

## US Daily: A Hot Streak for GDP and GDPNow (Hill)

- Strong data has driven Q3 growth expectations sharply higher over the last two months, with consensus rising from +0.5% in mid-August to +4.3% currently—and our own forecast rising from +1.5% to +4.6%. However, one Q3 GDP forecast has been elevated all along: the Atlanta Fed's GDPNow model, which currently points to an eye-popping +5.4%.
- GDPNow is historically less useful early in the quarter, and this could explain why consensus did not place more weight on its late-summer strength. Analyzing its live track record, we find that GDPNow's accuracy improves closer to the release, outperforming consensus at a 2- to 4-week forecast horizon. Moreover, GDPNow has enjoyed a recent hot streak—consistently outperforming consensus day-ahead GDP forecasts throughout 2022 and so far in 2023.
- In terms of this Thursday's report, nearly all of the divergence between our +4.6% forecast and GDPNow at +5.4% reflects the government spending and inventory components—as opposed to the fixed investment and net trade categories in which GDPNow has recently excelled. That being said, the uptrend in state and local payrolls and construction spending suggests scope for another strong gain in that sector, and given GDPNow's +3.3% assumption, we have boosted our state and local GDP growth forecast from +0.8% to +2.5% (qoq ar). We remain well below GDPNow on inventories (+0.2pp contribution to GDP growth vs. GDPNow at +0.7pp), in part because we expect a drawdown in the oil and farm segments.

