Goldman Sachs

Global Investment Research

The Goldman Sachs Group, Inc.

2023 US Equity Outlook

Paradise Lost

November 22, 2022

David J. Kostin
Chief US Equity Strategist Goldman, Sachs & Co. 1-212-902-6781 david.kostin@gs.com

Ben Snider
Senior US Equity Strategist Goldman, Sachs & Co. 1-212-357-1744 ben.snider@gs.com

2023 US Equity Outlook

Flatland: Zero EPS growth, Zero change in P/E multiple, Zero index price gain

S&P 500 Index: +1% rise to 4000 at year-end 2023

- Path: 3-month target of 3600 (-9%) and 6-month target of 3900 (-2%)
- 2023 will be about lack of EPS growth, while 2022 was about valuation decline

Earnings: No growth

- 2023 EPS of $224 reflects 0% growth vs. 2022
- Net margins (ex-Energy) fall to 2019 pre-pandemic level of 11.3% (from 12.7%)

Valuation: Unchanged P/E multiple of 17x

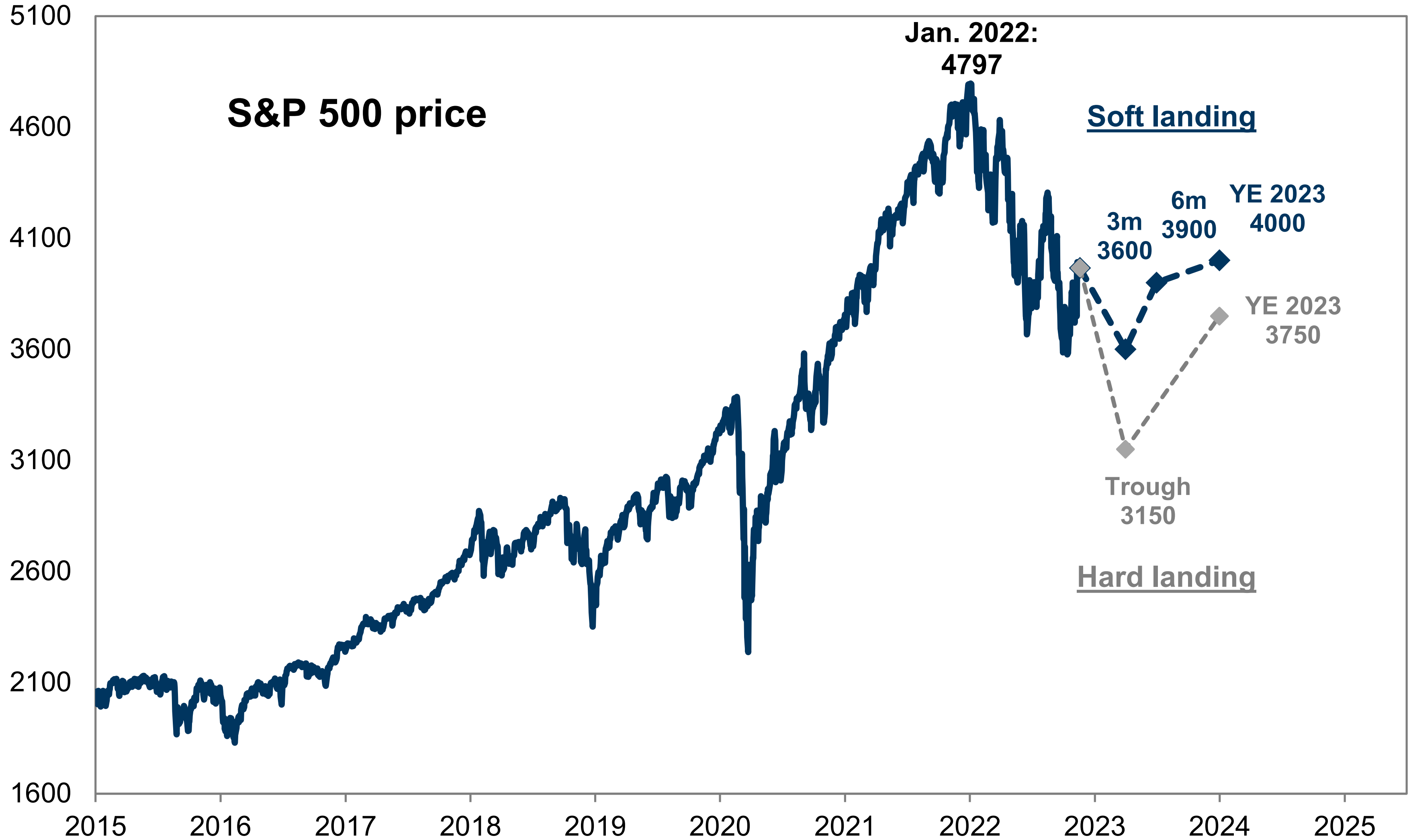
- Absolute: forecast 17x P/E multiple ranks in 74th percentile vs. history
- Relative: 400 bp yield gap vs. real rates ranks in 85th percentile vs. history

Recession scenario: EPS falls by 11% and index troughs at 3150 (-21%)

Goldman Sachs

Path of S&P 500: Soft vs. Hard landing scenarios

Index falls to 3600 in 1Q as rates rise, but recovers to 4000 by year-end

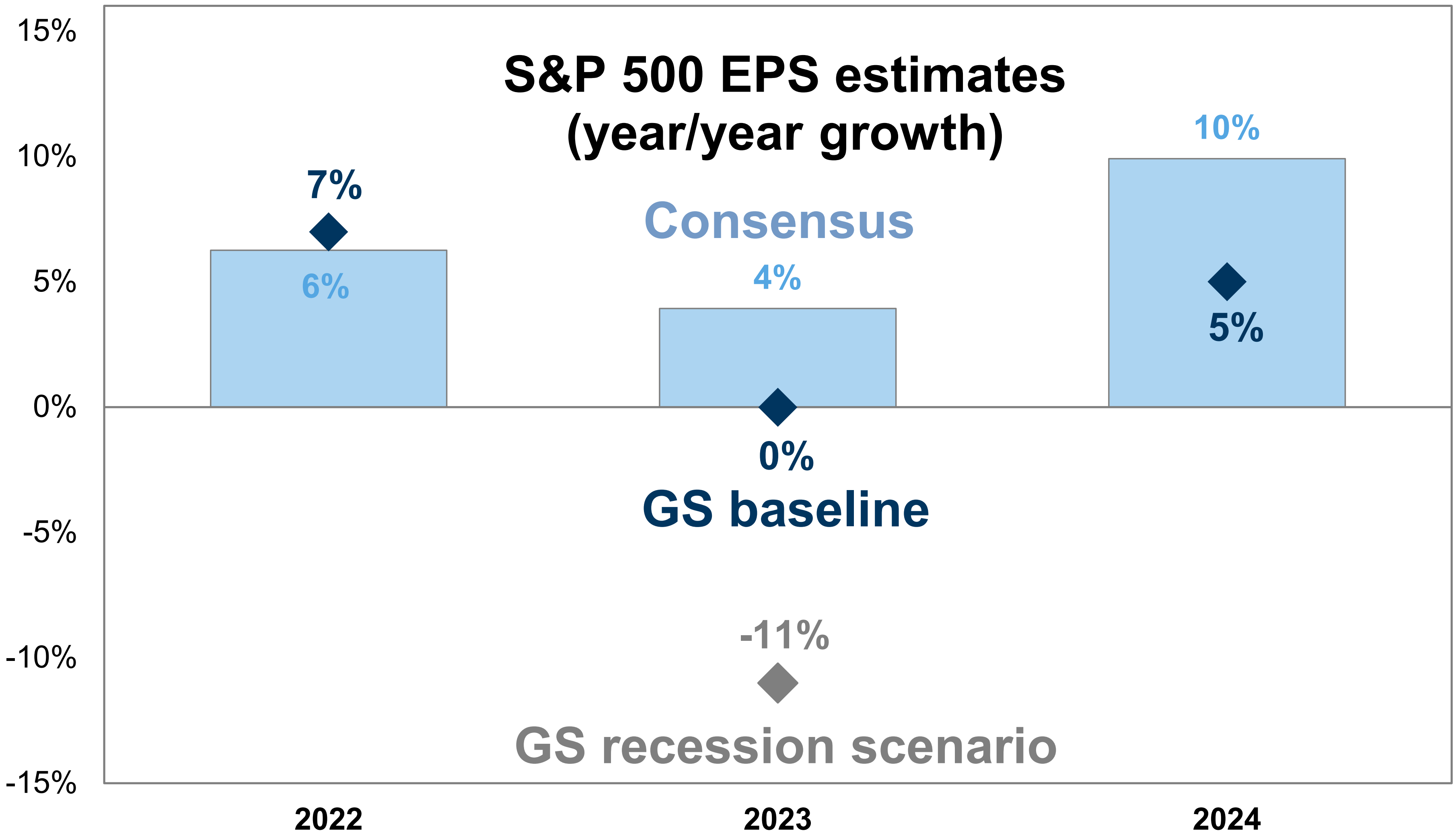


Source: Goldman Sachs Global Investment Research. As of November 18, 2022.

Goldman Sachs

Baseline S&P 500 EPS growth of 0% in 2023

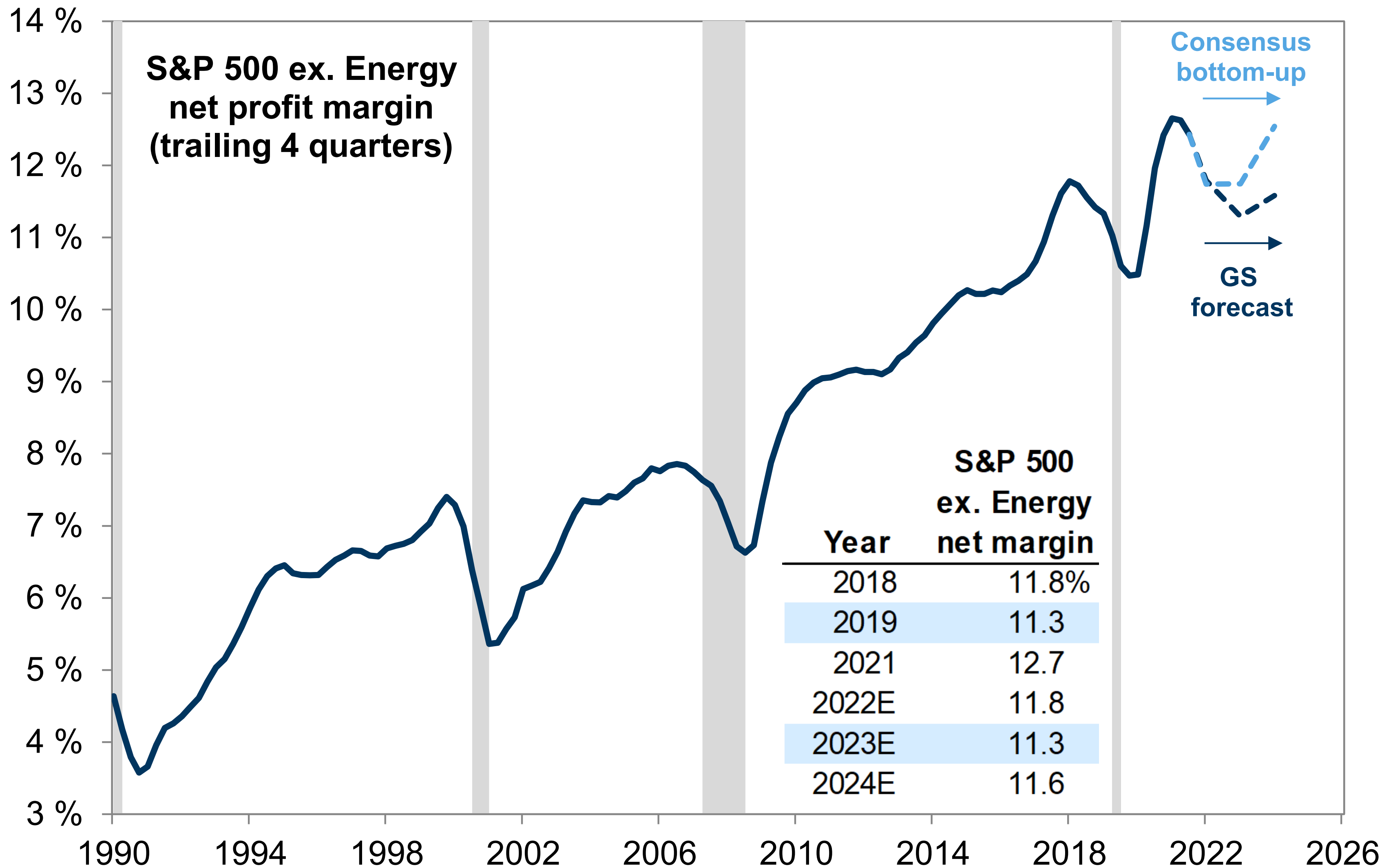
GS forecasts flat EPS growth in 2023 vs. consensus forecast of +4%



Source: Goldman Sachs Global Investment Research. As of November 18, 2022.

Margins ex-Energy will revert to pre-pandemic level

S&P 500 ex. Energy margin will fall from 12.7% peak (2021) to 11.3% (2023)

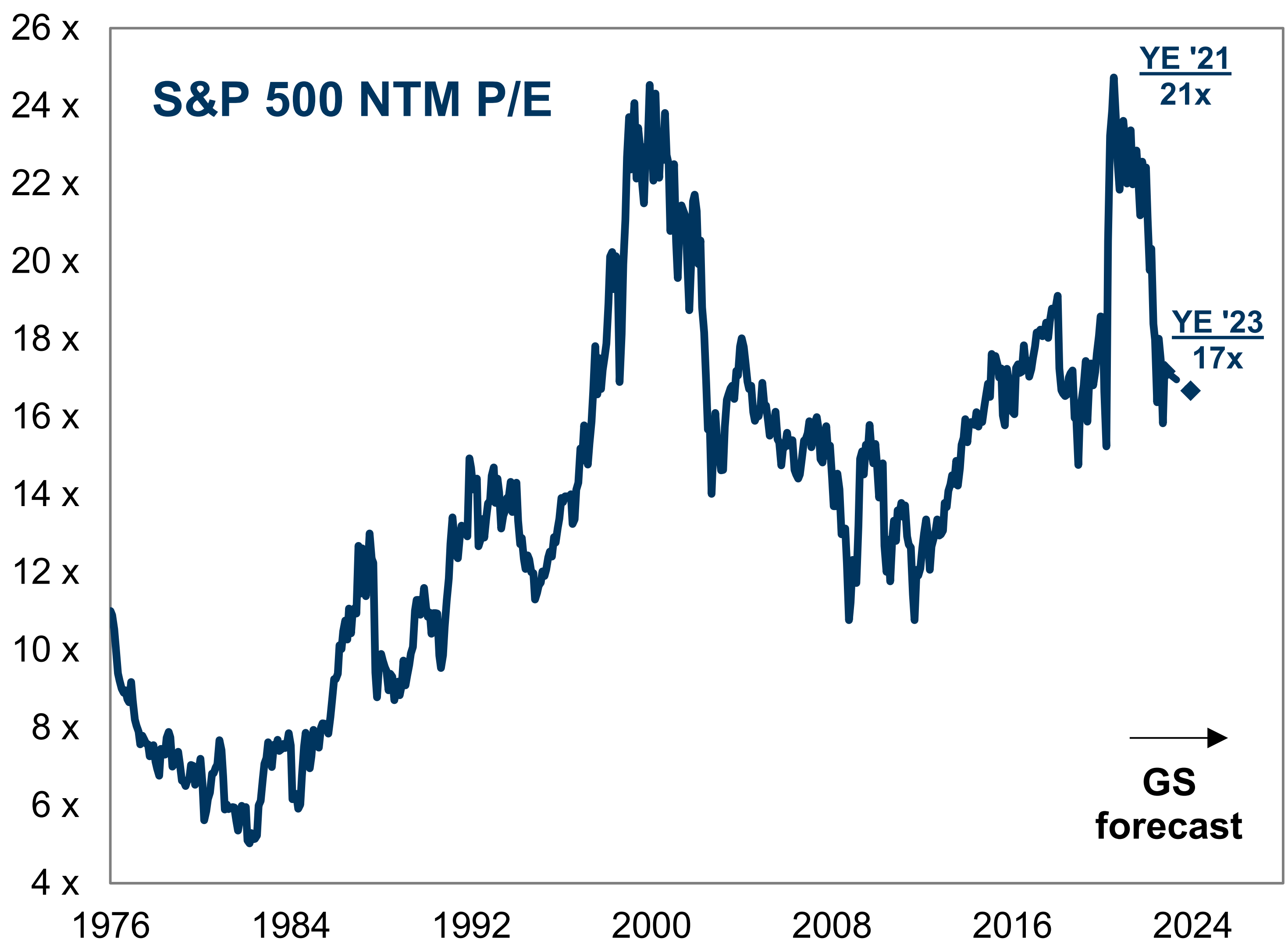


Year	S&P 500 ex. Energy net margin
2018	11.8%
2019	11.3
2021	12.7
2022E	11.8
2023E	11.3
2024E	11.6

Source: Compustat, Goldman Sachs Global Investment Research. As of November 18, 2022.

