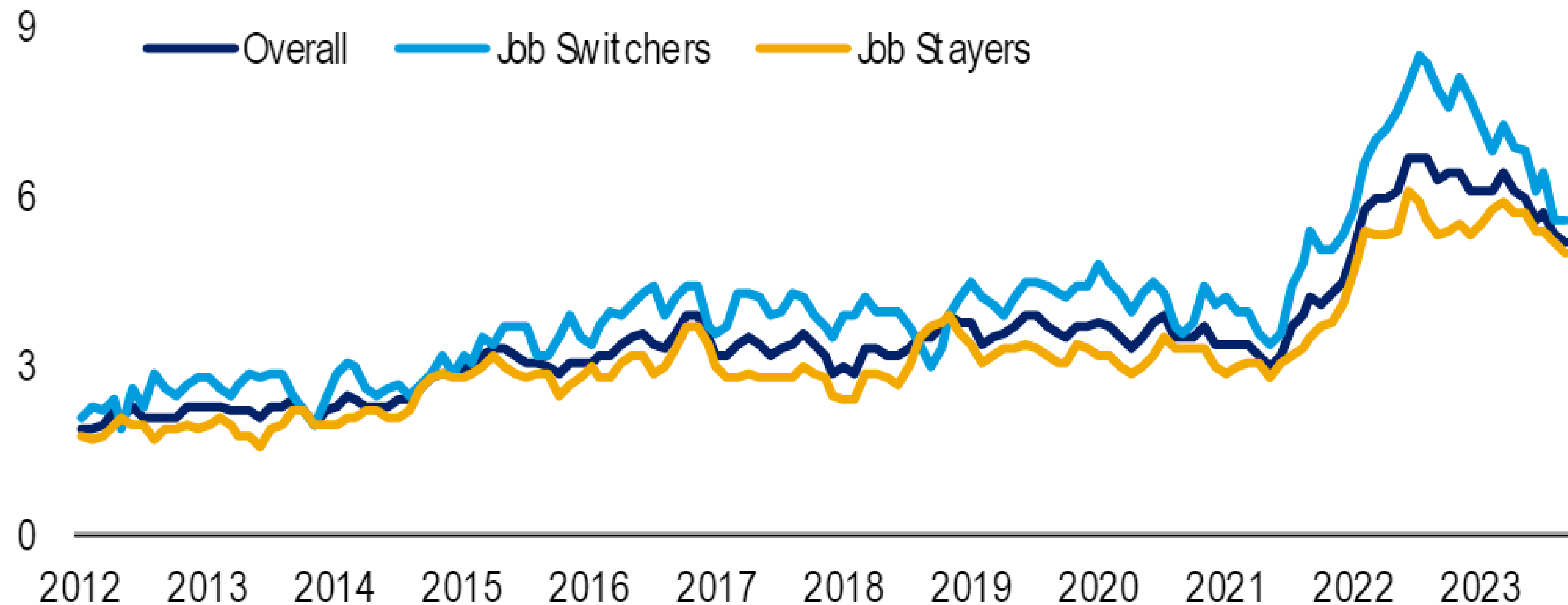


Note: Red shaded areas indicate recessions.

Source: Bloomberg, Federated Hermes Multi-Asset Team as of October 31, 2023.

# Wage growth for job switchers has slowed down significantly

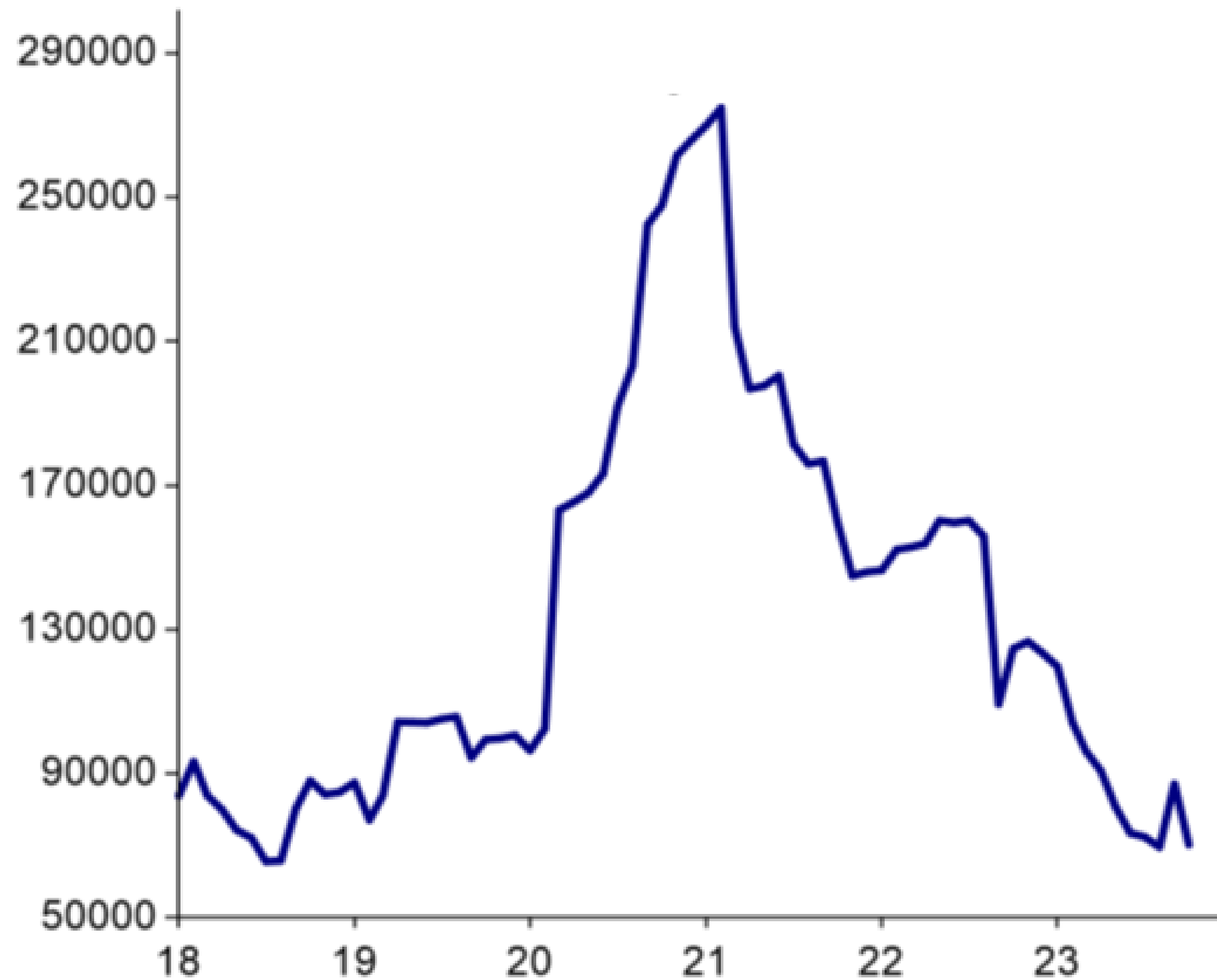
Atlanta Fed Tracker Median Wage Growth (3 Month MA, NSA, y/y%)



Source: Federal Reserve Bank of Atlanta, Haver Analytics, BofA Global Research. October 18, 2023. Data as of September 30, 2023

# Hiring plan announcements have all but disappeared

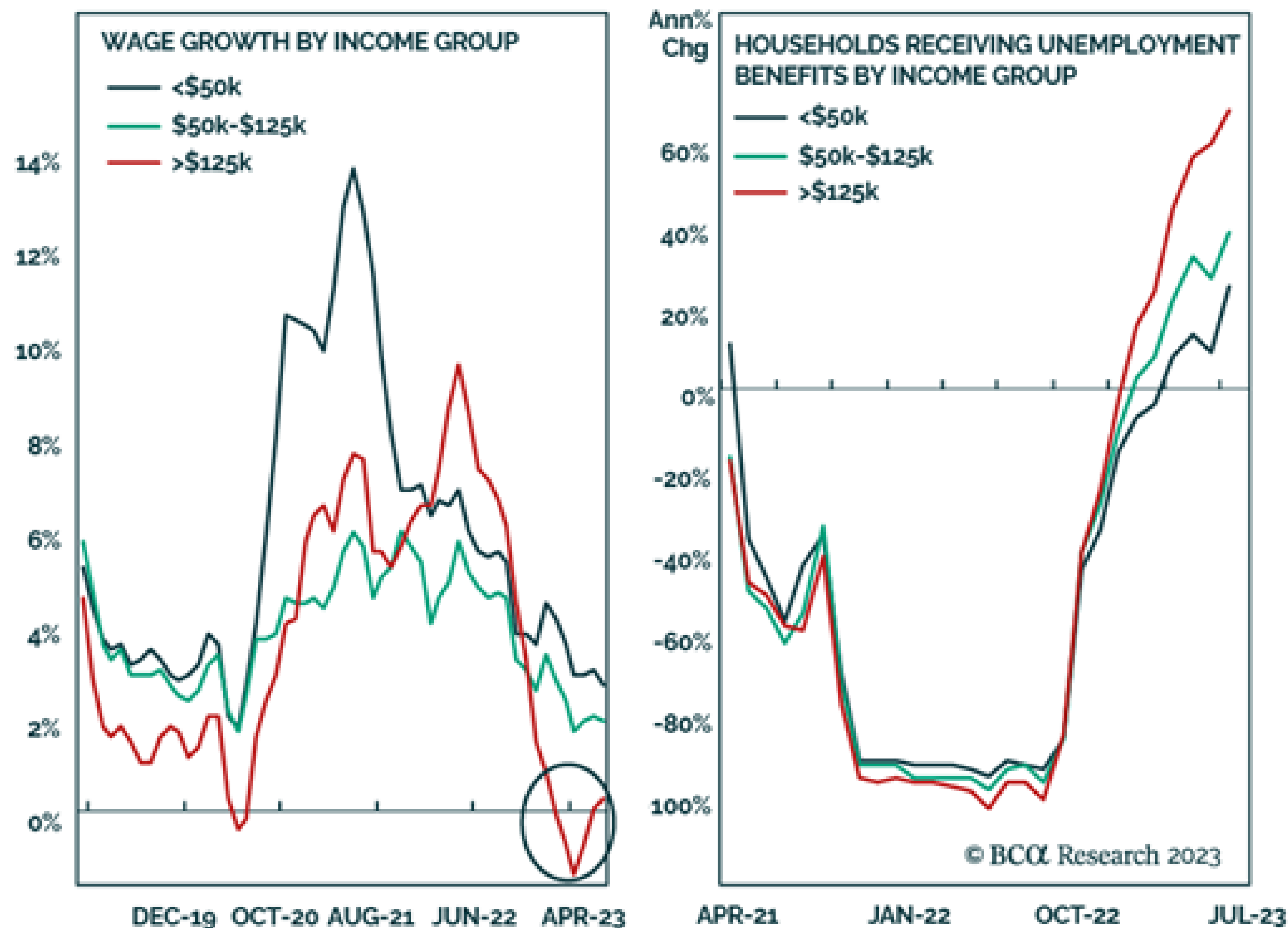
Challenger Hiring Plans, Seasonally Adjusted. 6-month M.A. October: 8



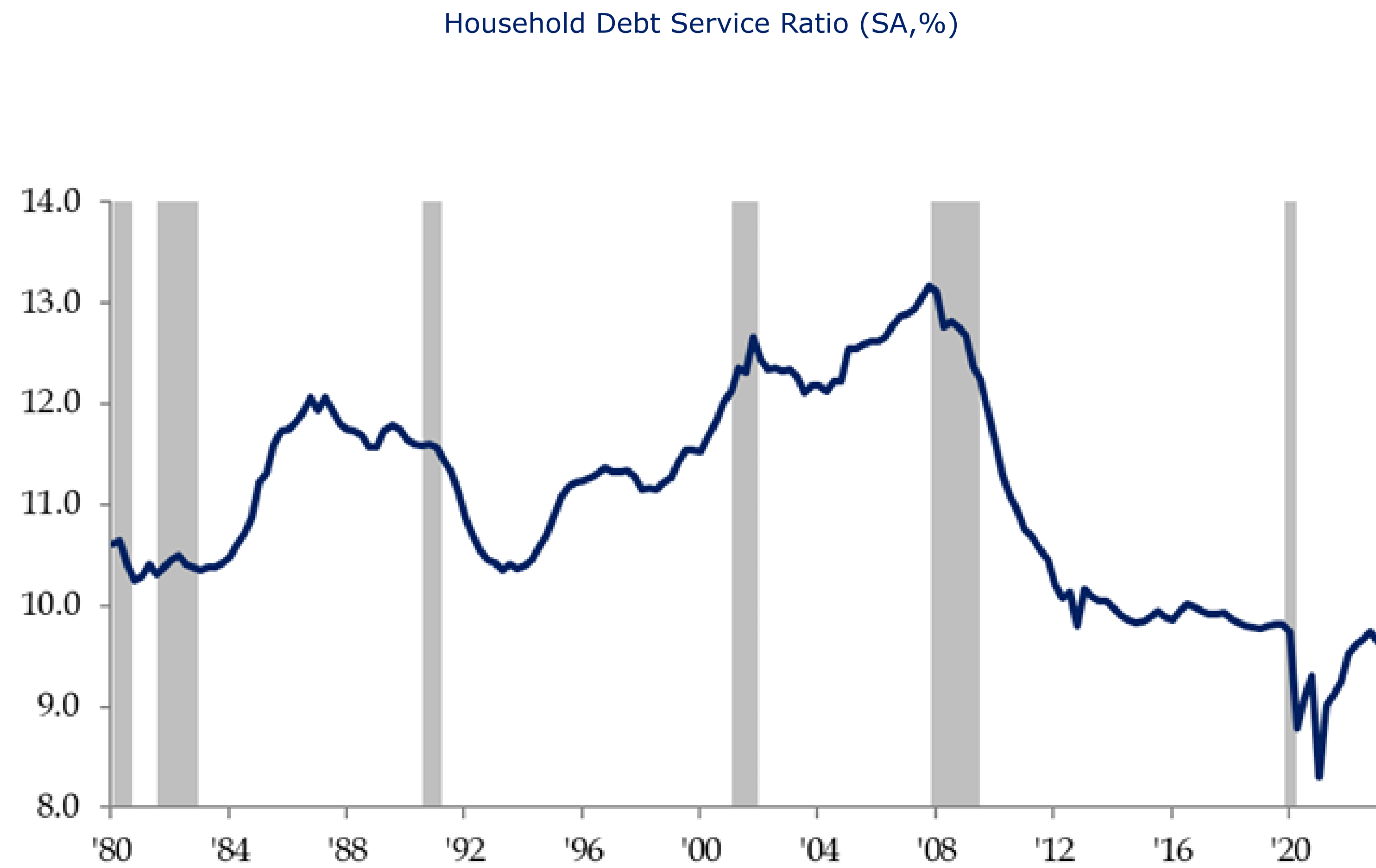
Source: Evercore ISI Research, Challenger. November 2, 2023. Data as of October 28, 2023

# Higher-income households affected most by recent layoffs

"Richcession" Will Be a Drag On Spending



# Consumers' ability to service debt remains historically strong

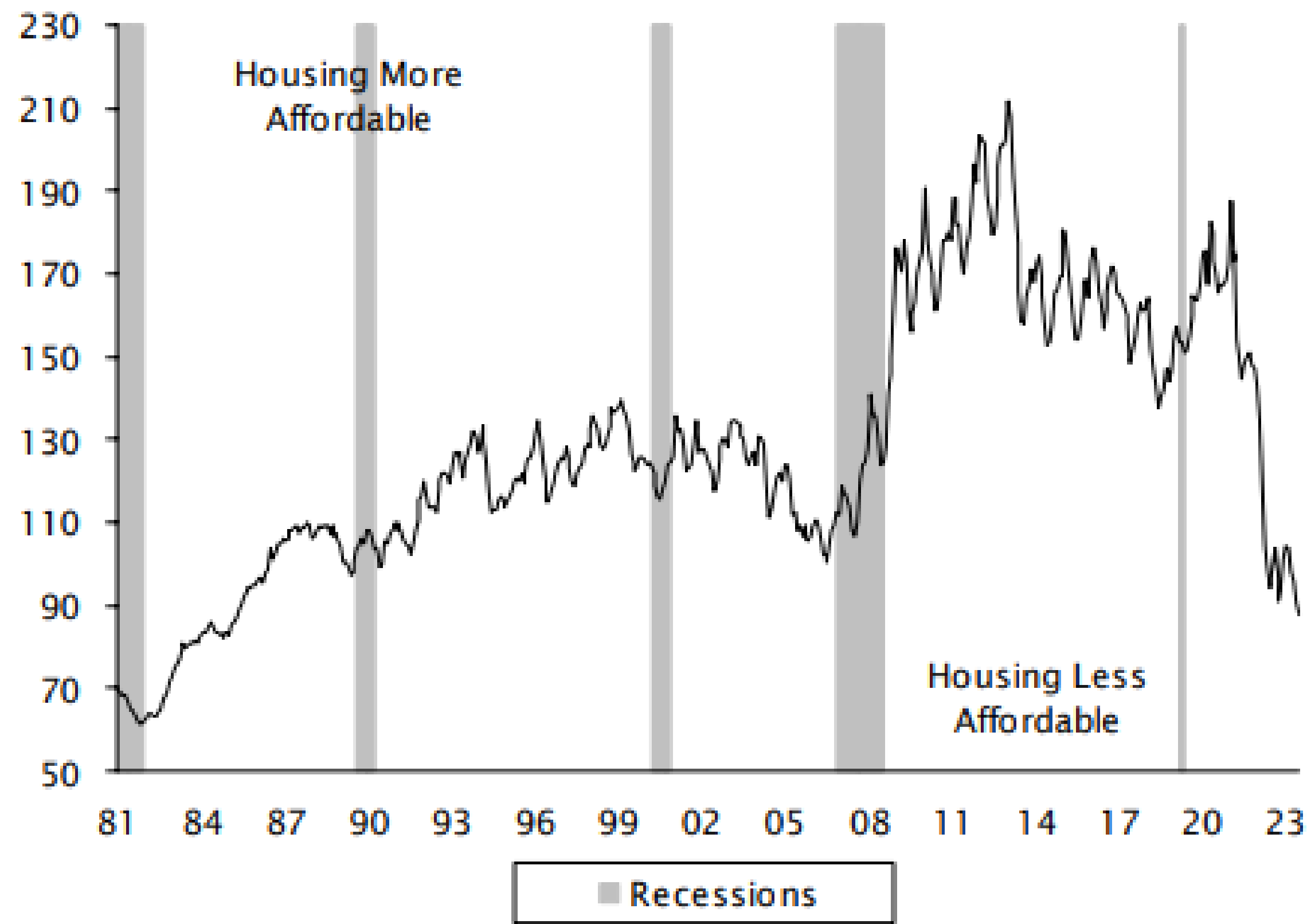


Source: Strategas Research. August 24, 2023  
Note: Shaded bars indicate recessions  
SA=Seasonally adjusted



# First-time homebuyers priced out

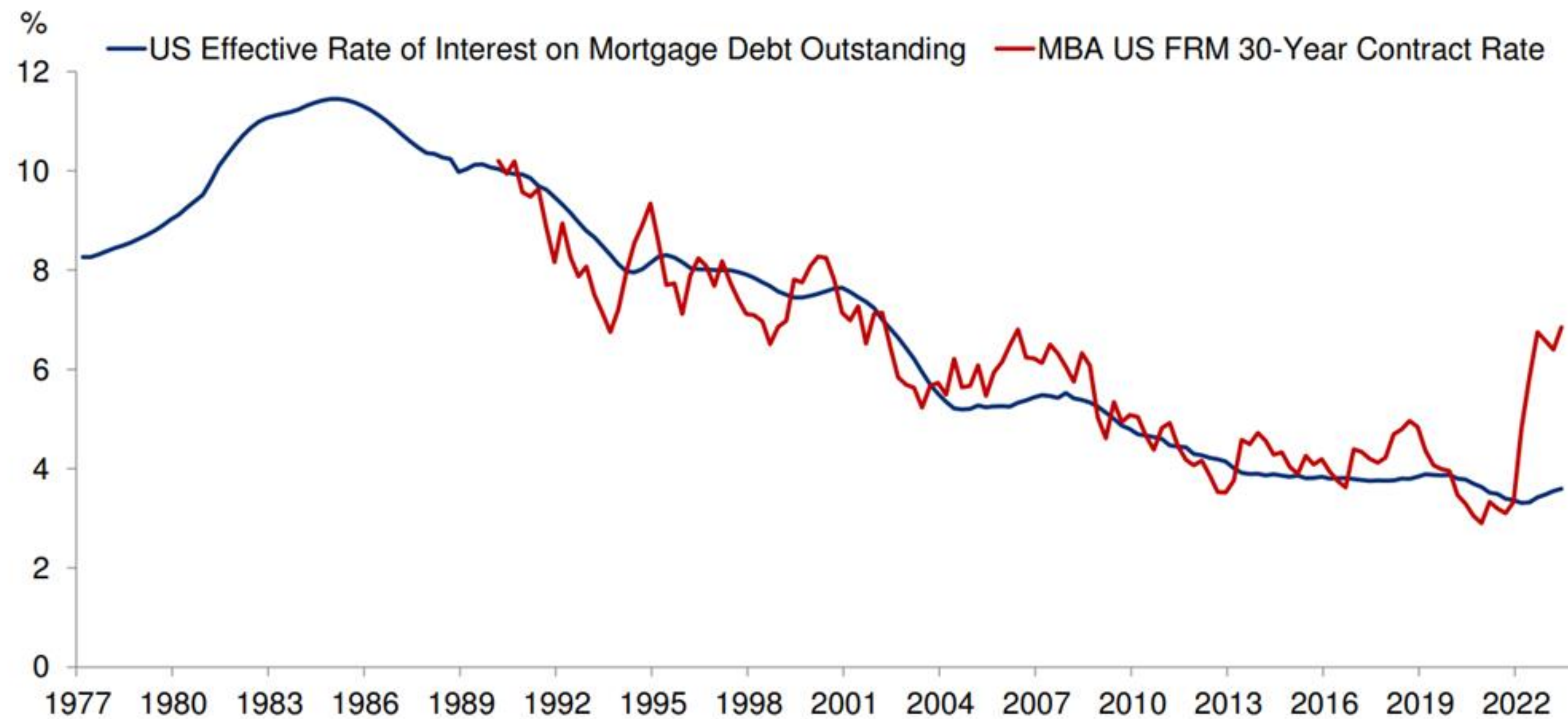
Housing Affordability Index\* 1981 Through September 2023E



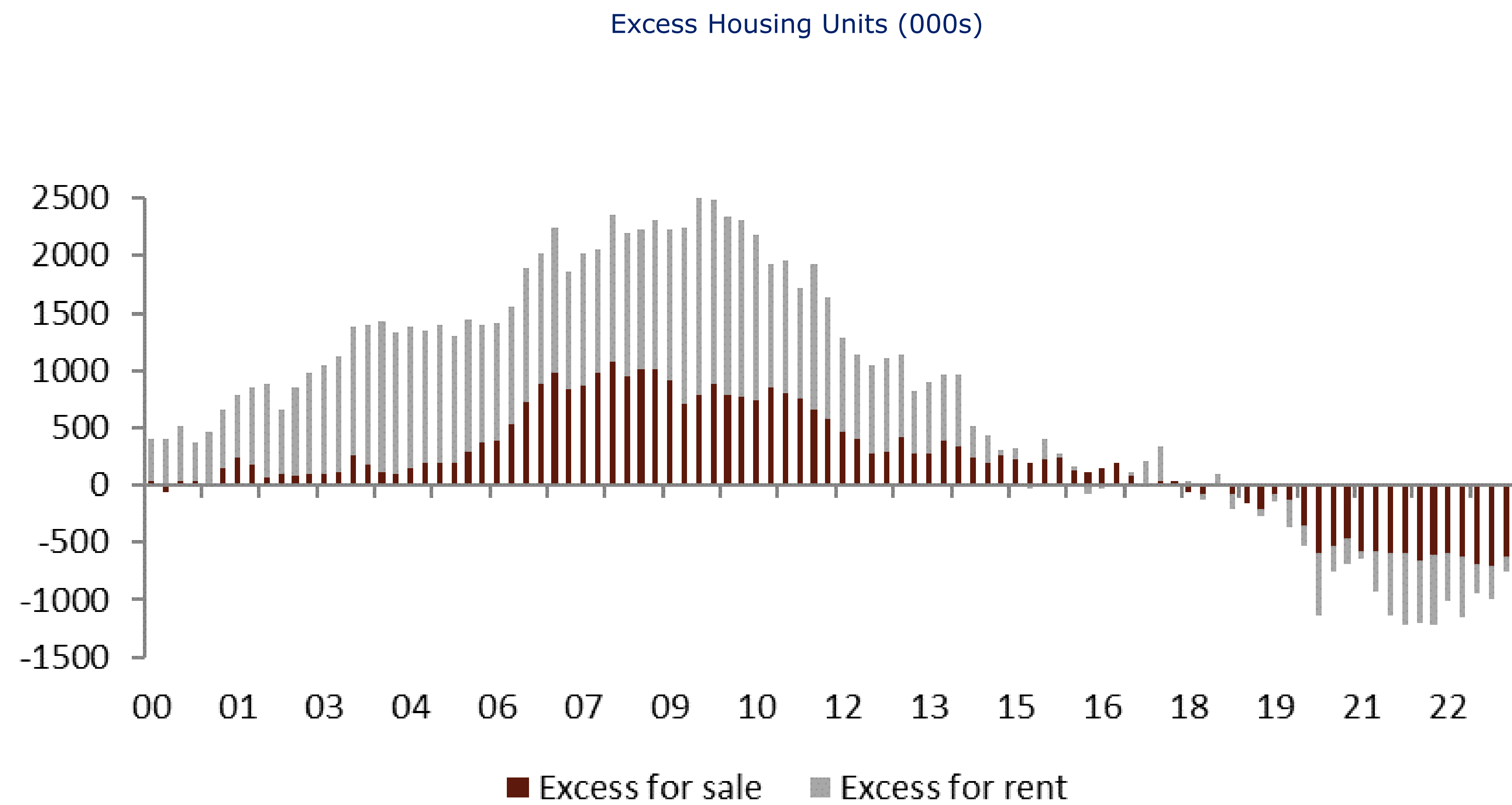
Source: Bloomberg L.P., National Association of Realtors, National Bureau of Economic Research, Empirical Research Partners Analysis and Estimates. October 10, 2023. Data through September 30, 2023  
\* A value of 100 indicates the qualifying income based on median home prices and 30-year fixed mortgage rates equals the median income throughout the U.S. A 20% down payment and 25% of income devoted to mortgage interest and principal are assumed.

# It's no wonder mortgage applications are the lowest since 1995

MBA U.S. FRM 30-Year Contract Rate Plus Effective Rate on ALL U.S. Mortgages



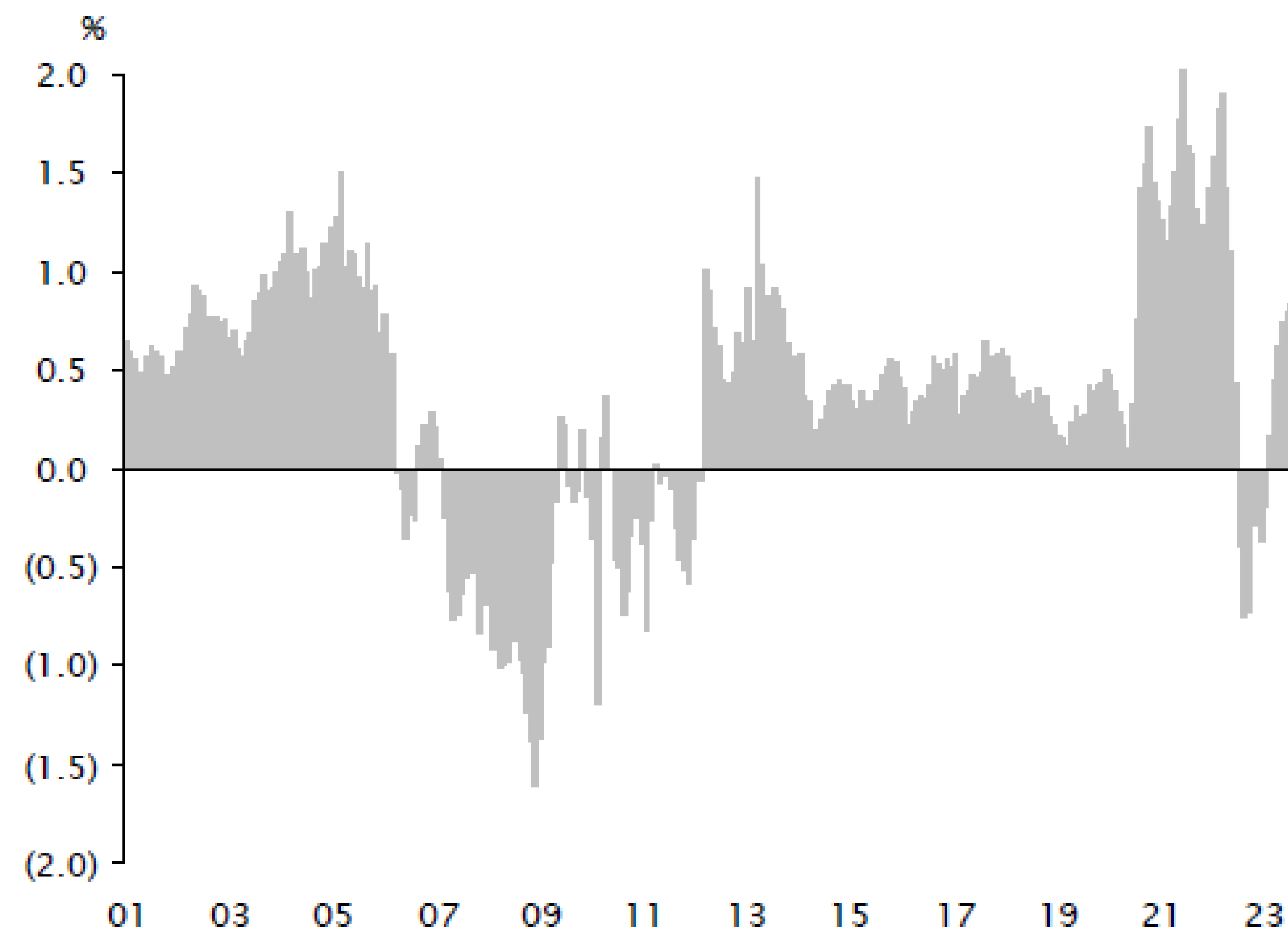
# Housing market historically tight



Source: Renaissance Macro Research. October 31, 2023.

# Bad news if you're waiting for prices to fall

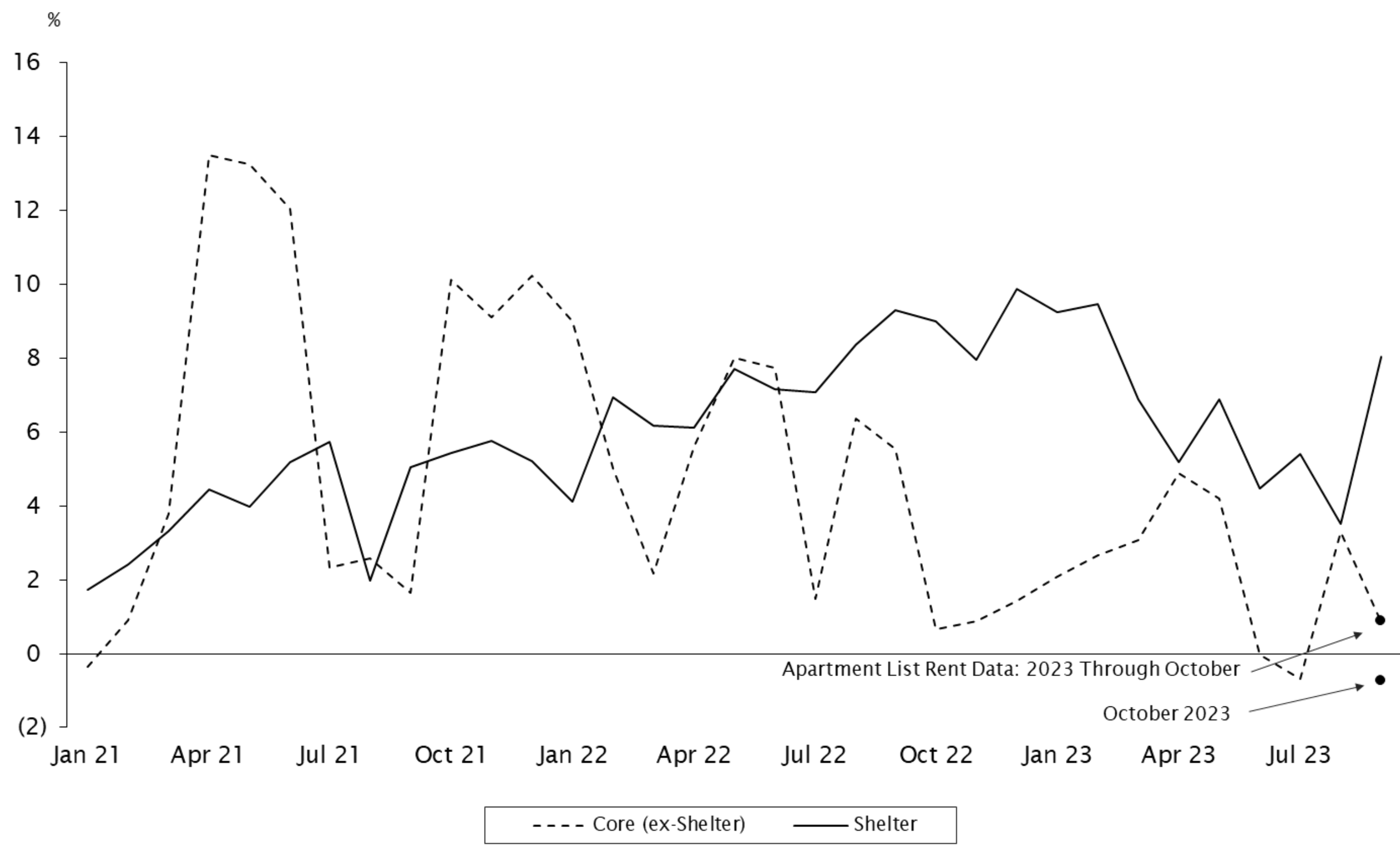
Home Prices Monthly Changes\*, 2001 Through July 2023E



Source: Standard& Poor's, Zillow, Empirical Research Partners Analysis. August 25, 2023  
\*Seasonally-adjusted price index computed based on trailing three-month same home sales.