### Jan Hatzius

+1(212)902-0394 | jan.hatzius@gs.com  
Goldman Sachs & Co. LLC

### Alec Phillips

+1(202)637-3746 | alec.phillips@gs.com  
Goldman Sachs & Co. LLC

### David Mericle

+1(212)357-2619 | david.mericle@gs.com  
Goldman Sachs & Co. LLC

### Spencer Hill, CFA

+1(212)357-7621 | spencer.hill@gs.com  
Goldman Sachs & Co. LLC

### Ronnie Walker

+1(917)343-4543 | ronnie.walker@gs.com  
Goldman Sachs & Co. LLC

### Tim Krupa

+1(202)637-3771 | tim.krupa@gs.com  
Goldman Sachs & Co. LLC

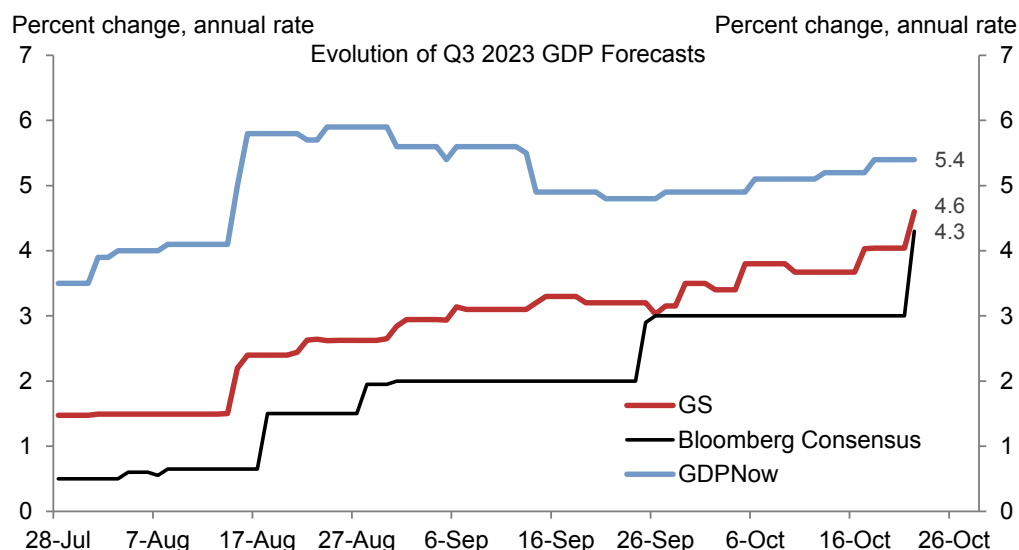
### Manuel Abecasis

+1(212)902-8357 | manuel.abecasis@gs.com  
Goldman Sachs & Co. LLC

## A Hot Streak for GDP and GDPNow

Strong data has driven Q3 growth expectations sharply higher over the last two months. As shown by the black line in Exhibit 1, consensus now expects a 4.3% annualized gain in this Thursday's Q3 GDP report, up from just +0.5% at the start of the quarter. And the one Q3 forecast that has been elevated all along —the Atlanta Fed's GDPNow model—now points to an eye-popping 5.4% pace (blue line).

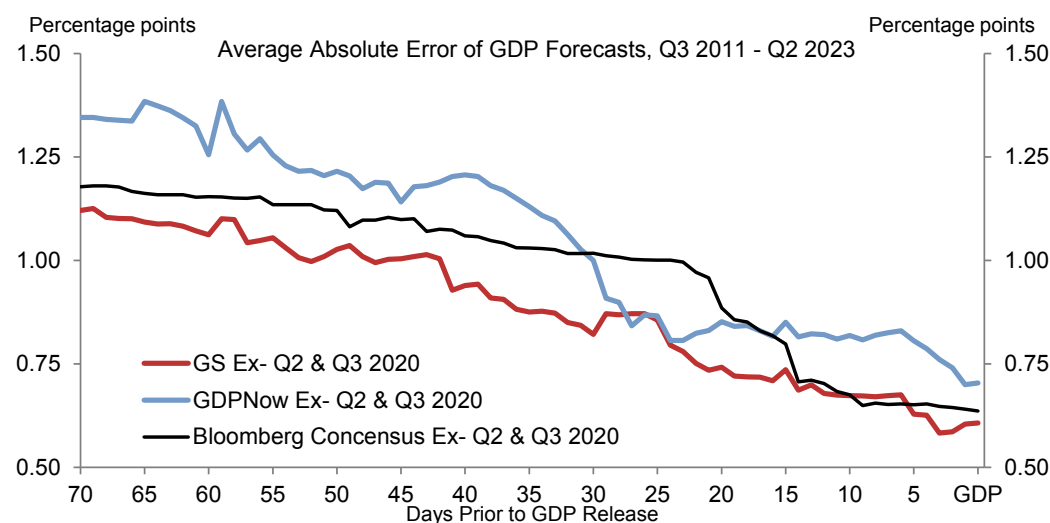
**Exhibit 1: Growth Expectations Have Steadily Increased Over the Course of Q3, Converging Upward Toward the Atlanta Fed's GDPNow Model**



Source: Bloomberg LP, Federal Reserve Bank of Atlanta, Goldman Sachs Global Investment Research

In Exhibit 2, we compare GDPNow's forecasting track record against consensus and our own GDP tracking estimates, excluding the Covid lockdown quarter and subsequent reopening quarter.<sup>1</sup> The x-axis represents the forecast horizon, specifically, the number of days until the advance GDP reading is published.

<sup>1</sup> We exclude Q2 and Q3 of 2020 because GDPNow does not incorporate any public health information into its estimates, and we believe the underperformance of GDPNow during those quarters provides little information on its accuracy in normal times. We include the 2011-14 period, which simulates the live performance of GDPNow based on real-time source data.

**Exhibit 2: The GDPNow Model Is Often Volatile Early in the Quarter (Before Most Source Data Is Released)**

Source: Bloomberg LP, Federal Reserve Bank of Atlanta, Goldman Sachs Global Investment Research

As shown by the blue line, GDPNow's large historical errors early in the quarter would caution against placing much weight on GDPNow until more of the source data has been released. This early-quarter volatility may explain why consensus forecasters—ourselves included—did not place more weight on the strength in GDPNow during August and September of this year. A related possibility is that consensus anchored its Q3 GDP estimate to its initial forecast of +0.5%—which itself reflected expectations of imminent recession.<sup>2</sup>