S&P 500 NTM P/E has fallen from 21x to 17x YTD

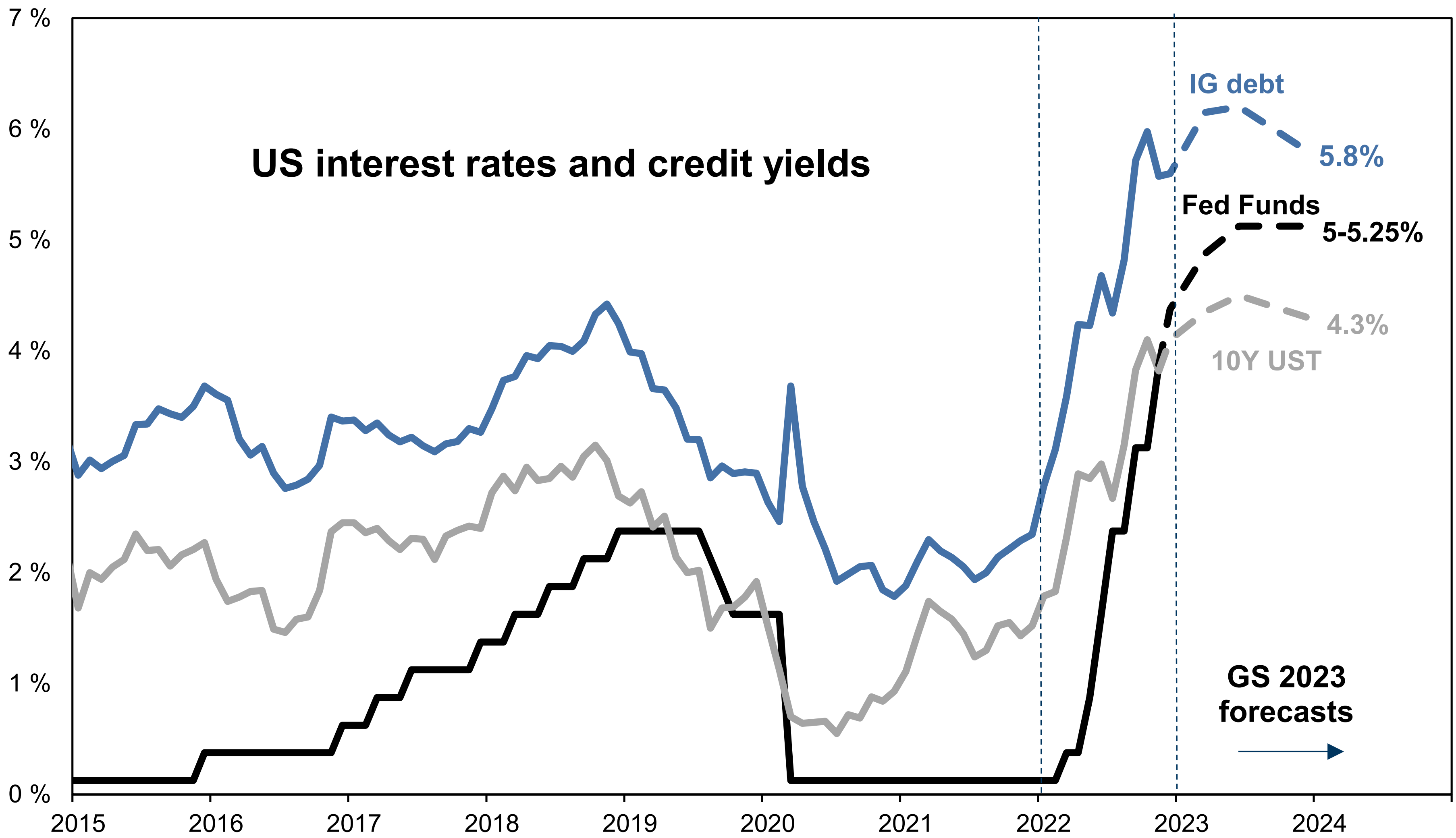
We expect the P/E multiple will end 2023 unchanged at 17x (74th percentile)



Source: Goldman Sachs Global Investment Research. As of November 18, 2022.

GS forecasts interest rates will remain high in 2023

Fed funds will rise to 5%-5.25% and Treasury yields will end next year at 4.3%

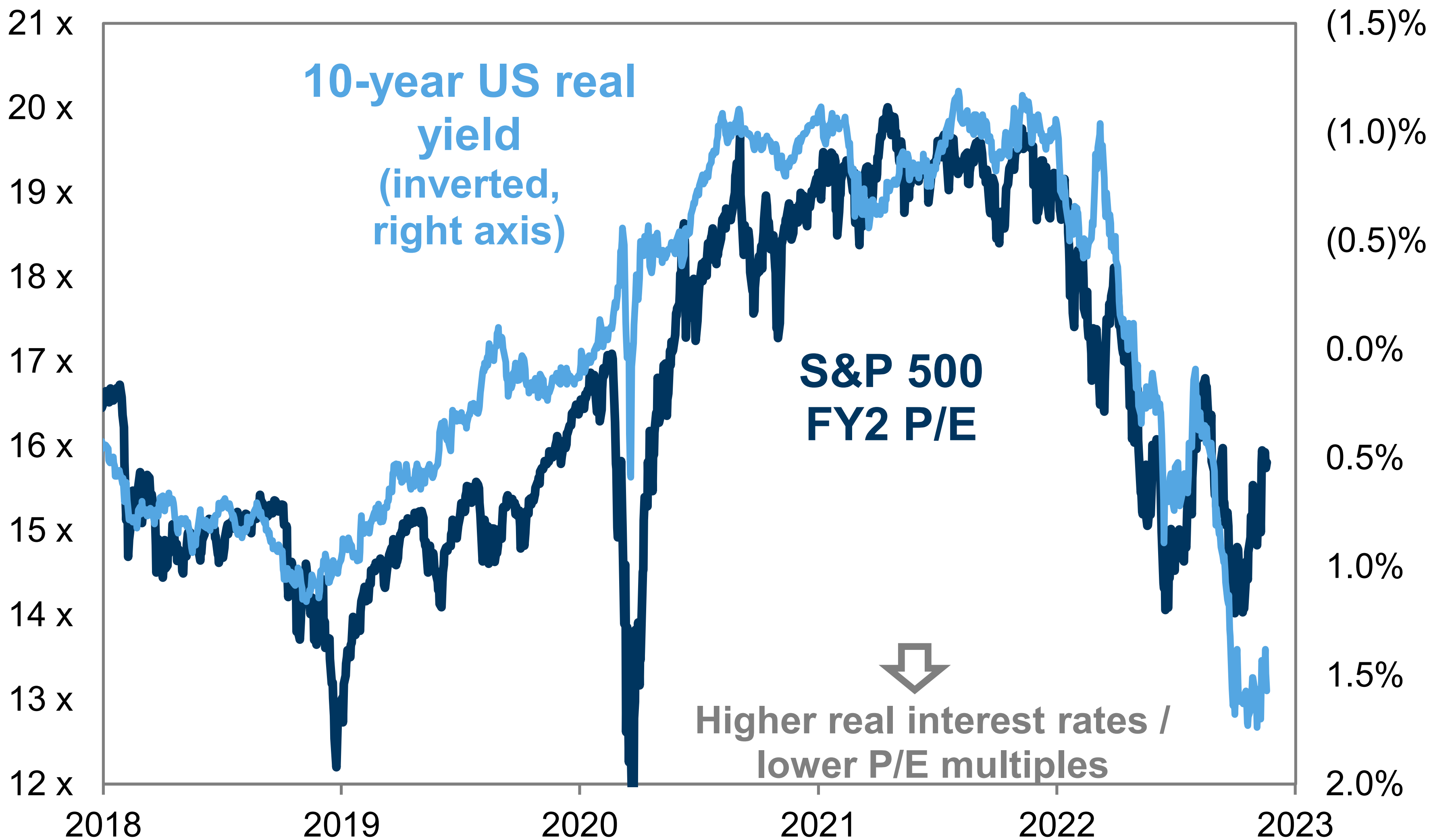


Source: Goldman Sachs Global Investment Research. As of November 18, 2022.

Goldman Sachs

S&P 500 P/E multiple vs. real 10-year Treasury yield

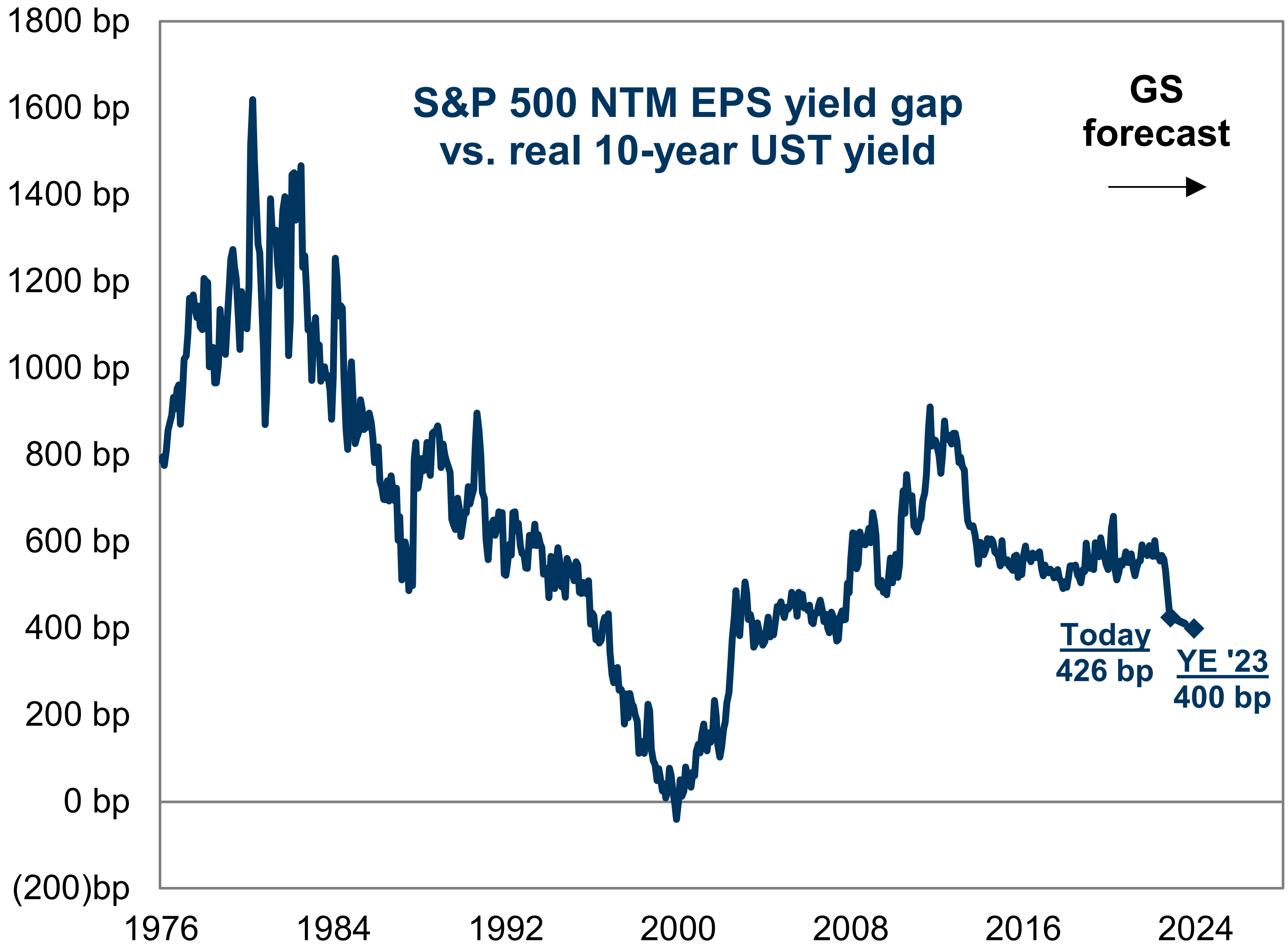
Equity valuation has fallen as real interest rates have climbed from -1.0% to +1.6%



Source: FactSet, Goldman Sachs Global Investment Research. As of November 18, 2022.