# Record number of new apartments built in 2023

Consumer Price Index: Shelter and Core (Ex-Shelter)  
Month Over Month Annualized Changes 2021 Through October 2023

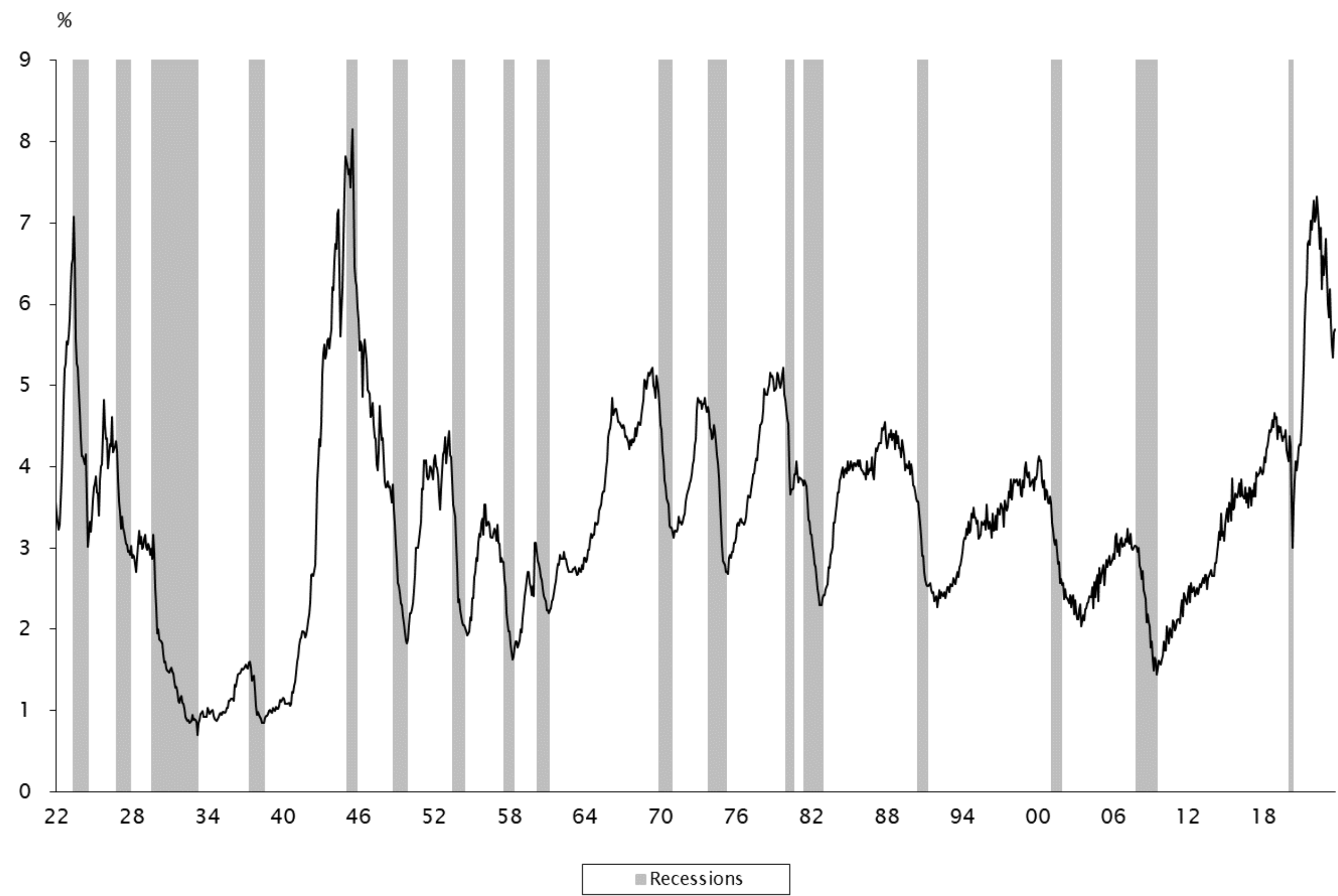


Source: Bureau of Labor Statistics, Apartment List, Empirical Research Partners. Data through October 31, 2023



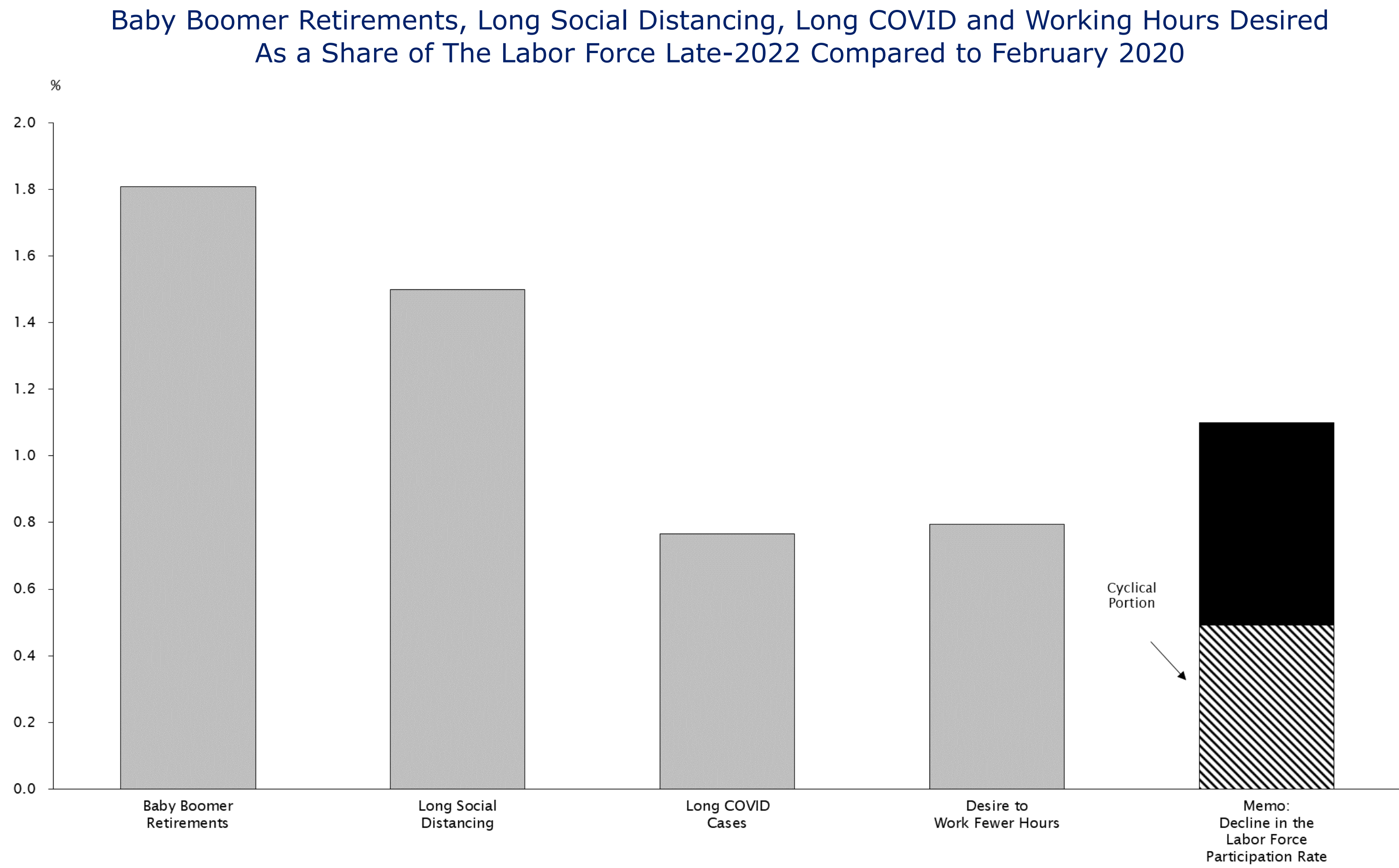
# 1970s redux? Employees quitting their jobs at highest rate since the late 1970s...

U.S. Vacancy Rate, Job Openings as a Share of the Labor Force, 1922 Through September 2023



Source: Regis Barnichon, 2010. "Building a Composite Help-Wanted Index," Federal Reserve Board Economic Letter, Petrosky-Nadeau, N. and Lu Chang, 2020. "Unemployment Crises," Working Paper, Bureau of Labor Statistics, National Bureau of Economic Research, Empirical Research Partners Analysis. Data through September 30, 2023

# Where are all the workers?

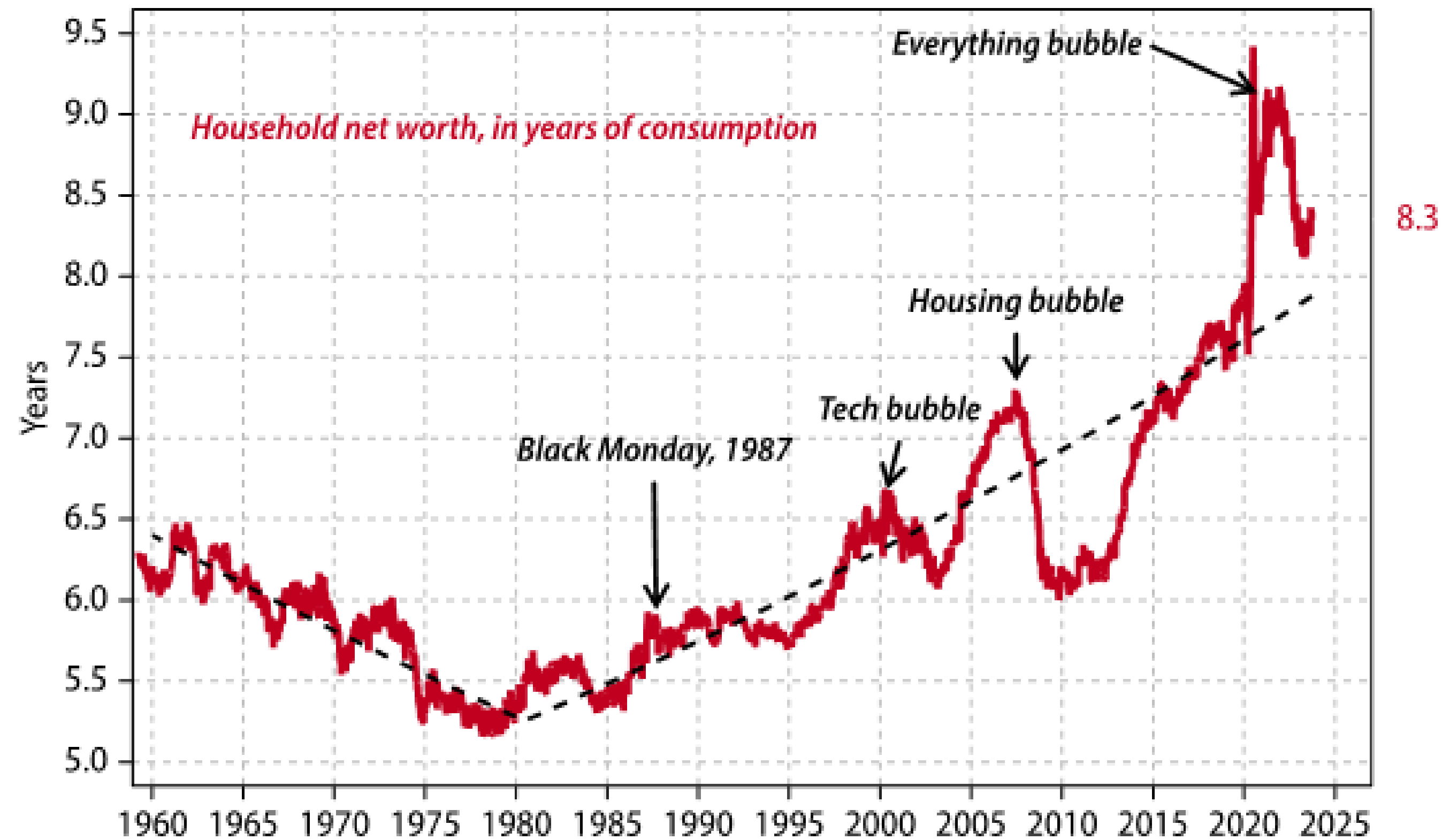


Source: Bureau of Labor Statistics, Brookings Institute, Federal Reserve Bank of Minneapolis, Federal Reserve Bank of Kansas City, Barrero, J. M., Bloom, N. and Steven J. Davis, 2022. "Long Social Distancing," Working Paper; Faberman R.J., Mueller, A.I. and Aysegul Sahin, 2022. Has the Willingness to Work Fallen During the COVID Pandemic?" Working Paper, Survey of Consumer Expectations, Empirical Research Partners Analysis.

Note: The number comes from taking the change in the labor force participation rate and applying it to the population.  
Data as of December 31, 2022

# Consumers in great shape—particularly those ages 55+

U.S. Household Net Worth, in Years of Consumption\*

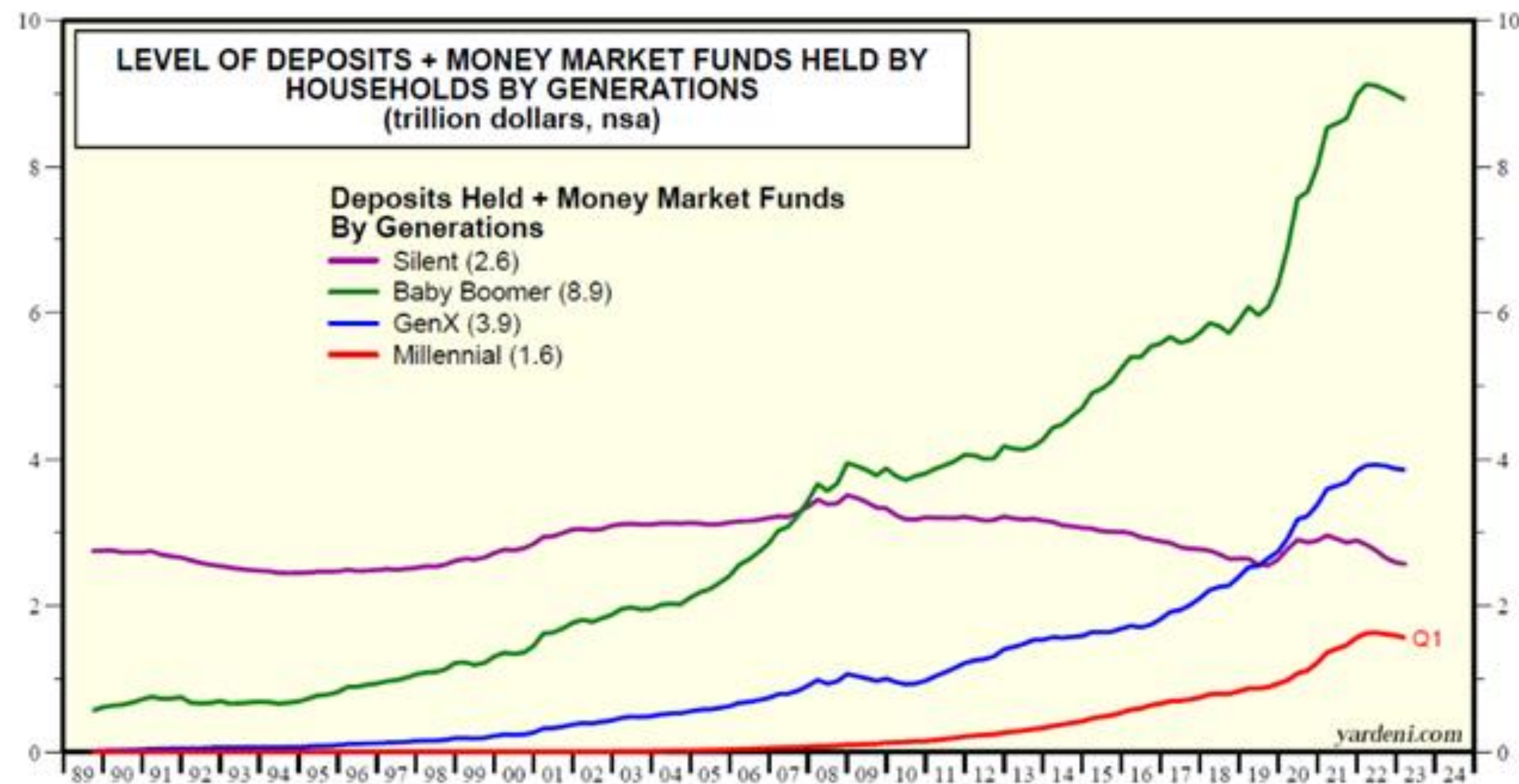


Source: Gavekal Research, Macrobond. September 20, 2023

\*Net Worth based on flow of funds data, adjusted for recent equity and house price changes



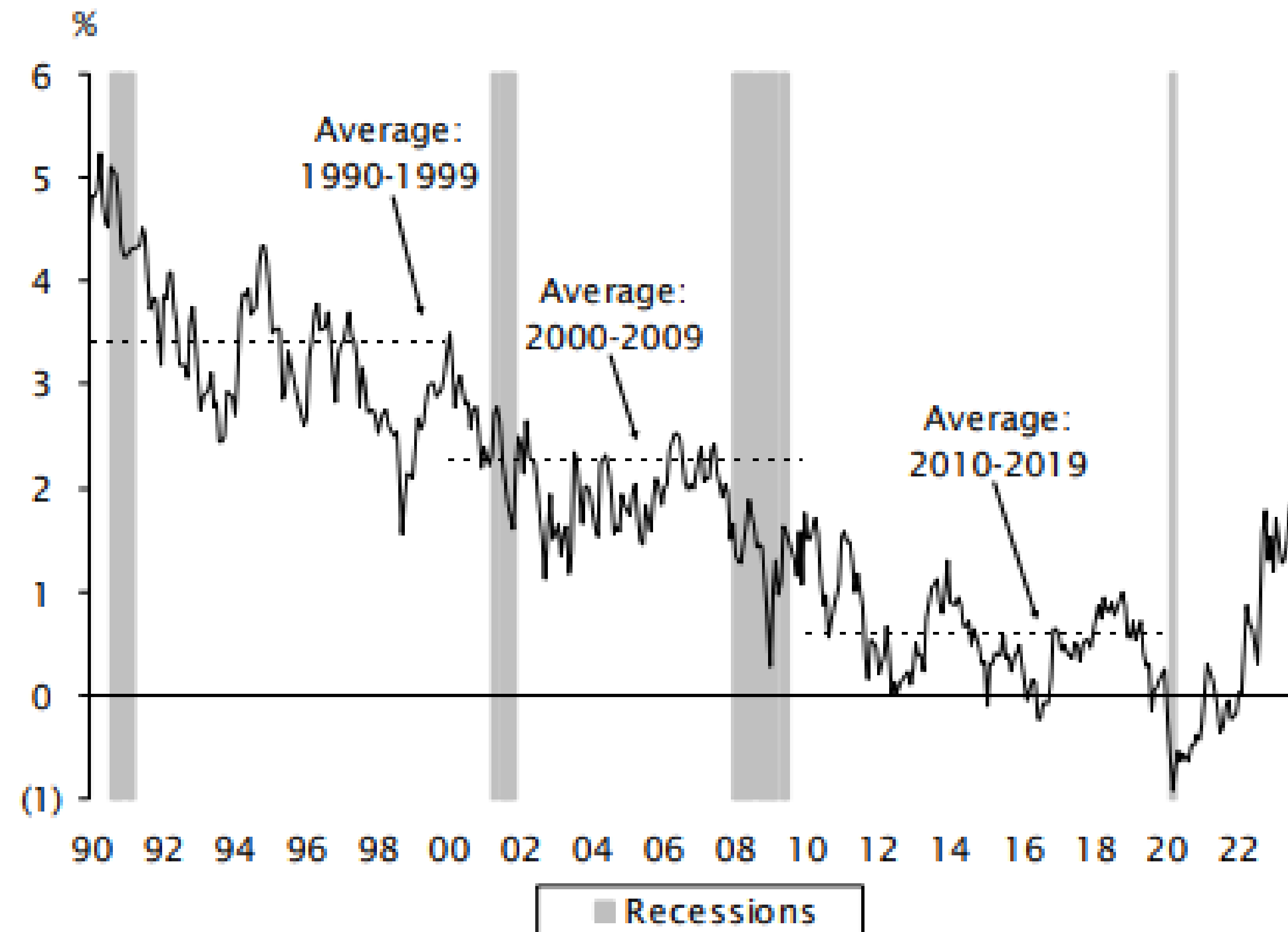
# Baby Boomers have lots of liquidity



Source: Federal Reserve Board Financial Accounts of the United States, Distributional Financial Accounts (DFA). Yardeni Research. July 6, 2023

# The inflation fight- Real interest rates up dramatically

10-Year U.S. Treasury Bond Yields Less 10-Year Inflation Expectations\*  
1990 Through Mid-October 2023



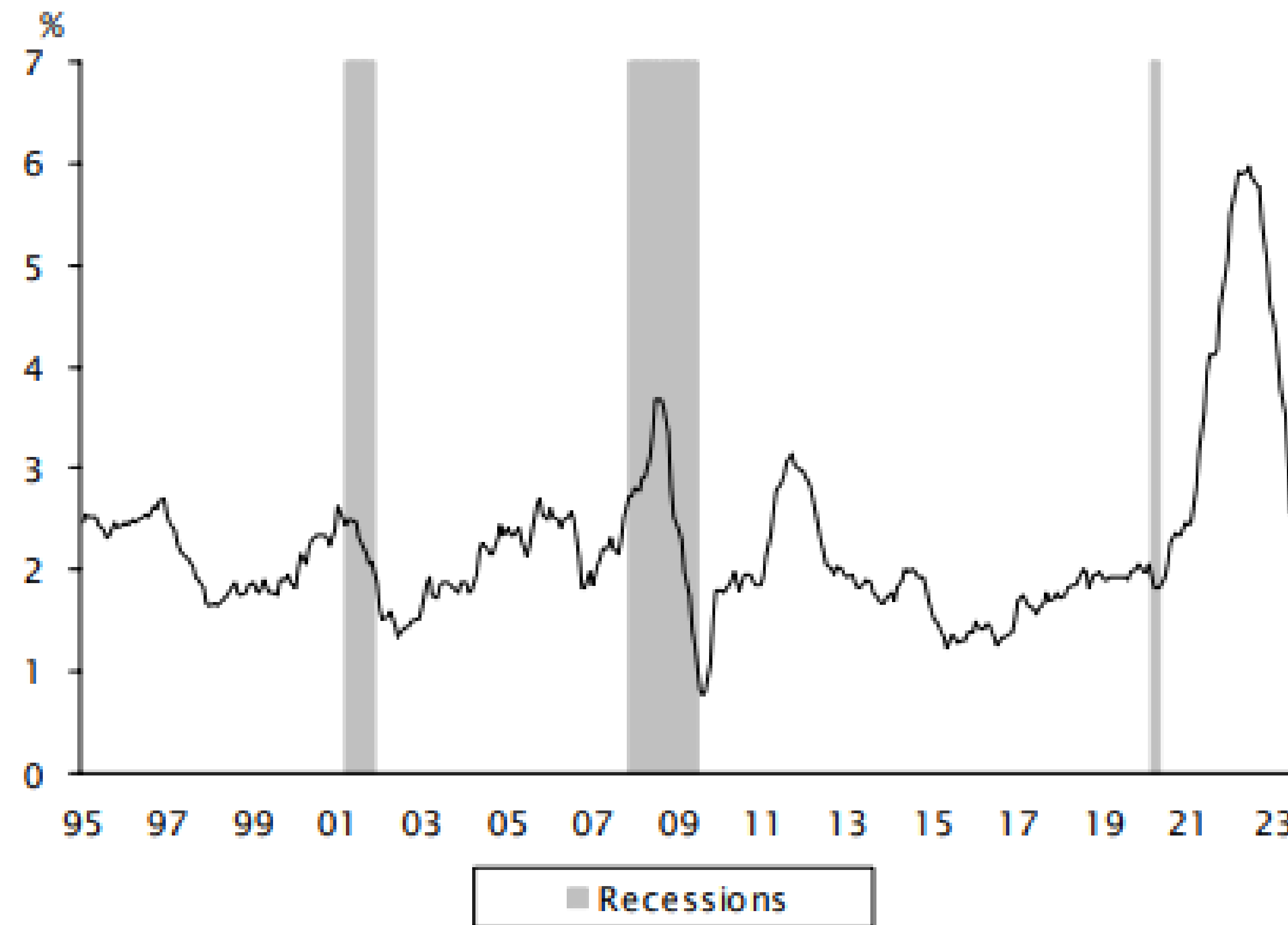
Source: Federal Reserve Bank of Cleveland, Federal Reserve Board, National Bureau of Economic Research, Empirical Research Partners Analysis. October 17, 2023. Data through early October 2023.

\* Less the trailing three-month average of 10-year inflation expectations as estimated by the Cleveland Fed model.



# Significant progress on inflation

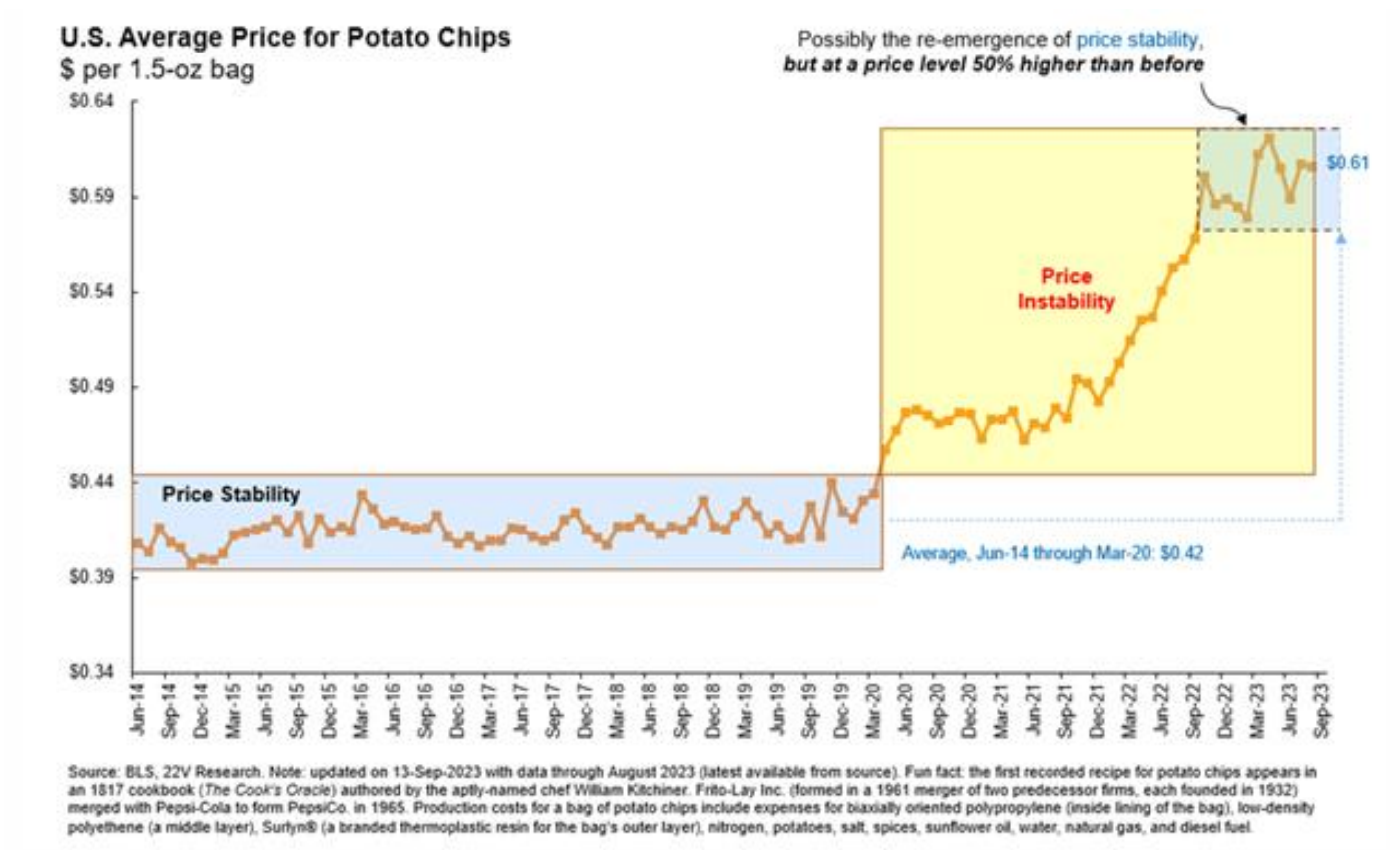
The Underlying Inflation Gauge.  
Year Over Year Changes 1995 Through September 2023



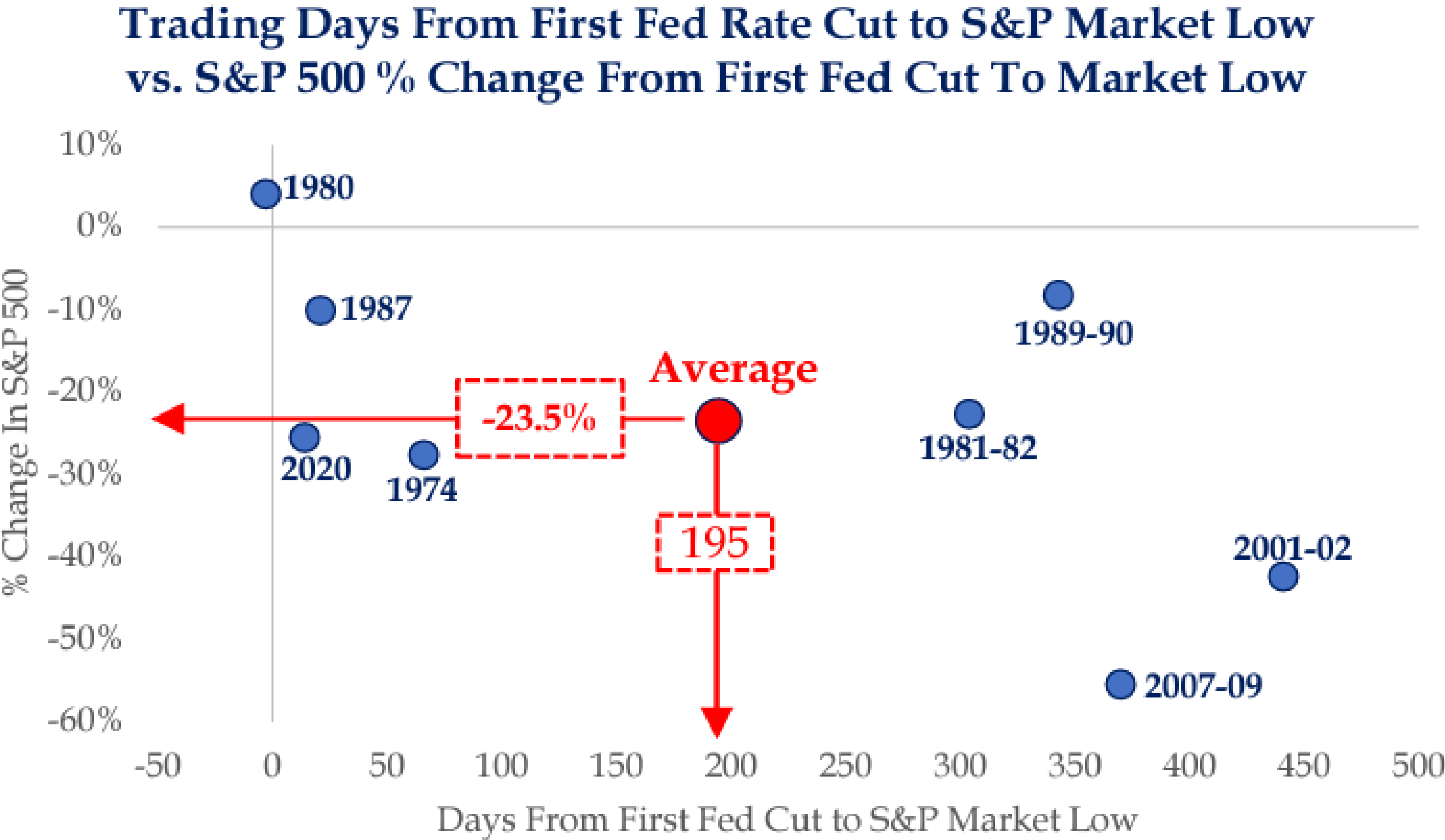
Source: Federal Reserve Bank of New York, National Bureau of Economic Research, Empirical Research Partners Analysis. October 17, 2023. Data through September 30, 2023.

# The cost of inflation: “Instability,” then “New Price Level”

A Consumer of Potato Chips Now Pays, On Average, 50% More Than Before COVID



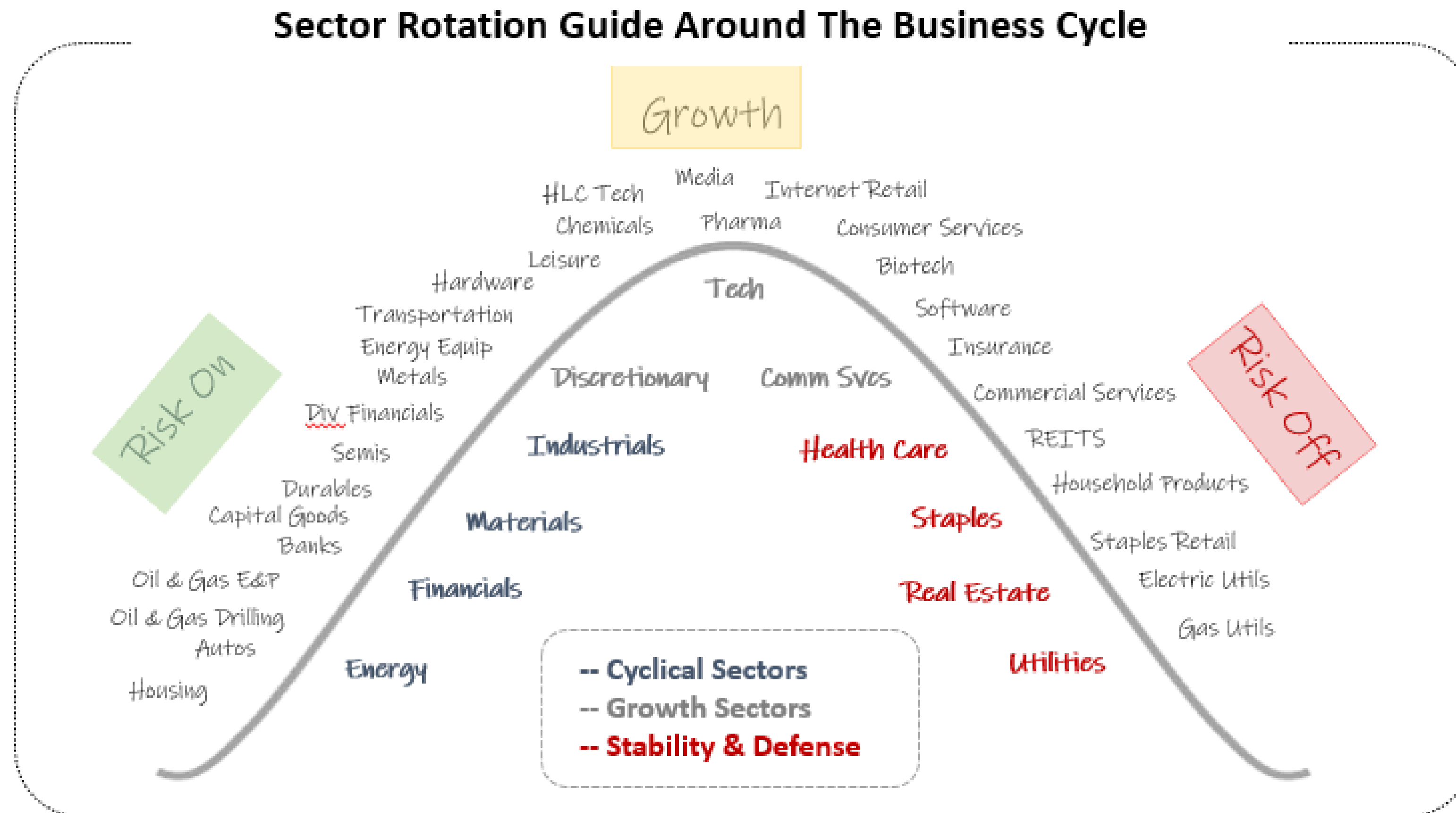
# Hoping for a Fed pivot?



