US Auto & Industrial Tech

US EV market view for 2024; TSLA 4Q deliveries preview; updating EV charging industry model

Mark Delaney, CFA
+1(212)357-0535 | mark.delaney@gs.com
Goldman Sachs & Co. LLC

Will Bryant
+1(212)934-4705 | will.bryant@gs.com
Goldman Sachs & Co. LLC

Morgan Leung
+1(212)934-4683 | morgan.leung@gs.com
Goldman Sachs & Co. LLC

Aman Gupta
+1(212)357-1549 | aman.s.gupta@gs.com
Goldman Sachs & Co. LLC

We believe a key debate and focus for investors in 2024 relates to the rate of EV growth. US EV (BEV) sales are up nearly 50% YTD in 2023, accounting for about 8% of industry sales in recent months and tracking to about 1.2 mn vehicles for the year. However, some OEMs have been struggling to meet their targets, sales volumes of several models have plateaued in recent months even as incentives have risen, and certain OEMs are moderating future EV investment plans (e.g., Ford and GM).

Importantly, we believe that in 2024 (and 2025) new vehicle models and generally lower EV vehicle prices (including point of sale deductibility for IRA credits) will help to support solid EV growth, and we estimate 2024 EV sales in the US will grow about 25% yoy to roughly 1.5 mn (although we recognize this is a meaningful deceleration from the ~50% rate in 2023). Long-term we continue to expect EVs to outgrow the market from the combination (and flywheel effect) of regulations, improving EV economics, and over time rising consumer preference (especially as EVs become more affordable, more models come to market, and charging coverage improves). With some geographies banning the sale of ICE vehicles from the 2035 timeframe, and autos being a long-cycle industry, we do not believe the management teams and boards of traditional OEMs can plan to rely on ICE businesses for the next 10-20 years, and EV market leaders such as BYD and Tesla have shown the potential profitability of EVs.

We show how much auto tier 1 and electronic component stocks have been impacted by EV risk-off sentiment in the market in this note, and we believe APTV and TEL remain especially well positioned for the EV transition given that they each have broad-based OEM exposure (including to leaders such as Tesla and BYD) and a material increase in content per vehicle on a BEV vs. ICE car (about 2X for TEL and 2-3X for APTV).

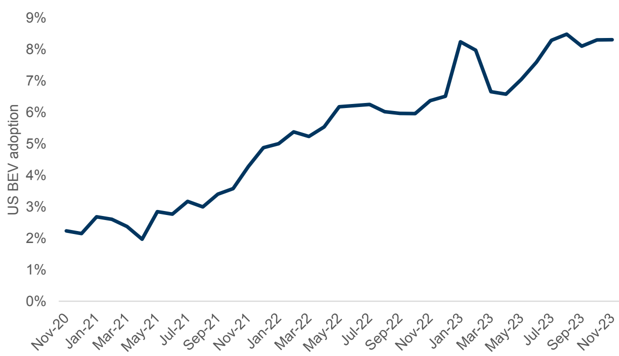
Separately, we believe that Tesla will report 4Q23 deliveries of about 480K, roughly in line with Visible Alpha consensus at 483K, although we believe deliveries will be back-end weighted.

US EV sales continue to outpace the market, although sales of some models have

recently plateaued

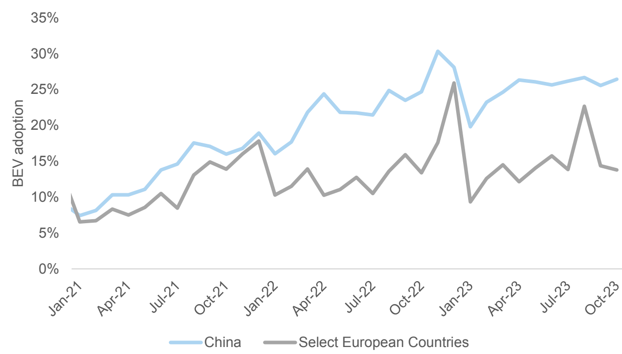
US EV market volume growth has been relatively strong in 2023, with EV sales up nearly 50% yoy in 2023 and accounting for about 8% of industry sales in recent months per Motor Intelligence (Autodata). EV volumes are tracking to about 1.2 mn units for the year. US EV (BEV) mix trails both Europe (where sales are up 34% YTD and tracking to a mid teens percent of the market) and China (where EV sales are up about 25% YTD and make up 25-30% of industry sales).