S&P 500 EPS yield gap vs. real 10-year UST yield

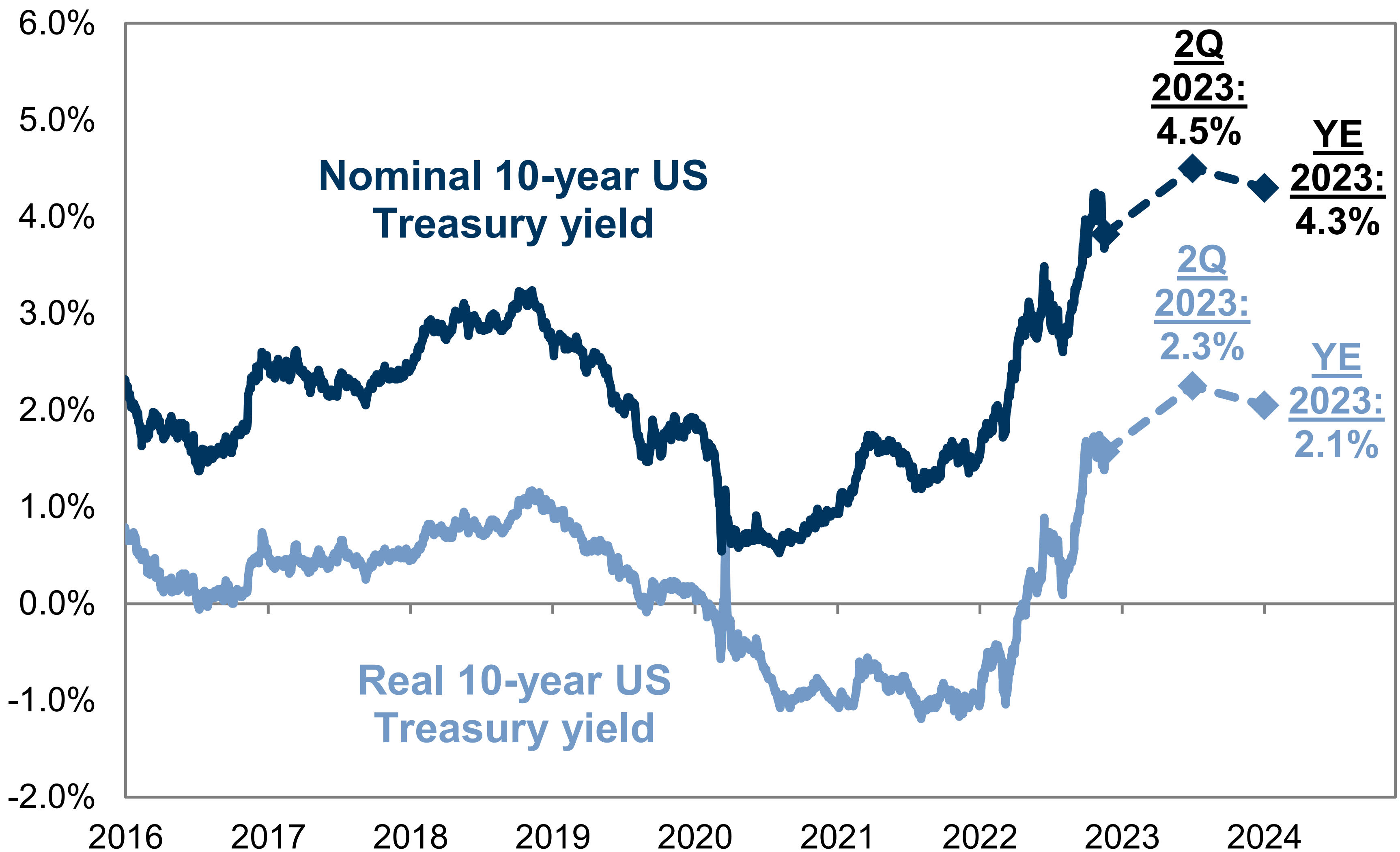
We expect yield gap will narrow modestly to 400 bp (85th percentile valuation)



Source: Goldman Sachs Global Investment Research. As of November 18, 2022.

Rates likely to peak in 2Q 2023 but remain high

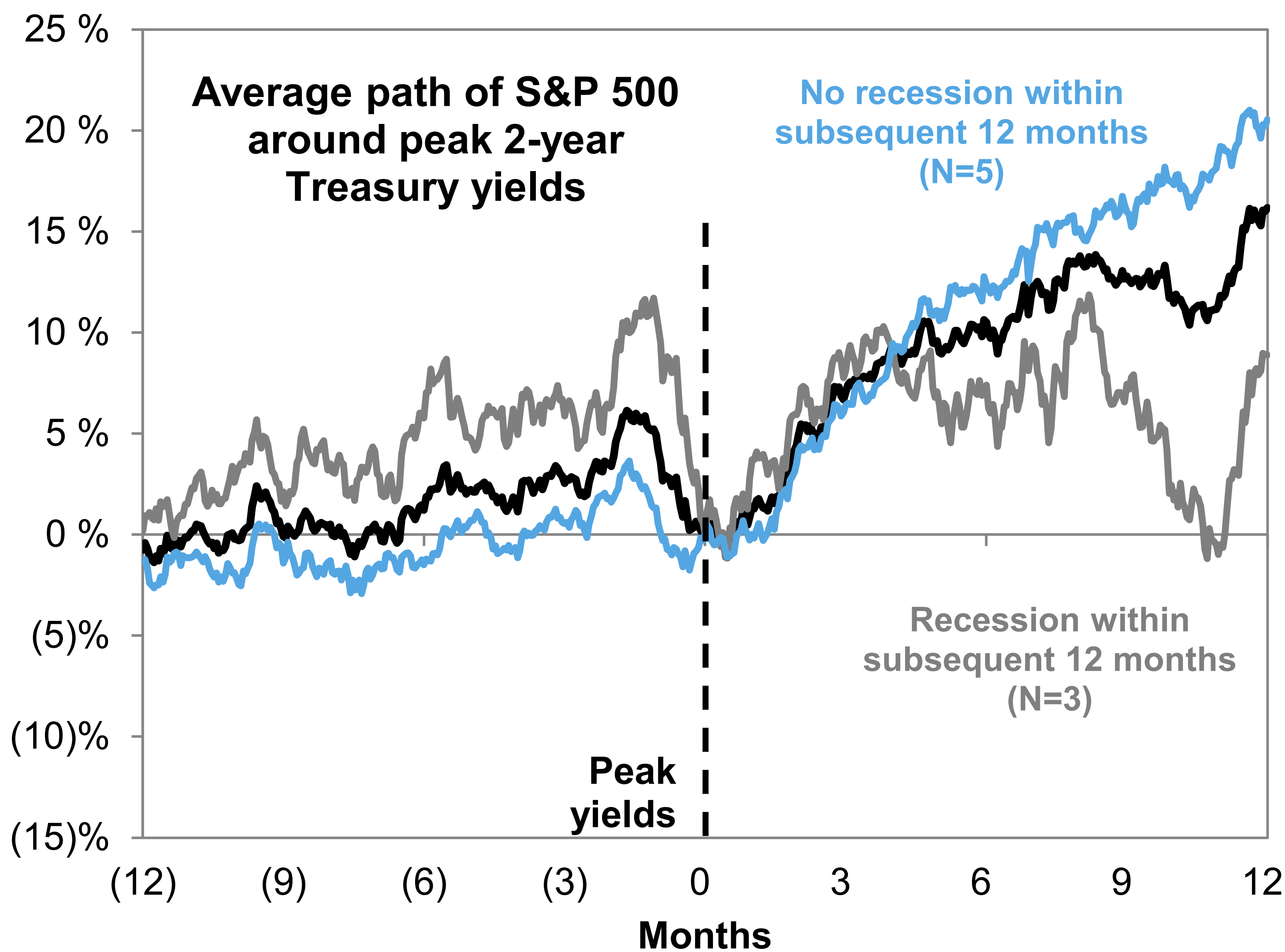
Real rates will climb to 2.3% in 2Q 2023 before receding to 2.1% by YE 2023



Source: Goldman Sachs Global Investment Research. As of November 18, 2022.

Signs of a trough: Peak rates and trough in growth

Market path following "peak hawkishness" depends on growth backdrop

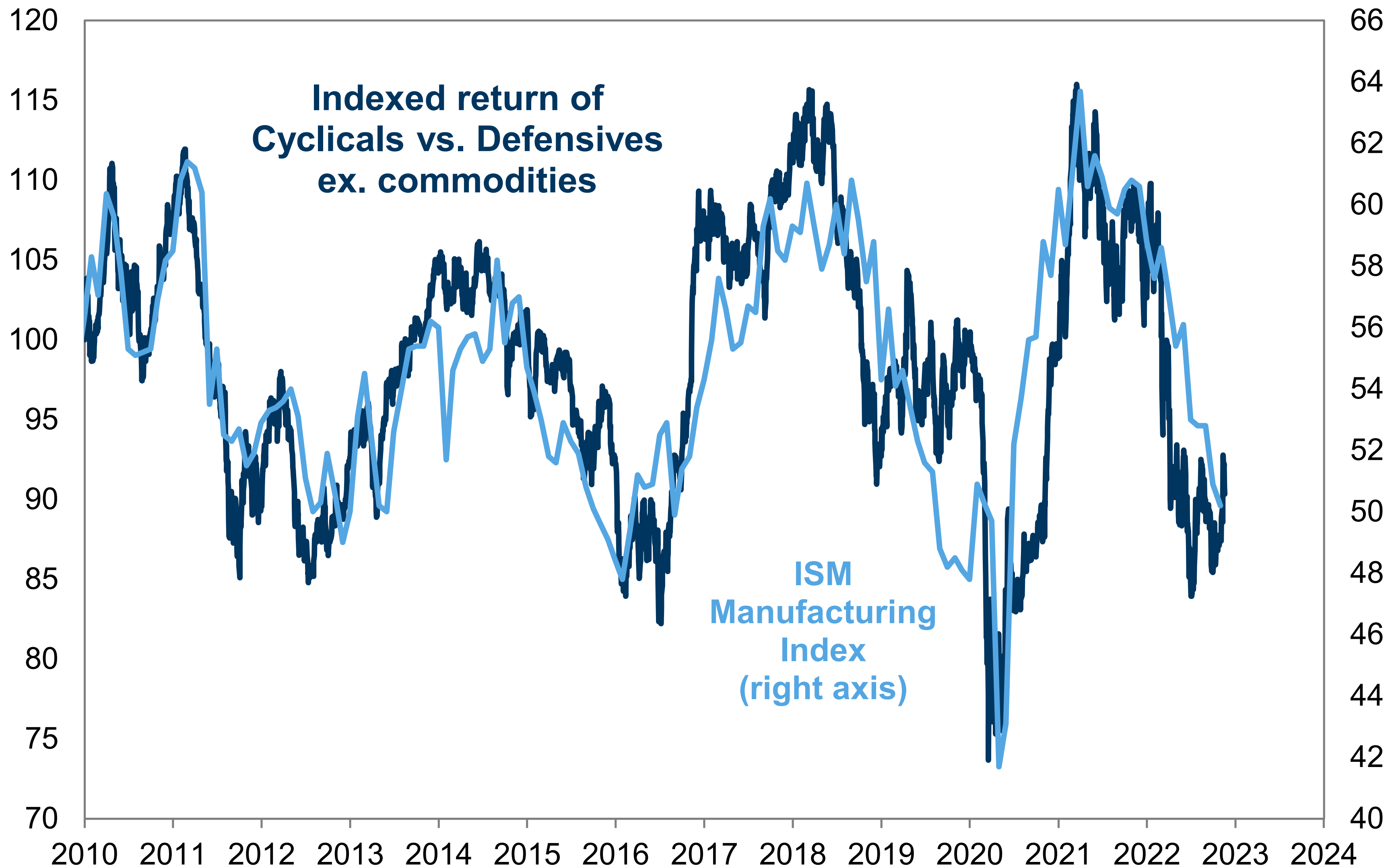


Source: Goldman Sachs Global Investment Research. As of November 18, 2022.

Goldman Sachs

Cyclicals vs. Defensives currently prices a soft landing

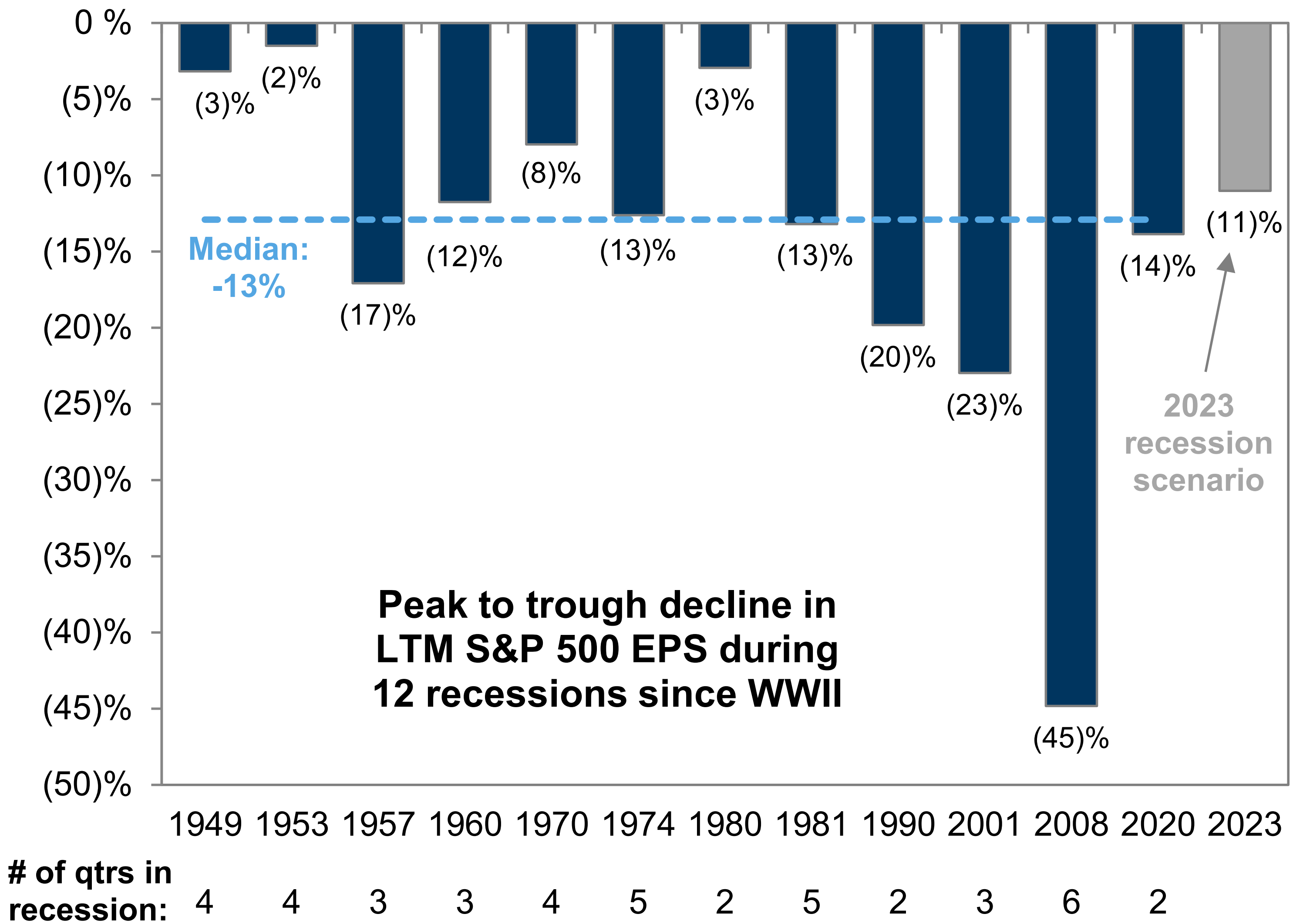
Cyclicals vs. Defensives consistent with a slowdown but not recession



Source: Goldman Sachs Global Investment Research. As of November 18, 2022.