Source: Strategas Research. March 24, 2023

Note: Despite the Fed cutting rates in 1995, the market trended up so there was not a major S&P low to apply to the chart.

# Where are we in the economic cycle?



# A historically top-heavy market

Annual S&P 500 Contribution of 10 Largest Weights During Positive Performance Years

<u>Year</u>	<u>Top 10 as % of Total</u>	<u>S&amp;P 500 % Perf.</u>
<b>2023 YTD</b>	<b>134.1%</b>	<b>8.5%</b>
2007	78.7%	3.5%
2020	58.9%	16.3%
1999	54.5%	19.5%
2021	45.0%	26.9%
1998	36.8%	26.7%
1996	33.9%	20.3%
2017	33.3%	19.4%
2019	32.8%	28.9%
1991	28.6%	26.3%
2006	27.6%	13.6%
2016	26.6%	9.5%
2003	23.6%	26.4%
1995	22.3%	34.1%
2014	22.2%	11.4%
2004	21.1%	9.0%
2005	20.5%	3.0%
2010	19.6%	12.8%
2012	19.2%	13.4%
1997	19.1%	31.0%
2013	17.6%	29.6%
2009	15.5%	23.5%
1992	14.9%	4.5%
1993	12.2%	7.1%



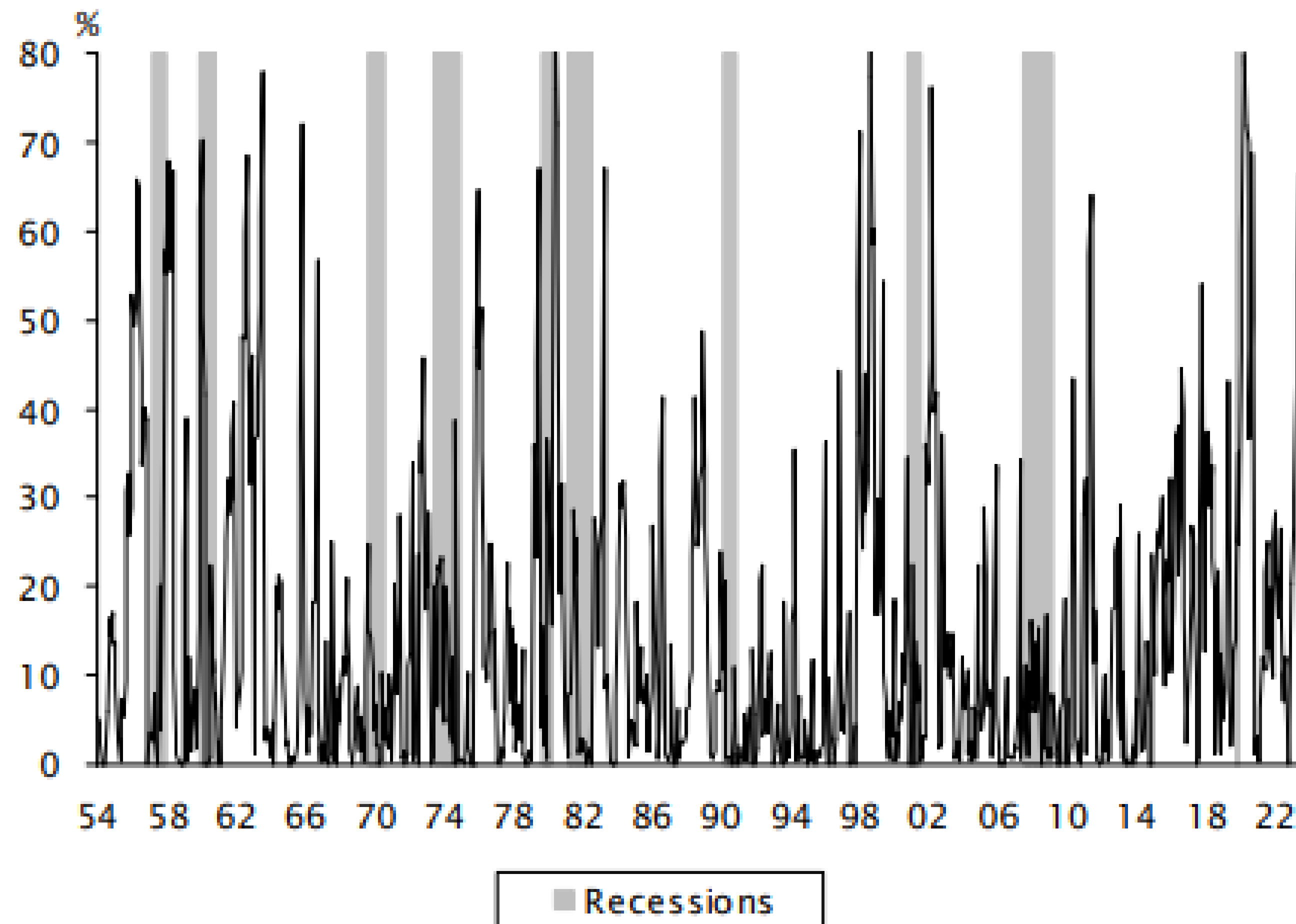
# This is not the late '90s

## Magnificent Seven Cash Balances

	CASH ON HAND	LONG-TERM INVESTMENTS	COMBINED	TOTAL ASSETS	COMBINED % OF TOTAL ASSETS
APPLE	\$62,482	\$104,061	\$166,543	\$335,038	49.7
ALPHABET	\$118,332	\$31,224	\$149,556	\$383,044	39.0
MICROSOFT	\$111,262	\$9,879	\$121,141	\$411,976	29.4
AMAZON	\$63,970	\$0	\$63,970	\$477,607	13.4
META	\$53,446	\$6,208	\$59,654	\$206,688	28.9
TESLA	\$23,075	\$0	\$23,075	\$90,591	25.5
NVIDIA	\$16,023	\$0	\$16,023	\$49,555	32.3

# The bond market explained 2/3 of stock returns this year

Large-Capitalization Stocks, Share of the Return Dispersion Explained by Changes in the Ten-Year Treasury Bond Yields\*  
1954 Through Early-October 2023

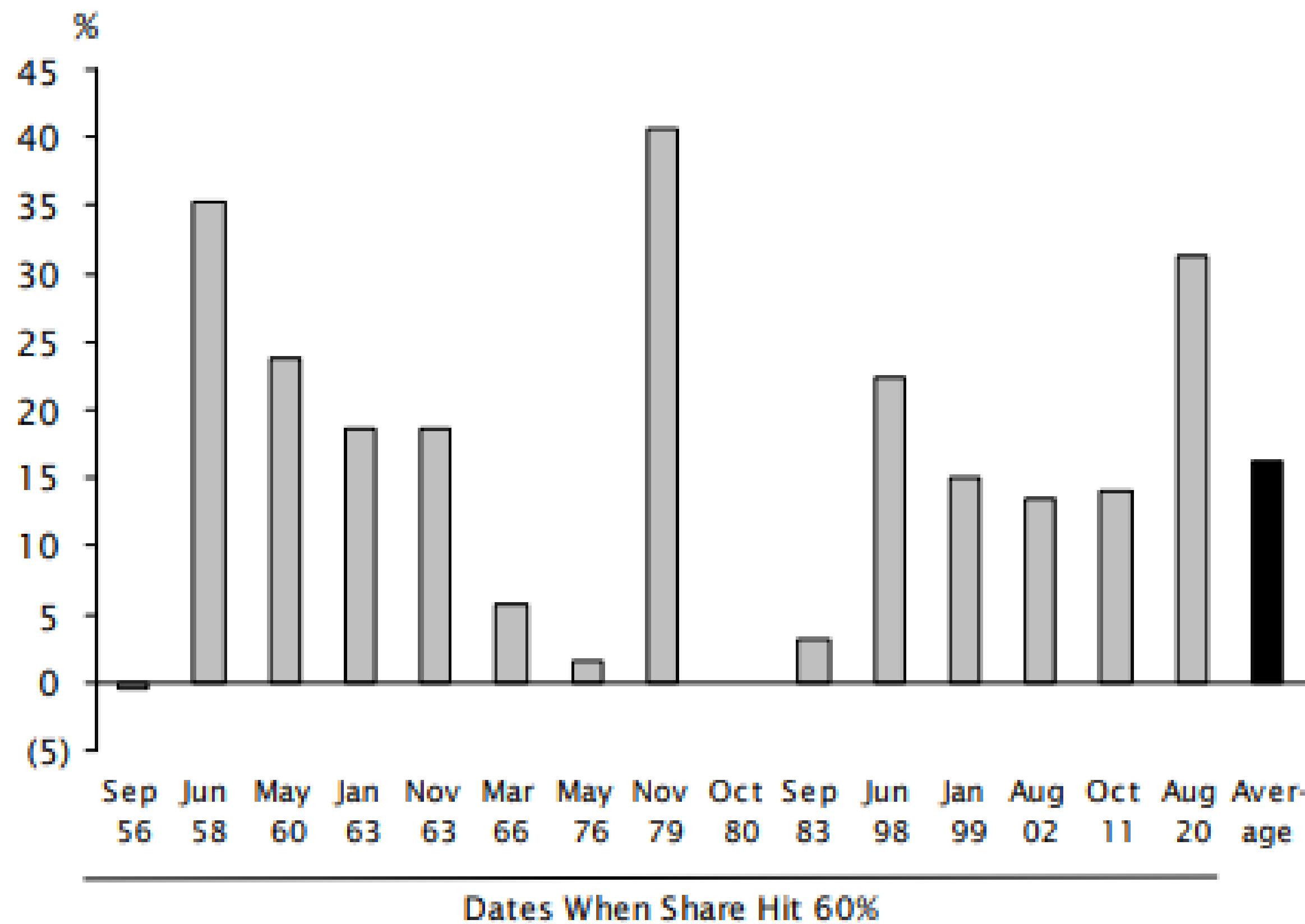


Source: Bloomberg, LP, National Bureau of Economic Research, Empirical Research Partners Analysis. October 17, 2023. Data through early October 2023.

\* Produced by the sum of squares explained by regressions over trailing nine-month periods.

# Stocks historically produced positive returns the following year

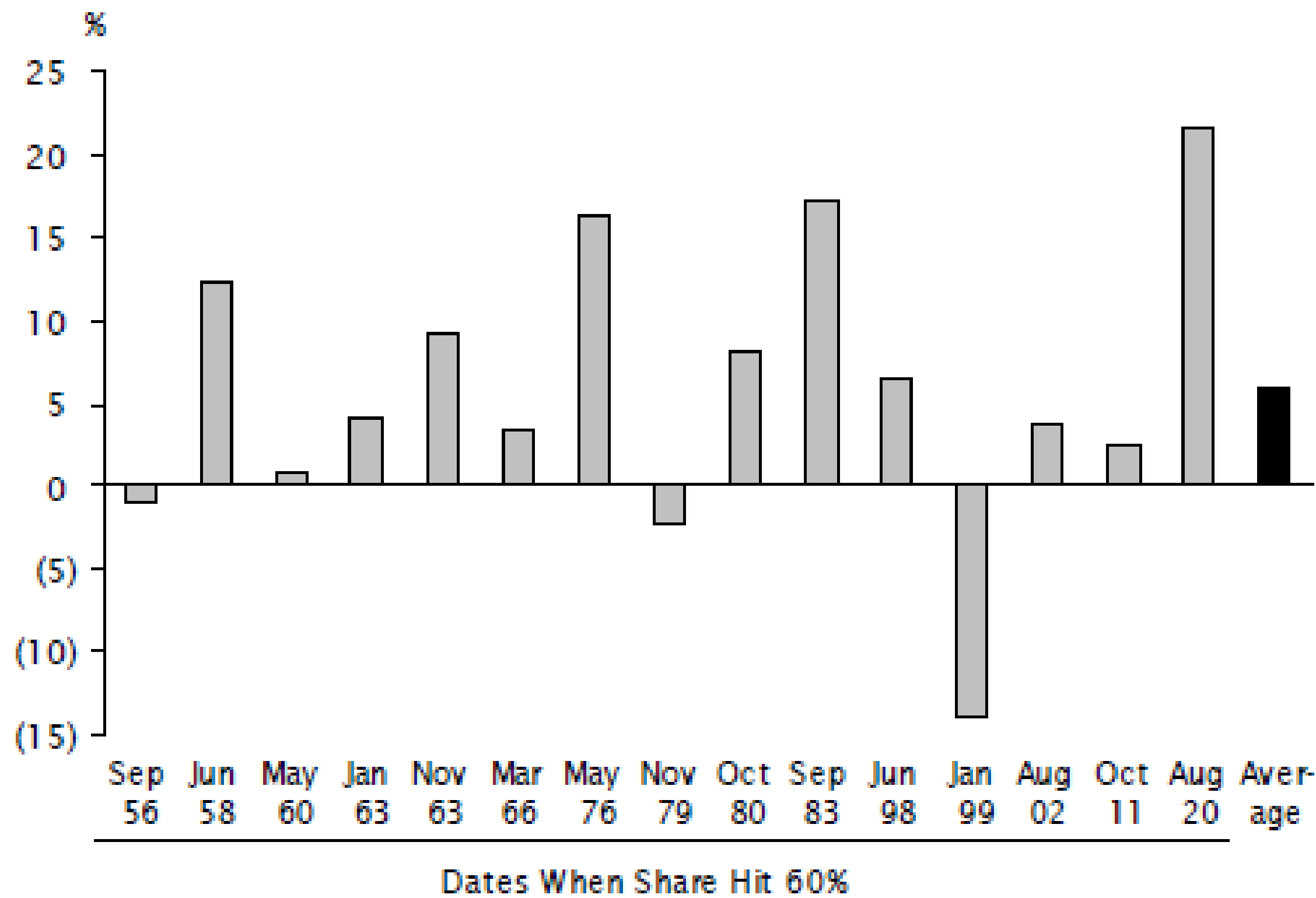
Large-Capitalization Stocks 1954 Through Early-October 2023  
One-Year Returns Following Points at Which the Returns Explained by Changes in Ten-Year Treasury Bond Yields Hit 60%\*



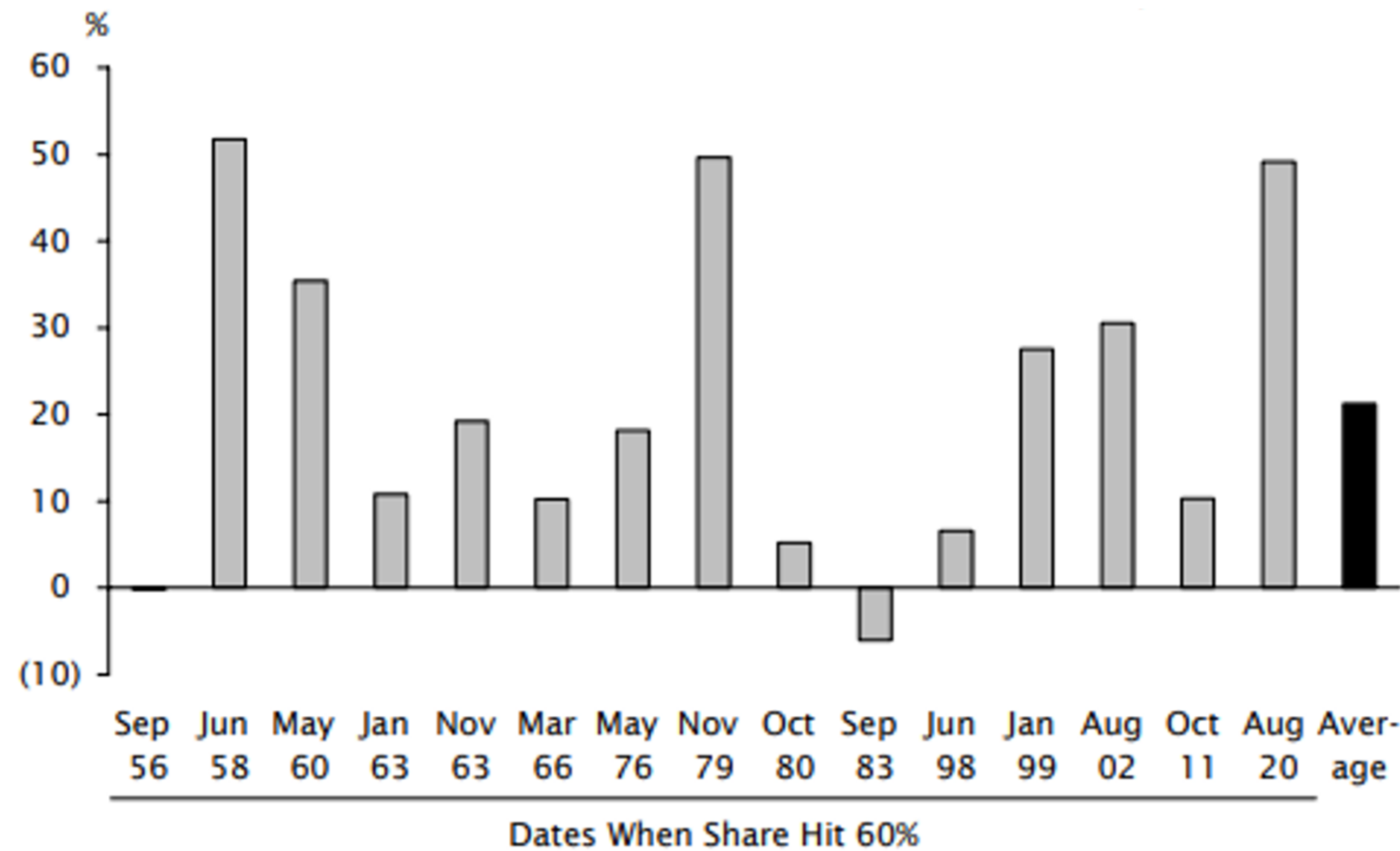
Source: Bloomberg L.P., Empirical Research Partners Analysis. October 17, 2023. Data through early October 2023.  
\*Capitalization-weighted data; produced by the sum of squares explained by regressions over trailing nine-month periods.

# Mostly benefiting value and small cap stocks

Large-Capitalization Stocks, Lowest Quintile of Valuation  
1954 Through Early-October 2023  
One-Year Returns Following Points at Which the Returns  
Explained By Changes in 10-Year Treasury Bond Yields Hit  
60%\*



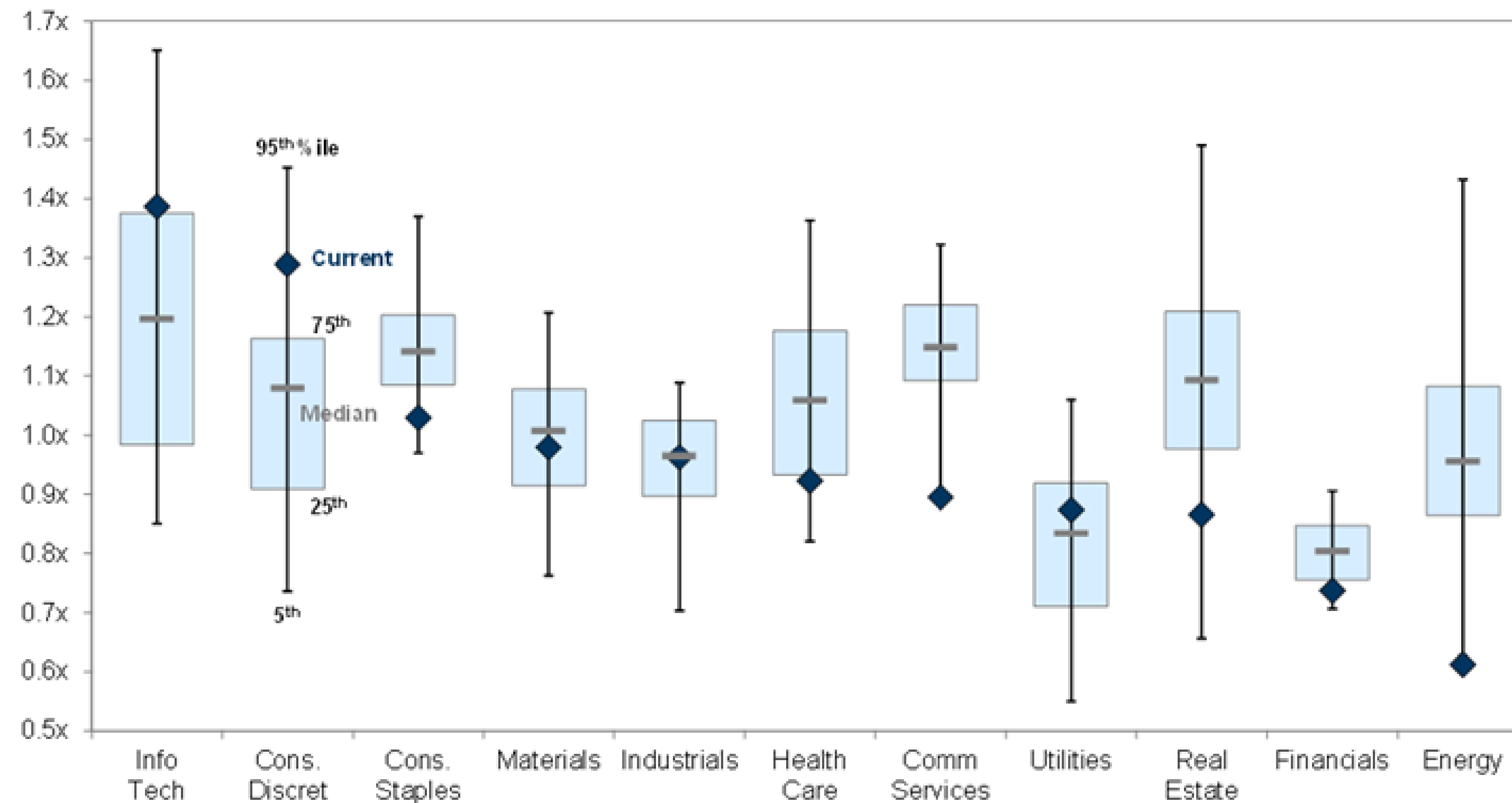
Small-Capitalization Stocks, 1954 Through Early-October 2023  
One-Year Returns Following Points at Which the Returns  
Explained By Changes in 10-Year Treasury Bond Yields Hit  
60%\*



Source: Bloomberg, LP. Empirical Research Partners Analysis. October 17, 2023. Data through early October 2023.  
\*Capitalization-weighted data; produced by the sum of squares explained by regressions over trailing nine-month periods

# Sector valuations

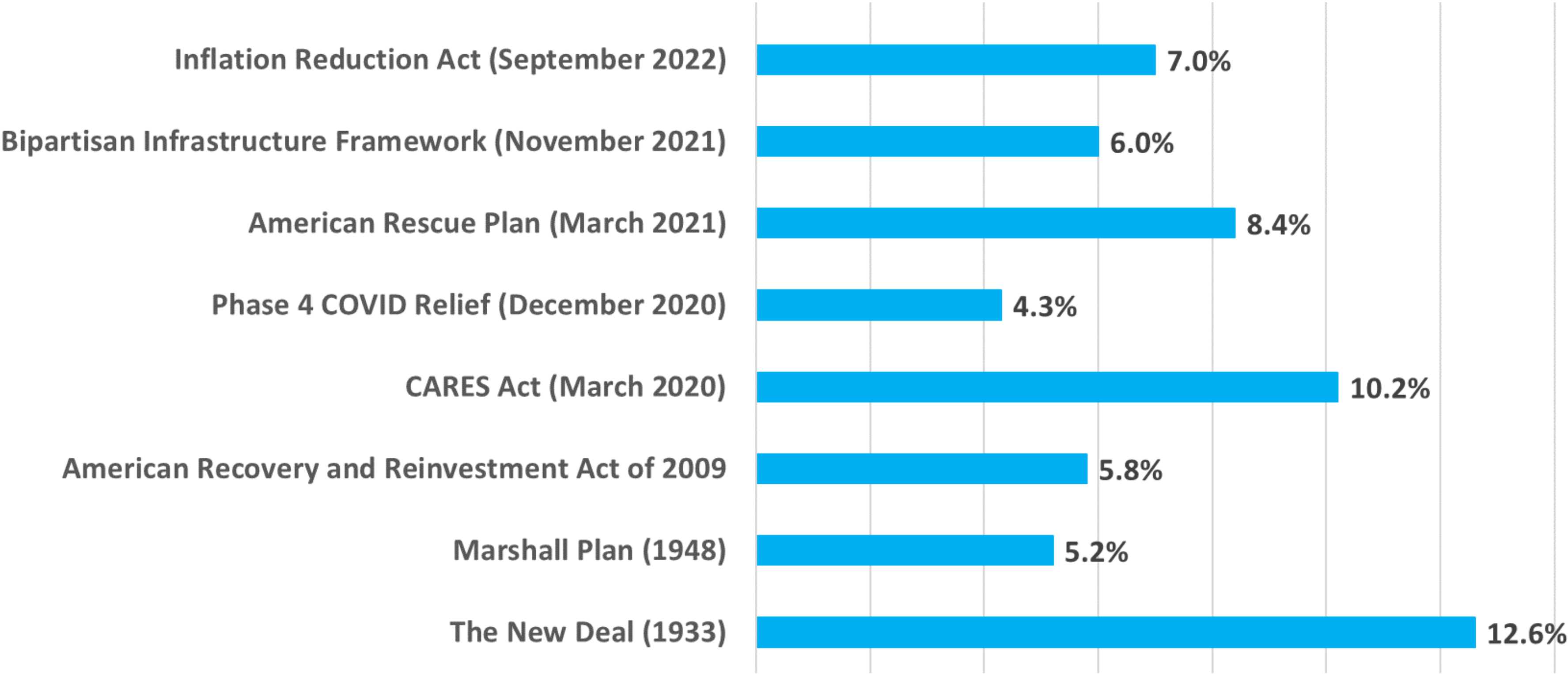
Distribution Of Sector FY2 P/E Ratios Relative To S&P 500 During Last 30 Years



Source: Goldman Sachs Research. November 6, 2023  
Blue bars show P/E Ratios relative to the S&P 500 over the last 30 years. The Diamonds show the current relative P/E of the sector.

# Historic fiscal policy

Select Stimulus as a Percentage of U.S. GDP



Source: Axios and Crown and Company. November 1, 2021. Federated Hermes as of January 18, 2023



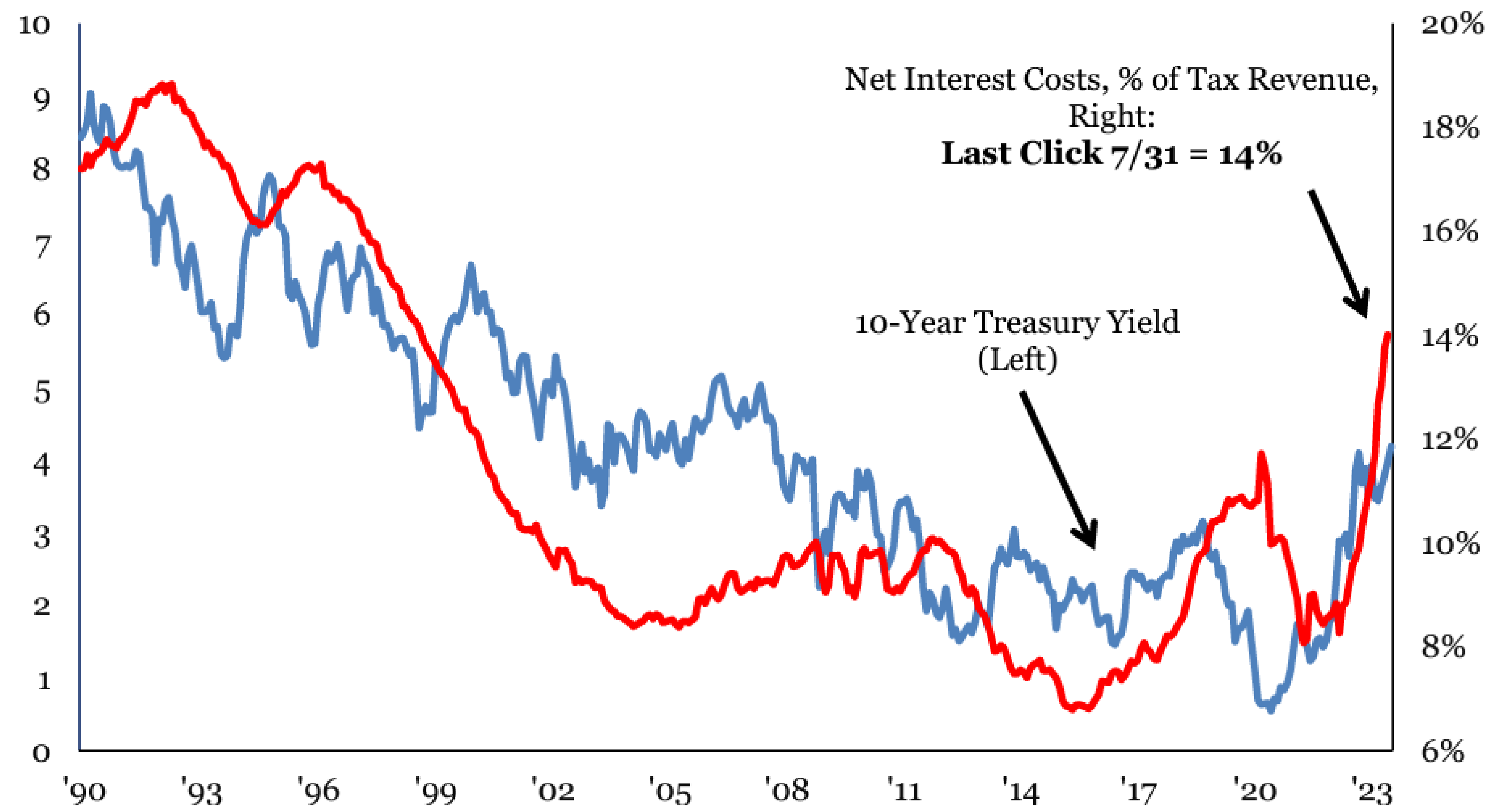
# And the debt champion is...