Exhibit 1: YTD BEV adoption is tracking to 7-8% of total sales
US BEV penetration



Source: Autodata, US Bureau of Economic Analysis (BEA), Wards

Exhibit 2: China BEV adoption is tracking to 25-30% of sales and Europe BEV adoption is tracking to a mid-teens percent in 2023



Source: CPCA, Goldman Sachs Global Investment Research, IHS

Although EV sales are up yoy, sales in the US of several models have trended generally sideways the last several months per Motor Intelligence including Model Y, Model 3, ID.4, Chevy Bolt and the Mustang Mach-E (Exhibit 3).

Exhibit 3: Sales of key EV models in the US

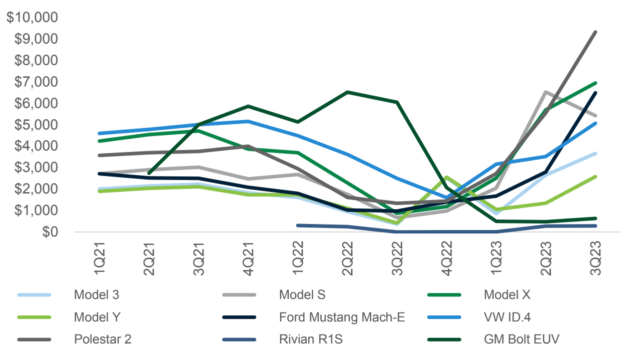
US EV unit sales by key models													
Vehicle model	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	TTM
Tesla Model Y	20664	30170	33782	34727	32960	33503	35781	35888	35059	31385	30906	31171	385996
Tesla Model 3	18868	19934	22320	20012	18994	19307	19680	19738	19283	17493	17227	17374	230230
Chevrolet Bolt EUV	4590	3702	4827	4279	3017	2183	3318	2452	2933	3408	3391	2840	40940
Ford Mustang Mach-E	4775	2626	1783	998	1606	2917	4110	3937	5033	5872	2732	4294	40683
Volkswagen ID.4	4043	3426	3031	3301	1494	2360	2836	3151	3471	4085	3464	3099	37761
Hyundai Ioniq 5	1720	1548	2074	2114	2323	2446	3136	4135	3572	3958	2979	2372	32377
Tesla Model X	2246	2155	2413	2354	2235	2271	2385	2393	2337	1544	1520	1533	25386
Chevrolet Bolt	2204	2497	2113	2282	1690	1731	2020	2060	2664	2318	1729	1048	24356
Ford F-Series Electric	2359	2264	404	691	1335	1707	1424	1552	1018	933	3712	4393	21792
Tesla Model S	3145	1616	1810	1766	1676	1704	1789	1794	1753	1029	1013	1022	20117
Kia EV6	1107	1110	1294	988	1241	2237	1458	1937	2449	2084	1542	1290	18737
Rivian R1S	114	97	175	280	347	420	170	2125	2496	3017	2744	2799	14784
Hyundai Ioniq 6				222	890	971	1162	1745	1663	1665	1239	1386	10943
Cadillac LYRIQ	32	233	449	286	422	452	474	1482	943	593	904	998	7268

Source: Autodata

Incentives have also been rising for several models (Exhibit 4 and Exhibit 5).

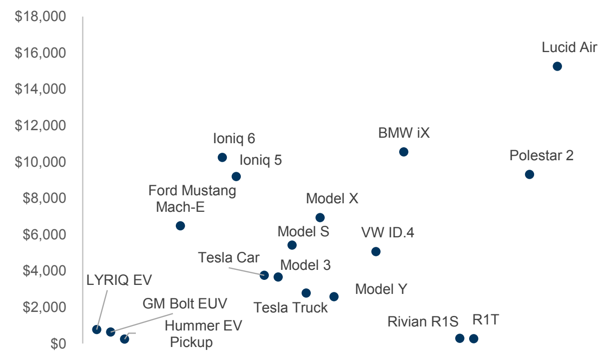
Exhibit 4: Incentives for key EV models have risen in recent quarters