Median EPS decline of 13% during prior recessions

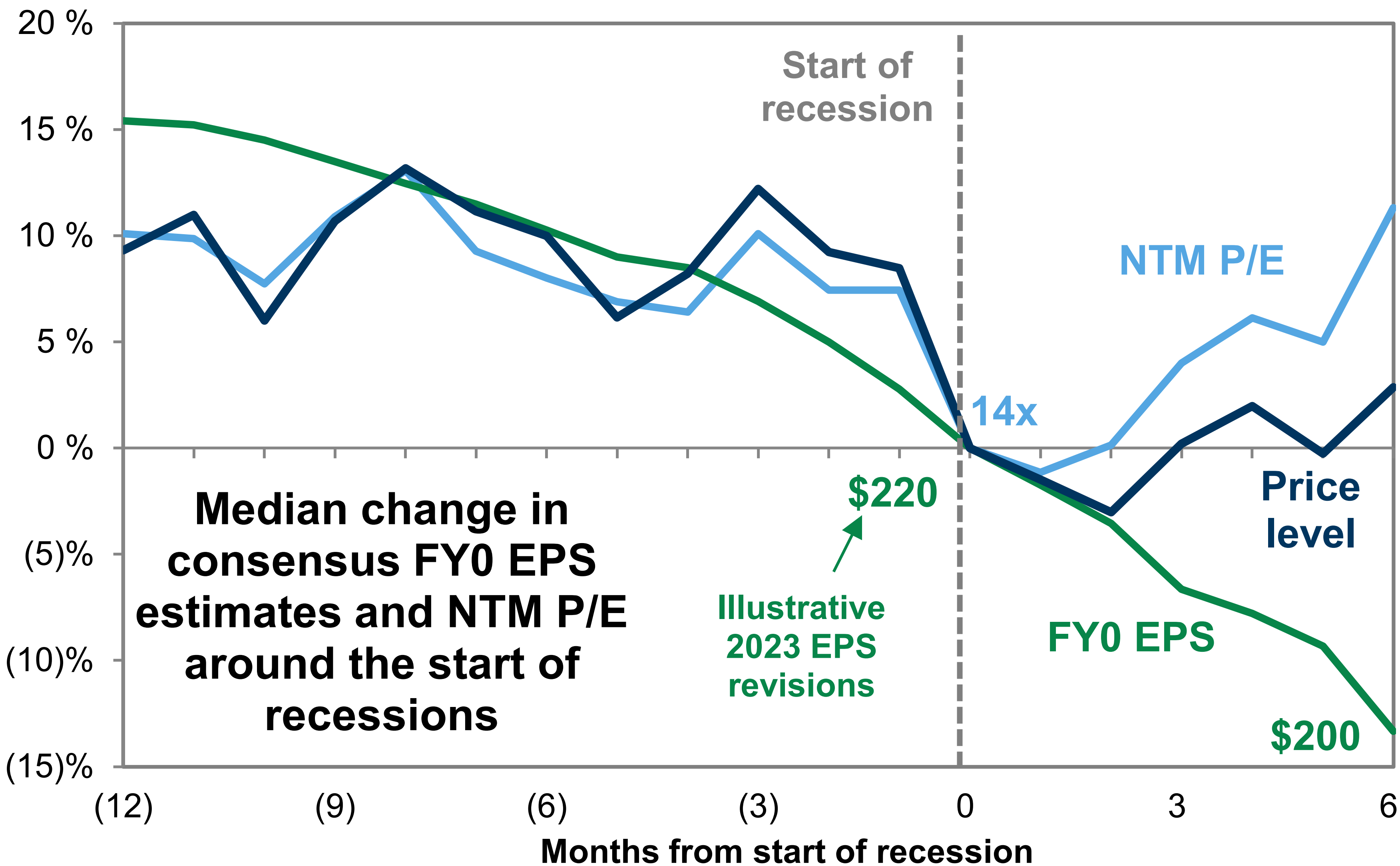
Recent declines were dominated by Autos (1990), Tech (2001), and Financials (2008)



Source: Goldman Sachs Global Investment Research.

Path of earnings and valuations around recessions

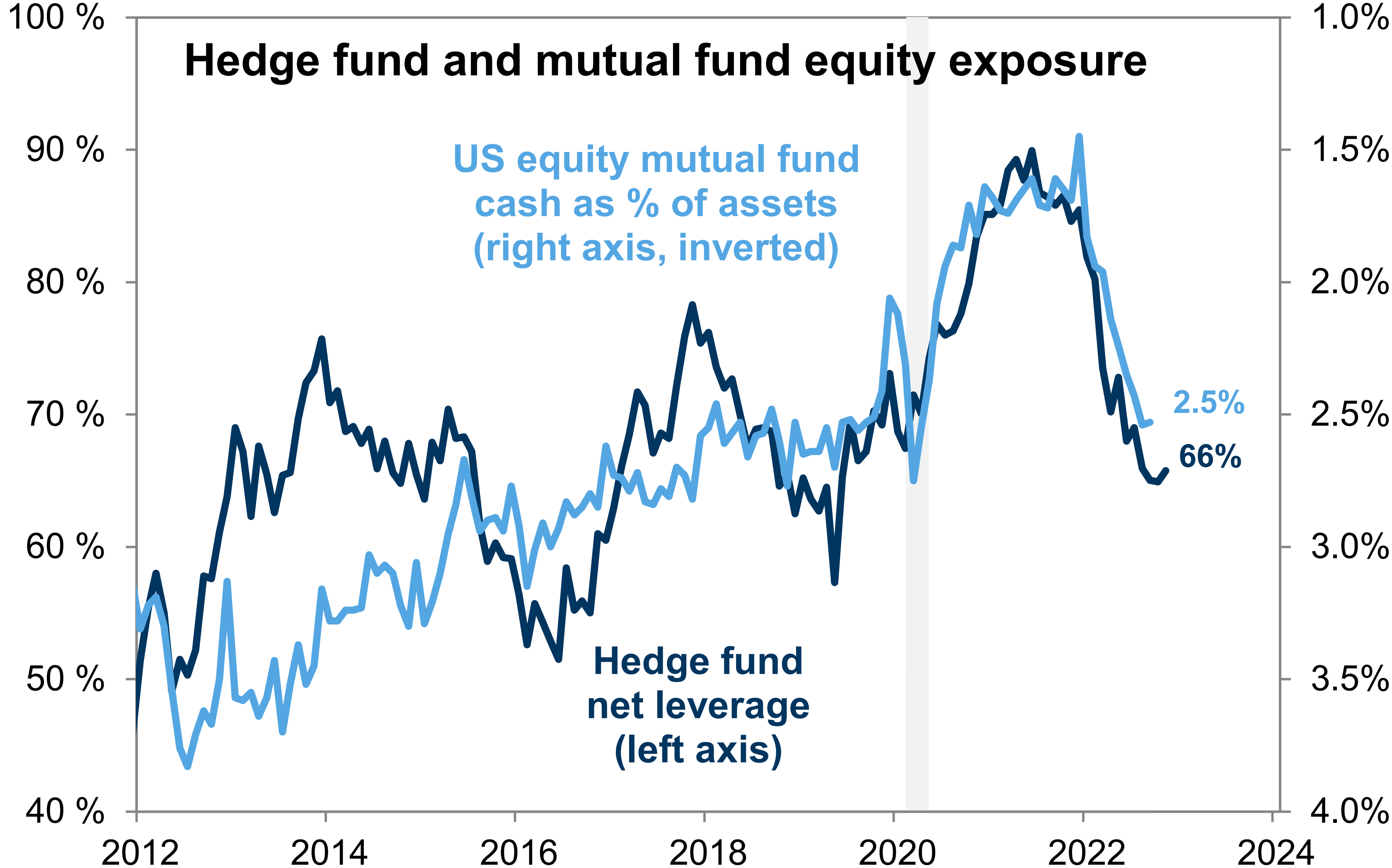
Earnings typically continue to fall but P/E stabilizes after a recession starts



Source: FactSet, Goldman Sachs Global Investment Research.

Mutual and hedge funds conservatively positioned

Increased equity mutual fund cash position and reduced hedge fund net leverage

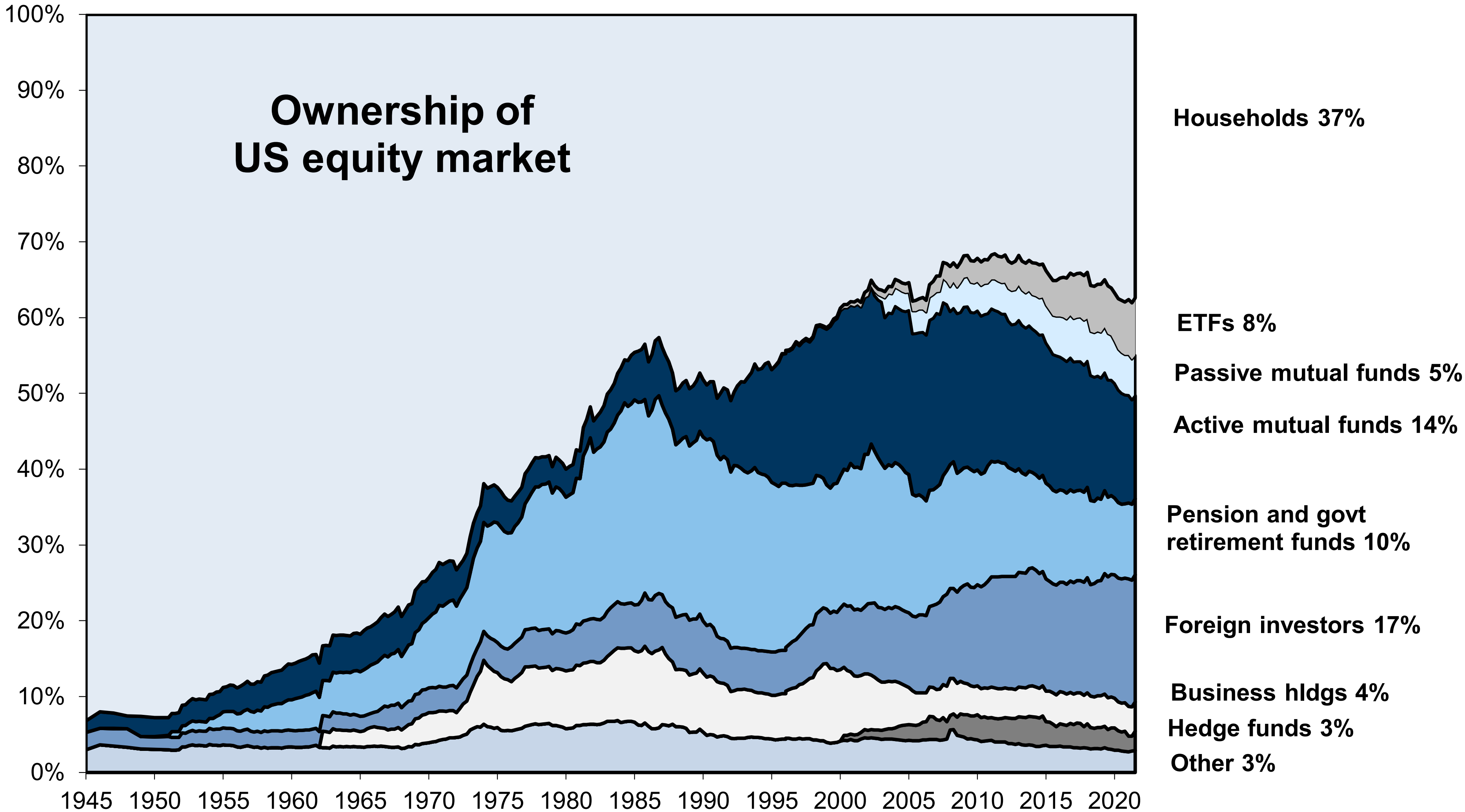


Source: ICI, GS Prime Services, Goldman Sachs Global Investment Research.

Goldman Sachs

Ownership of US equity market since 1945

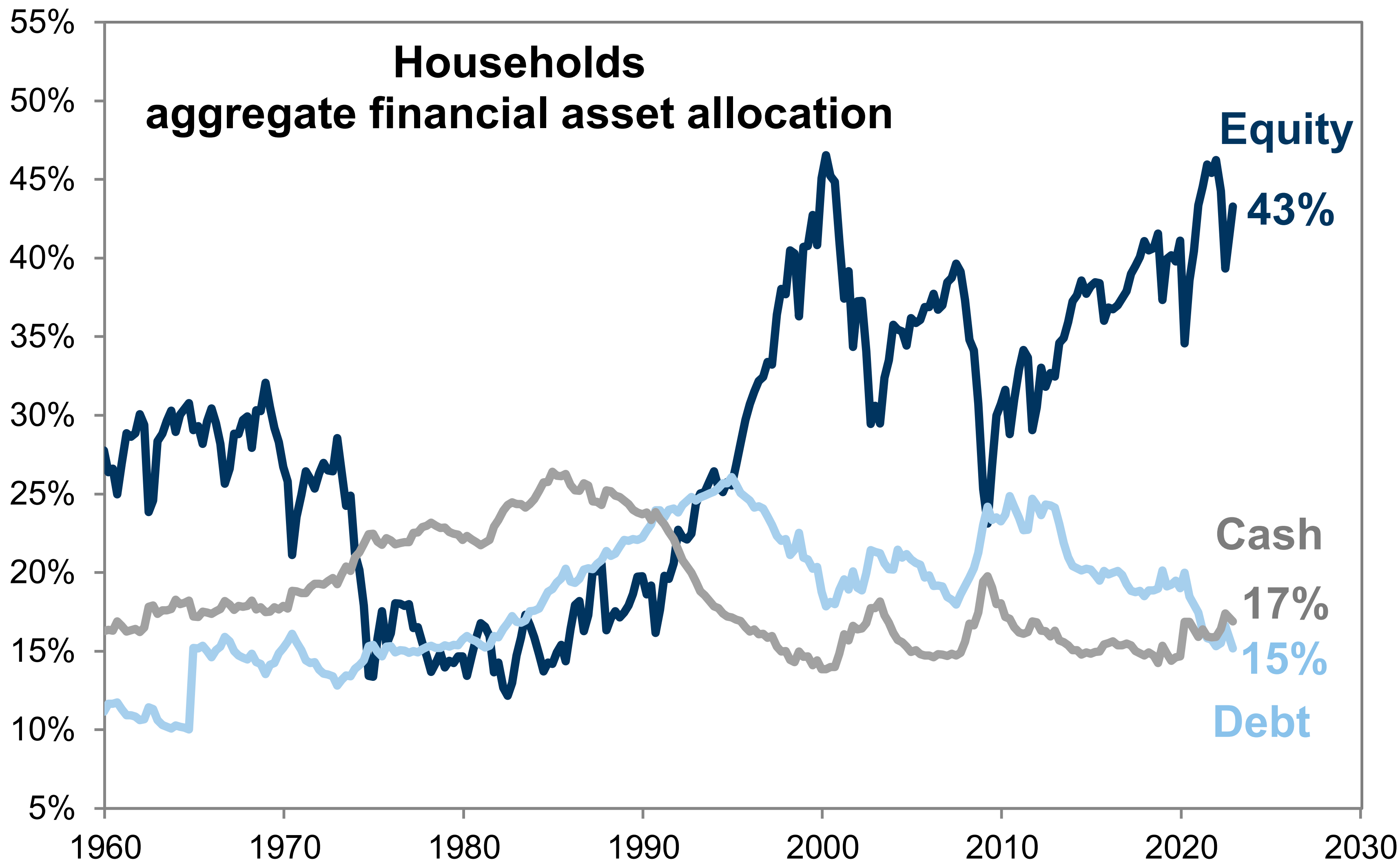
Households, mutual funds, pensions, and foreign investors own 91% of market



Source: Federal Reserve, Goldman Sachs Global Investment Research. As of 2Q 2022.