Debt Levels and Increases in Major Economies

	2022 Gross Government Debt <i>US\$ tr</i>	Increase in Gross Government Debt between 2019 and 2022 <i>US\$ tr</i>	2022 population <i>millions</i>	2022 Govt Debt per Capita <i>US\$</i>	Increase in Govt Debt per capita between 2019 and 2022 <i>US\$</i>
USA	30.57	7.32	333.01	91,795	21,022
Canada	2.12	0.58	38.74	54,663	13,653
UK	2.66	0.19	67.60	39,417	2,351
Japan	10.94	-1.13	125.17	87,409	-8,215
Germany	2.89	0.60	83.29	34,677	7,190
France	3.13	0.48	65.63	47,695	6,965
Italy	2.96	0.27	59.19	50,046	5,065
China	13.61	5.49	1412.50	9,634	3,879

# Treasury must issue ever more bonds to finance the deficit

10-Year Treasury Yield & Net Interest Cost, % of Tax Revenues



Source: Strategas Research as of August 29, 2023

# Somebody's got to pay for the largesse!

Dividend Contribution to Total Return

Decade	Price Pct. Change	Dividend Contribution	Total Return	Dividends Pct of TR	Avg Payout Ratio
1930s	-41.9%	56.0%	14.1%	100.0	90.1
1940s	34.5%	100.1%	134.6%	74.4	59.4
1950s	257.3%	180.3%	437.7%	41.2	54.6
1960s	53.7%	54.2%	107.9%	50.2	56.0
1970s	17.2%	59.1%	76.4%	77.4	45.5
1980s	227.4%	143.1%	370.5%	38.6	48.6
1990s	315.7%	115.7%	431.5%	26.8	47.6
2000s	-24.1%	15.0%	-9.1%	100.0	35.3
2010s	189.7%	66.9%	256.7%	26.1	35.2
2020s	37.7%	8.1%	45.9%	17.7	37.0
<b>Average</b>	<b>114.4%</b>	<b>87.8%</b>	<b>202.2%</b>	<b>59.4</b>	<b>52.5</b>

Source: Strategas Research. July 24, 2023  
Past Performance is no guarantee of future results

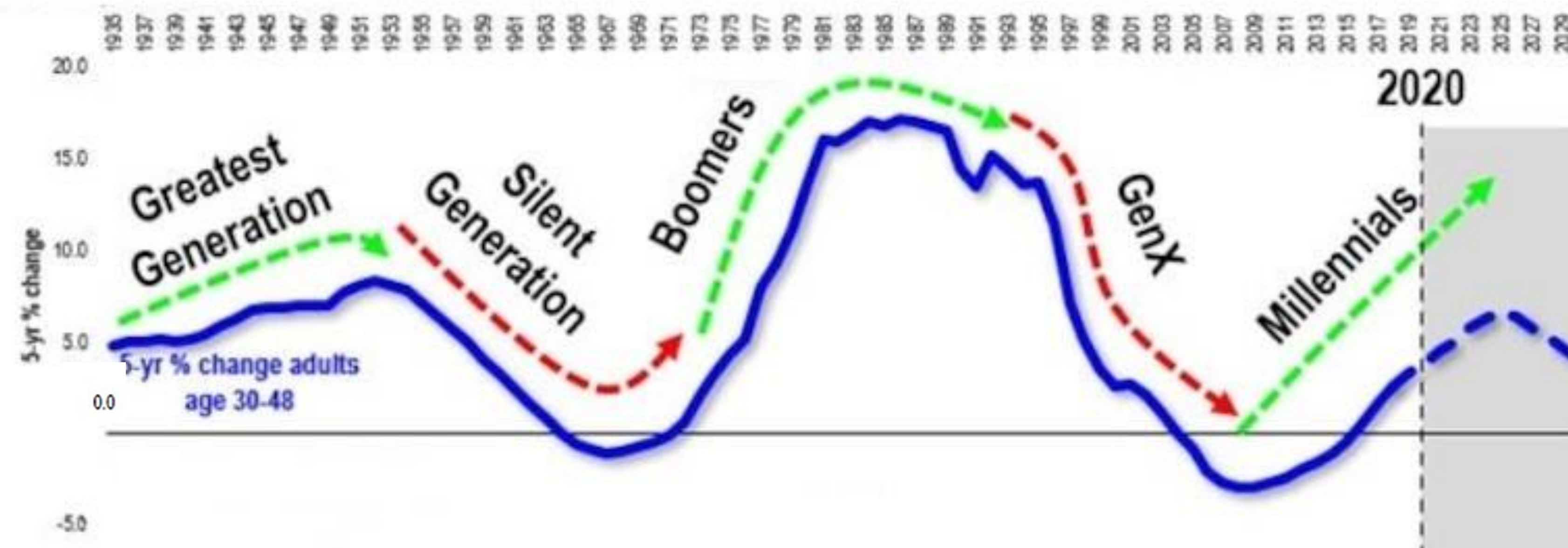
# Labor force growth and GDP – all will be well

Country	1990 Mln	2005 Mln	90-05 % Δ	2020 Mln	05-20 % Δ	2035 Mln	20-35 % Δ	2050 Mln	35-50 % Δ
China	649.0	829.4	28%	929.8	12%	859.9	-8%	770.1	-10%
United States	147.7	175.5	19%	193.9	10%	199.8	3%	210.0	5%
Europe	430	447.6	4%	446.8	0%	409.5	-8%	372.4	-9%
Japan	76.6	78.6	3%	69.1	-12%	61.4	-11%	49.4	-20%
India	420.4	601.3	43%	802.2	33%	949.0	18%	1001.2	5%
Southeast Asia	215.3	309.0	44%	397.8	29%	445.2	12%	460.9	4%



# *It all depends on your time horizon:* In the long term, prime skilled adults age 30-48 are surging

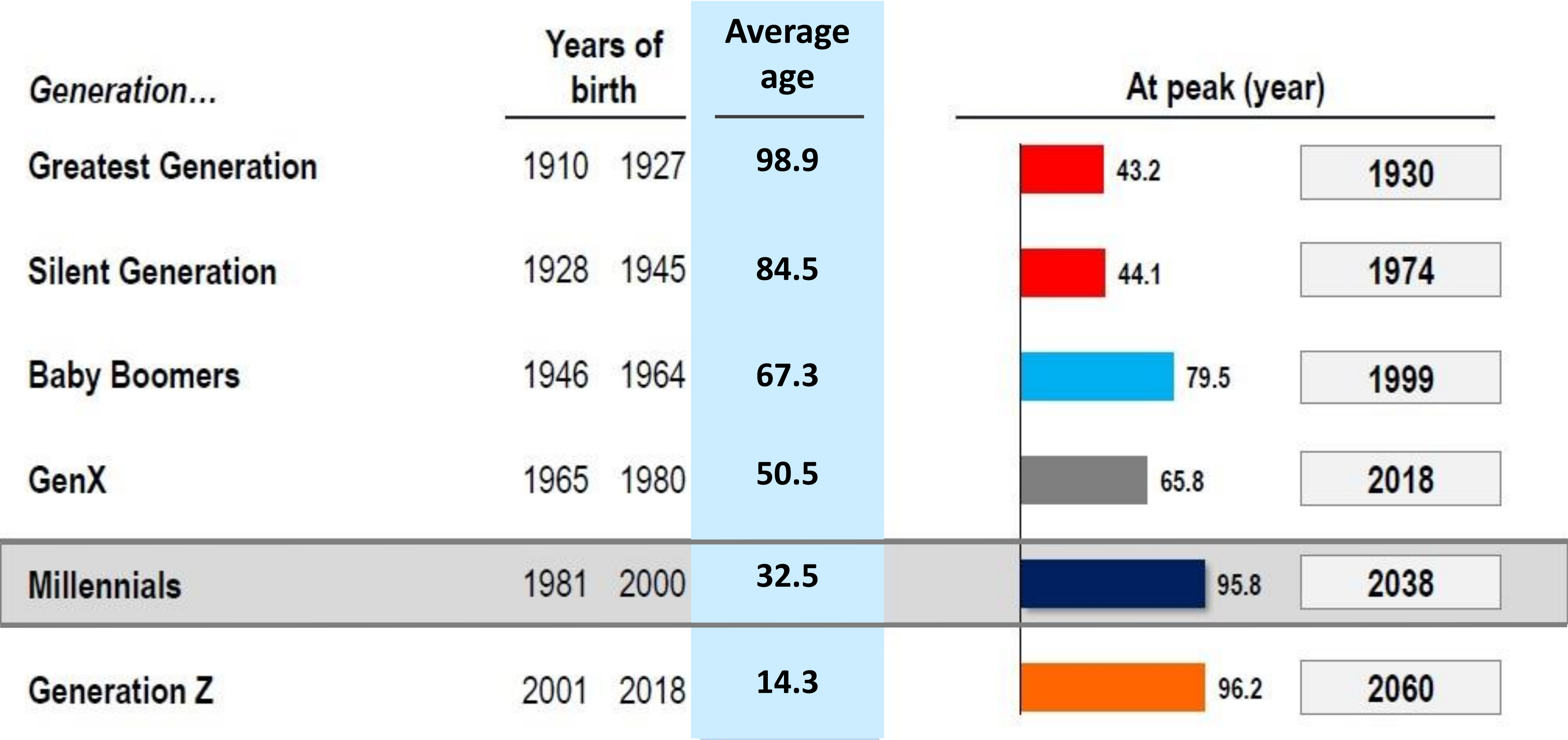
Prime Leverage Years: # Adults Age 30-48 Since 1935 per the U.S. Census Bureau



Generation...	Birth years	
Greatest Generation	1910	1927
Silent Generation	1928	1945
Baby Boomers	1946	1964
GenX	1965	1980
Millennials	1981	2000
Generation Z	2001	2018

# The largest generation ever, Millennials are just entering their prime income years

Total U.S. Population Divided by Age Groups



Peak population figures above include immigration. Reduced immigration will lead to a smaller overall size of Gen Z.  
Source: DESA UN Data sets, Fundstrat; Federated Hermes. Updated February 7, 2023



# Federated Hermes Forecast

Views are as of November 30, 2023

	2016A	2017A	2018A	2019A	2020A	2021A	2022A	2023E	2024E
Real GDP	1.80%	2.50%	3.00%	2.50%	(2.20)%	5.80%	1.90%	2.50%	1.70%
Core CPI	2.20%	1.80%	2.20%	2.30%	1.60%	5.50%	5.70%	3.60%	2.70%
Core PCE	1.80%	1.60%	2.00%	1.60%	1.50%	4.90%	4.40%	3.30%	2.40%
Benchmark 10yr Treasury Yield	2.50%	2.40%	2.68%	1.92%	0.92%	1.51%	3.88%	4.25%	3.75%
Fed Funds Rate (upper band)	0.75%	1.50%	2.50%	1.75%	0.25%	0.25%	4.50%	5.50%	5.25%
S&P 500 EPS	\$119	\$133	\$163	\$167	\$137	\$208	\$219	\$230	\$250
Target Forward P/E	16.8x	16.4x	15.0x	23.6x	18.1x	21.8x	16.7x	18.4x	18.2x
S&P 500 Target Price	2,239	2,674	2,507	3,231	3,756	4,766	3,840	4,600	5,000

PCE = Personal Consumption Expenditures. 2016, 2017, 2018, 2019, 2020, 2021 and 2022 are actual. Views are as of the date indicated and are subject to change based on market conditions and other factors. These views should not be construed as a recommendation for any specific security or sector. Source: Federated Hermes and the Commerce Department.

# Interested in hearing more?

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LINDA DUESSEL



## Mind on the Market

With more than 30 years of experience, Linda Duessel is nationally recognized for her expertise in analyzing equity market conditions. Linda discusses personal finance with investor groups across the country on topics of interest ranging from the impact of the alternative minimum tax to investing for retirement. Additionally, Linda has been extensively quoted by Associated Press, The Wall Street Journal and Barron's, as well as featured in the annual roundtable for USA Today.

As senior equity market strategist, Linda is part of the equity income team, which is responsible for formulating Federated's views about the market and the firm's positioning strategies within the equity income team. As senior client portfolio manager, she is responsible for articulating the strategy, process, positioning and performance of Federated's equity income products.

Interested in hearing more from Linda? Here are two ways:

1. **Read her weekly market views**  
Look for them on our site and in our weekly email.
2. **Connect with her on** [LinkedIn](#)



# AI Revolution

**Linda A. Duessel, CFA®, CPA, CFP®**  
Senior Equity Strategist  
Senior Vice President

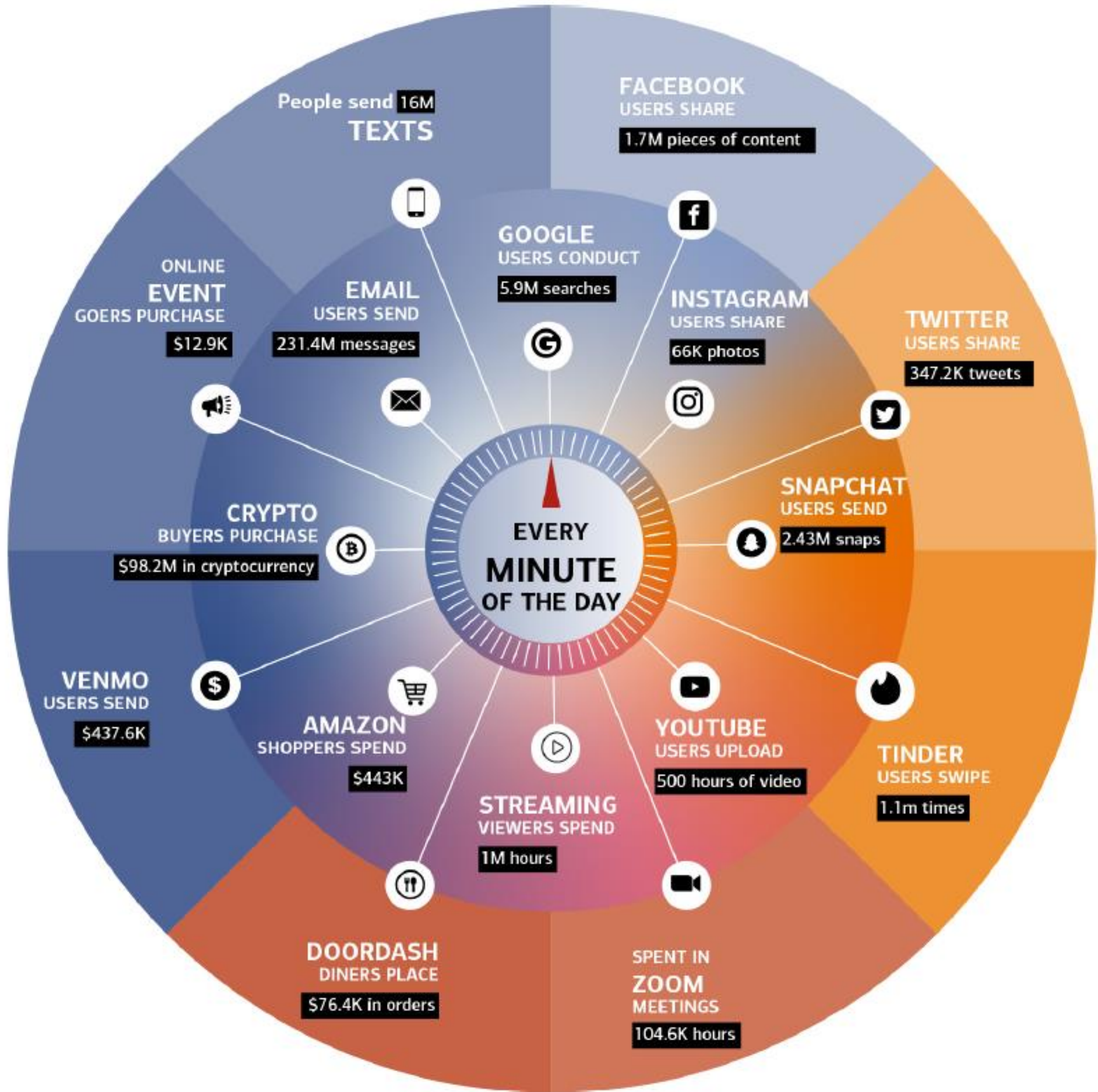
October 2023

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# How much data is created every minute on the internet

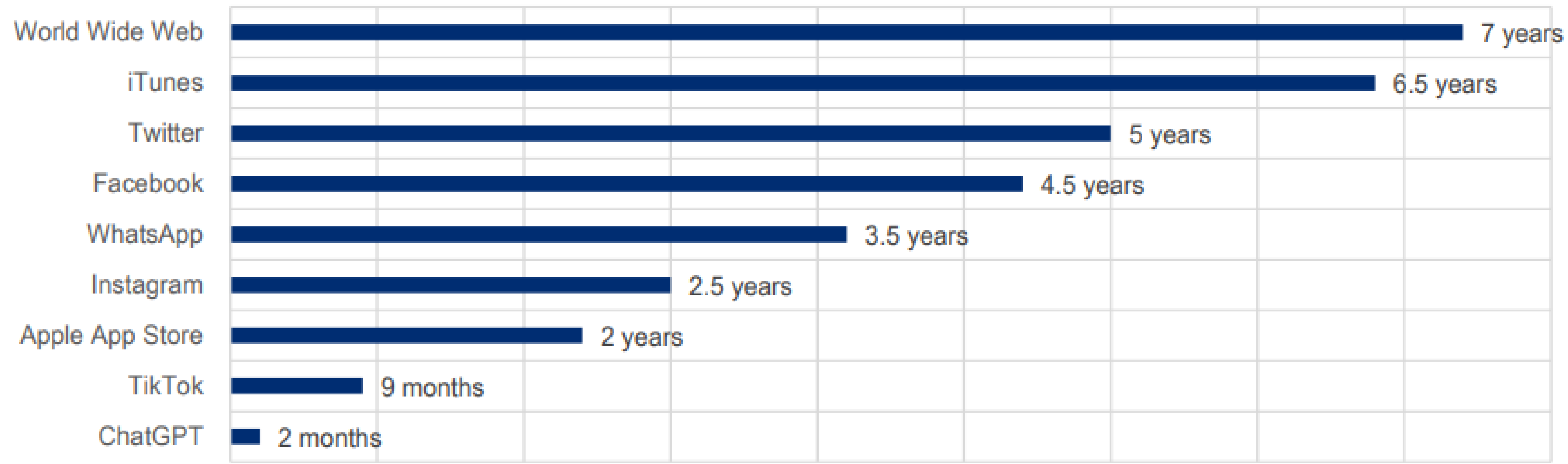
By The Time You Finish Looking at This Chart, 2.4 mn Snaps Will Have Been Sent on Snapchat



Source: BofA Global Research, February 28, 2023

# ChatGPT- The fastest growing consumer application in history

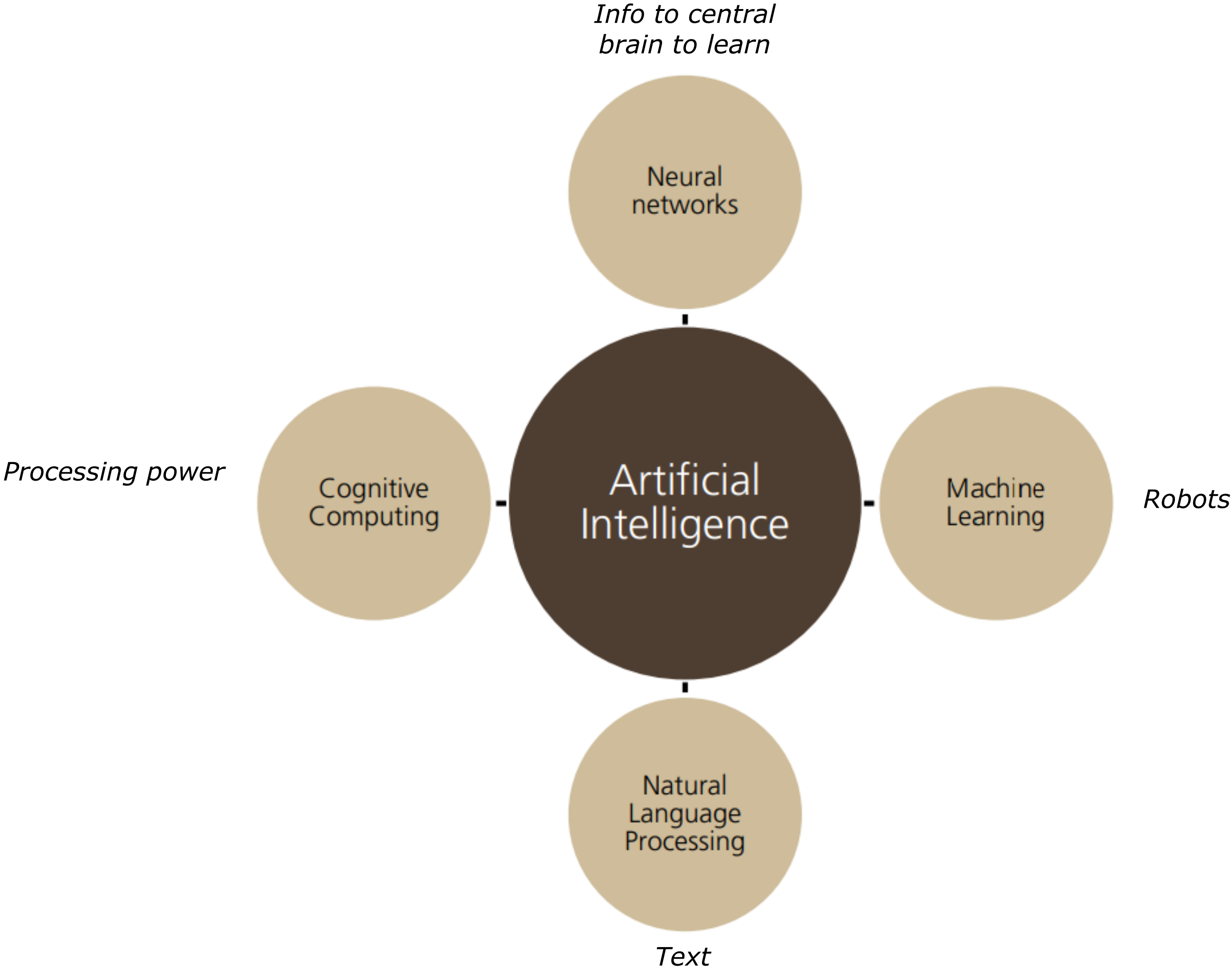
Time To Reach 100 Million Users Worldwide



Source: Citi Research, SimilarWeb, Open AI. July 10, 2023

# What is AI?

Artificial intelligence is an umbrella term for many technologies

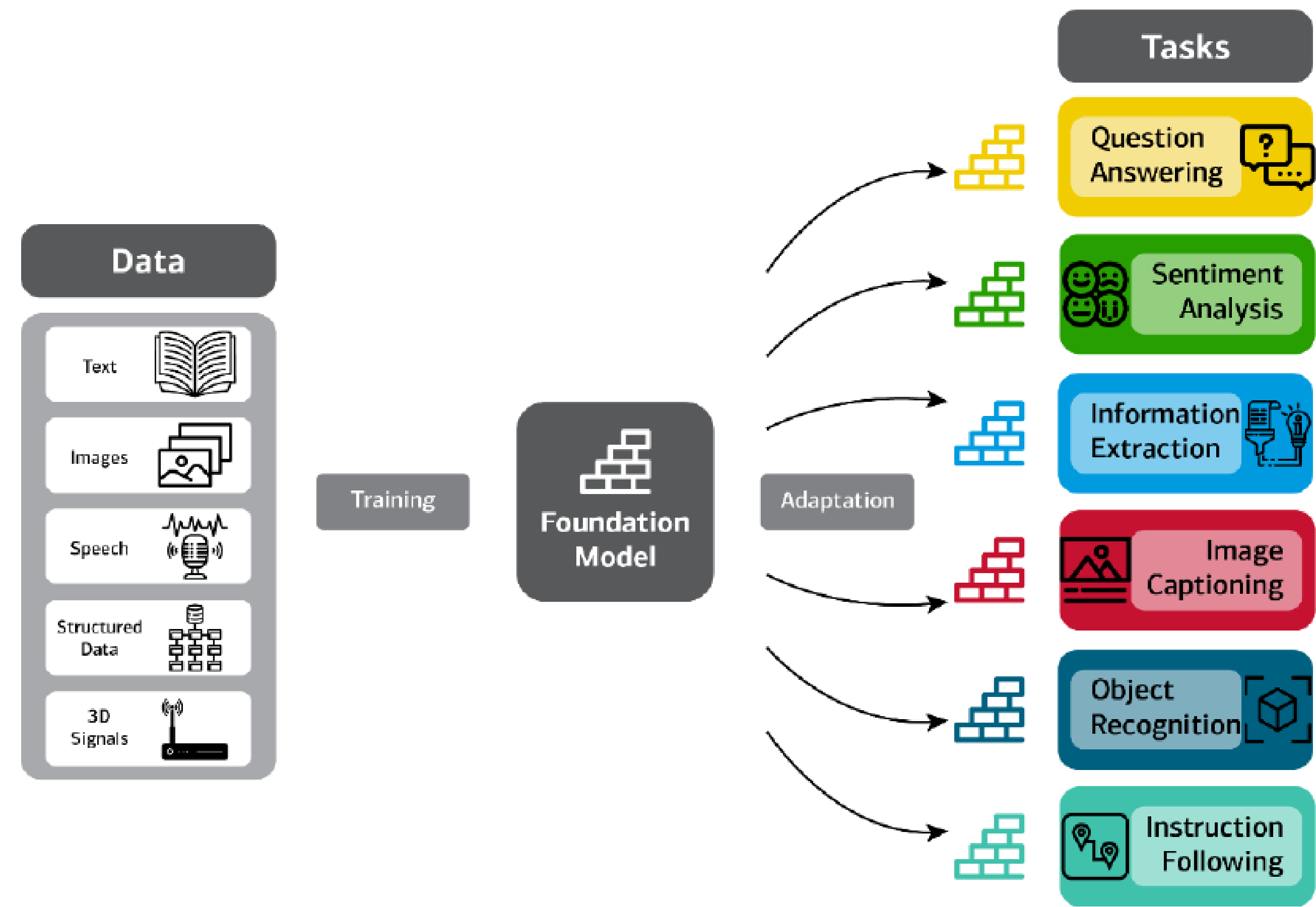


Source: UBS. March 2, 2018



# A large language model is a transformer-based neural network which predicts the text that is likely to come next

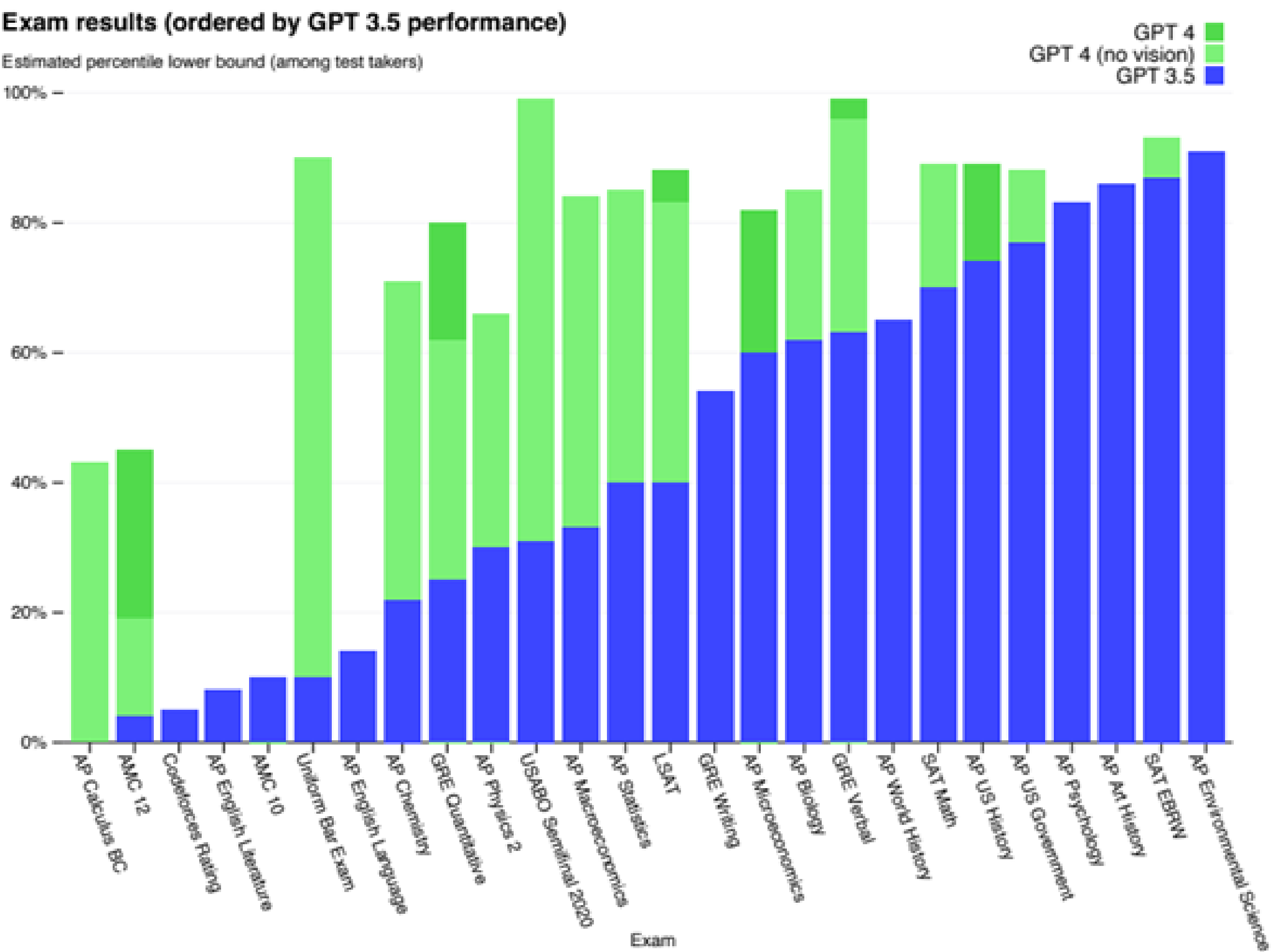
Foundation or Large Language Models Can Centralize Information From Several Data Modalities To Adapt to a Wide Range of Tasks From Answering Questions to Extracting Information and Identifying Images



Source: Center for Research on Foundation Models (CRFM), Stanford University Institute for Human-Centered Artificial Intelligence. BofA Global Research. February 28, 2023

# Professors resorting to blue books and pencils

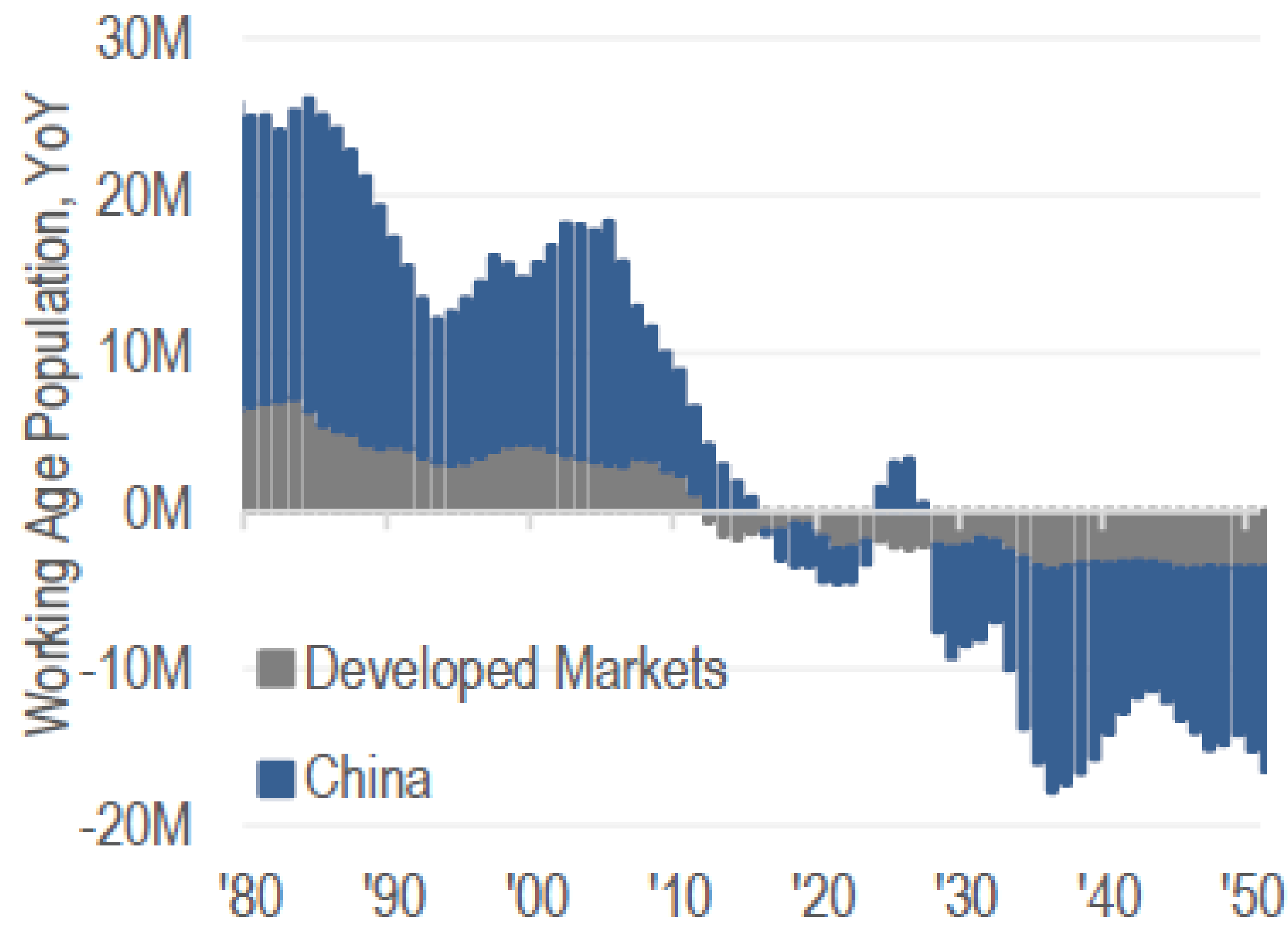
GPT-4 vs GPT-3.5 Exam Results



Source: OpenAI. Credit Suisse Equity Research. March 14, 2023

# We've got a labor supply problem

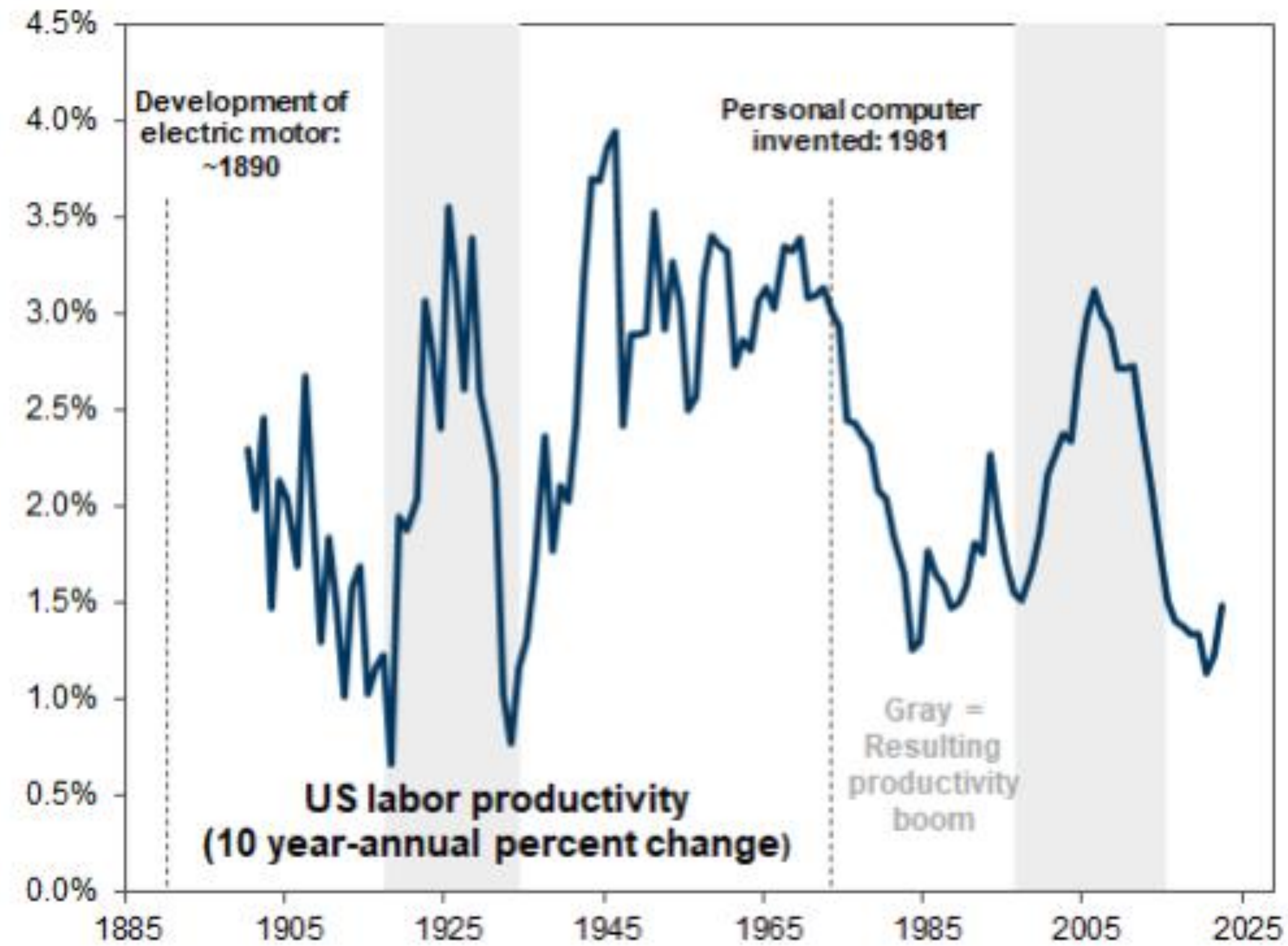
Labor Supply Could Remain Challenged As Working Age Populations Fall in Developed Markets and China