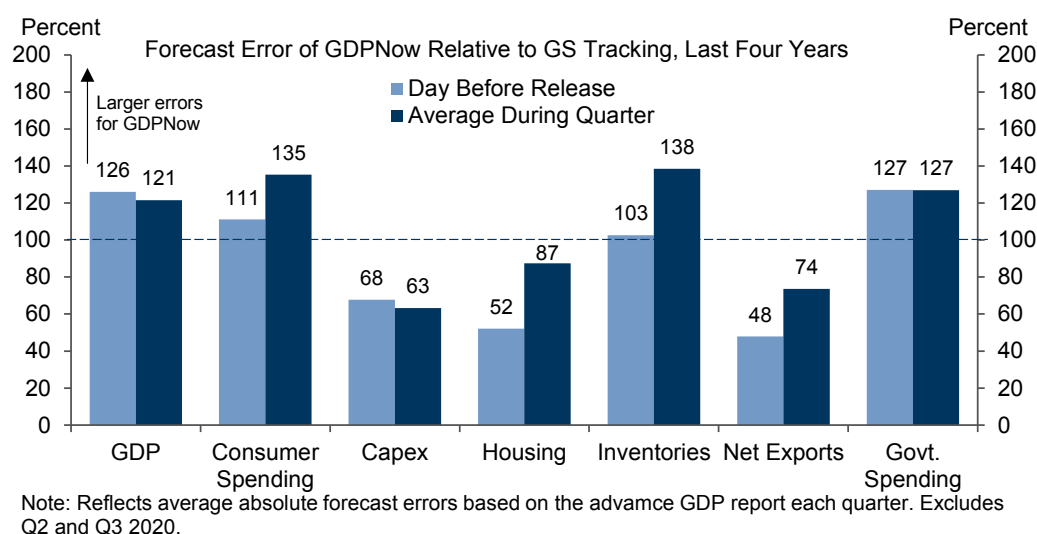
Closer to the release, we find that GDPNow provides a useful signal—outperforming the median forecast of economists at a 2- to 4-week forecast horizon. GDPNow has also enjoyed a hot streak more recently—consistently outperforming GDP consensus on a day-ahead basis throughout 2022 and so far in 2023, and in 9 of the last 10 advance readings.

To explore the component-level drivers of this outperformance, in Exhibit 3 we summarize GDPNow's track record over the last four years relative to our own forecasts.<sup>3</sup> Both on a day-ahead basis and on average during the quarter being forecasted, GDPNow exhibits lower average errors for business fixed investment (capex), residential investment (housing), and foreign trade (net exports). We also find similar average errors for the inventory component on a day-ahead basis (but higher errors earlier in the quarter).

<sup>2</sup> If so, consensus may not fully incorporate the implications of stronger source data. Indeed, first-reported GDP growth has exceeded consensus in 3 of the last 4 quarters, and we might expect an objective model like Atlanta Fed to outperform in such an environment. This logic would also argue for a better-than-expected report this Thursday given continued recession fears.

<sup>3</sup> Consensus information on GDP subcomponents is sparse and often unreliable, so we compare GDPNow to our own estimates instead. We again exclude the pandemic lockdown and summer 2020 reopening quarters.

### Exhibit 3: GDPNow Has Performed Particularly Well in Forecasting Fixed Investment and Foreign Trade In Recent Years



Source: Goldman Sachs Global Investment Research

In terms of this Thursday's GDP report, GDPNow currently projects 5.4% annualized growth, 0.8pp above our forecast and 1.1pp above consensus. However, as shown in Exhibit 4, nearly all of the divergence relative to our forecast reflects government spending and inventories—as opposed to the fixed investment and net trade categories in which GDPNow has recently excelled.