Household allocations to equity remain elevated

Regime change from “TINA” to “TARA” supports household asset rotation

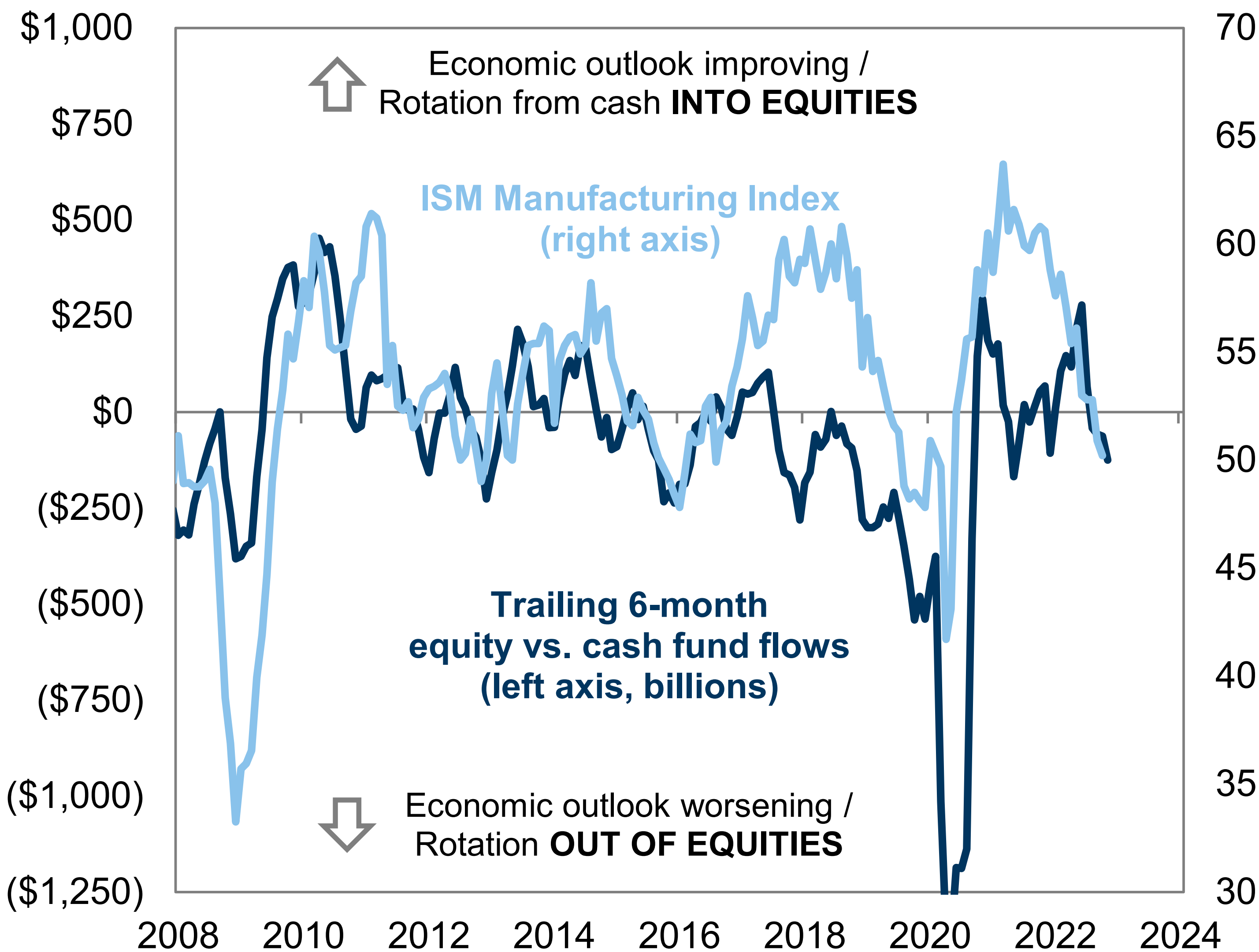


Source: Federal Reserve, Goldman Sachs Global Investment Research.

Goldman Sachs

Household equity outflows in a weakening economy

If a hard landing materializes households may rotate assets from equities to cash



Source: Federal Reserve, Goldman Sachs Global Investment Research.

GS Portfolio Strategy net equity demand forecasts

We expect household assets will shift from equities to cash and bonds in 2023

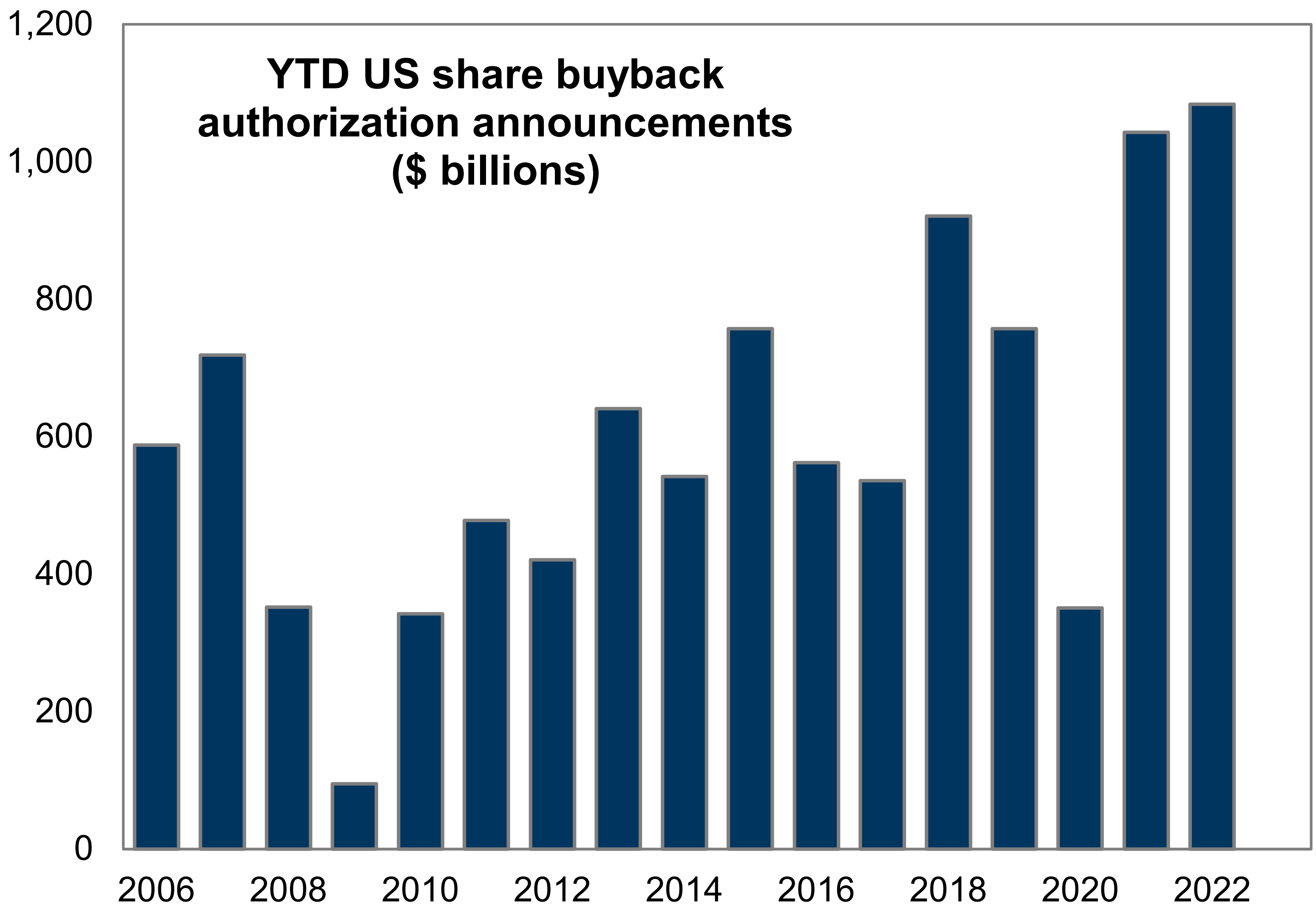
	Net US equity demand ($ billions)		
Category	**2021**	**2022E**	**2023E**
Corporations	$ 623	**$ 700**	**$ 500**
Households	448	**100**	**(100)**
Foreign Investors	(45)	**100**	**(150)**
Pension Funds	(223)	**(100)**	**200**
Mutual Funds	(317)	**(350)**	**(200)**
Life Insurance	(80)	**-**	**-**
Other	(49)	**-**	**-**
less			
Credit ETFs	203	**150**	**200**
Purchases of foreign stocks	155	**300**	**50**

Source: Federal Reserve, Goldman Sachs Global Investment Research.

Goldman Sachs

US share buyback authorization announcements YTD

Buybacks are the largest and most consistent source of demand for equities



Source: Goldman Sachs Buybacks Desk, Goldman Sachs Global Investment Research.

Goldman Sachs

Change in buybacks around past recessions

Buybacks fall by 10% in soft landing scenario, but will fall by 40% in hard landing

Recession	Length (quarters)	Peak to trough change in buybacks around recession
1990	2	(53)%
2001	3	(27)
2008	6	(67)
2020	2	(38)
Median	**3**	**(46)%**
2023 recession scenario		***(40)***
2023 baseline		***(10)***

Source: Goldman Sachs Buybacks Desk, Goldman Sachs Global Investment Research.

Goldman Sachs

Investment strategies for 2023

Growth, rates, inflation, and margins support three long and two short strategies

Growth

- Own defensive sectors with low inflation and growth risk: Health Care, Staples

Margins

- Own companies with resilient margins
- Avoid stocks with vulnerable margins if recent decline in SG&A reverses

Inflation and rates

- Own stocks with leverage to a decelerating inflation environment
- Avoid unprofitable long-duration equities

Goldman Sachs

Goldman Sachs recommended sector allocations

Overweight Health Care, Staples, Energy, Telecom, Cons. Durables & Apparel

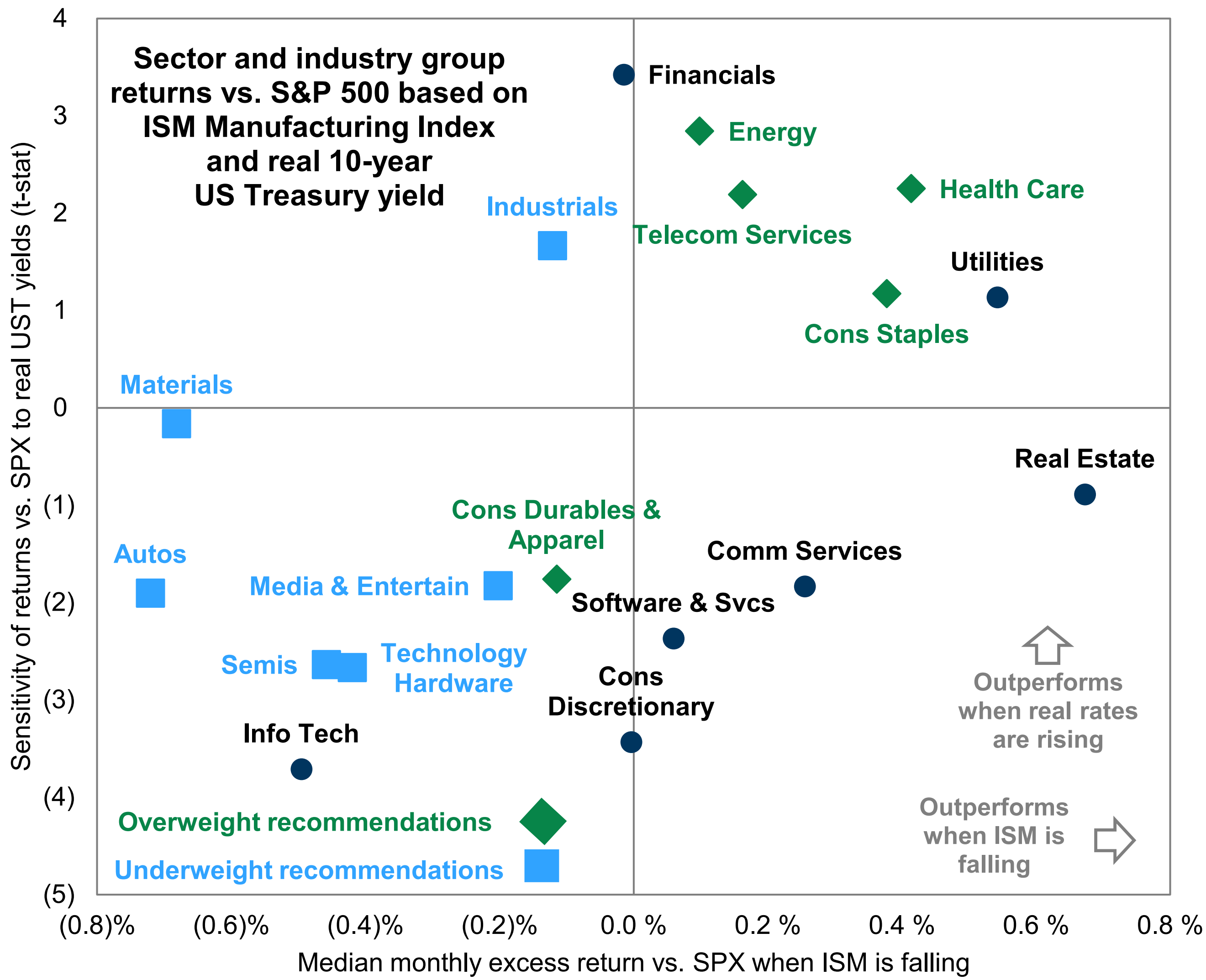
Sector	Goldman Sachs recommended sector weightings	Current S&P 500 weight	Total return YTD
Health Care	Overweight	15 %	(3)%
Consumer Staples		7	(1)
Energy		5	72
Telecommunication Services*		1	(5)
Consumer Durables & Apparel**		1	(34)
Software & Services+	Neutral	13	(25)
Financials		12	(8)
Cons. Discretionary ex. Autos & Durables		8	(29)
Utilities		3	(2)
Real Estate		3	(25)
Technology Hardware+	Underweight	9	(16)
Industrials		8	(5)
Media & Entertainment*		6	(41)
Semiconductors+		5	(32)
Materials		3	(10)
Automobiles & Components**		2	(46)
S&P 500		**100 %**	**(16)%**

* Industry groups within the Communication Services sector.
** Industry groups within the Consumer Discretionary sector.
\+ Industry groups within the Information Technology sector.

Source: FactSet, Goldman Sachs Global Investment Research. As of November 18, 2022.

We prefer sectors insulated from growth and rate risk

Sector allocation framework considers the growth and interest rate outlooks



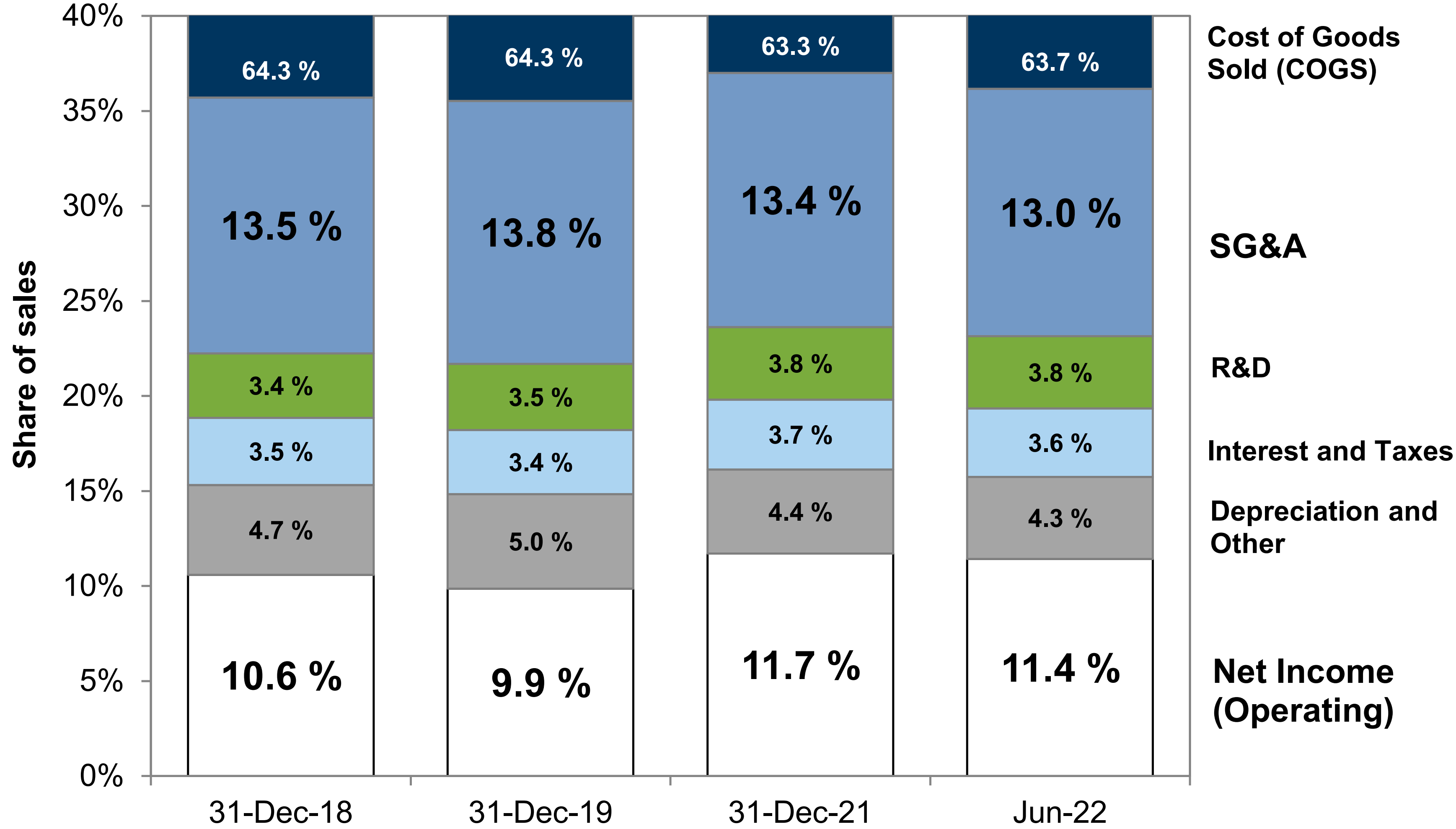
Performance during ISM cycles since 1974. Real Estate returns only since 2002. Rates betas calculated on a quarterly basis since 2015, controlling for breakeven inflation.