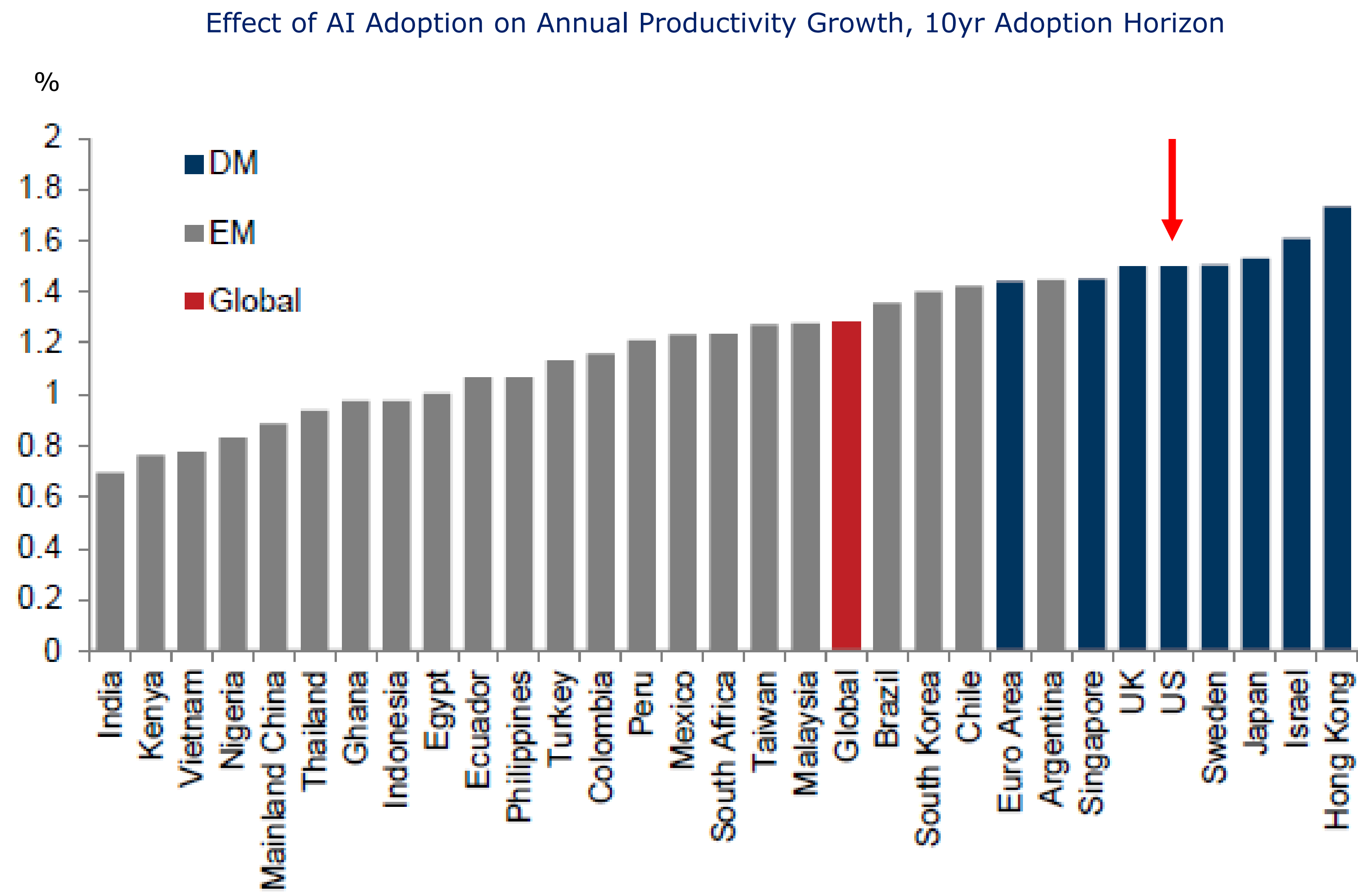
Source: UN Population Prospects, Evercore ISI Research. June 22, 2023

# We've got a productivity problem

Historical 10-Year Annual Productivity



# AI adoption could boost productivity growth >1%/yr over 10 yrs

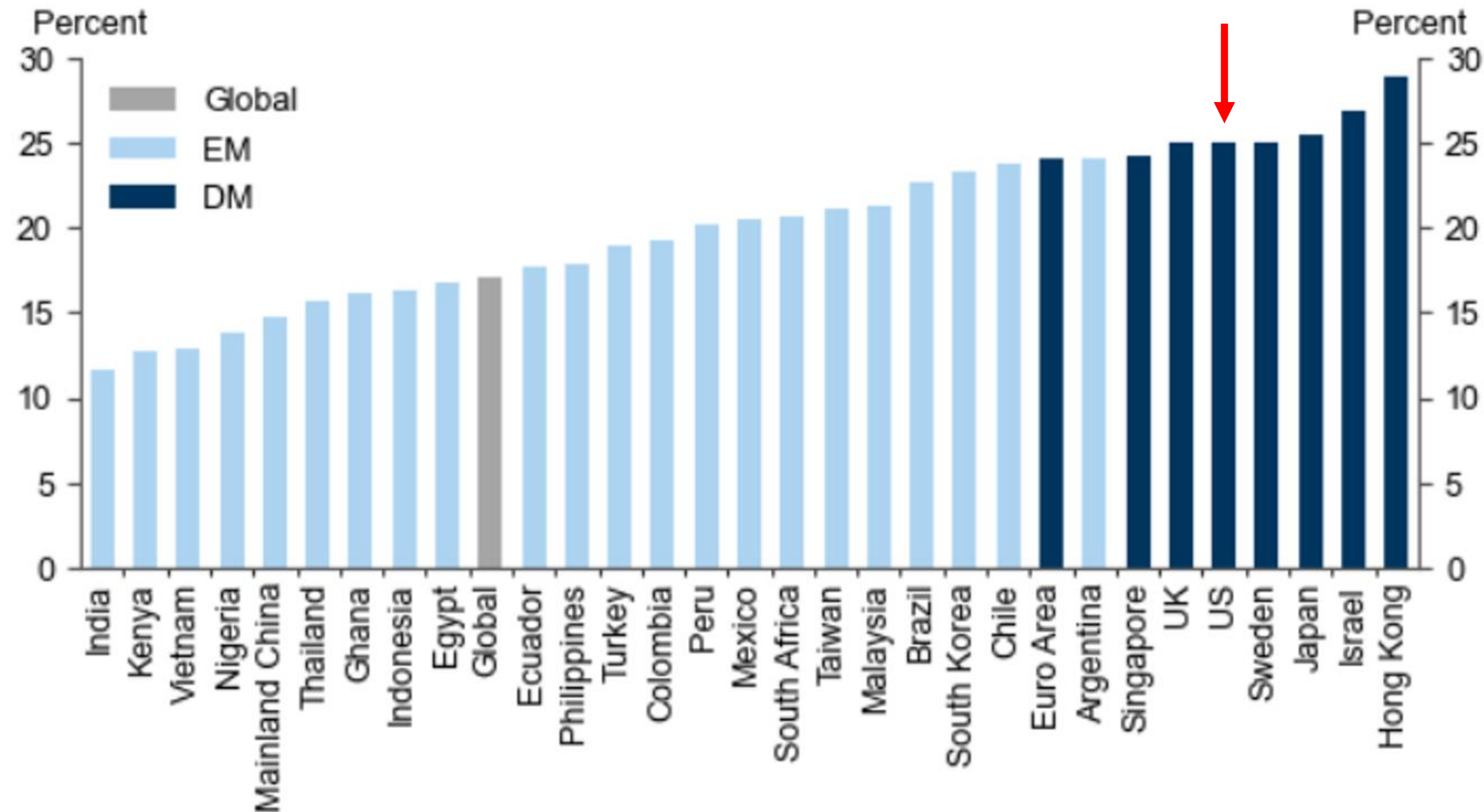


Source: Goldman Sachs GIR. July 5, 2023

## Jobs Winners & Losers

# Lots of work could be automated by AI, especially in DMs

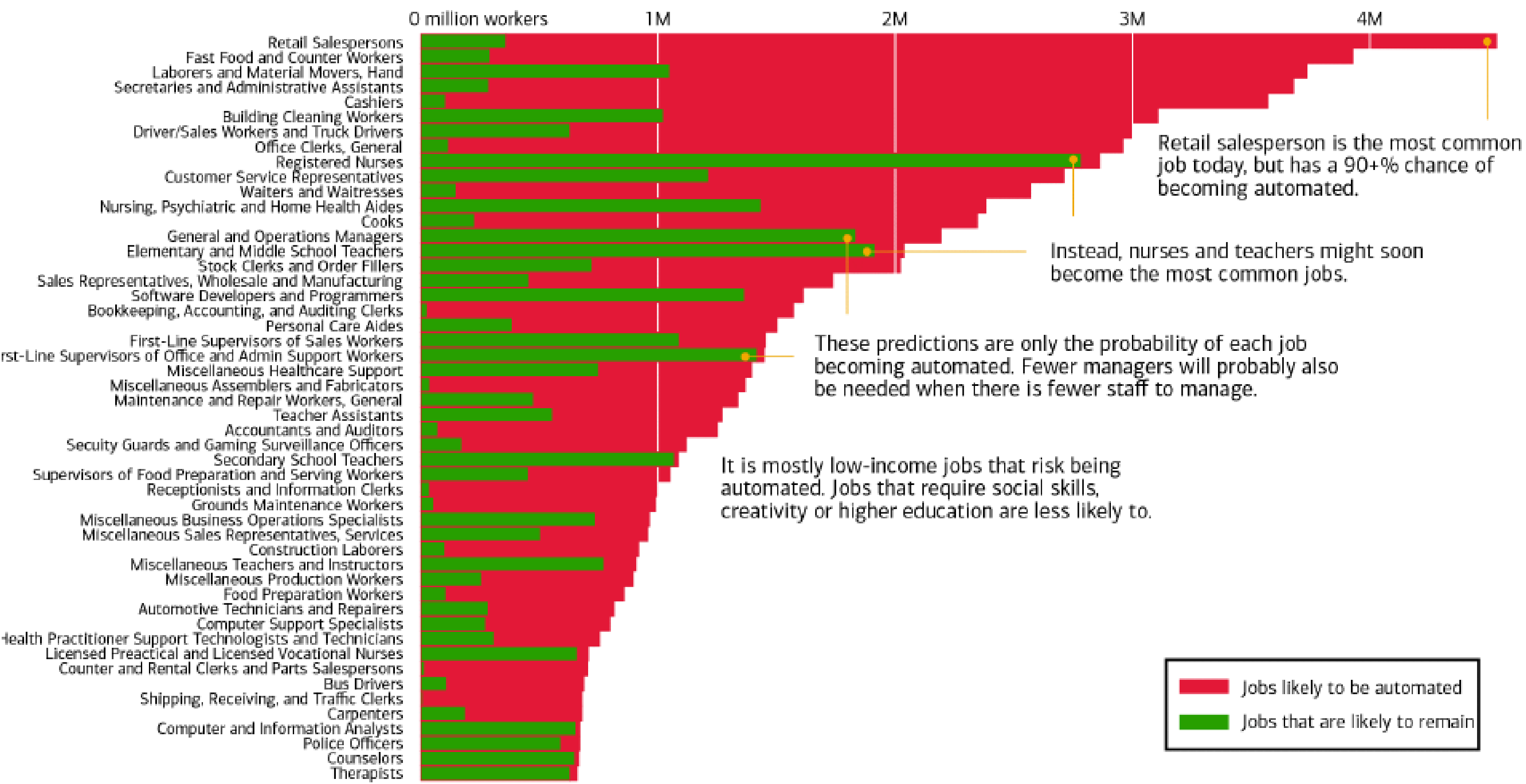
Share of Full-Time Equivalent Employment Exposed to Automation by AI





# Future of employment: Forget the mall, become a nurse or a teacher

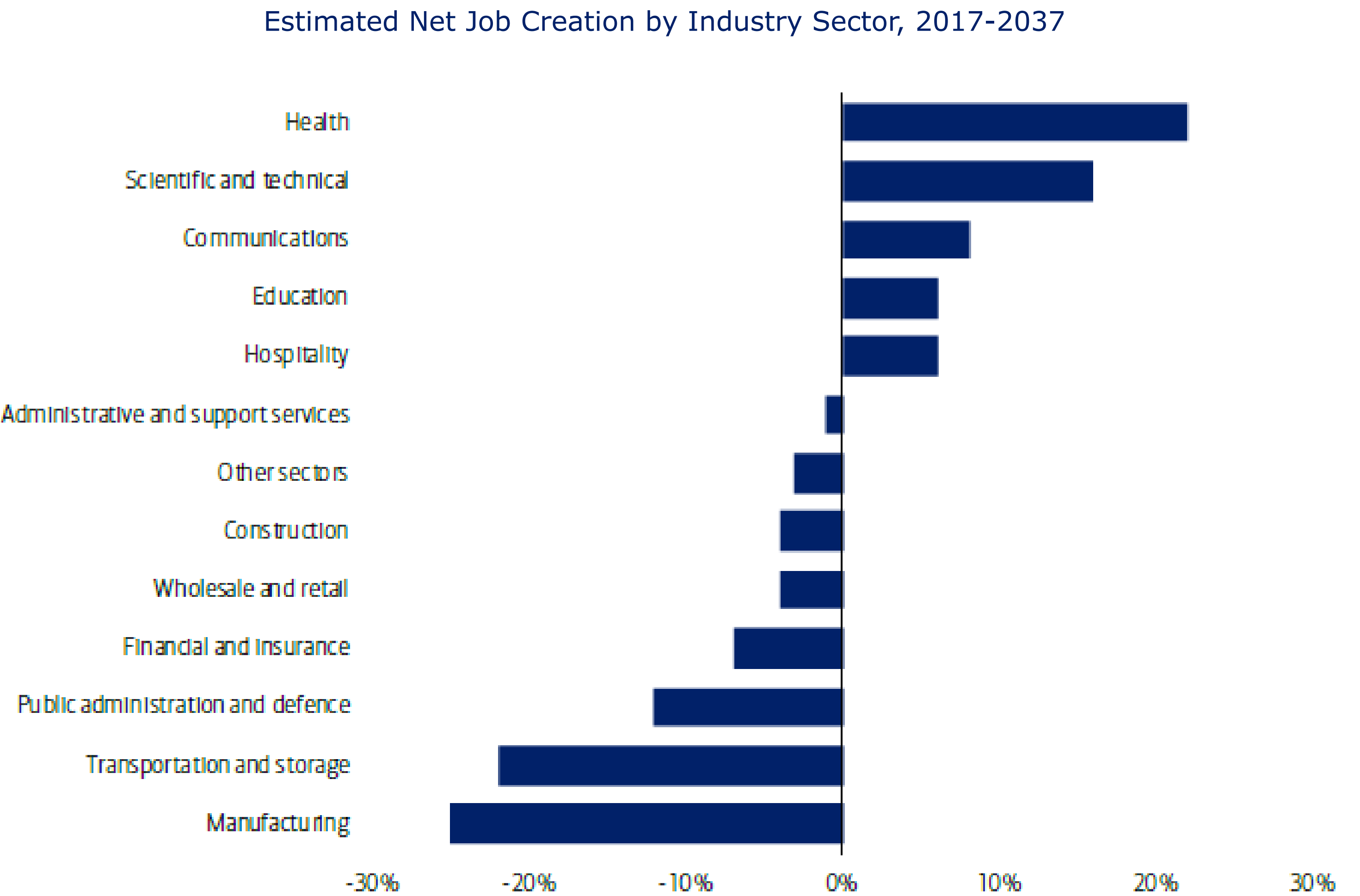
Likelihood of Job Automation (Today vs Next 20 Years) Where Green Bars Denote Jobs Likely To Remain



Source: U.S. Bureau of Labor Statistics, Frey & Osborne, The Future of Employment, Henrik Lindberg, Visual Capitalist. BofA Global Research. February 28, 2023

Industry Winners & Losers

Sectors with more routine/limited training tasks at higher risk of automation

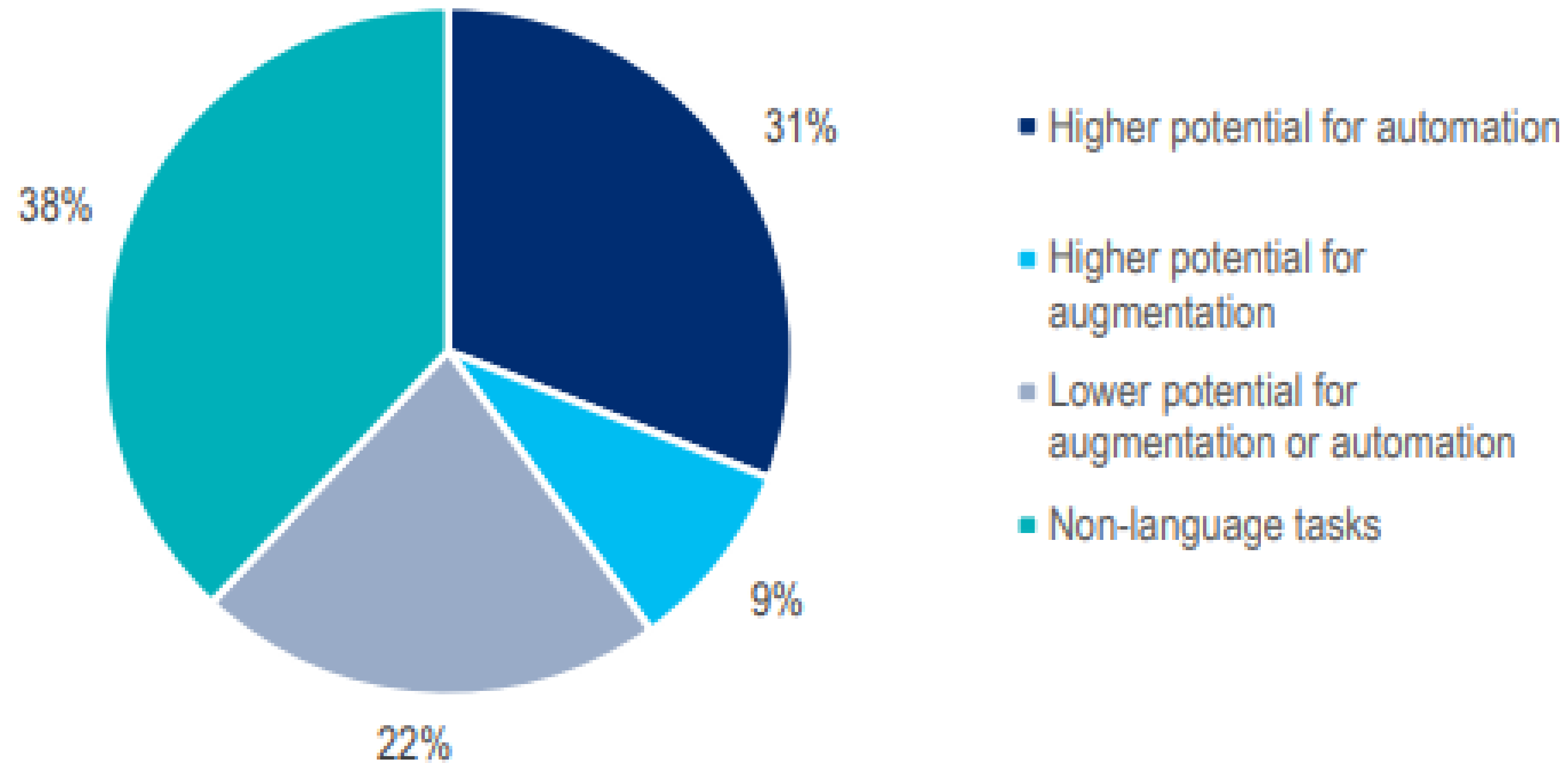


Source: BofA Global Research Estimates, PWC. February 28, 2023

## Companies Adopting AI

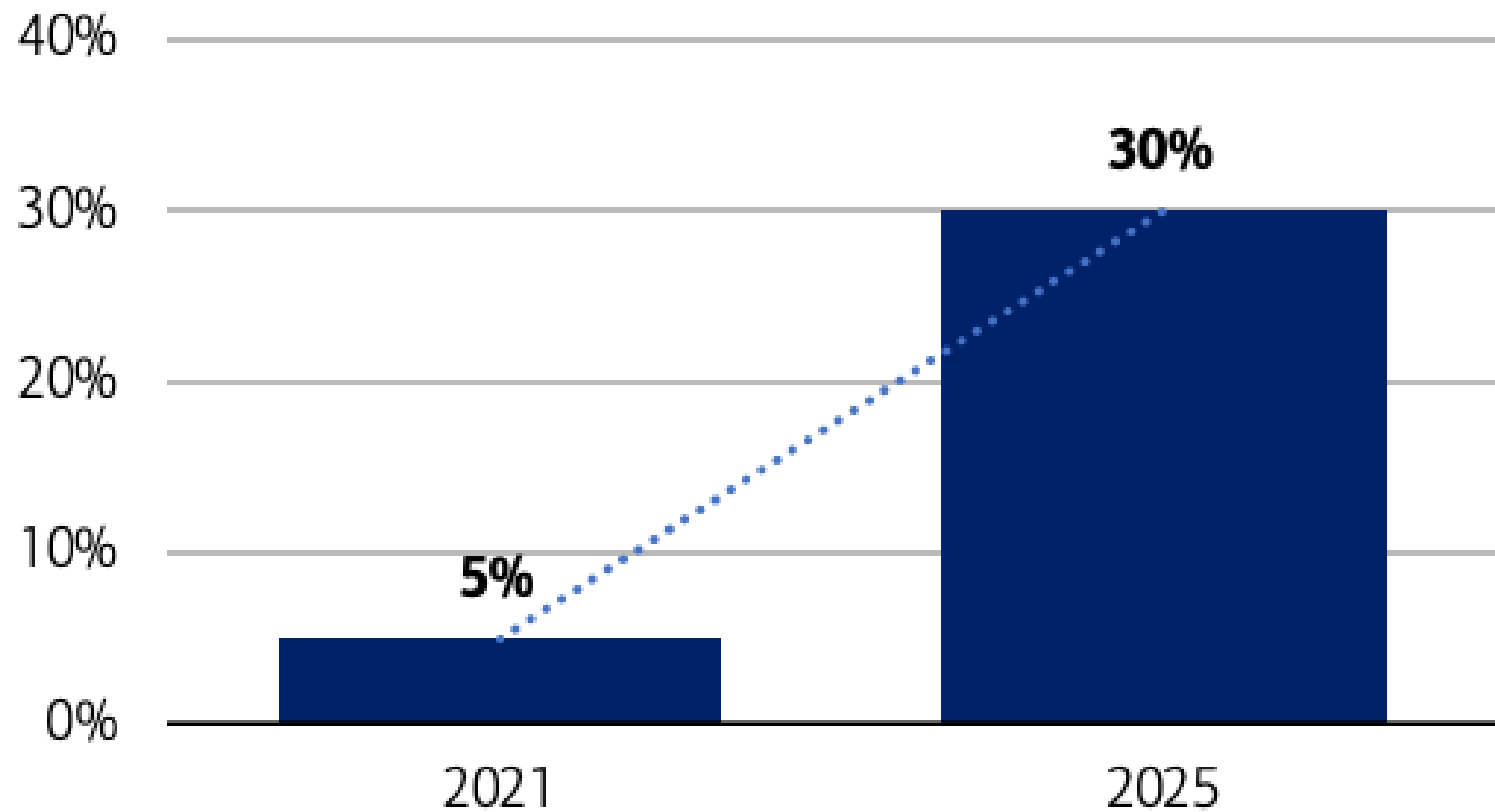
# Generative AI holds tremendous potential to transform work-share of tasks

Generative AI's Potential To Transform (Industry Average)



# Companies likely to significantly increase AI use over time

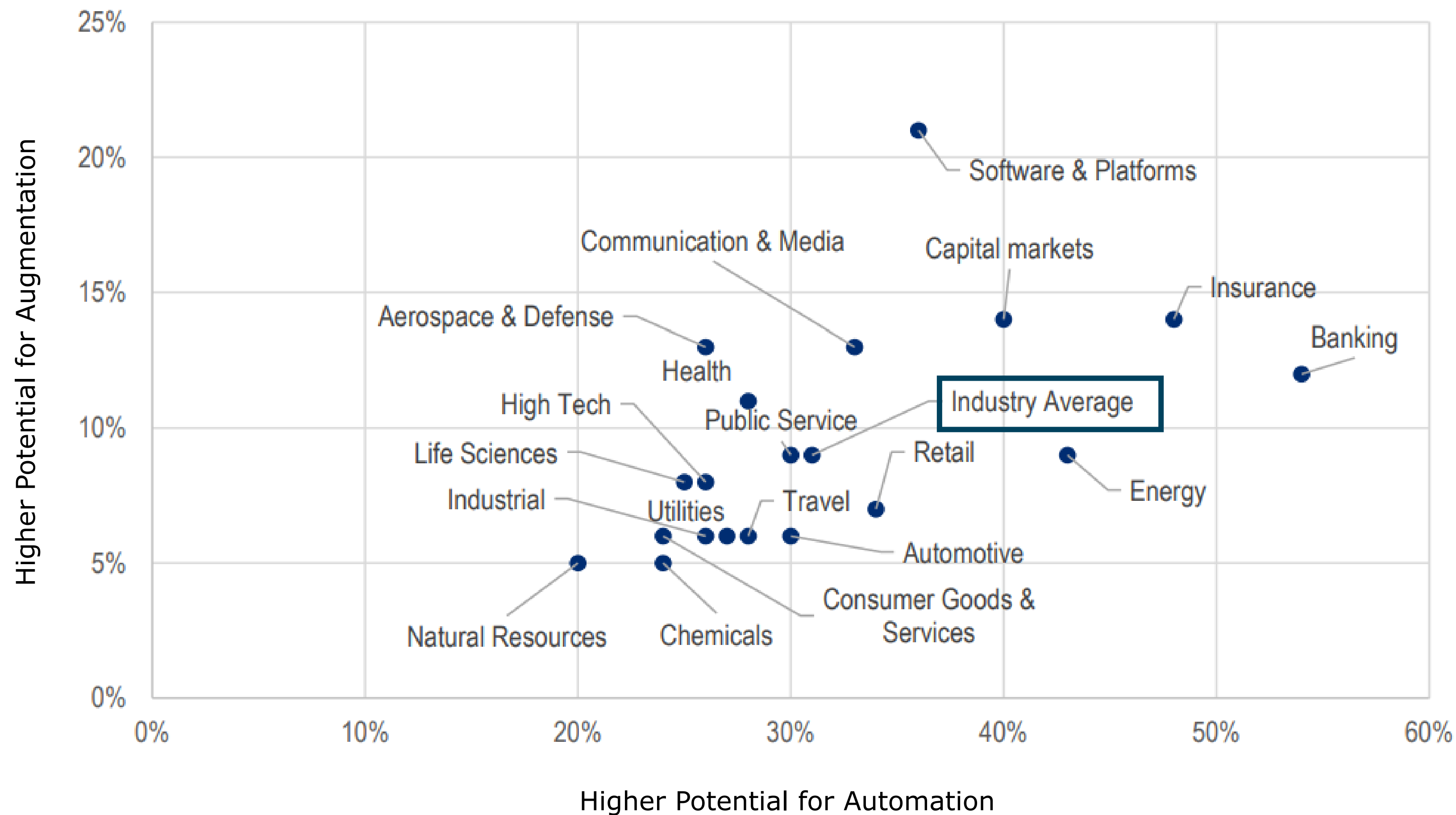
Estimated % of Enterprises Implementing AI-Augmented Development and Testing Strategies



Source: BofA Global Research, Gartner \*A.I./M.L. = Artificial Intelligence/Machine Learning. July 6, 2023

# AI revolution in the workplace

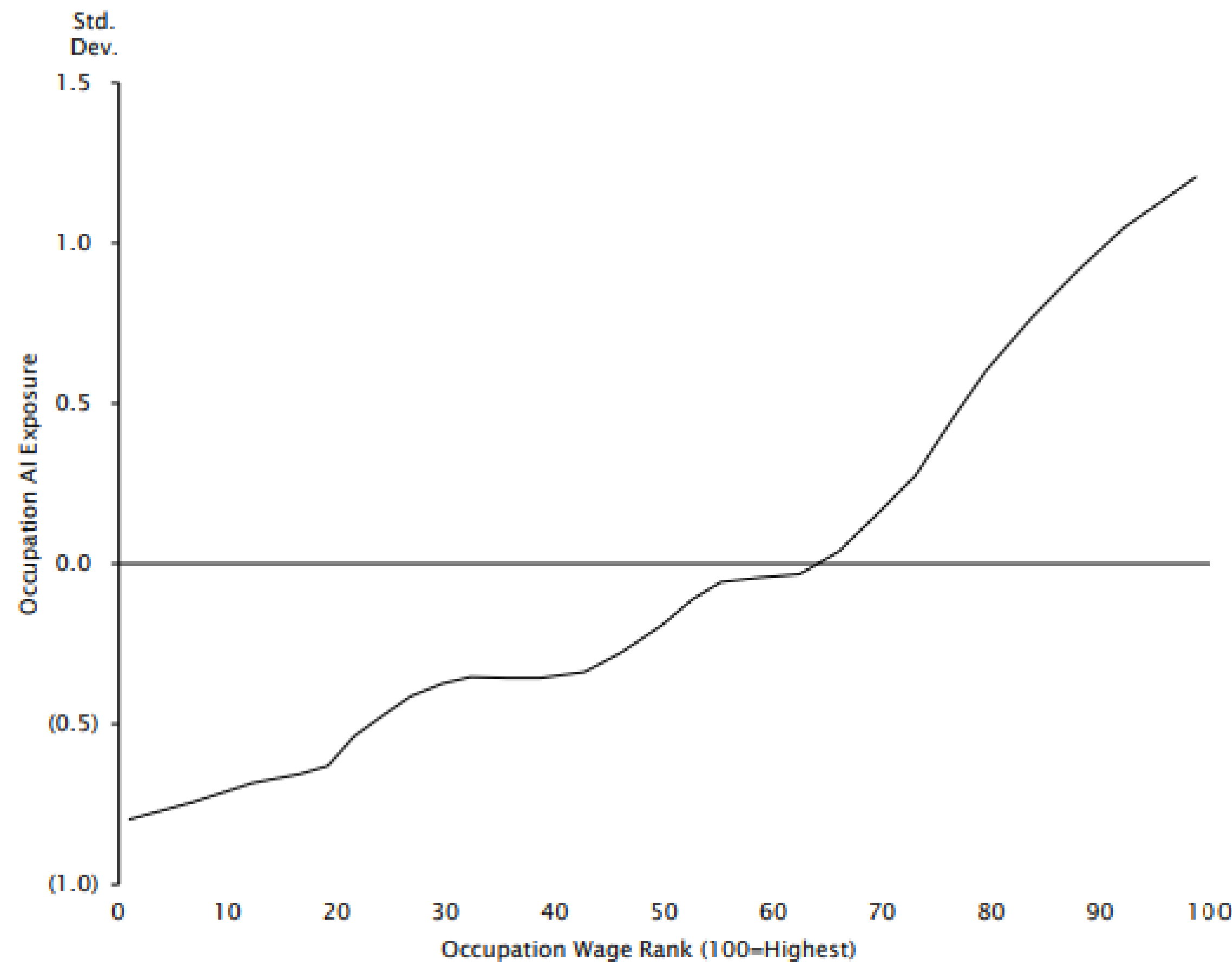
Generative AI Will Transform Work Across Industries



Source: Citi Group Inc. Accenture. July 10, 2023

# The highest paying jobs are most exposed to AI disruption!

U.S. Occupations  
AI Exposure Versus Wage Rank\* 2010 Through 2018



Source: Acemoglu, D., Autor, D., Hazell, J., and Pascual Restrepo, 2022. "AI and Jobs." NBER Working Paper. Empirical Research Partners Analysis. June 20, 2023  
\*Occupations ranked by their average hourly wages over the period of the analysis.