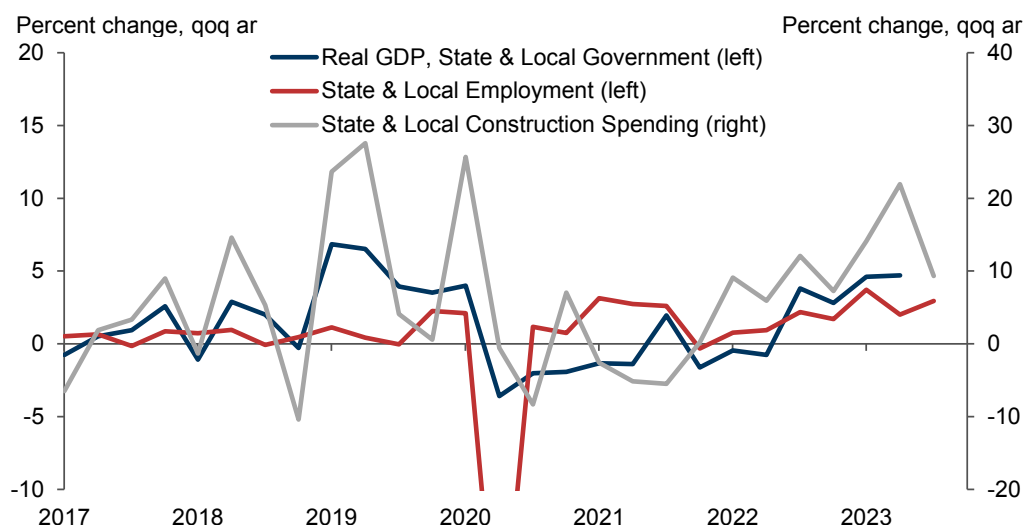
### Exhibit 4: GDPNow's +5.4% Estimate for Q3 Reflects Relatively Strong Contributions from Government and Inventories

Q3 GDP Forecasts, Q/Q AR			
	GS	Atlanta Fed GDPNow	Consensus
<b>Real GDP</b>	<b>4.6</b>	<b>5.4</b>	<b>4.3</b>
Consumer Expenditure	4.0	4.1	4.0
Business Fixed Investment	0.7	1.6	
Residential Investment	2.1	4.8	
Government Spending	2.1	3.1	
<i>Contribution from:</i>			
Net Exports	1.1	1.0	
Inventories	0.2	0.7	

Source: Goldman Sachs Global Investment Research, Bloomberg LP

With respect to government spending—for which the advance GDP reading relies in large part on budget information and BEA assumptions—the source data available do indeed suggest the possibility of another strong quarter in the state and local segment (see Exhibit 5). Given this and given GDPNow's +3.3% assumption, we have boosted our own state and local estimate from +0.8% to +2.5% (qoq ar). In contrast, we see no clearcut argument for above-normal growth in the federal segment (GS +1.5%, GDPNow +2.7%).

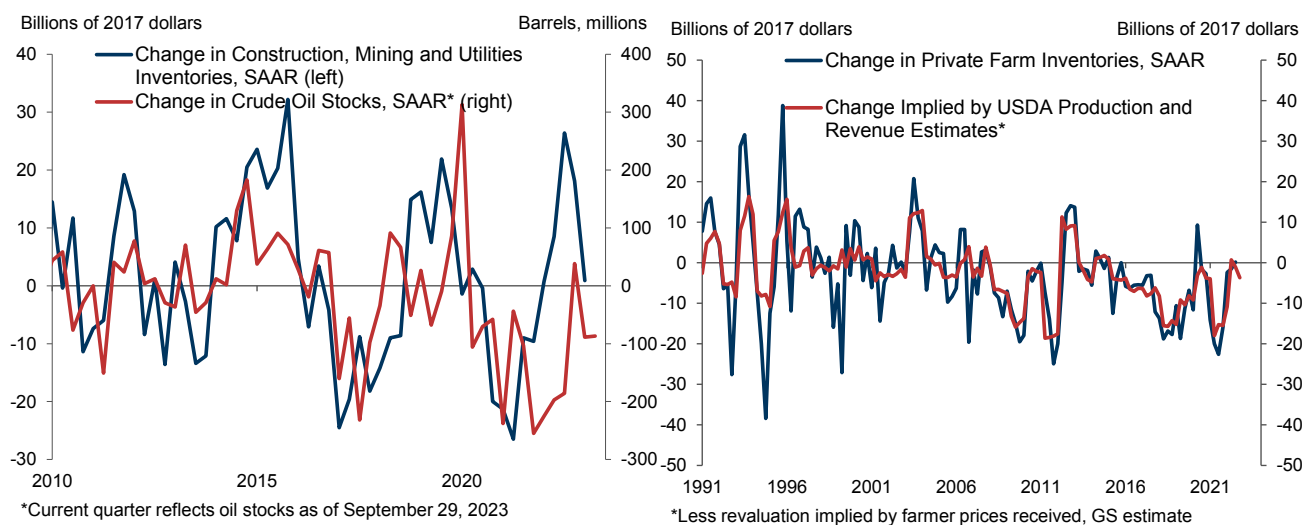
### Exhibit 5: The Uptrend in State & Local Payrolls and Constructing Spending Creates Scope for Another Strong GDP Gain in That Sector