Source: FactSet, Goldman Sachs Global Investment Research.

Goldman Sachs

Cost breakdown of S&P 500 (excluding Financials)

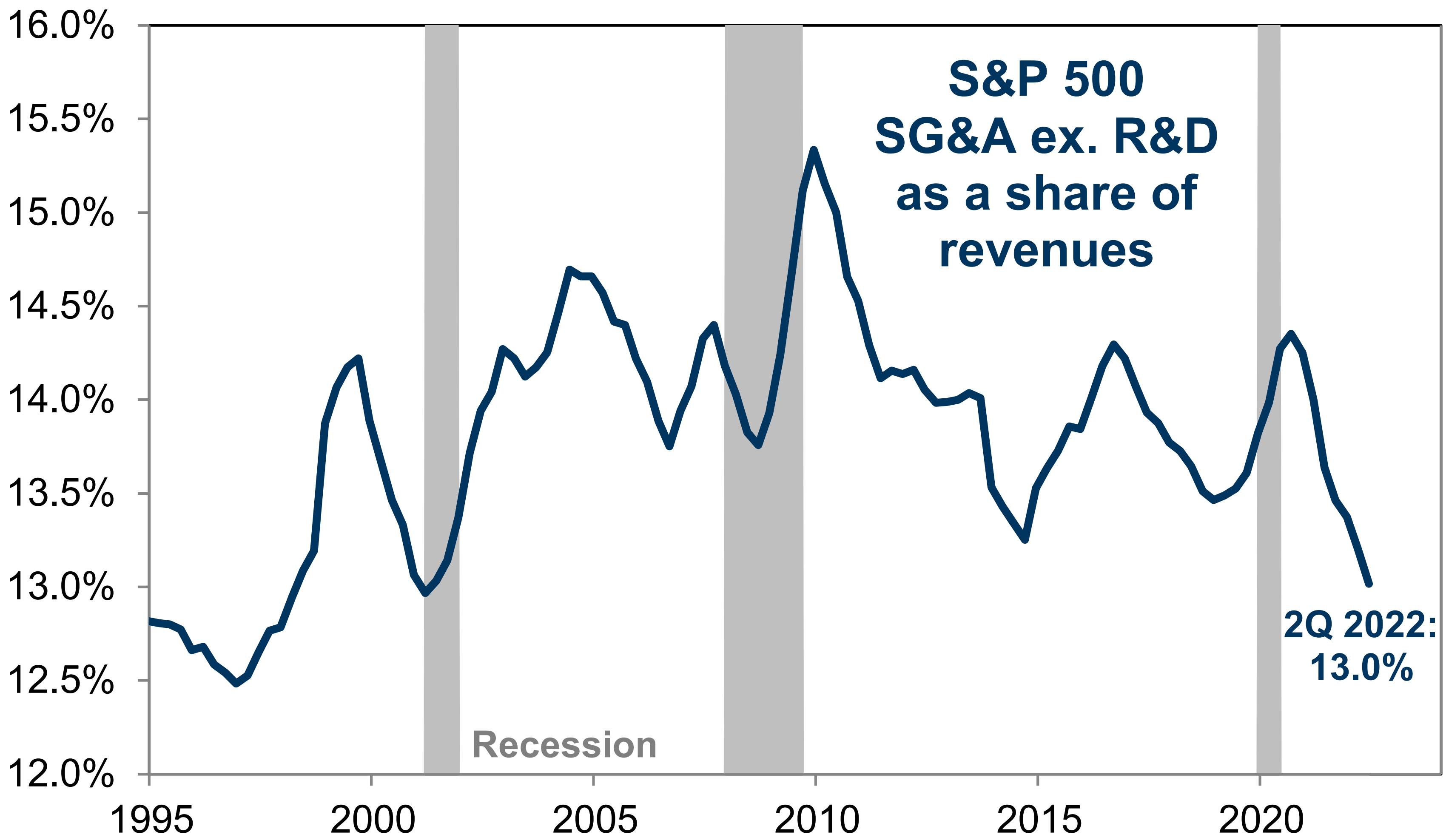
Declining SG&A as a share of sales has been major driver of rising margins



Source: Compustat, Goldman Sachs Global Investment Research.

SG&A costs as percent of S&P 500 sales

SG&A excluding R&D as a share of sales has recently declined sharply

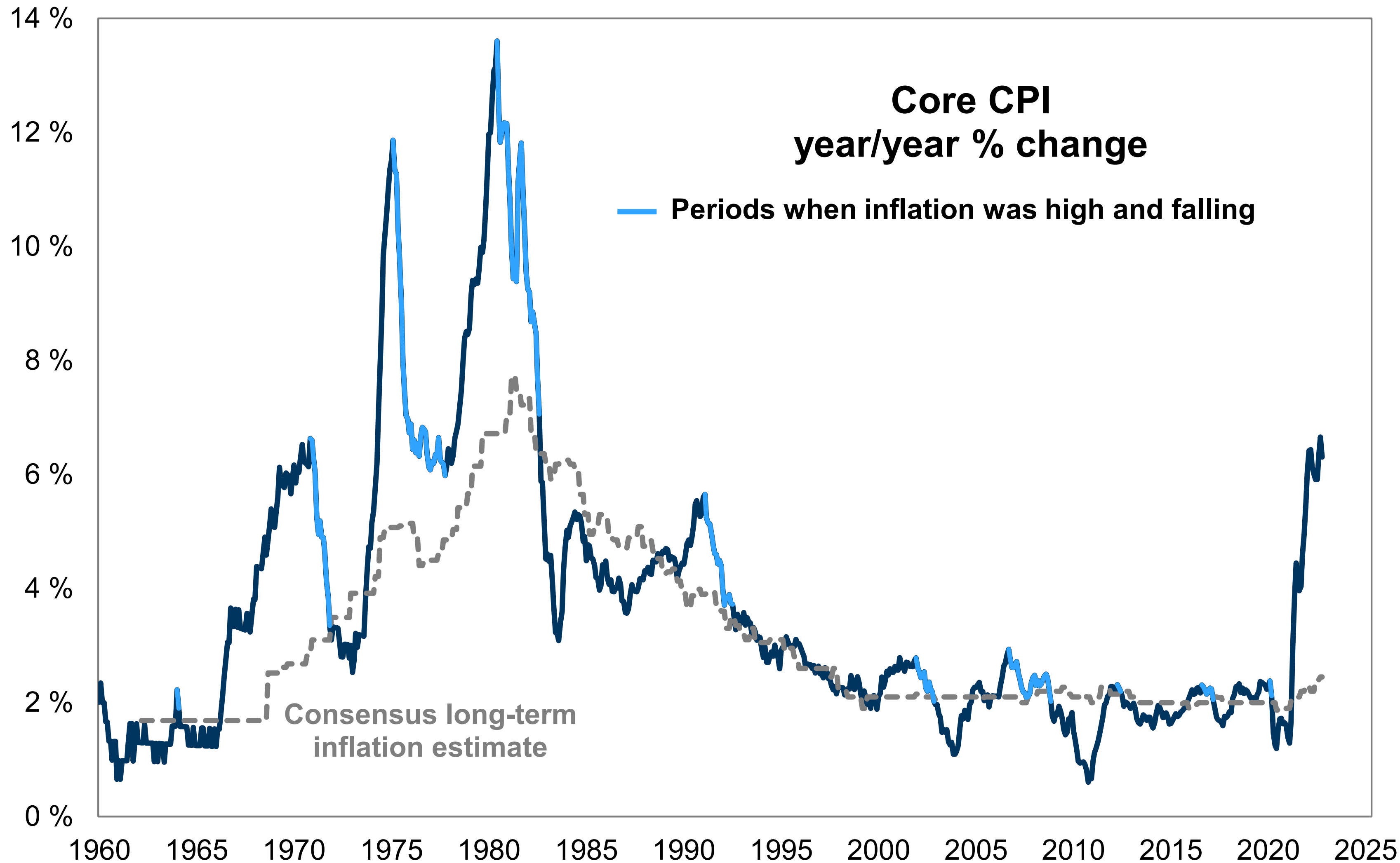


Source: Compustat, Goldman Sachs Global Investment Research.

Goldman Sachs

Own stocks leveraged to decelerating inflation

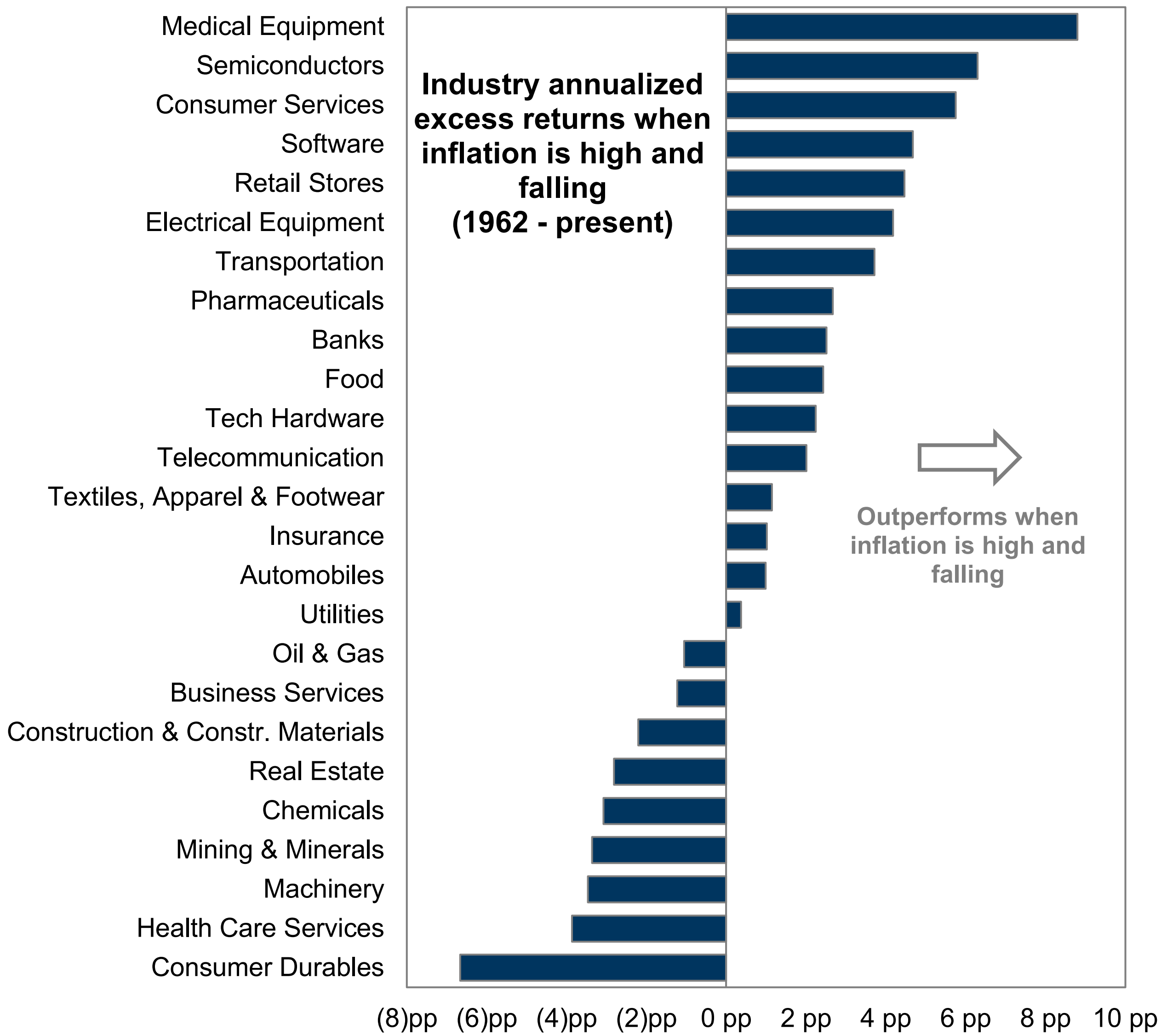
Shifting from environment of high and rising inflation to high and falling inflation



Source: Federal Reserve, Goldman Sachs Global Investment Research.