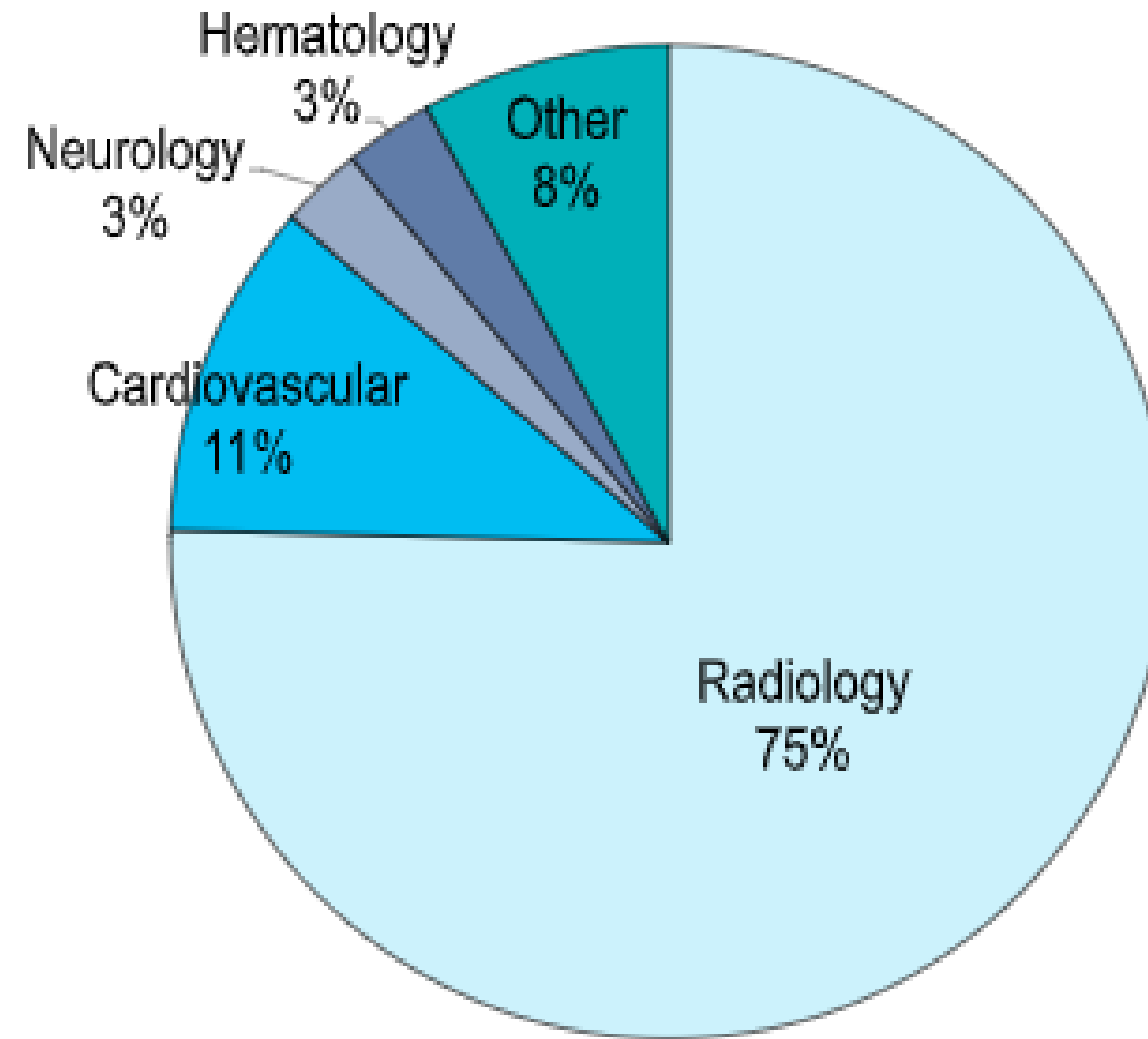
## AI in Automobiles

Every Car Will Generate 4TB of Data Everyday...Excluding the Data From All These Cars Communicating



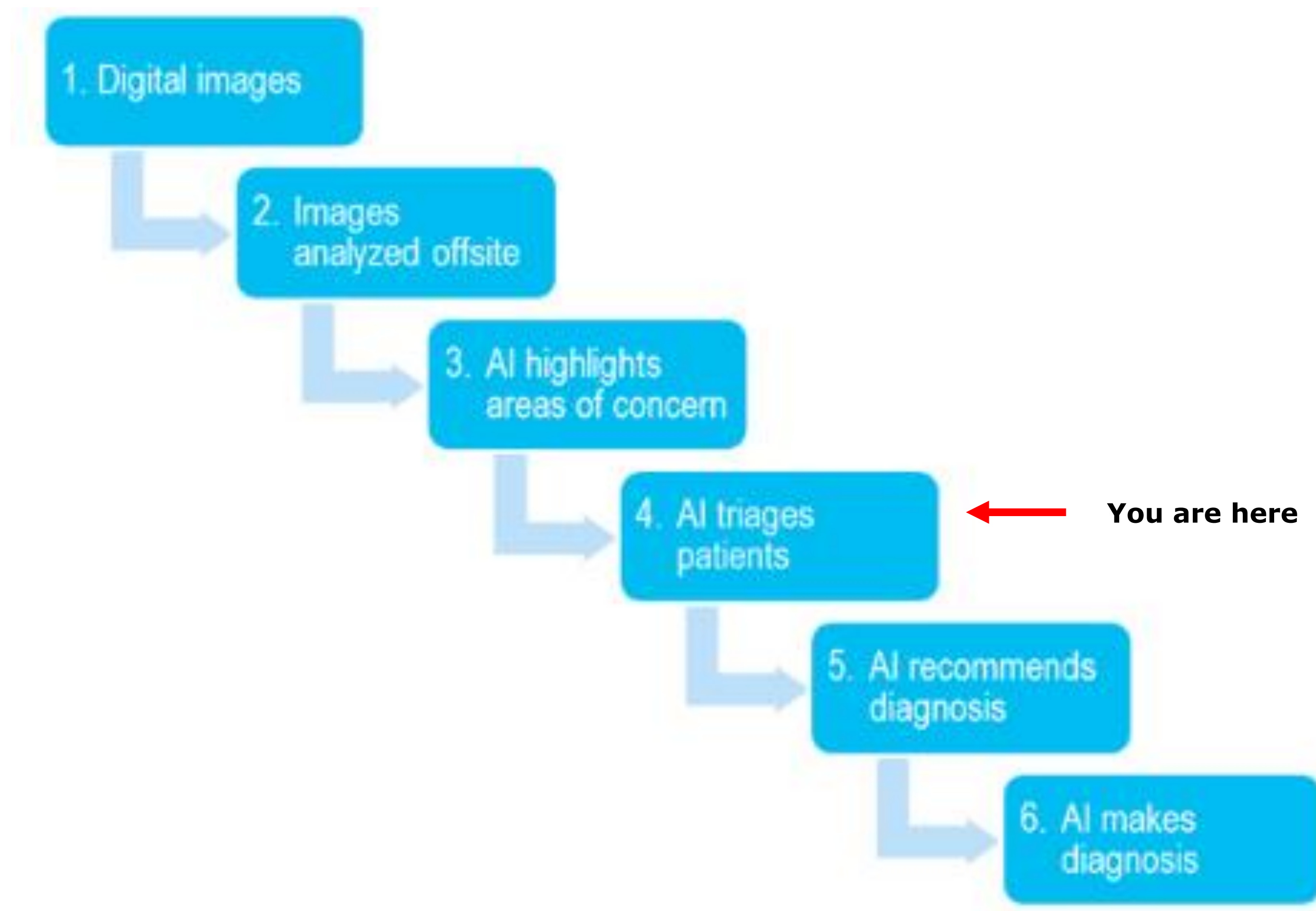
# AI in healthcare-medical AI products

AI-Enabled Devices—Branch of Medicine Served



# Most current AI solutions stop at stage 4; stage 6 may be decades away

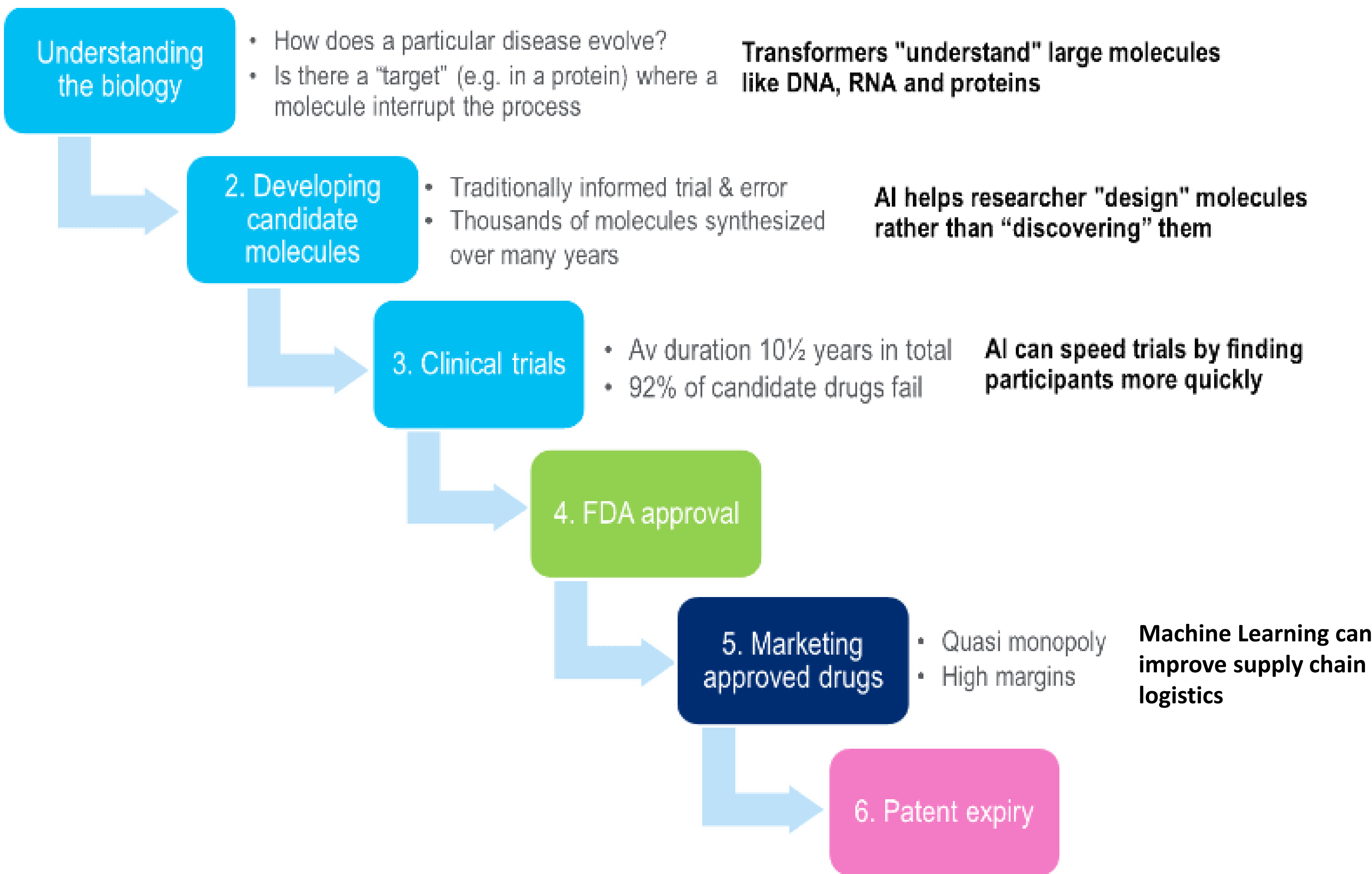
Stages of Automation in Radiology



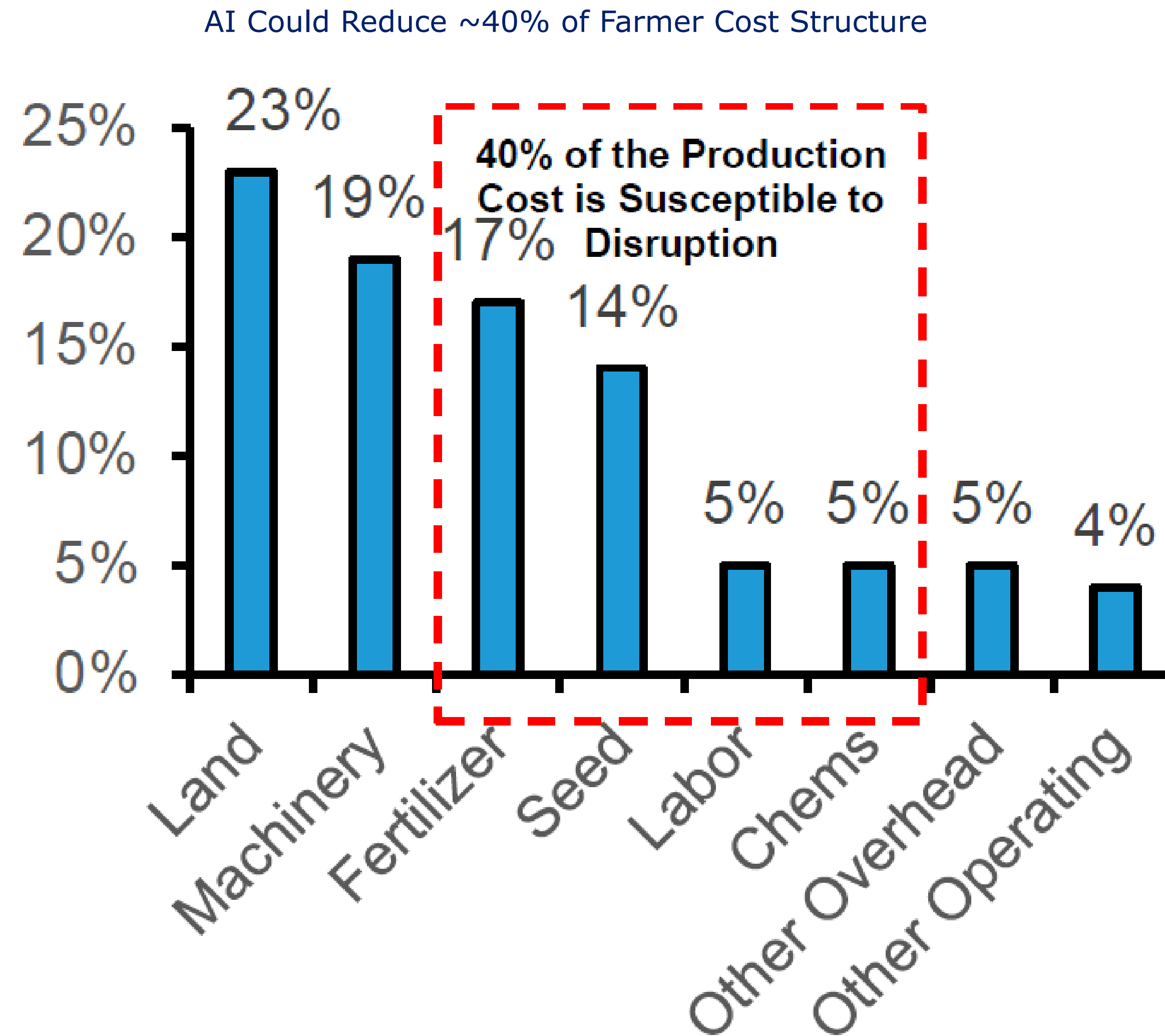


# AI can help with almost every aspect of biopharma

## Biopharma Process and Impact of AI



# AI in agriculture





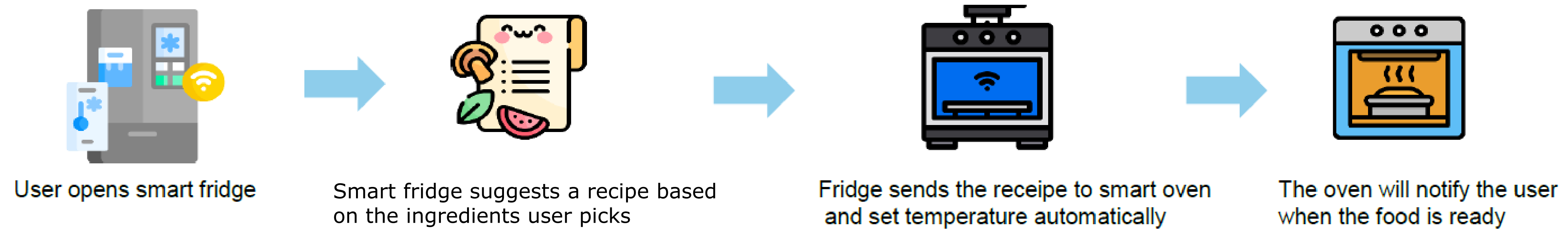
# AI in online grocery

Online grocery technology value chain	FRONT-END	INVENTORY MANAGEMENT	PICKING	ROUTING	DELIVERY
Online grocery process	Customer browsing & placing an order		Order picked and prepared for delivery		Order out for delivery
Impact of AI	MEDIUM	HIGH	HIGH	MEDIUM	LOW
Impact of AI details	Personalisation of website  Better availability of items through inventory visibility  Increased basket sizes with personalised interstitials  Opportunity to create subscription orders	Improved forecasting  Better product availability through single stock view  Reduced product wastage  Reduced markdowns  Optimised grid in real-time based on orders & weather	Collaborative on-grid robots  Predictive movements enabling high speed robots  Robotic arms removing labour through visual AI	Reactive real-time optimised routing based on weather, traffic etc  Flexible order allocation to optimise drops per hour	Autonomous vehicles delivering orders  <b>Automated Guided Vehicles in the warehouse to shuttle products around</b>

# Smart refrigerator



# Smart kitchen



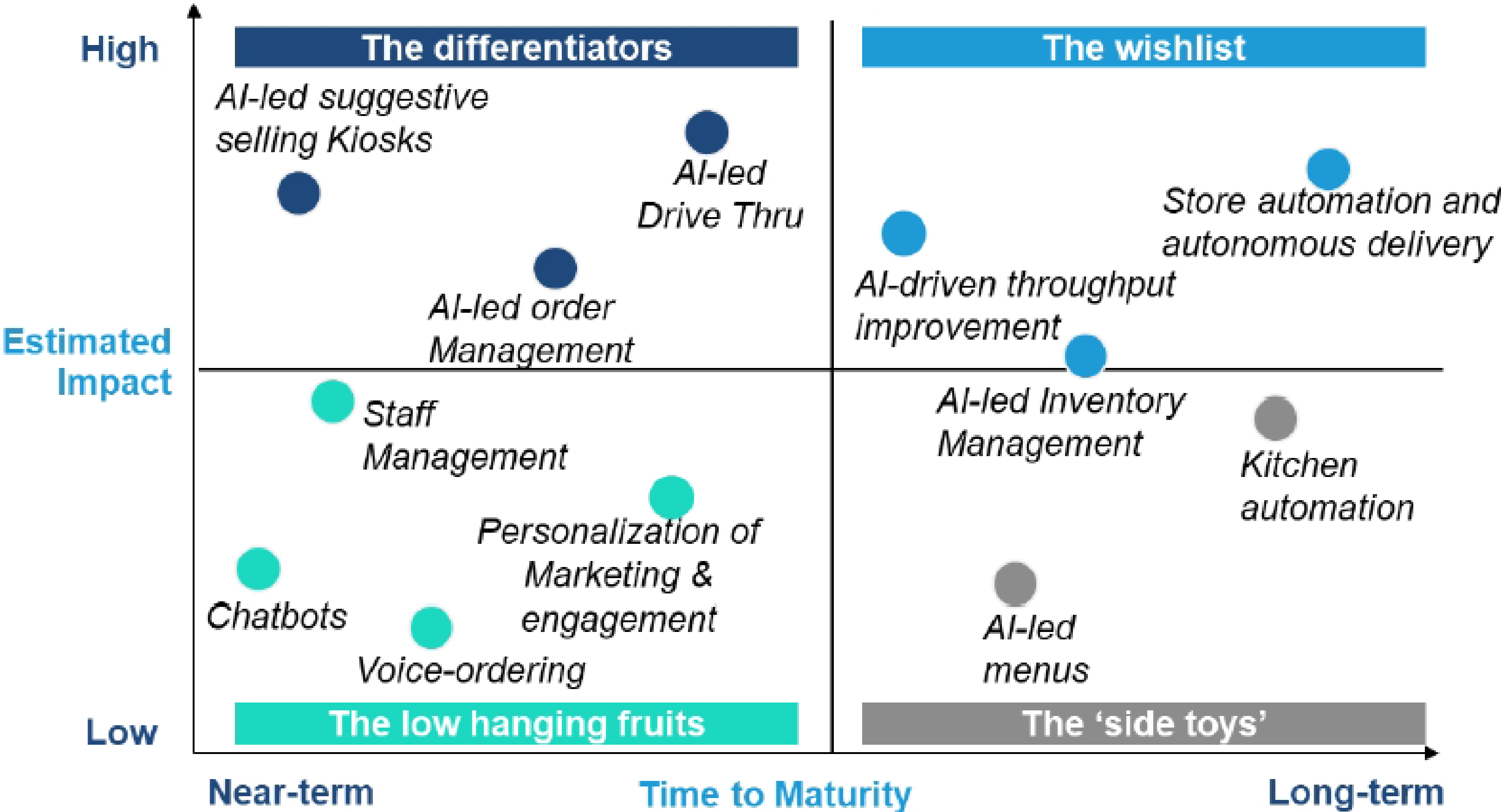
# AI in retail

Try Lipstick Shades Virtually



# AI in the restaurant industry

Five Critical Areas Drive Maximum Impact in the Shortest Time  
AI Use Case Impact Analysis- Illustrative

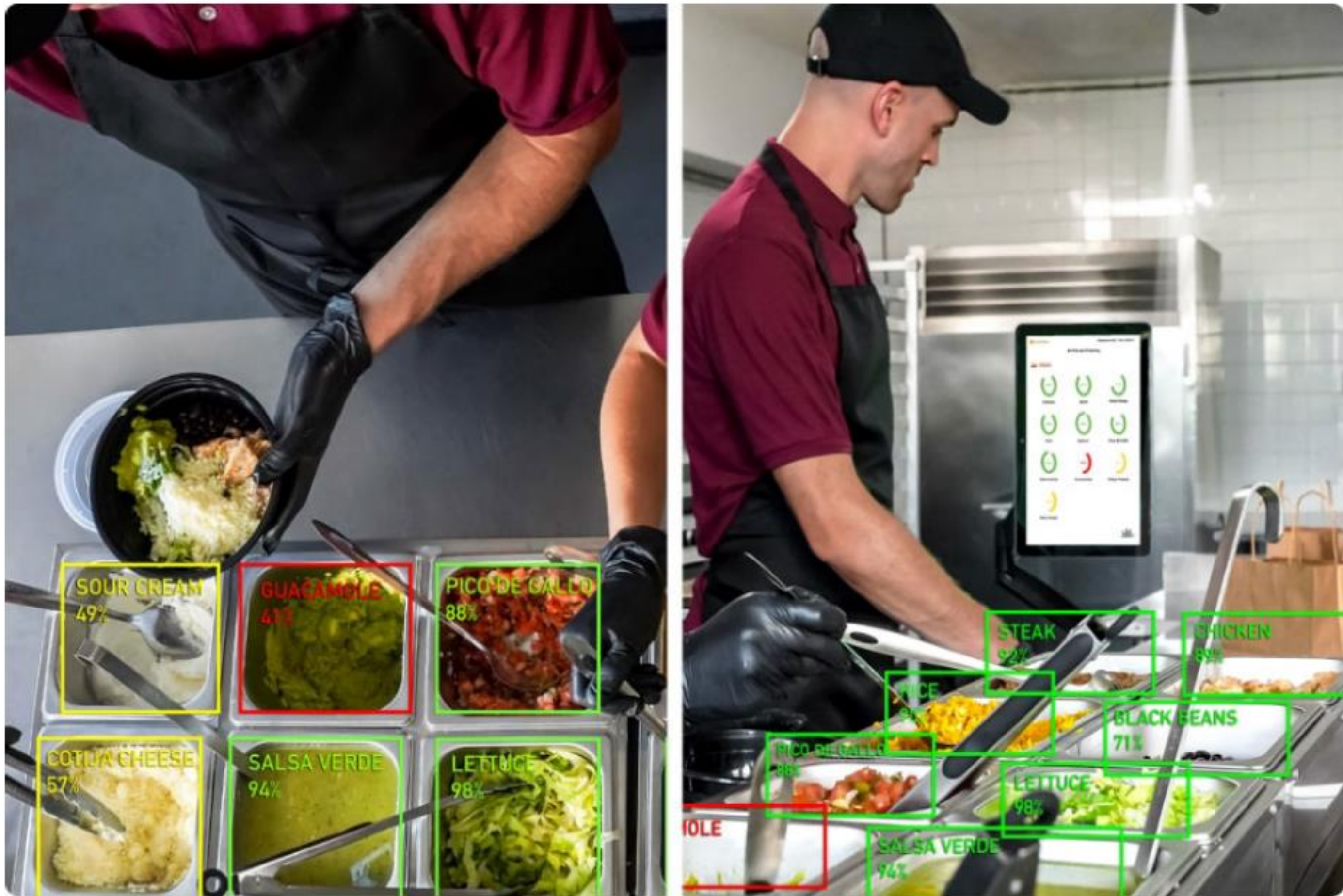


Source: Bernstein Analysis. May 2023



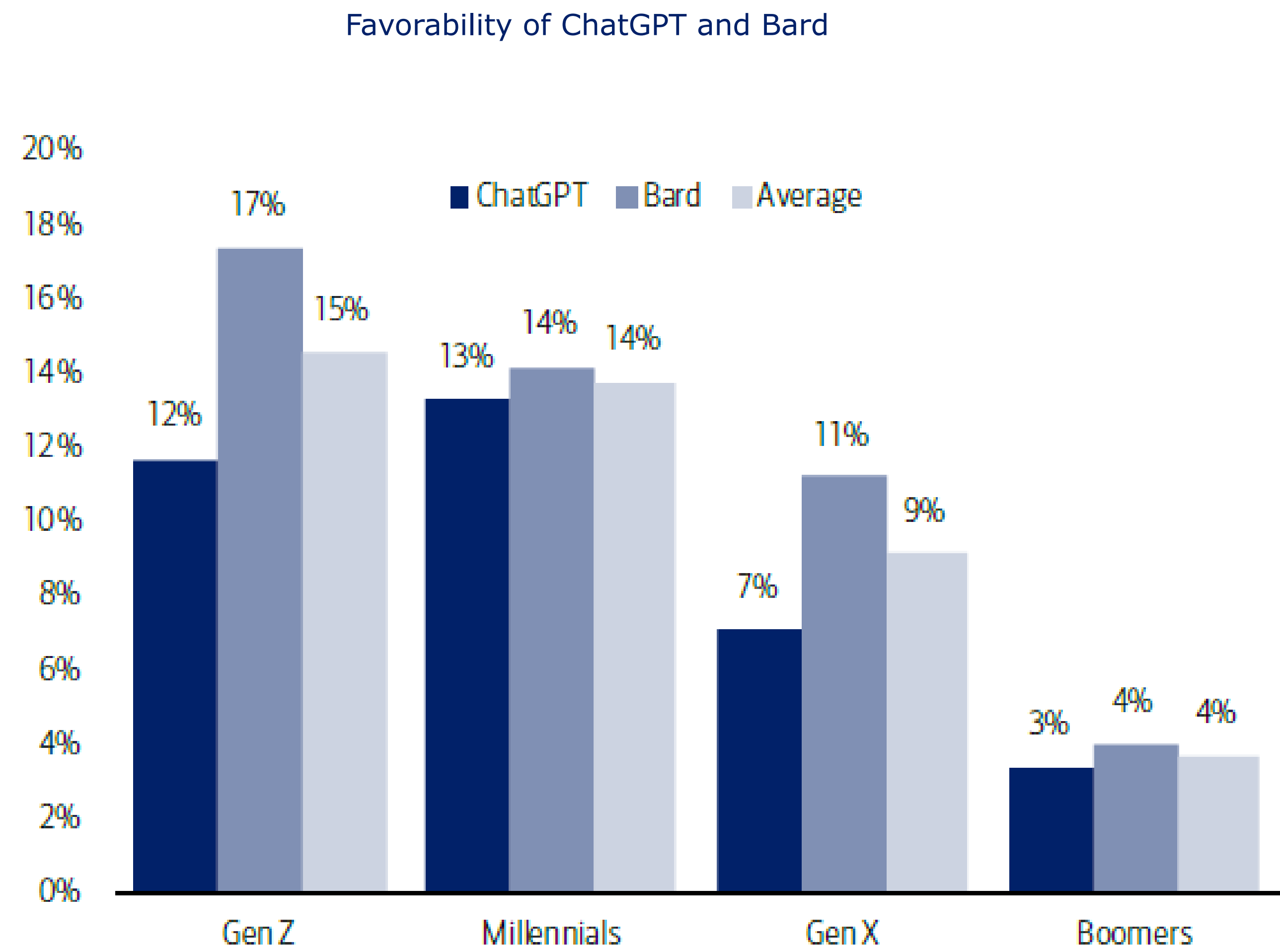
# AI in fast food

Vision AI Could Significantly Assist in Order Preparation and Accuracy



Source: Precitaste, Bernstein Analysis. May 2023

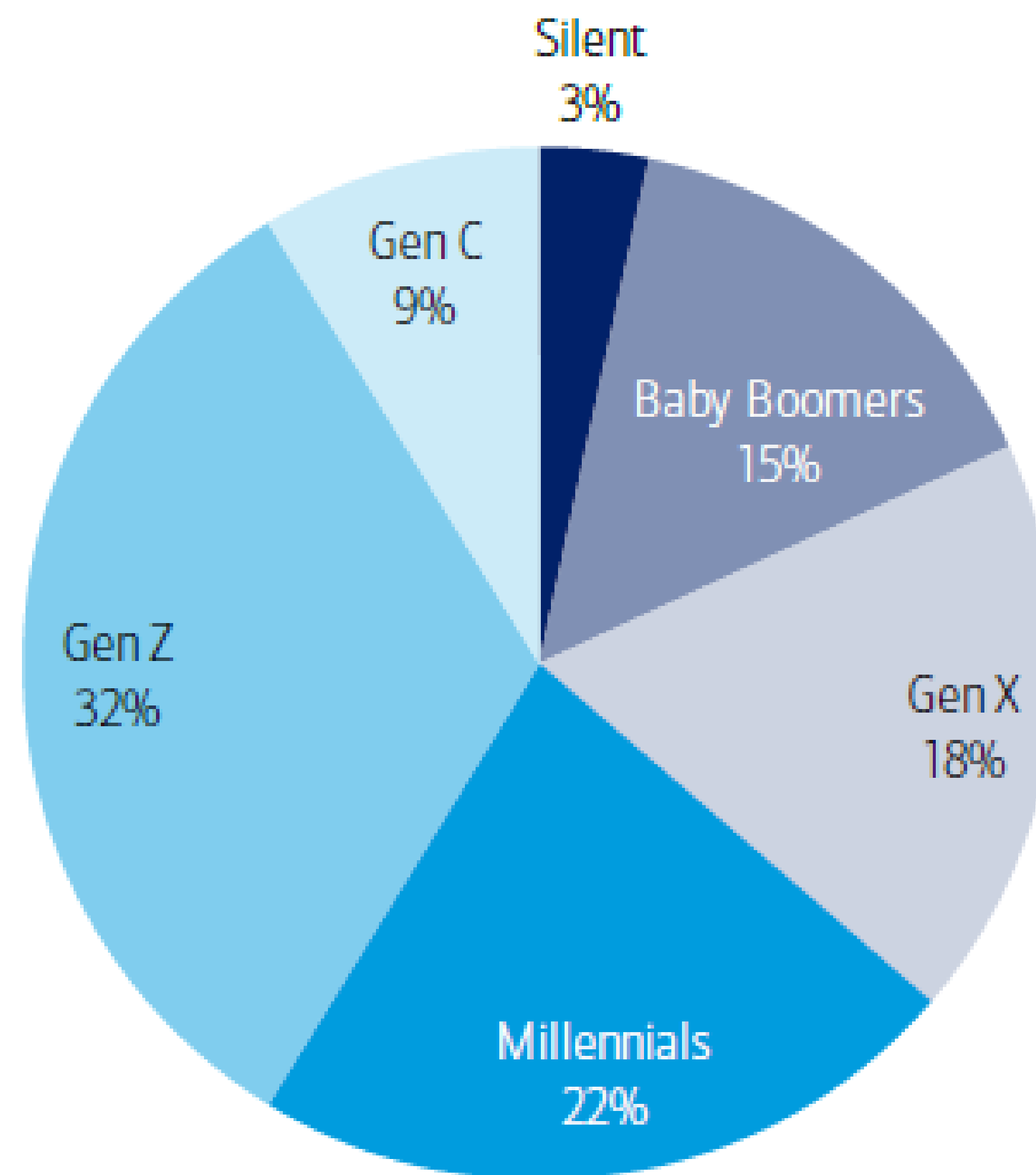
# Younger generations are more positive about ChatGPT/Bard



Source: BofA Global Research, MorningConsult. Note: Favorability is the proportion of people who responded with very favorable or somewhat favorable. February 28, 2023

# A third of the global population is Gen Z and 9% is Gen C

Share of the Global Population by Generation

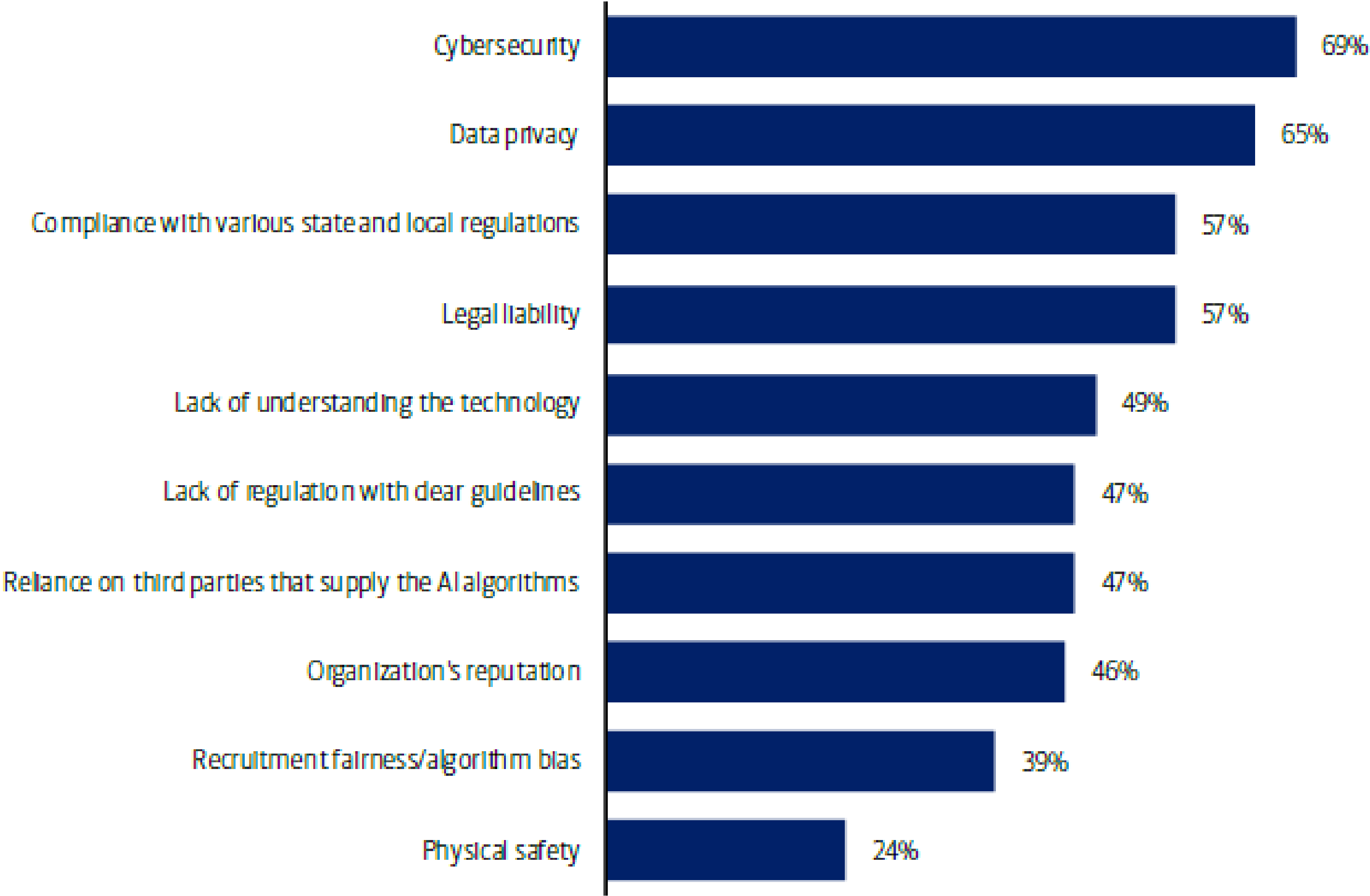


Source: UN. BofA Global Research. February 28, 2023



# 69% of executives think that cybersecurity is their biggest AI-related risk

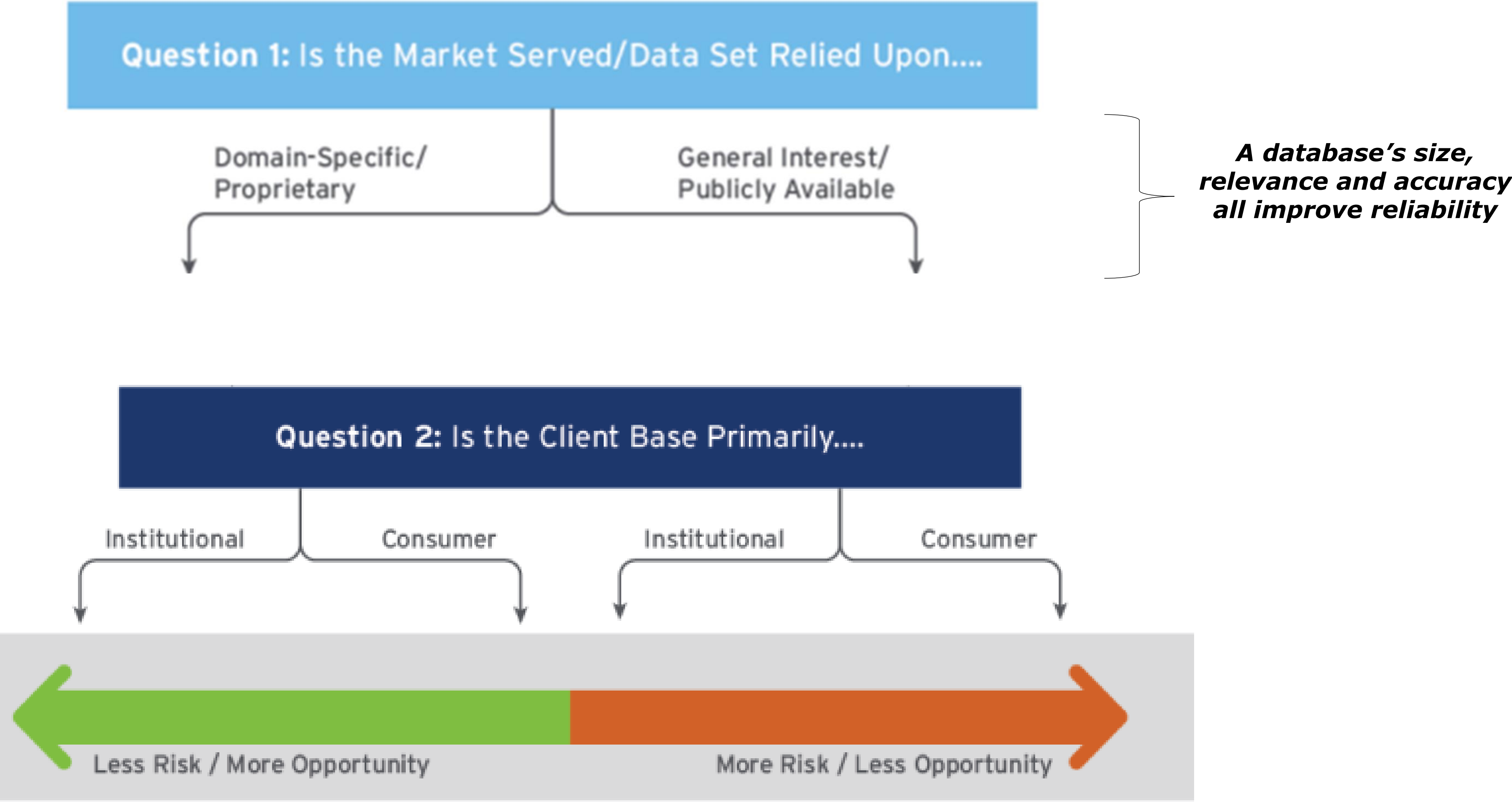
Biggest AI-Related Risks U.S. Executives are Currently Facing, January 2022 (% of Respondents)