Source: Haver Analytics, Goldman Sachs Global Investment Research

Turning to inventories, GDPNow projects a +0.7pp contribution to GDP growth, compared to our projection of +0.2pp. As shown in Exhibit 6, we are assuming a \$12bn GDP drag (or -0.25pp on GDP growth) from drawdowns in the oil and agriculture sector. We also expect a 0.3pp drag from the inventory valuation adjustment (IVA) due to higher energy and intermediate goods prices during the quarter.

### Exhibit 6: We Expect a \$12bn GDP Drag from Drawdowns of Oil and Farm Inventories



Source: Bloomberg LP, Haver Analytics, Department of Agriculture, Department of Energy, Goldman Sachs Global Investment Research

Taken together, we estimate a +4.6% annualized gain in this Thursday's advance Q3 GDP reading—above consensus of +4.3% and more than double the +2.1% pace in Q2, but below GDPNow of +5.4%.

---

**Spencer Hill**

*We thank Jessica Rindels for her contribution to this report.*

# Disclosure Appendix

## Reg AC

We, Jan Hatzius, Alec Phillips, David Mericle, Spencer Hill, CFA, Ronnie Walker, Tim Krupa and Manuel Abecasis, 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 Global Investment Research 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 U71410MH2006FTC160634, 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. Investment in securities market are subject to market risks. Read all the related documents carefully before investing. Registration granted by SEBI and certification from NISM in no way guarantee performance of the intermediary or provide any assurance of returns to investors. Goldman Sachs (India) Securities Private Limited Investor Grievance E-mail: [india-client-support@gs.com](mailto:india-client-support@gs.com). Compliance Officer: Anil Rajput | Tel: + 91 22 6616 9000 | Email: [anil.m.rajput@gs.com](mailto:anil.m.rajput@gs.com). **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. 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 Type II Financial Instruments Firms Association, The Investment Trusts Association, Japan, and Japan Investment Advisers 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

Goldman Sachs Global Investment Research 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 Brasil: 0800 727 5764 and / or [contatogoldmanbrasil@gs.com](mailto: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](mailto: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.

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 and the Republic of Ireland; GSI - Succursale de Paris (Paris branch) which is authorised by the French Autorité de contrôle prudentiel et de résolution ("ACPR") and regulated by the Autorité de contrôle prudentiel et de résolution and the Autorité des marchés 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 (Sv. 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 (Finansinspektionen) 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 Global Investment Research. Goldman Sachs & Co. LLC, the United States broker dealer, is a member of SIPC (<https://www.sipc.org>).

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](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 Goldman Sachs Global Investment Research 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.

© 2023 Goldman Sachs.

**No part of this material may be (i) copied, photocopied or duplicated in any form by any means or (ii) redistributed without the prior written consent of The Goldman Sachs Group, Inc.**