Own stocks leveraged to decelerating inflation

Median monthly returns vs. market in periods of high and falling inflation

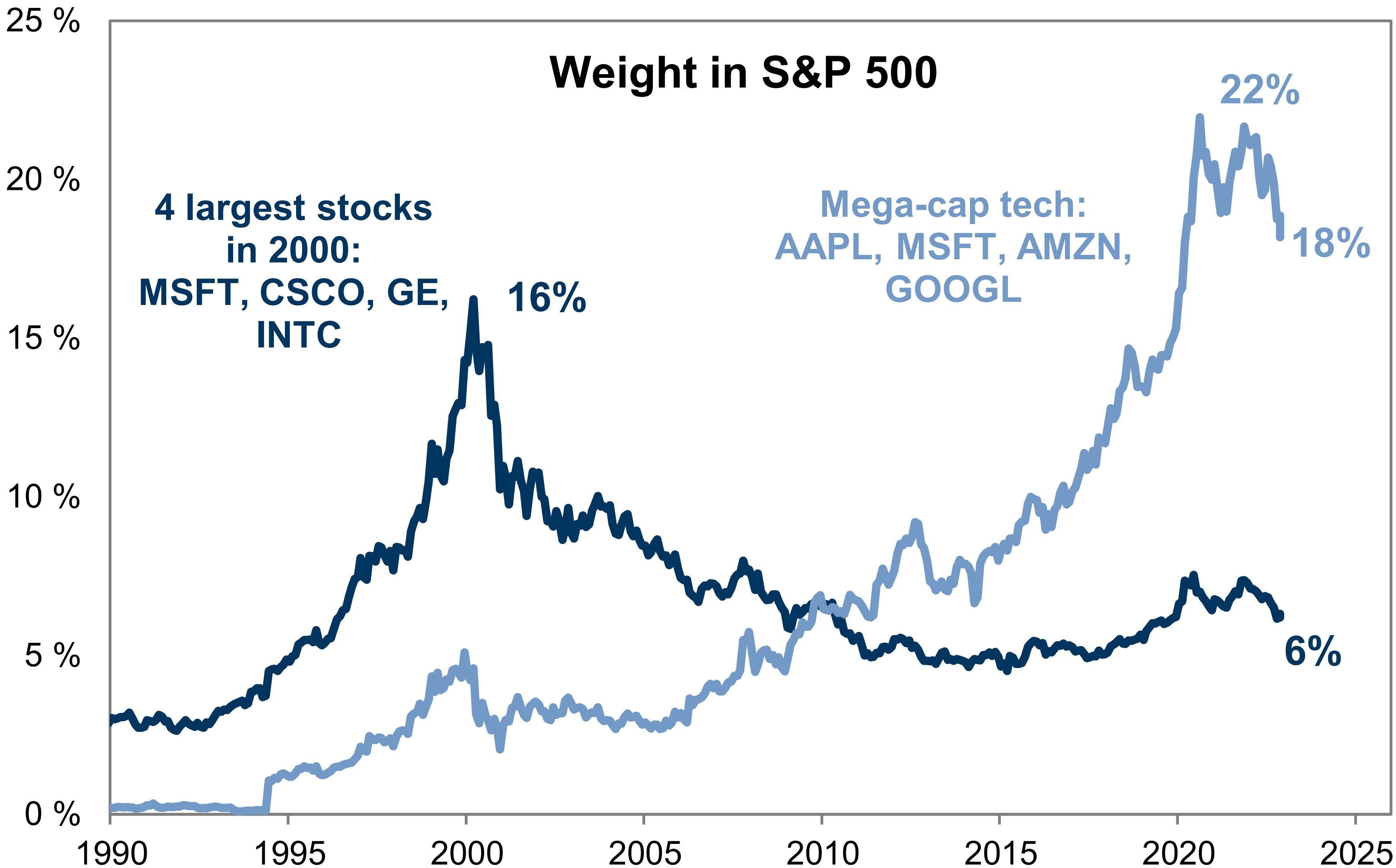


Source: Kenneth R. French, Goldman Sachs Global Investment Research.

Goldman Sachs

Mega-cap tech market share of S&P 500 is now 18%

Top 4 stocks in 2000 show market leadership is difficult to maintain

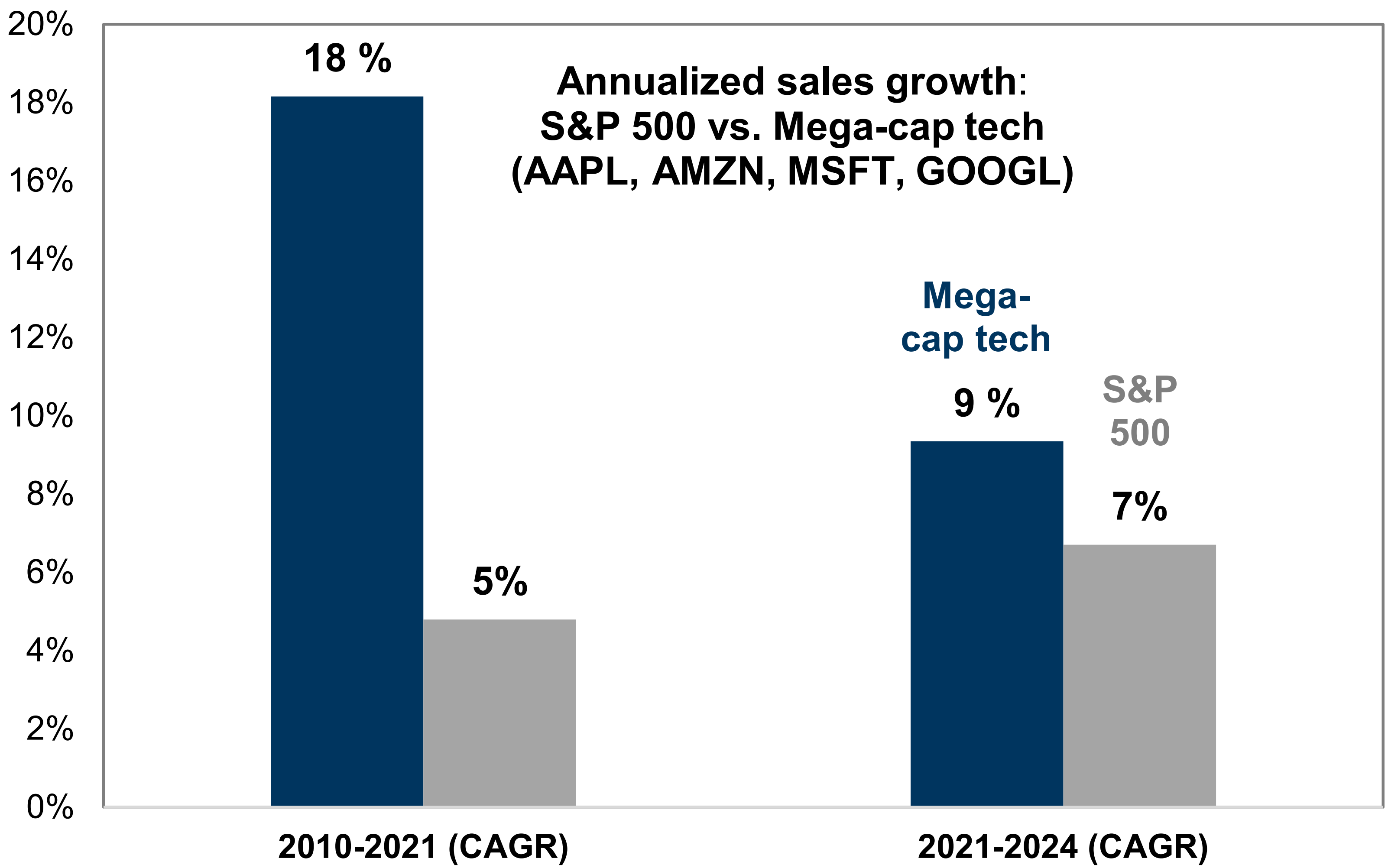


Source: Compustat, Goldman Sachs Global Investment Research.

Goldman Sachs

Diminished annualized sales growth premium for tech

2010-2021 annualized sales of 18% vs. 5%; forecast 2021-24 gap is 9% vs. 7%

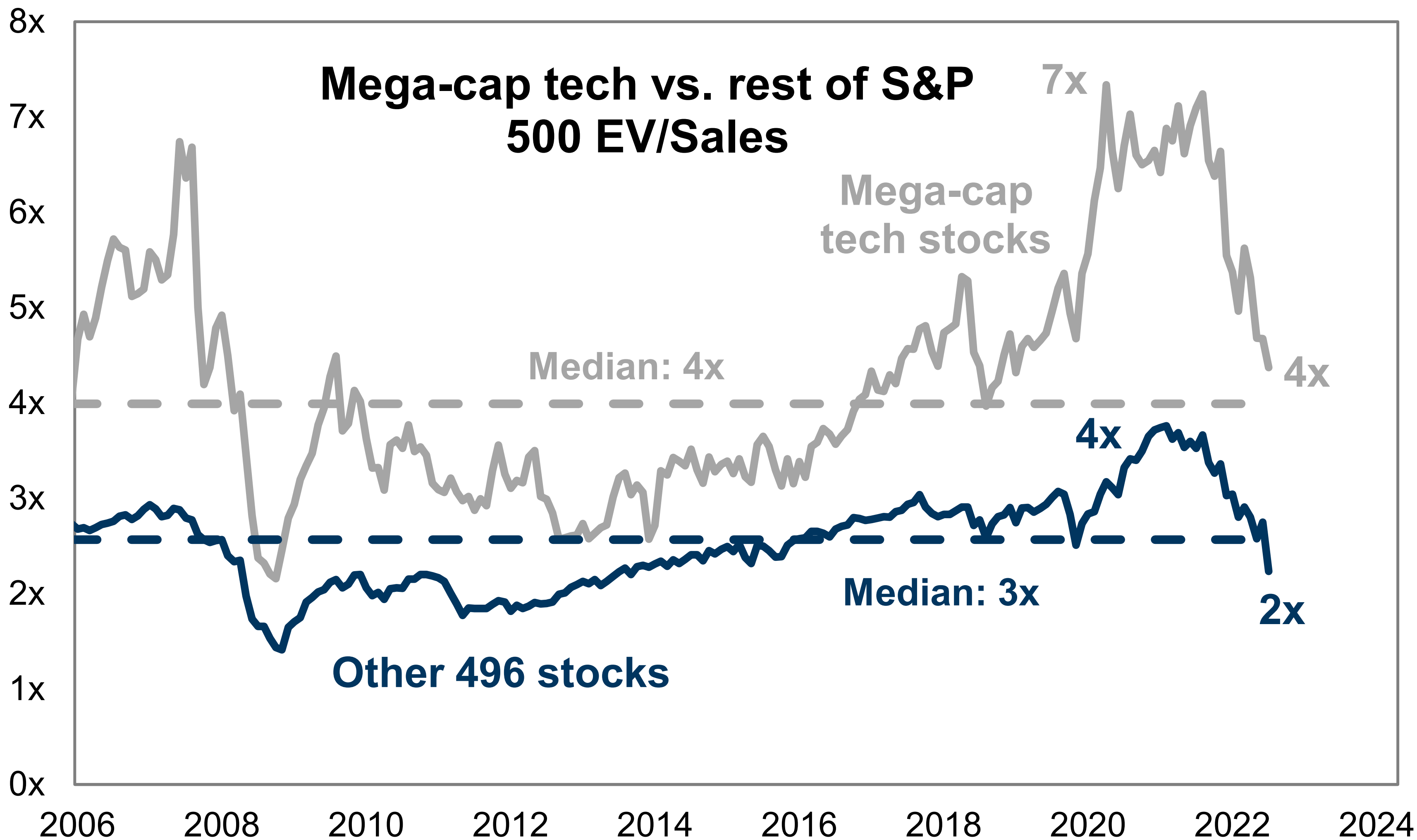


Source: FactSet, Goldman Sachs Global Investment Research.

Goldman Sachs

Mega-cap tech valuation premium has contracted

EV/sales multiple for mega-cap tech is slightly above historical average

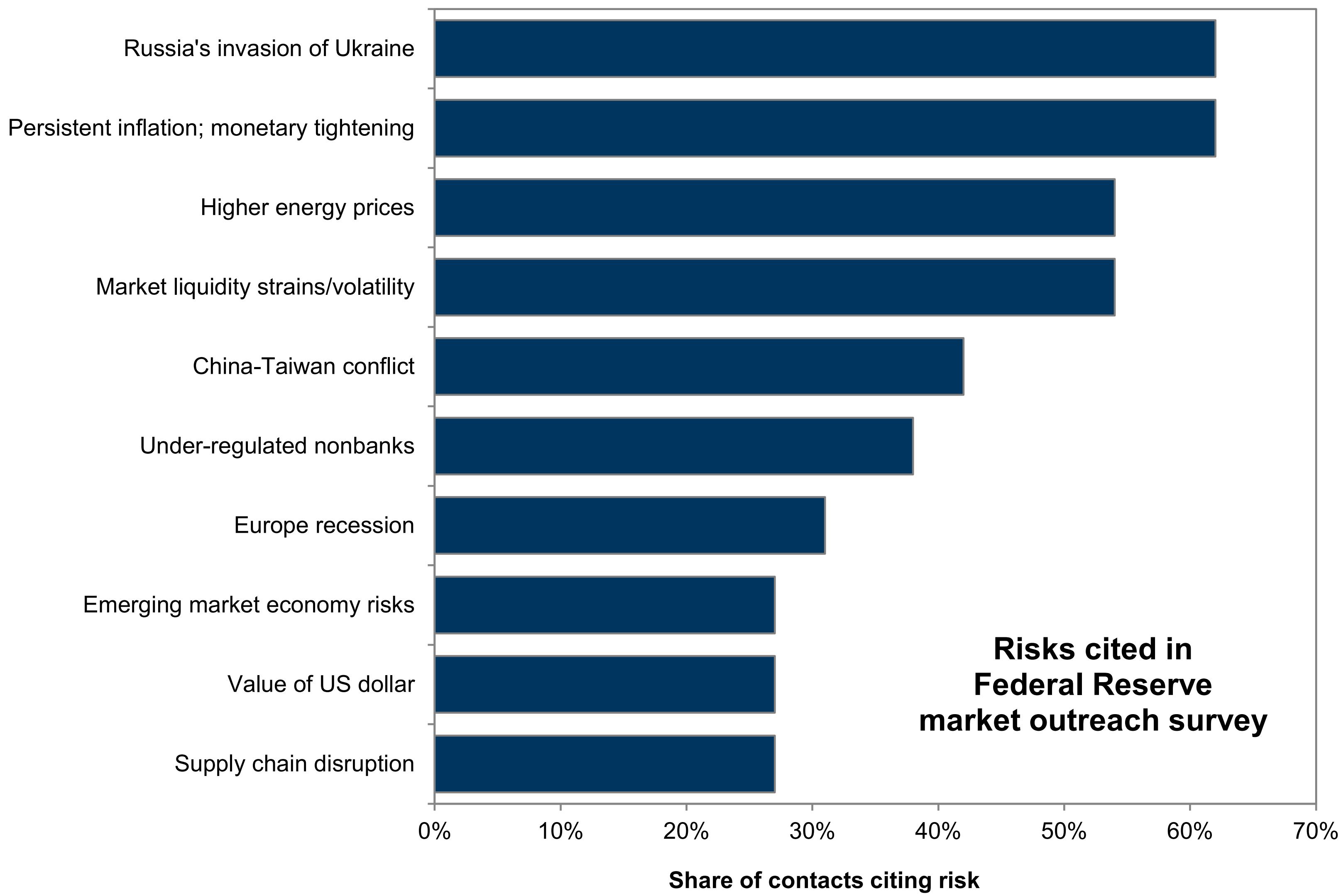


Source: Compusat, FactSet, Goldman Sachs Global Investment Research.

Goldman Sachs

Risks to the market in 2023

Risks related to geopolitics and monetary tightening top the list of concerns



Source: Federal Reserve Bank of New York, Goldman Sachs Global Investment Research.

Disclosure Appendix

Reg AC

We, David J. Kostin, Ben Snider, Ryan Hammond, Cormac Conners, Lily Calcagnini, Jenny Ma and Daniel Chavez, hereby certify that all of the views expressed in this report accurately reflect our personal views, which have not been influenced by considerations of the firm's business or client relationships.

Unless otherwise stated, the individuals listed on the cover page of this report are analysts in Goldman Sachs' Global Investment Research division.

Disclosures

Regulatory disclosures

Disclosures required by United States laws and regulations

See company-specific regulatory disclosures above for any of the following disclosures required as to companies referred to in this report: manager or co-manager in a pending transaction; 1% or other ownership; compensation for certain services; types of client relationships; managed/co-managed public offerings in prior periods; directorships; for equity securities, market making and/or specialist role. Goldman Sachs trades or may trade as a principal in debt securities (or in related derivatives) of issuers discussed in this report.