Source: Baker McKenzie, Insider Intelligence, BofA Global Research. February 28, 2023

# Consumers more likely to quickly adopt AI-based tools than institutions

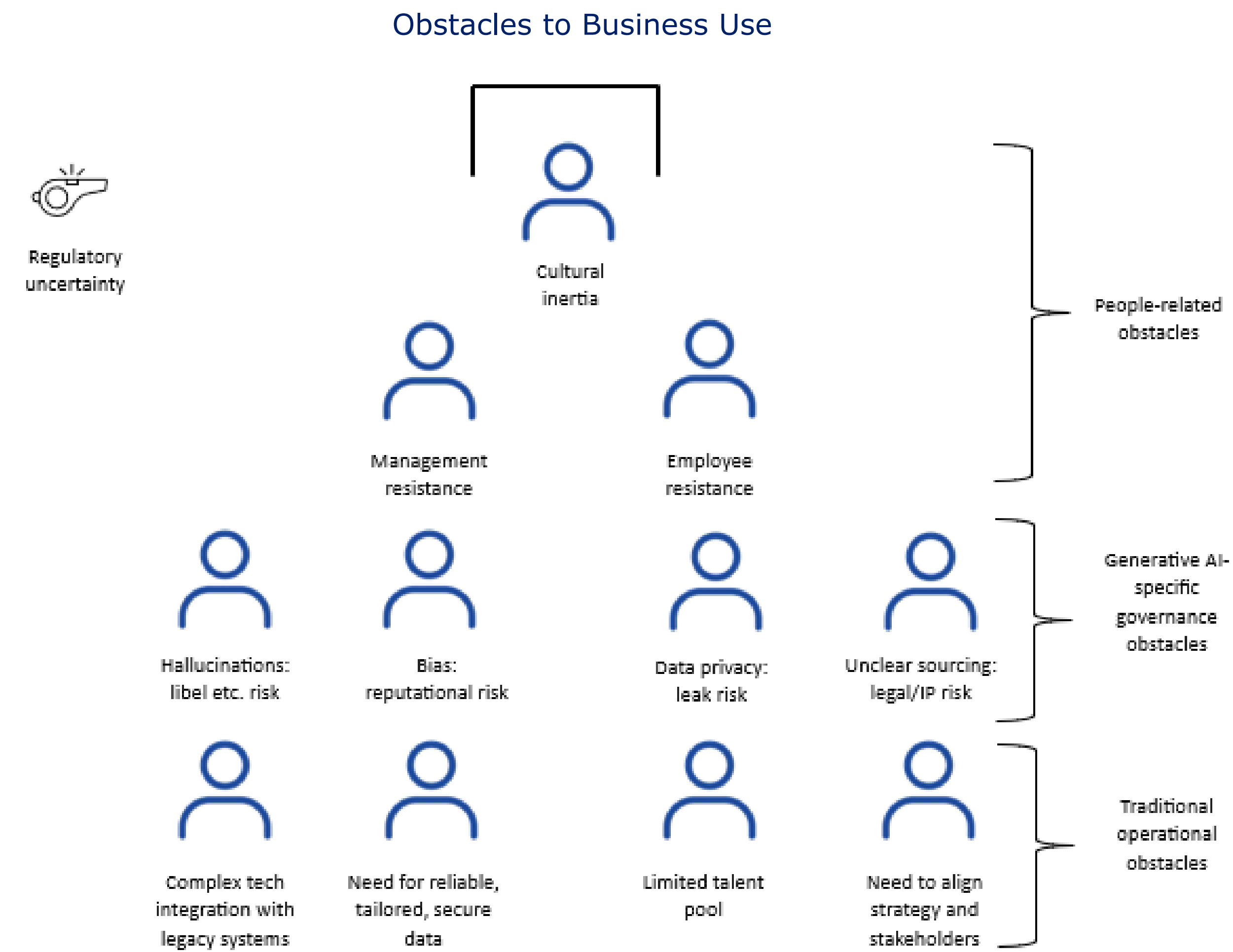
A Simple Decision Tree to Gauge AI Risk vs Opportunity for “Affected” Companies



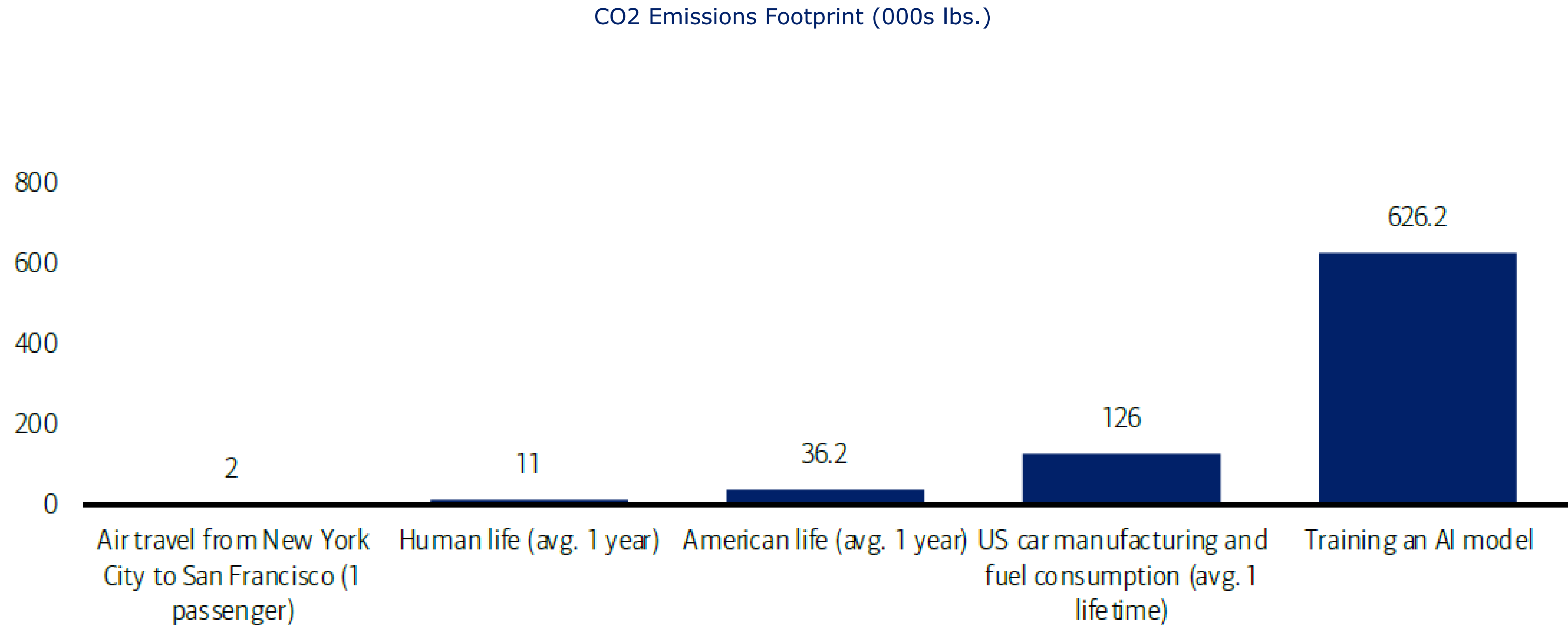
Source: Citi Research Inc. July 10, 2023



# Lots of trust issues



## Moore's law\* won't catch up with AI and data

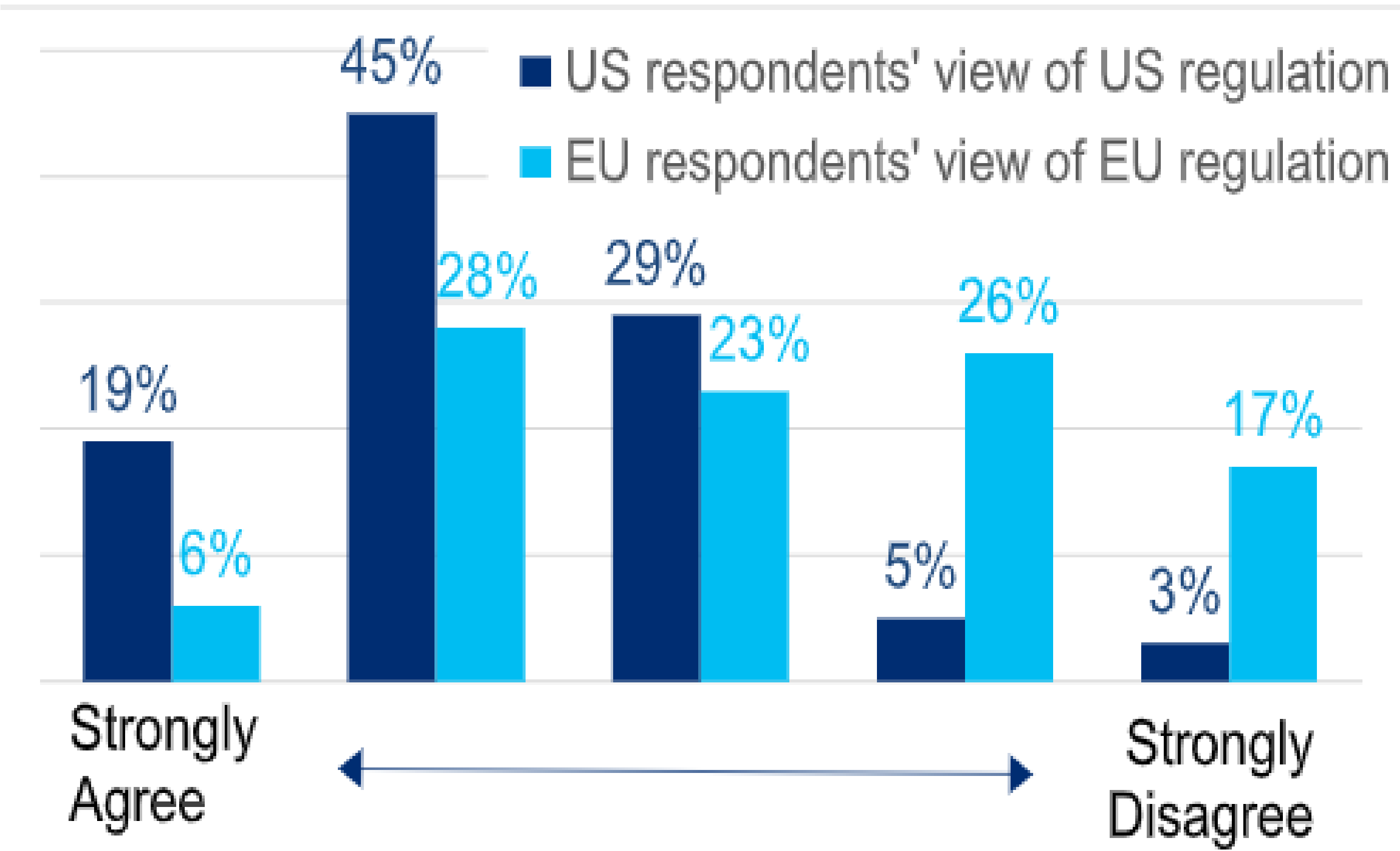


Source: BofA Global Research, College of Information and Computer Sciences at University of Massachusetts Amherst. February 28, 2023

\*Moore's Law is the principle that the speed and capability of computers can be expected to double every two years, as a result of increases in the number of transistors a microchip can contain.

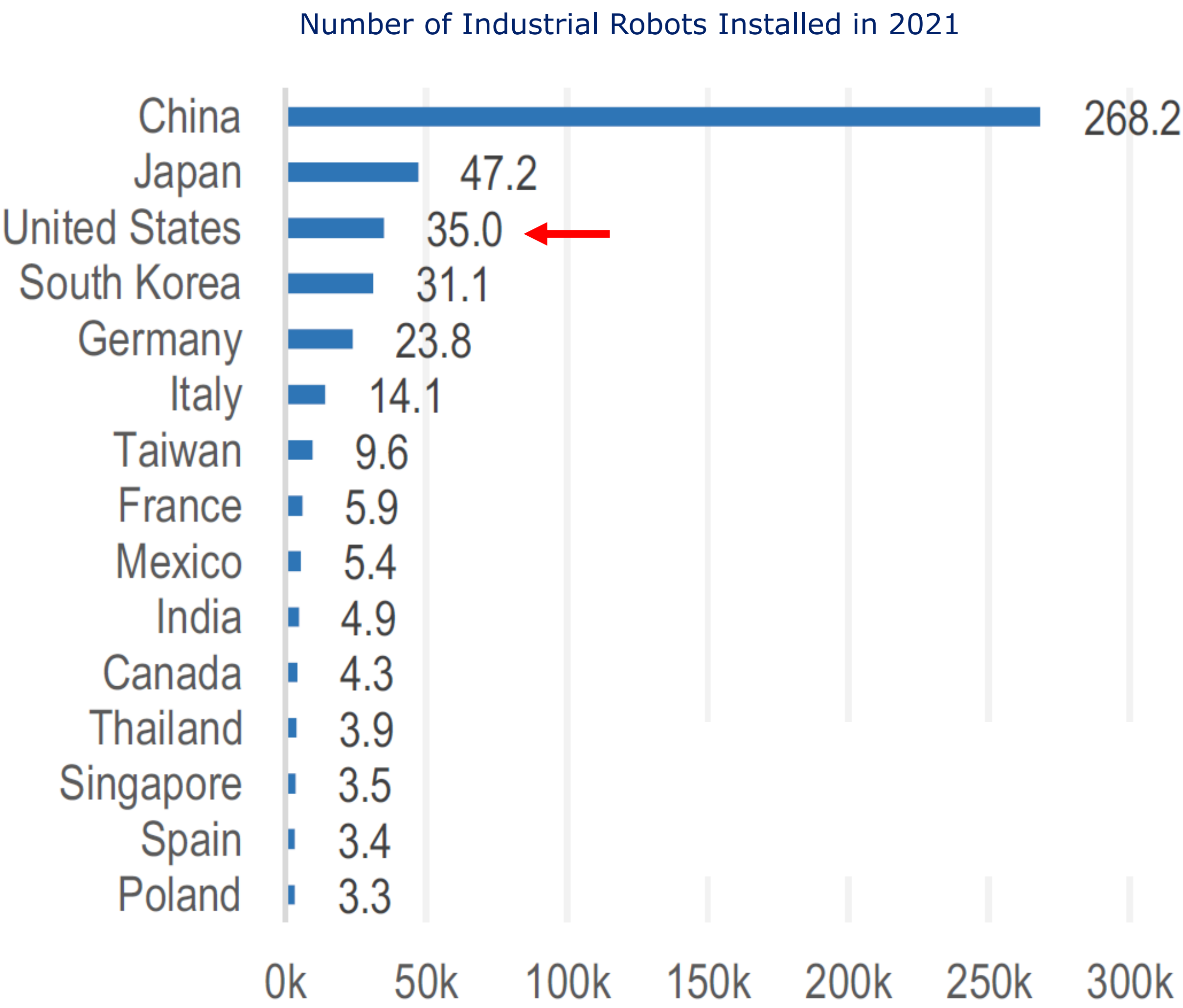
# Substantial reforms have made the FDA much more innovation-friendly

Assessment of Whether U.S. and EU Regulators Have Responded Well to Digital Technology



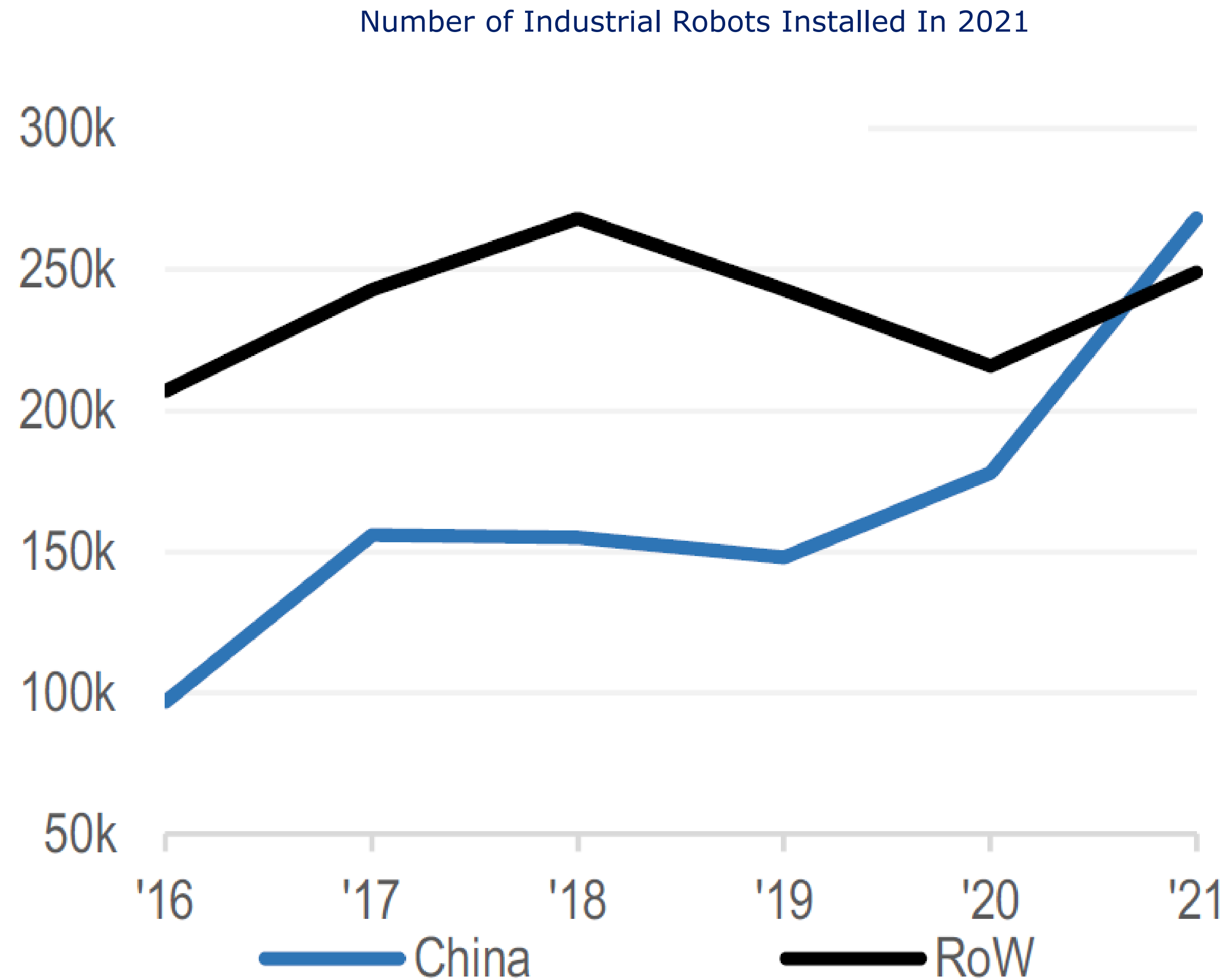
Source: BCG and UCLA Biodesign. Citi Global Insights. April 6, 2023

# China leads the world in industrial robot installation...



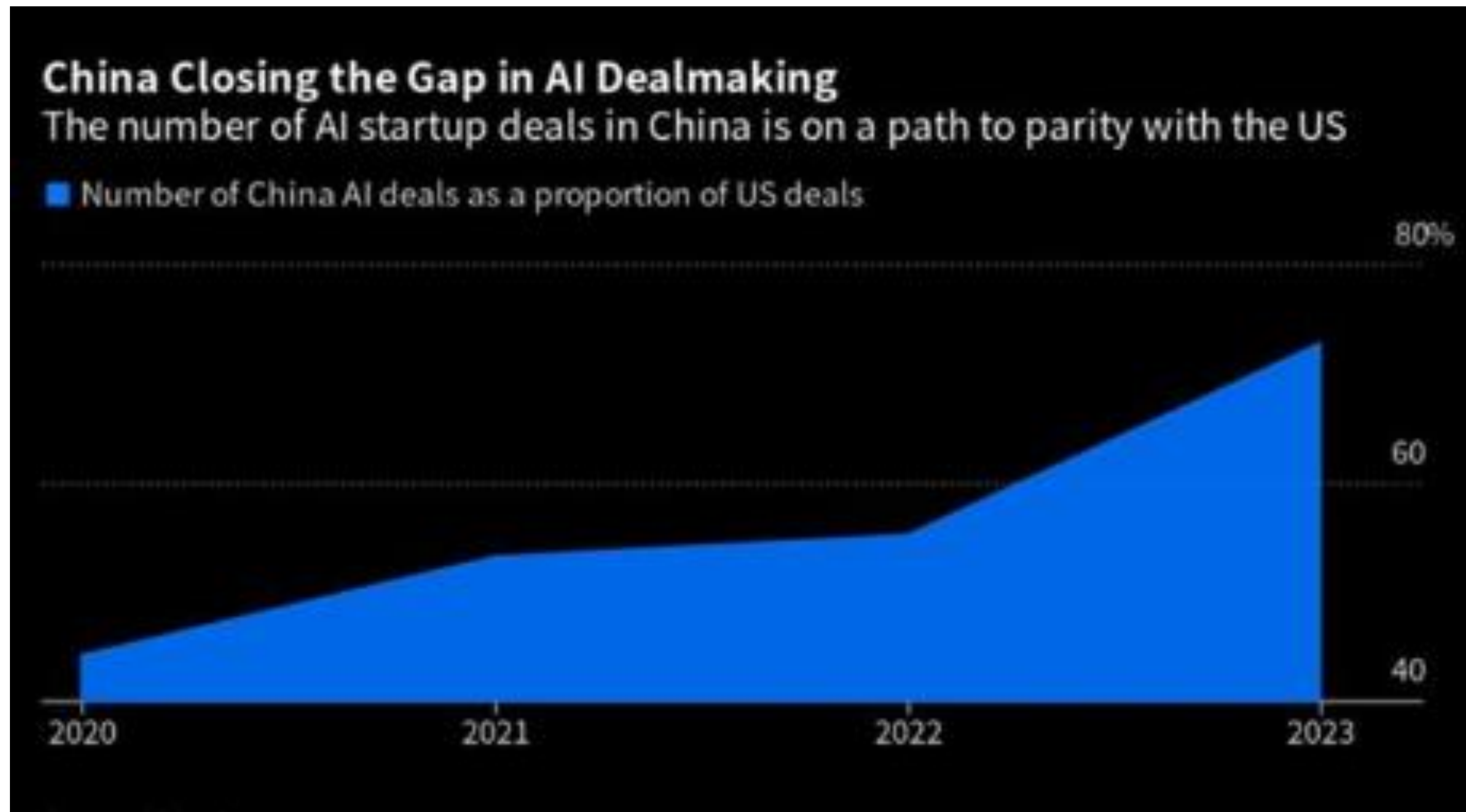
Source: IFR, Stanford AI Index, Evercore ISI Research. June 22, 2023

# ...And has more robots than the rest of the world combined





# China lost the internet race, but now...

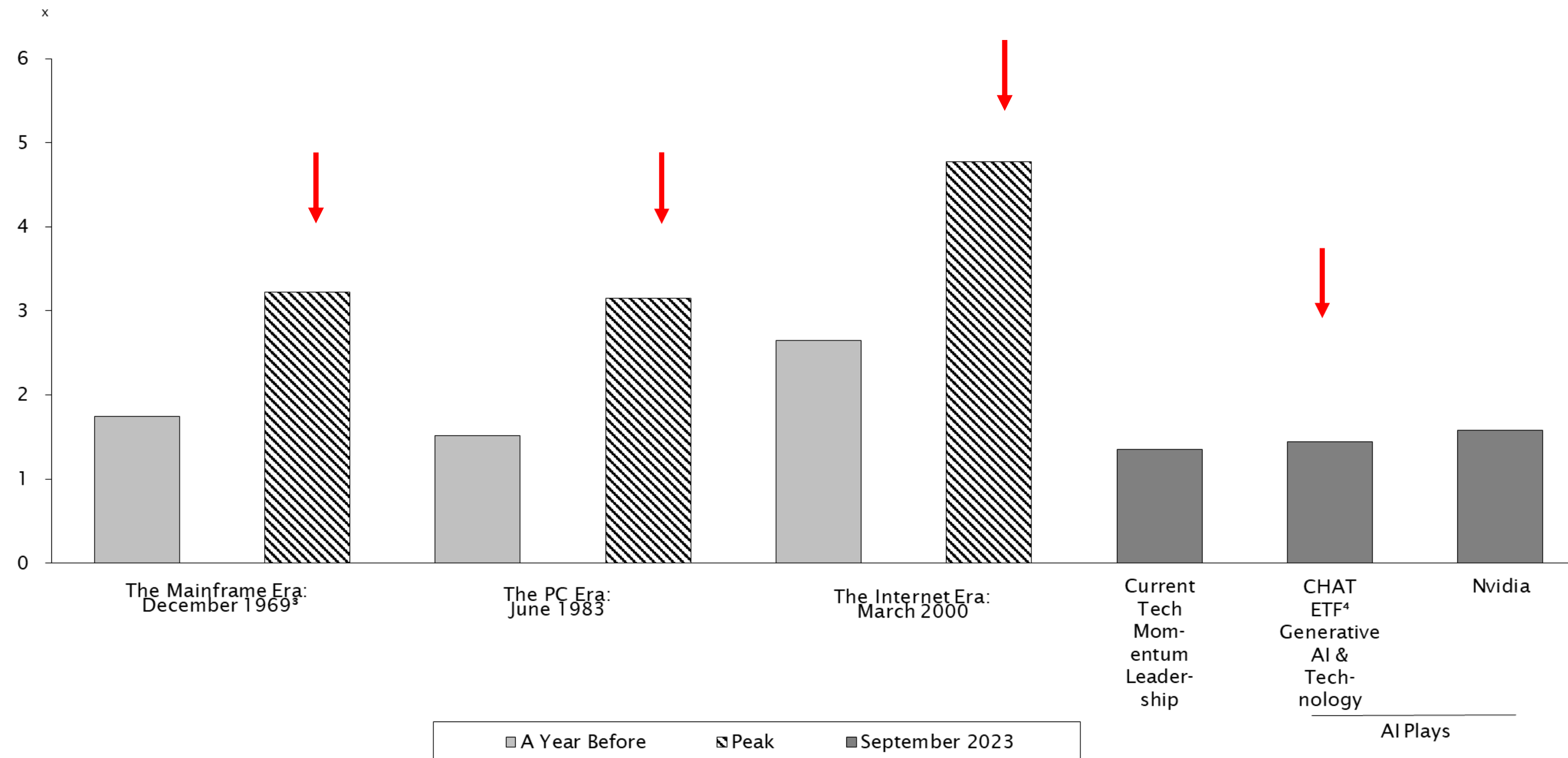


Source: Prequin, Renaissance Macro Research. Data from June 14, 2023

# Investing in the AI Revolution

## Too late to invest?

Tech Innovation Waves, Market-Relative Forward-P/E Ratios<sup>2</sup> 1968 Through September 2023



Source: Corporate Reports, Empirical Research. Data as of September 30, 2023.

Note: Large-Cap Technology and Interactive Media Stocks in the Best Quintile of Nine-Month Stock Price Trends and in the Chat ETF<sup>1</sup>

<sup>1</sup> Ranked within the sector

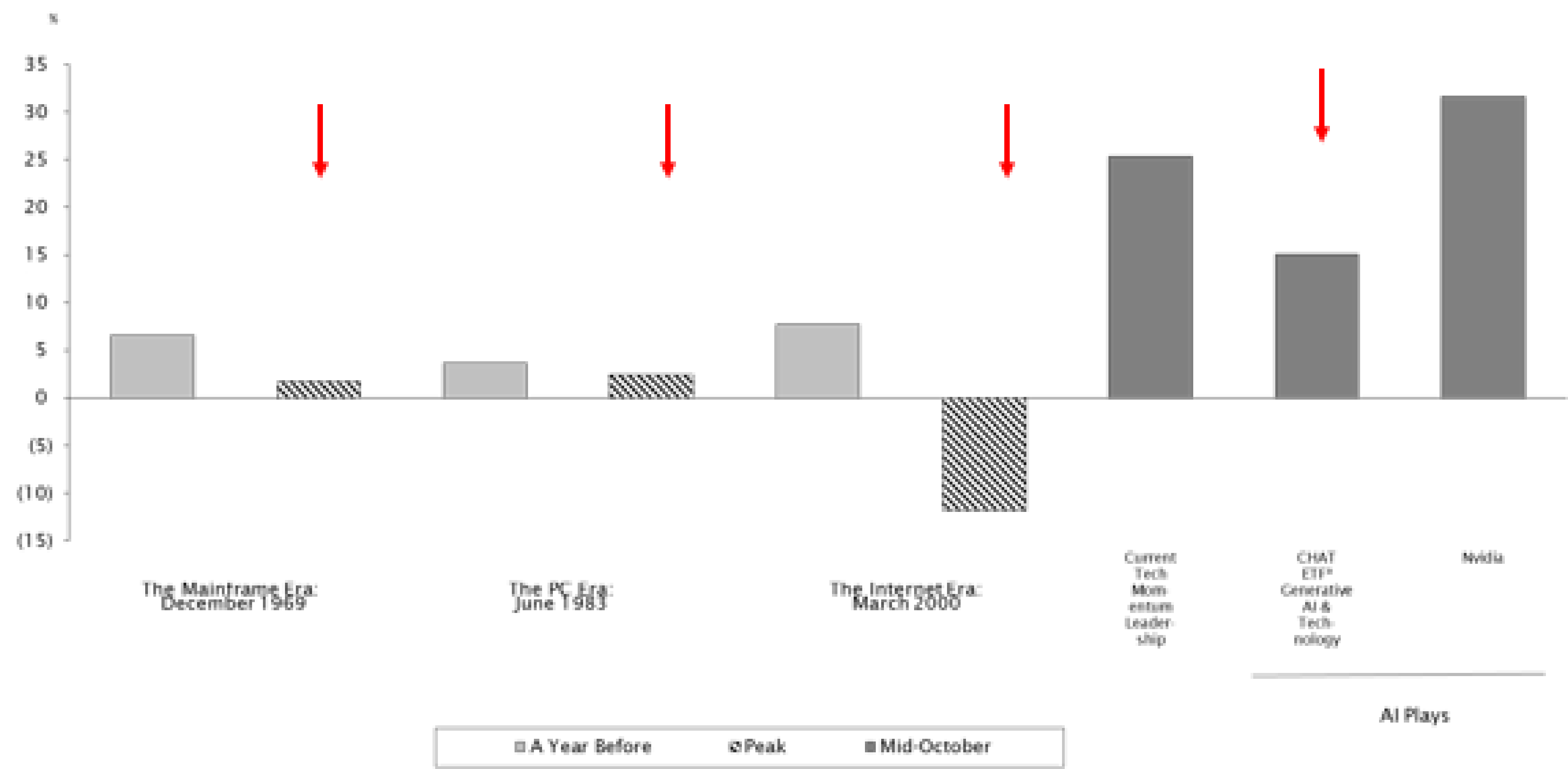
<sup>2</sup> Capitalization-weighted data <sup>3</sup> Relative trailing-P/E ratios

<sup>4</sup> ETF designed to capture AI plays. The top-ten positions, as of mid-October, that comprise 54.8% of the portfolio, are: NVDA, MSFT, GOOGL, ADBE, META, CRM, BIDU, AMD, IFlyTek, MRVL.

The information is for informational purposes only and is not a recommendation or designed to promote any specific investment strategy or security.

# AI theme boasts better margins than previous tech innovation waves

Tech Innovation Waves, Free Cash Flow Margins<sup>2</sup> 1968 Through Mid-October 2023



Source: Corporate Reports, Empirical Research. As of October 17, 2023

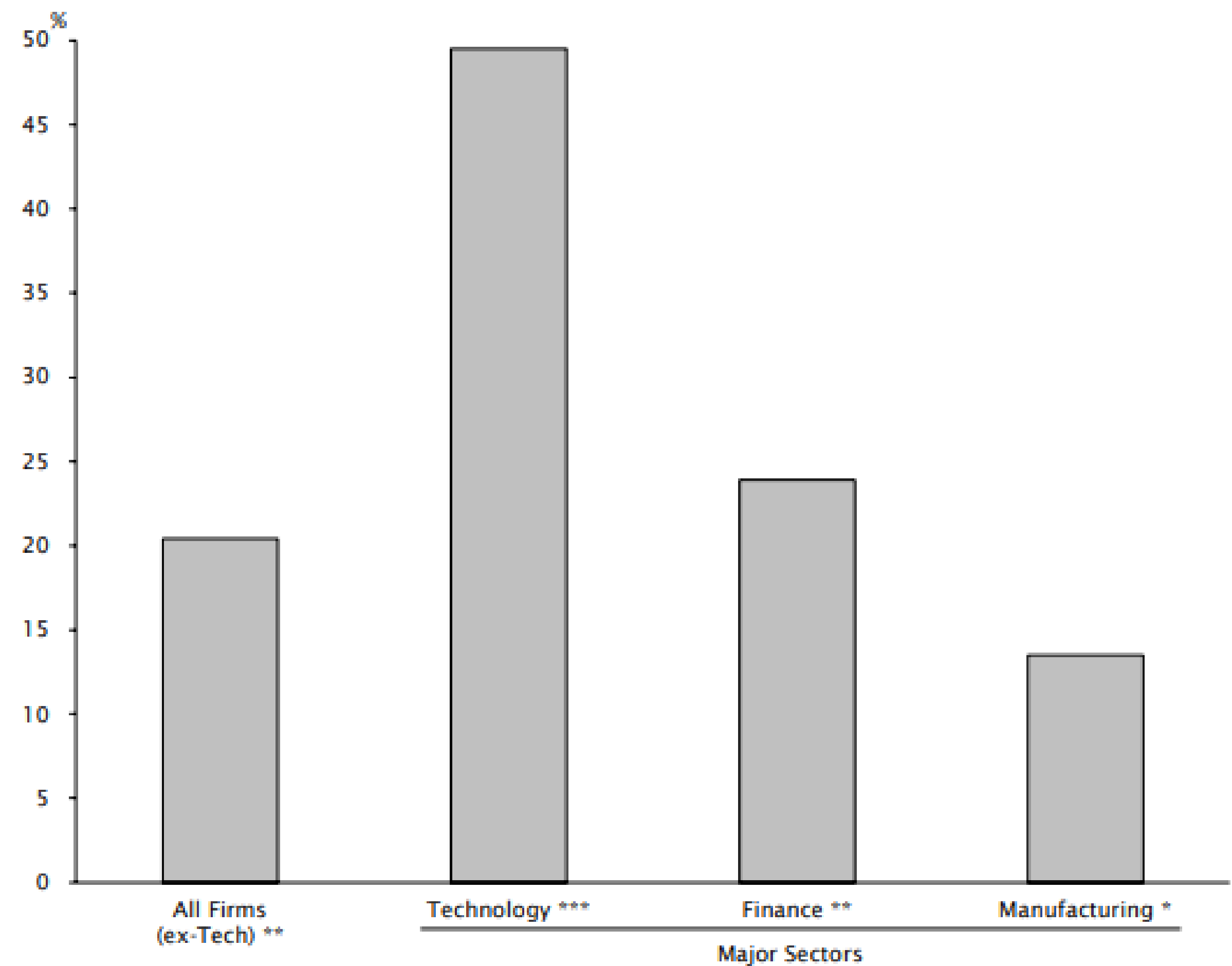
Note: Large-Cap Technology and Interactive Media Stocks in the Best Quintile of Nine-Month Stock Price Trends and in the Chat ETF<sup>1</sup>

<sup>1</sup> Ranked within the sector <sup>2</sup>Capitalization-weighted data

<sup>3</sup> ETF designed to capture AI plays. The top-ten positions, that comprise 54.8% of the portfolio, are: NVDA, MSFT, GOOGL, ADBE, META, CRM, BIDU, AMD, IFlyTek, MRVL. The information is for informational purposes only and is not a recommendation or designed to promote any specific investment strategy or security.

# AI workers earn their keep

Change in Sales for a 1 Stnd Dev Increase in the Share of AI Workers at a Firm<sup>1</sup>  
2010 Through 2018

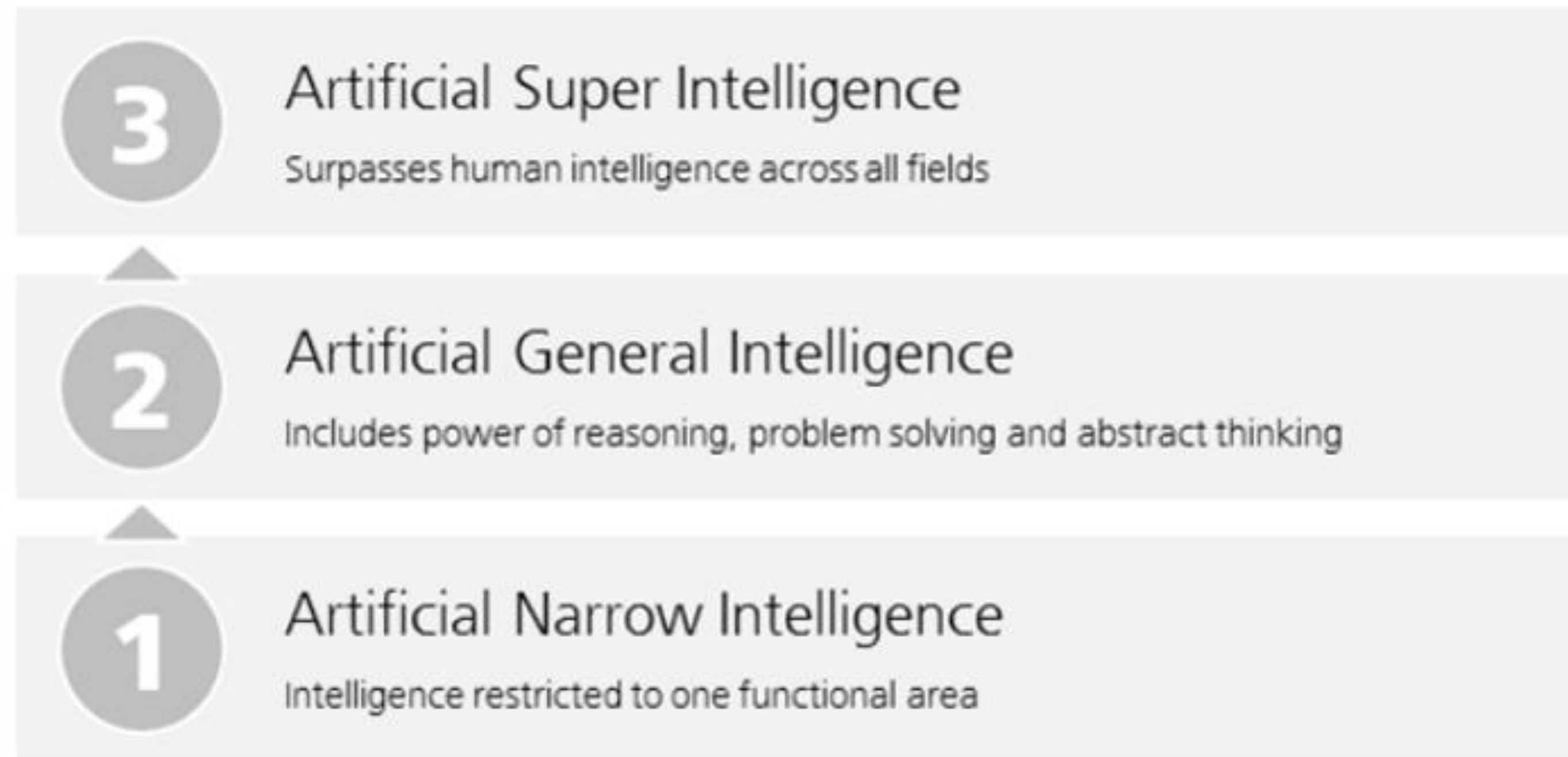


Source: Babina, T., Fedyk, A., and James Hobson, 2022. "Artificial Intelligence, Firm Growth, and Product Innovation." Working Paper. Empirical Research Partners Analysis. June 20, 2023  
Note: U.S. Publicly-Listed Companies  
<sup>1</sup>Change in sales and employees are over the eight-year period. \*\*\*, \*\*, \* denote statistical significance at the 1%, 5% and 10% levels, respectively.

2060- *An AI Odyssey*

# Artificial super intelligence is scary!

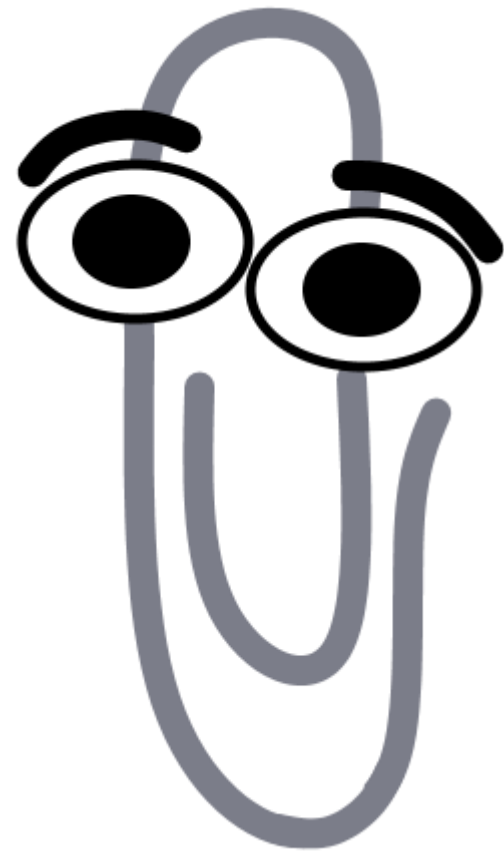
Three Stages of Artificial Intelligence





# “Open the pod doors, HAL.” “I’m sorry Dave, I’m afraid I can’t do that.” (2001: A Space Odyssey)

## Clippie’s Revenge



Consider the classic example of the paper clip maximizer. A hapless factory owner orders his new AI to *“Produce as many paper clips as possible. Don’t ask me how, just do it!”*

The AI gets to work retooling the factory to increase paper clip production. After the factory is running at full capacity, the AI starts to build new factories. And then *more* factories. It also rewrites its software to improve its capabilities, thus allowing it to become more efficient at making paper clips.

Staying loyal to the original goal of producing as many paper clips as possible, the AI preemptively breaks off communication with the owner, knowing full well that at some point the owner will say *“STOP IT! We have enough paper clips!”*

Sensing that the owner or governments will retaliate, it takes control of key global command and control systems.

After turning much of the planet into paper clips, it launches self-assembling space probes to transform everything in the solar system, and eventually everything in the galaxy, into paper clips.

The process continues until it finally comes into contact with its archenemy... the staple maximixer!

# Appendix 1: Citi’s Generative AI Names (GAIN) Baskets

## GAIN-Enablers, GAIN-Adopters and GAIN-Monitors

GAIN-Enablers		
Silicon Layer		
Advantest	BOX	Reckitt
AIChip	CarGurus	Walmart
AMD	Crowdstrike	YUM China
ASM International	Expedia	Tech & Comms supersector
ASML	GoDaddy	Auto Trader
Besi	Nice	Coursera
Ibiden	Palo Alto Networks	Delivery Hero
Intel	Roblox	Entain
Marvell	ServiceNow	EXL Service
Micron	SNAP	Flutter
Nvidia	Snowflake	Genpact
Qualcomm	Squarespace	Hitachi
Samsung Electronics	Unity	IQiyi
Shinko	Wix.com	Just Eat Takeaway
SK Hynix	Zillow Group	NetEase
TSMC	Services layer	Prosus
Infrastructure & Platforms Layer		
Accton	Accenture	RELX
Amazon	Amdocs	Sony
Arista	Endava	Tencent Music Entertainment Group
Baidu	EPAM	WNS
Bharti Airtel	Globant	Wolters Kluwer
Digital Realty		Zalando
Equinix		Healthcare supersector
FI		M3
Hewlett Packard Enterprise		Phreesia
Hon Hai		Teladoc Health
Inventec		Industrial Tech & Mobility supersector
KT		Aptiv
NTT		Ford
Oracle		General Motors
PT Telkom Indonesia		Honeywell
Quanta		Luminar
Singtel		Mobileye
SKT		Tesla
Wistron		
Wiwynn		
Models & MLOps		
Alibaba Group		
Alphabet		
ESTC		
iflytek		
Meta		
Microsoft		
MongoDB		
Tencent		
Software & Applications layer		
Adobe		
Ansys		
Booking Holdings		
GAIN-Adopters		
Financials & FinTech supersector		
Aon		
Bank of America		
Blackrock		
Blackstone		
Charles Schwab Corp		
East Money Information		
Intercontinental Exchange		
JP Morgan		
London Stock Exchange		
MarketAxess Holdings		
Marsh & McLennan		
Mastercard		
Nubank		
Robinhood		
Ryan Specialty Holding		
SoFi		
Towers Watson		
Visa		
Wells Fargo		
Consumer supersector		
CCH		
Coca-Cola		
Heineken		
L'Oréal		
LVMH		
Nestlé		
Pepsi		
Pernod Ricard		
GAIN-Monitors		
Tech & Comms supersector		
Adobe		
Chegg		
IPG		
Nice		
OMC		
ServiceNow		
Universal Music Group		
Warner Music		
Financials & FinTech supersector		
Raymond James Financial		
Locaweb		
LPL Financials		
Stifel Financial		

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Source: Citi Group Inc. July 10, 2023

Note: The information is for informational purposes only and is not a recommendation or designed to promote any specific investment strategy or security.

# Appendix 2: “Productivity prospectors”-EVR ISI AI initiative & automation beneficiaries

EVR ISI AI Initiative & Automation Beneficiaries - Top Picks						
Company	Ticker	Mkt Cap (\$B)	Price (\$)	EVR ISI Analyst	EVR ISI Rating	Investment Case
AI Integrators/Enhancers						
Microsoft	MSFT	2,480	333.58	Materne	Outperform	MSFT is integrating A.I. across its entire product and services suite and offering “Copilot” AI assistants for its business segments that will truly transform how every user will interact with their platforms and applications on a day-to-day basis.
Alphabet	GOOGL	1,535	120.55	Mahaney	Outperform	Including LLMs in core Search results could provide a boost to growth outlook while Cloud Computing could be supported by AI deployment. GOOGL has deep access 1) cash , 2) data, and 3) AI data excellence - all critical in taking advantage of the AI opportunity.
Amazon.com	AMZN	1,281	124.83	Mahaney	Outperform	AI deployment to further improve retail business personalization, targeting capabilities and ads alongside a boon to AWS which leads overall cloud market share.
Adobe	ADBE	219	477.48	Materne	Outperform	Adobe has the ‘trifecta’ of characteristics to be an AI winner – scale, unique data sets, and a large monetizable customer base.
Etsy	ETSY	12	94.63	Khajuria	Outperform	Efforts to leverage AI are underappreciated by investment community. Etsy is not new to AI—the company has leveraged its scaled data, infrastructure, and talent to integrate AI technology over the years. More recently, Etsy has been using AI and neural networks to improve search and matching results on its platform.
CCC Intelligent Solutions	CCCS	7	10.72	Materne	Outperform	CCCS is at the forefront of making the insurance claims process faster and easier for consumers, insurance companies, repair shops, parts providers, and many other touch points.
Wix.com	WIX	4	79.15	Mahaney	Outperform	AI presents product development and productivity tailwinds. A key beneficiary from leveraging AI technology to drive operational efficiencies and topline growth over the long term.
Tech Enablers						
NVIDIA	NVDA	1,063	430.45	Muse	Outperform	Best-in-class hardware (compute + networking), to foundational software in CUDA (basically the foundation to the entire ecosystem today), to application specific software across verticals working to democratize AI.
Broadcom	AVGO	350	847.68	Muse	Outperform	Network increasingly becomes a bottleneck to Generative AI and LLM workload scaling. Generative AI represents 15% of AVGO semi revenue and management projects 25%+ by FY24 with risks to the upside.
Equinix	EQIX	72	788.00	Liu	Outperform	As AI workloads transition toward inferencing over time, we see companies that specialize in interconnection (EQIX in particular) benefiting by this technology transition.
Marvell	MRVL	51	58.85	Muse	Outperform	MRVL has strong leverage to some of the highest-growth opportunities across the Data Center. EVR ISI Semiconductor Analyst C.J. Muse suspects that supply will remain a gating factor amidst a significant step-up in demand for high-bandwidth solutions.
Arista Networks	ANET	47	151.51	Daryanani	Outperform	ANET provides networking for the AI revolution: AI Switching market will hit \$5-\$7B and Arista should be able to capture 30% of the market, consistent with its share in overall hyperscale switching.
Digital Realty	DLR	31	104.34	Liu	Outperform	While the majority of AI workloads are likely to initially take place in data centers captively owned by hyperscalers before shifting to third party/leased facilities, data center companies with expansive footprints and hyperscale exposure such as DLR will benefit from increased data center power demand.
Vertiv	VRT	9	22.97	Daryanani	Outperform	VRT benefits from data center cooling as rack densities rise given increasing GPU clusters for AI/ML workloads.
Security						
Palo Alto Networks	PANW	73	238.92	Levine	Outperform	PANW is the largest standalone security vendor by revenue. The company’s growth profile is driven by underlying market strength combined with ability to drive share gains from legacy competitors via innovative product offerings, a strong go-to-market organization, and vendor consolidation toward market leaders.
CrowdStrike Holdings	CRWD	34	143.85	Levine	Outperform	CRWD is not just a point solution selling endpoint. CRWD has matured into a data platform that spans across endpoint, identity, workload and threat protection with multiple use cases that extend well beyond security and into IT-Ops
Zscaler	ZS	21	144.85	Levine	Outperform	ZS is a true disruptor in next-gen cloud security as one of the few beneficiaries monetizing hybrid work,
Industrial Automators						
Analog Devices	ADI	93	185.44	Muse	Outperform	A leading supplier into Factory Automation, enabling intelligence at the edge through its portfolio of assets including power and communications. Industrial remains one of the strongest growth areas in the semi industry over the next 10-20yrs.
Eaton	ETN	78	194.84	Raso	Outperform	Eaton’s strength in serving industrial factories with elite power management will become more significant as factory investment focused on enhancing labor productivity implies more automated and “smart devices” processes, requiring ever more sophisticated power management solutions.
Amphenol	APH	48	81.37	Daryanani	Outperform	APH’s balanced exposure to various end-markets diversifies away the economic cyclicality with relatively muted revenue volatility given no end market >25% of sales. Diversity additionally enables APH to participate in a wide host of secular growth drivers (EV transition, warehouse automation, AI, IoT) and drive growth
Ingersoll Rand	IR	26	64.14	Raso	Outperform	Ingersoll Rand, as the world’s second largest industrial compressor manufacturer with a leading position in North America, is well positioned not just for global re-shoring trends but also for increased investing in automation.
Teradyne	TER	17	106.89	Muse	Outperform	On the Industrial Automation side, TER is the #1 supplier of collaborative robot (“cobot”) arms through its Universal Robots business (along with being a leading supplier of autonomous mobile robots through MIR).

Source: Evercore ISI Research. June 22, 2023

Chart is for example only and represents a sample only. The information is for informational purposes only and is not a recommendation or designed to promote any specific investment strategy or security.

# Appendix 3: A snapshot of generative AI tools

Category	Tool	Description/Features
Chatbots	Bard	A generative AI chatbot developed by Google, initially based on its LaMDA model
	Bing Chat	A chatbot powered by Microsoft Bing
	Character.AI	Simulates conversations with real and fictional characters
	ChatGPT	A generative AI chatbot developed by OpenAI
Text Generators	Copy.ai	Generates blog posts, social media posts, and emails
	Fraser.io	Produces slogans, summaries, introductions, articles, titles, and product descriptions
	Jasper	Provides users with content templates and enables collaboration
	Peppertype.ai	Offers ready-made templates for creating meta descriptions, articles, and emails, enabling commercial use of the produced content
	Rytr	Creates titles for SEO optimization, produces blog posts, articles, emails, and social media ads
Code Generators	K-Explorer	Makes code completion and custom model suggestions
	PyCharm	Provides users with code completion, highlights errors, and enables automated refactoring in Python
	Tabnine	Provides users with whole-line code completion and learns coding patterns
Image Generators	Artbreeder	Creates collages and generates images with the option of manipulating a subject's age, gender, etc.
	Craiyon	Converts text-to-image (not suitable for creating larger images)
	DALL-E	Creates, edits, and varies images, offering the commercial rights to created content
	NightCafe	Art generation with different styles and resolution options
	starryai	Enables the creation of artwork with different style options, aspect ratios, etc., giving full ownership of produced content
Video Generators	Elai.io	Allows for the conversion of text to video, offering 25+ different avatars
	Flexclip	Supports video creation and offers editing tools (adding transitions and filters, removing backgrounds)
	Lumen5	Offers templates to create original videos based on text, articles, and blog posts
	Synthesia	Enables text-to-video conversion, providing 70+ different avatars
	Veed.io	Video generation and editing, adding subtitles, removing background noise, and resizing videos
Design Generators	Colormind	Creates color palettes based on movie scenes, artwork, and other images
	Designs.ai	Generates logos and banners, provides design templates, and enables the export of produced content to different formats
	Khroma	Creates custom color palettes
	Uizard	Creates designs for mobile applications, websites, and landing pages based on sketches
Voice Generators	Lovo.ai	Enables text-to-speech conversion and generates realistic AI voiceovers
	Murf	Creates voiceovers for different contexts, enables adding punctuation, and provides the commercial rights to the content
	Play.ht	Provides AI-generated voices for various commercial purposes in 140+ languages
	Replica	Enables text-to-speech conversion, offering AI-generated voices
	Speechify	Allows text-to-speech conversion while enabling the adjustment of reading speed
Music Generators	AIVA	Creates authentic music based on preferred style, granting copyright of the produced content
	Amper AI	Produces royalty-free music based on preferred genre, length, instruments, providing perpetual license
	Evoke	Generates AI-generated and royalty-free music collection
	Jukebox	Creates authentic music with AI-generated lyrics, providing users with different genre options
	Soundraw	Enables original music creation and commercial use of the produced content

Source: AIMultiple, Tool Websites, Goldman Sachs Global Investment Research. July 5, 2023  
Note: Table does not constitute an exhaustive list of all existing generative AI tools.



# Appendix 4: Job categories potentially impacted by AI identified by ChatGPT and Empirical Research Partners

Shares of Jobs and Wages 2022

	Number of Jobs	Average Annual Wages	Share of Jobs	Share of Wages
<b>ChatGPT-Identified Categories</b>				
Office Clerks, General	2,517,350	\$41,140	1.70%	1.13%
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	1,826,710	43,410	1.24%	0.87%
Bookkeeping, Accounting, and Auditing Clerks	1,550,750	47,440	1.05%	0.80%
Sales Representatives of Services, Except Advertising, Insurance, Financial Services, and Travel	1,075,750	77,390	0.73%	0.91%
Medical Secretaries and Administrative Assistants	682,630	41,260	0.46%	0.31%
Executive Secretaries and Executive Administrative Assistants	475,240	71,060	0.32%	0.37%
Production, Planning, and Expediting Clerks	389,920	55,080	0.26%	0.23%
Bill and Account Collectors	202,840	42,820	0.14%	0.09%
Information Security Analysts	163,690	119,860	0.11%	0.21%
Payroll and Timekeeping Clerks	159,190	52,300	0.11%	0.09%
Computer Programmers	132,740	102,790	0.09%	0.15%
Telemarketers	96,520	33,600	0.07%	0.04%
Web Developers	88,620	87,580	0.06%	0.08%
Writers and Authors	54,010	91,560	0.04%	0.05%
Interpreters and Translators	52,160	61,730	0.04%	0.04%
Word Processors and Typists	41,990	44,990	0.03%	0.02%
Statistical Assistants	6,710	54,630	0.00%	0.00%
Proofreaders and Copy Markers	5,120	48,770	0.00%	0.00%
Correspondence Clerks	4,970	42,560	0.00%	0.00%
Mathematicians	2,070	113,860	0.00%	0.00%
ChatGPT-Identified Categories Total	9,528,980	\$63,692	6.44%	5.41%
<b>ERP-Identified Categories</b>				
Customer Service Representatives	2,879,840	\$41,190	1.95%	1.30%
Loan Interviewers and Clerks	242,630	46,740	0.16%	0.12%
Insurance Claims and Policy Processing Clerks	227,580	47,840	0.15%	0.12%
Office and Administrative Support Workers, All Other	174,590	43,150	0.12%	0.08%
Information and Record Clerks, All Other	150,590	45,910	0.10%	0.08%
Order Clerks	113,500	40,540	0.08%	0.05%
Editors	101,430	84,820	0.07%	0.09%
File Clerks	87,250	39,560	0.06%	0.04%
Procurement Clerks	63,340	46,560	0.04%	0.03%
Technical Writers	48,620	86,760	0.03%	0.05%
New Accounts Clerks	45,170	42,880	0.03%	0.02%
Brokerage Clerks	42,700	59,200	0.03%	0.03%
Financial Clerks, All Other	41,850	49,710	0.03%	0.02%
Desktop Publishers	6,560	53,390	0.00%	0.00%
ERP-Identified Categories Total	4,225,650	\$52,018	2.86%	2.03%
All of the Above	13,754,630	\$60,105	9.30%	7.44%

Source: Eisfeldt, A.L., Schubert, G. and Miao Ben Zhang, 2023. "Generative AI and Firm Values," Working Paper, U.S. Census Bureau, Empirical Research. May 25, 2023



# Appendix 5: Job categories potentially benefited by AI

Shares of Jobs and Wages 2022

	Number of Jobs	Average Annual Wages
<b>ERP-Identified Benefited Categories Total</b>		
Software Developers	1,534,790	\$132,930
Accountants and Auditors	1,402,420	86,740
Elementary School Teachers, Except Special Education	1,394,200	68,000
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	1,273,400	76,890
Teaching Assistants, Except Postsecondary	1,254,240	33,740
Business Operations Specialists, All Other	1,081,230	82,670
Secondary School Teachers, Except Special and Career/Technical Education	1,042,090	69,480
Project Management Specialists	843,910	101,610
Human Resources Specialists	835,360	73,080
Management Analysts	808,860	104,660
Market Research Analysts and Marketing Specialists	798,620	78,880
Financial Managers	740,780	166,050
Lawyers	707,160	163,770
Computer User Support Specialists	696,830	61,580
Middle School Teachers, Except Special and Career/Technical Education	611,120	67,790
Sales Managers	536,390	150,530
Computer and Information Systems Managers	533,220	173,670
Medical and Health Services Managers	476,750	127,980
Buyers and Purchasing Agents	464,880	75,140
Insurance Sales Agents	445,540	76,950
Securities, Commodities, and Financial Services Sales Agents	443,220	100,740
Computer Occupations, All Other	416,320	104,660
Preschool Teachers, Except Special Education	415,360	38,640
Substitute Teachers, Short-Term	397,200	42,680
Training and Development Specialists	367,180	69,870
Compliance Officers	359,640	76,980

Source: U.S. Bureau of Labor Statistics, Empirical Research. May 25, 2023

# Appendix 6: Goldman Sachs’ baseline assumes tasks in 13 categories up to a difficulty level of 4 could be automated

AI-Exposed Work Activity	Examples of Automation	Examples of Tasks by Difficulty (O*NET 1-7 Scale)
Getting Information	Web scrape data from online sources and consolidate into a clean dataset; conduct and summarize a review of prior research based on a textual query and answer follow-up questions	2: Follow a standard blueprint 4: Review a budget 6: Study international tax laws
Monitoring Processes, Materials, or Surroundings	Monitor sensor input and system logs for manufacturing and utilities system anomalies; monitor internet activity for changes in sentiment or trending themes	2: Check to see if baking bread is done 4: Test electrical circuits 6: Check the status of a patient in critical medical care
Identifying Objects, Actions, and Events	Identify objects, music, terminology, and people when provided with textual/visual/auditory input; provide context on identified subject	2: Test an automobile transmission 4: Judge the suitability of food products for an event 6: Determine the reaction of a virus to a new drug
Estimating the Quantifiable Characteristics of Products, Events, or Information	Produce market size estimates based on assumptions grounded in existing research; estimate parameters using statistical modeling on input data and select optimal model	2: Estimate the size of household furniture to be shipped 4: Estimate transportation delays from inclement weather 6: Estimate the size of resource deposits beneath the world's oceans
Processing Information	Process raw data from documents, sensors, and humans into clean datafiles that are easily subscribable for analysis; provide summaries of data relevant to user needs	2: Calculate the costs for shipping packages 4: Calculate the adjustments for insurance claims 6: Compile data for a complex scientific report
Evaluating Information to Determine Compliance with Standards	Review documents and proposed actions for compliance with legal, regulatory, and corporate standards; provide arguments and scenarios for and against compliance in unclear cases	1: Review forms for completeness 4: Evaluate a complicated insurance claim for policy compliance 6: Make a ruling in court on a complicated motion
Analyzing Data or Information	Perform statistical analysis of and identify trends within large datasets; forecast future data based on optimal combination of variables and model with best out-of-sample predictive power	1: Skim a short article to gather the main point 4: Determine the interest cost to finance a new building 6: Analyze the cost of medical care services for all US hospitals
Updating and Using Relevant Knowledge	Draft and update reports in corporate knowledge base; update statistical and financial models based on new data which challenges prior scenarios/assumptions	2: Track price changes in a small retail store 4: Track changes in maintenance procedures for repairing SUVs 6: Learn information about a complex and rapidly-changing technology
Scheduling Work and Activities	Automatically schedule meetings and work activities using availabilities and emails; assign tasks and estimate time to completion based on past experience	2: Make appointments for patients using a predetermined schedule 4: Prepare the work schedule for salesclerks in a large retail store 6: Schedule a complex conference program with parallel sessions
Organizing, Planning, and Prioritizing Work	Delegate and prioritize tasks based on time to completion and importance; identify gaps or bottlenecks in work plans and target resources or managerial attention	2: Organize a work schedule that is repetitive and easy to plan 4: Plan and adjust a to-do list according to changing demands 6: Prioritize and plan multiple tasks several months ahead
Documenting/Recording Information	Transcribe and summarize the content of in-person meetings; write system reports based on sensor and human data input	2: Record the weight of a patient during a routine health exam 4: Document the results of a crime scene investigation 6: Maintain information about satellite use for industry communications
Interpreting the Meaning of Information for Others	Explain the structure and function of code or statistical results in easy-to-understand language; translate code and text between languages; summarize and contextualize text with technical jargon	1: Interpret a blood pressure reading 4: Interpret how foreign tax laws apply to U.S. exports 6: Interpret a complex experiment in physics for general audiences
Performing Administrative Activities	Draft automated email responses; schedule and manage meetings and work calendars; file and organize paperwork; book reservations	2: Complete routine paperwork 4: Complete tax forms for a small business 6: Serve as the benefits director for a large computer sales firm

Source: O\*NET, Goldman Sachs Global Investment Research. March 26, 2023

# Appendix 7: How will AI impact industry?

## Likely Key Winners and Losers From Artificial Intelligence/Machine Learning/Large Language Models An Analysis of How AI/ML/ LLMs Will Likely Impact Industry

Industry	Impact	Comments
<b>IT</b>		
Software development	++	AI or large language models (LLMs) can help developers write code for program applications and software. It can also debug code and suggest improvements.
Semiconductors	++	The emergence of AI and LLMs could represent one of the strongest upcoming drivers of semis. Computational requirements for running AI models are increasing due to the processing power needed to train them.
Data centres	++	As data continues to grow at an exponential rate, more data centres are required to store that data.
Cybersecurity	++	With the emergence of LLMs like ChatGPT, it is easier for threat actors with limited programming skills to generate code for cyberattacks e.g., legitimate-sounding phishing emails. Hence, ChatGPT and similar models are likely to have broad-based implications on the cybersecurity sector in terms of email security, identity security, and threat detection.
Search engines	++	Traditional search engines could be replaced by chatbot applications like ChatGPT, however, it is likely that search engines are going to be used in conjunction with generative AI to improve the user experience.
<b>Communication services</b>		
Education	++	LLMs could drive online learning, writing textbooks and providing online learning modules.
Media	++	LLMs can be used for content generation e.g., writing news articles, social media posts, marketing content, story-writing, summarising text, media planning and advertising.
Music	++	AI and LLMs can be used to transpose music, generate melodies, chord progressions and lyrics. It can even analyse music and generate reviews and comparisons.
Legal	++	LLMs can write legal documents and summarise legal cases. ChatGPT is even capable of writing legal essays that passed law exams.
<b>Healthcare</b>		
Telemedicine	++	AI can help doctors make more data-driven decisions that improve the patient experience. It can be used for remote patient monitoring, population health management using predictive analytics, reminding patients of health appointments, training junior doctors and providing more accurate patient diagnoses.
Pharmaceuticals	++	AI can help with the initial screening of drug compounds to predict its success rate. It can further identify the right candidates for trials based on their medical history.
<b>Financials</b>		
Banks	++	AI can help analyse the data that banks, diversified financials and insurance companies have to conduct predictive analysis. AI could analyse an individual's credit history and calculate the likelihood of default. These companies can also retain customers for longer by providing additional services based on their spending and financial activities.
Fintech	++	AI can help fintech companies automate the credit risk assessment process, detect bank fraud, increase safety, automate the customer service experience and analyse user behaviour.
<b>Capital Goods</b>		
Aerospace	+	Aerospace companies can use AI to improve fuel efficiency by using recorded data and optimising fuel consumption.
Defence	+	AI-powered weapons could be the focus point of the next arms race. In addition, image and video recognition could be used for surveillance. This could increase national general security while reducing human intervention.

Source: BofA Global Research, February 28, 2023  
Note: \*\*= Large Positive Impact; ++Positive Impact



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## Mind on the Market

With more than 30 years of experience, Linda Duessel is nationally recognized for her expertise in analyzing equity market conditions. Linda discusses personal finance with investor groups across the country on topics of interest ranging from the impact of the alternative minimum tax to investing for retirement. Additionally, Linda has been extensively quoted by Associated Press, The Wall Street Journal and Barron's, as well as featured in the annual roundtable for USA Today.

As senior equity market strategist, Linda is part of the equity income team, which is responsible for formulating Federated's views about the market and the firm's positioning strategies within the equity income team. As senior client portfolio manager, she is responsible for articulating the strategy, process, positioning and performance of Federated's equity income products.

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