The following are additional required disclosures: Ownership and material conflicts of interest: Goldman Sachs policy prohibits its analysts, professionals reporting to analysts and members of their households from owning securities of any company in the analyst's area of coverage. Analyst compensation: Analysts are paid in part based on the profitability of Goldman Sachs, which includes investment banking revenues. Analyst as officer or director: Goldman Sachs policy generally prohibits its analysts, persons reporting to analysts or members of their households from serving as an officer, director or advisor of any company in the analyst's area of coverage. Non-U.S. Analysts: Non-U.S. analysts may not be associated persons of Goldman Sachs & Co. LLC and therefore may not be subject to FINRA Rule 2241 or FINRA Rule 2242 restrictions on communications with subject company, public appearances and trading securities held by the analysts.

Additional disclosures required under the laws and regulations of jurisdictions other than the United States

The following disclosures are those required by the jurisdiction indicated, except to the extent already made above pursuant to United States laws and regulations. **Australia:** Goldman Sachs Australia Pty Ltd and its affiliates are not authorised deposit-taking institutions (as that term is defined in the Banking Act 1959 (Cth)) in Australia and do not provide banking services, nor carry on a banking business, in Australia. This research, and any access to it, is intended only for "wholesale clients" within the meaning of the Australian Corporations Act, unless otherwise agreed by Goldman Sachs. In producing research reports, members of the Global Investment Research Division of Goldman Sachs Australia may attend site visits and other meetings hosted by the companies and other entities which are the subject of its research reports. In some instances the costs of such site visits or meetings may be met in part or in whole by the issuers concerned if Goldman Sachs Australia considers it is appropriate and reasonable in the specific circumstances relating to the site visit or meeting. To the extent that the contents of this document contains any financial product advice, it is general advice only and has been prepared by Goldman Sachs without taking into account a client's objectives, financial situation or needs. A client should, before acting on any such advice, consider the appropriateness of the advice having regard to the client's own objectives, financial situation and needs. A copy of certain Goldman Sachs Australia and New Zealand disclosure of interests and a copy of Goldman Sachs' Australian Sell-Side Research Independence Policy Statement are available at: https://www.goldmansachs.com/disclosures/australia-new-zealand/index.html. **Brazil:** Disclosure information in relation to CVM Resolution n. 20 is available at https://www.gs.com/worldwide/brazil/area/gir/index.html. Where applicable, the Brazil-registered analyst primarily responsible for the content of this research report, as defined in Article 20 of CVM Resolution n. 20, is the first author named at the beginning of this report, unless indicated otherwise at the end of the text. **Canada:** This information is being provided to you for information purposes only and is not, and under no circumstances should be construed as, an advertisement, offering or solicitation by Goldman Sachs & Co. LLC for purchasers of securities in Canada to trade in any Canadian security. Goldman Sachs & Co. LLC is not registered as a dealer in any jurisdiction in Canada under applicable Canadian securities laws and generally is not permitted to trade in Canadian securities and may be prohibited from selling certain securities and products in certain jurisdictions in Canada. If you wish to trade in any Canadian securities or other products in Canada please contact Goldman Sachs Canada Inc., an affiliate of The Goldman Sachs Group Inc., or another registered Canadian dealer. **Hong Kong:** Further information on the securities of covered companies referred to in this research may be obtained on request from Goldman Sachs (Asia) L.L.C. **India:** Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (India) Securities Private Limited, Research Analyst - SEBI Registration Number INH000001493, 951-A, Rational House, Appasaheb Marathe Marg, Prabhadevi, Mumbai 400 025, India, Corporate Identity Number U74140MH2006FTC160634, Phone +91 22 6616 9000, Fax +91 22 6616 9001. Goldman Sachs may beneficially own 1% or more of the securities (as such term is defined in clause 2 (h) the Indian Securities Contracts (Regulation) Act, 1956) of the subject company or companies referred to in this research report. **Japan:** See below. **Korea:** This research, and any access to it, is intended only for "professional investors" within the meaning of the Financial Services and Capital Markets Act, unless otherwise agreed by Goldman Sachs. Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (Asia) L.L.C., Seoul Branch. **New Zealand:** Goldman Sachs New Zealand Limited and its affiliates are neither "registered banks" nor "deposit takers" (as defined in the Reserve Bank of New Zealand Act 1989) in New Zealand. This research, and any access to it, is intended for "wholesale clients" (as defined in the Financial Advisers Act 2008) unless otherwise agreed by Goldman Sachs. Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (Asia) L.L.C., Seoul Branch. **New Zealand:** Goldman Sachs New Zealand Limited and its affiliates are neither "registered banks" nor "deposit takers" (as defined in the Reserve Bank of New Zealand Act 1989) in New Zealand. This research, and any access to it, is intended for "wholesale clients" (as defined in the Financial Advisers Act 2008) unless otherwise agreed by Goldman Sachs. A copy of certain Goldman Sachs Australia and New Zealand disclosure of interests is available at: https://www.goldmansachs.com/disclosures/australia-new-zealand/index.html. **Russia:** Research reports distributed in the Russian Federation are not advertising as defined in the Russian legislation, but are information and analysis not having product promotion as their main purpose and do not provide appraisal within the meaning of the Russian legislation on appraisal activity. Research reports do not constitute a personalized investment recommendation as defined in Russian laws and regulations, are not addressed to a specific client, and are prepared without analyzing the financial circumstances, investment profiles or risk profiles of clients. Goldman Sachs assumes no responsibility for any investment decisions that may be taken by a client or any other person based on this research report. **Singapore:** Goldman Sachs (Singapore) Pte. (Company Number: 198602165W), which is regulated by the Monetary Authority of Singapore, accepts legal responsibility for this research, and should be contacted with respect to any matters arising from, or in connection with, this research. **Taiwan:** This material is for reference only and must not be reprinted without permission. Investors should carefully consider their own investment risk. Investment results are the responsibility of the individual investor. **United Kingdom:** Persons who would be categorized as retail clients in the United Kingdom, as such term is defined in the rules of the Financial Conduct Authority, should read this research in conjunction with prior Goldman Sachs research on the covered companies referred to herein and should refer to the risk warnings that have been sent to them by Goldman Sachs International. A copy of these risks warnings, and a glossary of certain financial terms used in this report, are available from Goldman Sachs International on request.

European Union and United Kingdom: Disclosure information in relation to Article 6 (2) of the European Commission Delegated Regulation (EU) (2016/958) supplementing Regulation (EU) No 596/2014 of the European Parliament and of the Council (including as that Delegated Regulation is implemented into United Kingdom domestic law and regulation following the United Kingdom's departure from the European Union and the European Economic Area) with regard to regulatory technical standards for the technical arrangements for objective presentation of investment recommendations or other information recommending or suggesting an investment strategy and for disclosure of particular interests or indications of conflicts of interest is available at https://www.gs.com/disclosures/europeanpolicy.html which states the European Policy for Managing Conflicts of Interest in Connection with Investment Research.

Japan: Goldman Sachs Japan Co., Ltd. is a Financial Instrument Dealer registered with the Kanto Financial Bureau under registration number Kinsho 69, and a member of Japan Securities Dealers Association, Financial Futures Association of Japan and Type II Financial Instruments Firms Association. Sales and purchase of equities are subject to commission pre-determined with clients plus consumption tax. See company-specific disclosures as to any applicable disclosures required by Japanese stock exchanges, the Japanese Securities Dealers Association or the Japanese Securities Finance Company.

Global product; distributing entities

The Global Investment Research Division of Goldman Sachs produces and distributes research products for clients of Goldman Sachs on a global basis. Analysts based in Goldman Sachs offices around the world produce research on industries and companies, and research on macroeconomics, currencies, commodities and portfolio strategy. This research is disseminated in Australia by Goldman Sachs Australia Pty Ltd (ABN 21 006 797 897); in Brazil by Goldman Sachs do Brasil Corretora de Títulos e Valores Mobiliários S.A.; Public Communication Channel Goldman Sachs Brazil: 0800 727 5764 and / or contatogoldmanbrasil@gs.com. Available Weekdays (except holidays), from 9am to 6pm. Canal de Comunicação com o Público Goldman Sachs Brasil: 0800 727 5764 e/ou contatogoldmanbrasil@gs.com. Horário de funcionamento: segunda-feira à sexta-feira (exceto feriados), das 9h às 18h; in Canada by Goldman Sachs & Co. LLC; in Hong Kong by Goldman Sachs (Asia) L.L.C.; in India by Goldman Sachs (India) Securities Private Ltd.; in Japan by Goldman Sachs Japan Co., Ltd.; in the Republic of Korea by Goldman Sachs (Asia) L.L.C., Seoul Branch; in New Zealand by Goldman Sachs New Zealand Limited; in Russia by OOO Goldman Sachs; in Singapore by Goldman Sachs (Singapore) Pte. (Company Number: 198602165W); and in the United States of America by Goldman Sachs & Co. LLC. Goldman Sachs International has approved this research in connection with its distribution in the United Kingdom.

Effective from the date of the United Kingdom's departure from the European Union and the European Economic Area ("Brexit Day") the following information with respect to distributing entities will apply:

Goldman Sachs International ("GSI"), authorised by the Prudential Regulation Authority ("PRA") and regulated by the Financial Conduct Authority ("FCA") and the PRA, has approved this research in connection with its distribution in the United Kingdom.

European Economic Area: GSI, authorised by the PRA and regulated by the FCA and the PRA, disseminates research in the following jurisdictions within the European Economic Area: the Grand Duchy of Luxembourg, Italy, the Kingdom of Belgium, the Kingdom of Denmark, the Kingdom of Norway, the Republic of Finland, the Republic of Cyprus and the Republic of Ireland; GS -Succursale de Paris (Paris branch) which, from Brexit Day, will be authorised by the French Autorité de contrôle prudentiel et de resolution ("ACPR") and regulated by the Autorité de contrôle prudentiel et de resolution and the Autorité des marches financiers ("AMF") disseminates research in France; GSI - Sucursal en España (Madrid branch) authorized in Spain by the Comisión Nacional del Mercado de Valores disseminates research in the Kingdom of Spain; GSI - Sweden Bankfilial (Stockholm branch) is authorized by the SFSA as a "third country branch" in accordance with Chapter 4, Section 4 of the Swedish Securities and Market Act (Sw. lag (2007:528) om värdepappersmarknaden) disseminates research in the Kingdom of Sweden; Goldman Sachs Bank Europe SE ("GSBE") is a credit institution incorporated in Germany and, within the Single Supervisory Mechanism, subject to direct prudential supervision by the European Central Bank and in other respects supervised by German Federal Financial Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, BaFin) and Deutsche Bundesbank and disseminates research in the Federal Republic of Germany and those jurisdictions within the European Economic Area where GSI is not authorised to disseminate research and additionally, GSBE, Copenhagen Branch filial af GSBE, Tyskland, supervised by the Danish Financial Authority disseminates research in the Kingdom of Denmark; GSBE - Sucursal en España (Madrid branch) subject (to a limited extent) to local supervision by the Bank of Spain disseminates research in the Kingdom of Spain; GSBE - Succursale Italia (Milan branch) to the relevant applicable extent, subject to local supervision by the Bank of Italy (Banca d'Italia) and the Italian Companies and Exchange Commission (Commissione Nazionale per le Società e la Borsa "Consob") disseminates research in Italy; GSBE - Succursale de Paris (Paris branch), supervised by the AMF and by the ACPR disseminates research in France; and GSBE - Sweden Bankfilial (Stockholm branch), to a limited extent, subject to local supervision by the Swedish Financial Supervisory Authority (Finansinpektionen) disseminates research in the Kingdom of Sweden.

General disclosures

This research is for our clients only. Other than disclosures relating to Goldman Sachs, this research is based on current public information that we consider reliable, but we do not represent it is accurate or complete, and it should not be relied on as such. The information, opinions, estimates and forecasts contained herein are as of the date hereof and are subject to change without prior notification. We seek to update our research as appropriate, but various regulations may prevent us from doing so. Other than certain industry reports published on a periodic basis, the large majority of reports are published at irregular intervals as appropriate in the analyst's judgment.

Goldman Sachs conducts a global full-service, integrated investment banking, investment management, and brokerage business. We have investment banking and other business relationships with a substantial percentage of the companies covered by our Global Investment Research Division. Goldman Sachs & Co. LLC, the United States broker dealer, is a member of SIPC (https://www.sipc.org).

Disclosure Appendix

Our salespeople, traders, and other professionals may provide oral or written market commentary or trading strategies to our clients and principal trading desks that reflect opinions that are contrary to the opinions expressed in this research. Our asset management area, principal trading desks and investing businesses may make investment decisions that are inconsistent with the recommendations or views expressed in this research.

We and our affiliates, officers, directors, and employees, will from time to time have long or short positions in, act as principal in, and buy or sell, the securities or derivatives, if any, referred to in this research, unless otherwise prohibited by regulation or Goldman Sachs policy.

The views attributed to third party presenters at Goldman Sachs arranged conferences, including individuals from other parts of Goldman Sachs, do not necessarily reflect those of Global Investment Research and are not an official view of Goldman Sachs.

Any third party referenced herein, including any salespeople, traders and other professionals or members of their household, may have positions in the products mentioned that are inconsistent with the views expressed by analysts named in this report.

This research is focused on investment themes across markets, industries and sectors. It does not attempt to distinguish between the prospects or performance of, or provide analysis of, individual companies within any industry or sector we describe.

Any trading recommendation in this research relating to an equity or credit security or securities within an industry or sector is reflective of the investment theme being discussed and is not a recommendation of any such security in isolation.

This research is not an offer to sell or the solicitation of an offer to buy any security in any jurisdiction where such an offer or solicitation would be illegal. It does not constitute a personal recommendation or take into account the particular investment objectives, financial situations, or needs of individual clients. Clients should consider whether any advice or recommendation in this research is suitable for their particular circumstances and, if appropriate, seek professional advice, including tax advice. The price and value of investments referred to in this research and the income from them may fluctuate. Past performance is not a guide to future performance, future returns are not guaranteed, and a loss of original capital may occur. Fluctuations in exchange rates could have adverse effects on the value or price of, or income derived from, certain investments.

Certain transactions, including those involving futures, options, and other derivatives, give rise to substantial risk and are not suitable for all investors. Investors should review current options and futures disclosure documents which are available from Goldman Sachs sales representatives or at https://www.theocc.com/about/publications/character-risks.jsp and https://www.fiadocumentation.org/fia/regulatory-disclosures_1/fia-uniform-futures-and-options-on-futures-risk-disclosures-booklet-pdf-version-2018. Transaction costs may be significant in option strategies calling for multiple purchase and sales of options such as spreads. Supporting documentation will be supplied upon request.

Differing Levels of Service provided by Global Investment Research: The level and types of services provided to you by the Global Investment Research division of GS may vary as compared to that provided to internal and other external clients of GS, depending on various factors including your individual preferences as to the frequency and manner of receiving communication, your risk profile and investment focus and perspective (e.g., marketwide, sector specific, long term, short term), the size and scope of your overall client relationship with GS, and legal and regulatory constraints. As an example, certain clients may request to receive notifications when research on specific securities is published, and certain clients may request that specific data underlying analysts' fundamental analysis available on our internal client websites be delivered to them electronically through data feeds or otherwise. No change to an analyst's fundamental research views (e.g., ratings, price targets, or material changes to earnings estimates for equity securities), will be communicated to any client prior to inclusion of such information in a research report broadly disseminated through electronic publication to our internal client websites or through other means, as necessary, to all clients who are entitled to receive such reports.

All research reports are disseminated and available to all clients simultaneously through electronic publication to our internal client websites. Not all research content is redistributed to our clients or available to third-party aggregators, nor is Goldman Sachs responsible for the redistribution of our research by third party aggregators. For research, models or other data related to one or more securities, markets or asset classes (including related services) that may be available to you, please contact your GS representative or go to https://research.gs.com.

Disclosure information is also available at https://www.gs.com/research/hedge.html or from Research Compliance, 200 West Street, New York, NY 10282.