Incentives for key EV models



Source: Autodata

Exhibit 5: Incentives for key EV models in 3Q23

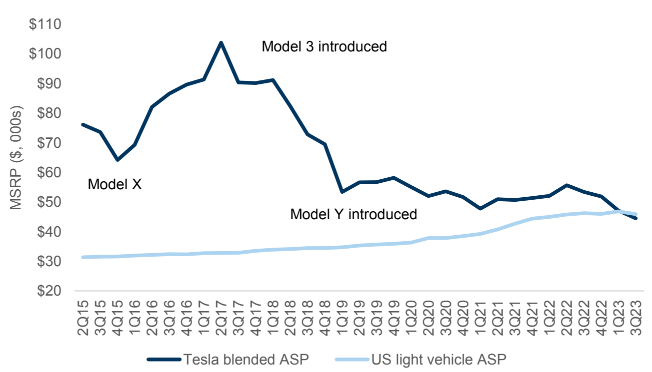


Source: Autodata

In certain categories like pickup trucks we believe slower than expected EV demand is due to premium pricing and/or limits for some potential use cases (e.g., range being impacted by towing). For other potential EV buyers, charging considerations and/or a lack of vehicle choice may be factors (and we recognize for example there is limited supply of more economical options in certain vehicle segments like full-sized SUVs).

We also believe that Tesla's price reductions this year have likely hindered sales of competitor products especially in crossovers and sedans (to the extent competitor vehicles offer less range and lack access to the full Tesla charging network, but are priced at a premium). That said, Tesla has suggested that there may be only so much interest for certain vehicles like Model Y, given how successful it has already been. Importantly, we see cost as less of an issue in sedans and crossovers, with Tesla's blended global prices on par with the average price of a new vehicle in the US in the mid $40K range (and pricing is especially attractive when considering potential consumer IRA tax credits).

Exhibit 6: Tesla's blended ASP is now similar to the average US LV ASP

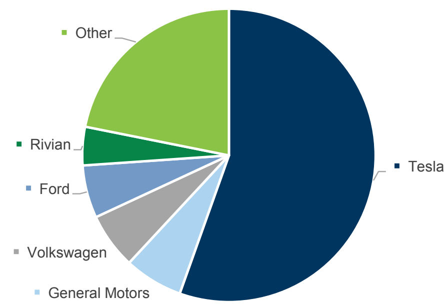


Source: Company data, US Bureau of Economic Analysis (BEA), Goldman Sachs Global Investment Research

Tesla has been able to maintain a strong share of the US EV market with over 50%

share YTD per Motor Intelligence, which we attribute in part to its reduced prices but also vehicle features (e.g., range, acceleration, safety and software) as well as access to the full Tesla charging network.

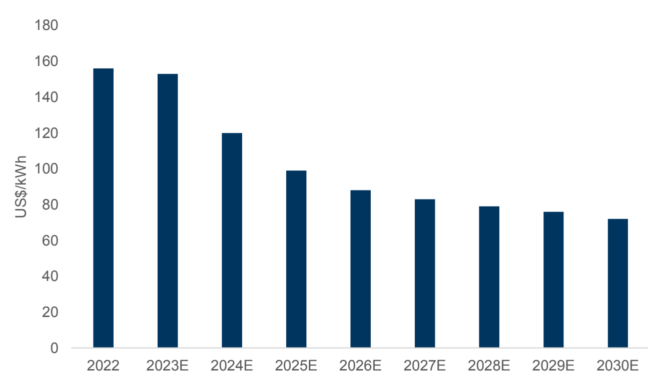
Exhibit 7: Tesla has a strong market position with over 50% market share in the US YTD
YTD US EV market share by OEM



Source: Autodata, Company data

We believe point of sale IRA deductibility (i.e., buyers can receive IRA credits when they purchase a vehicle rather than waiting until filing taxes, although we recognize some vehicles will likely lose credits including some SKUs of Model 3) and increased vehicle choice from new launches and/or expanded supply (e.g., EV9, R1S, Equinox, and potentially a refreshed Model 3) will generally help EV growth in 2024. Moreover, EV battery prices are falling. Our GS colleagues estimate that battery pricing for the industry could fall by about 35% from 2023 to 2025. We believe this will also lead to reduced EV pricing for consumers.

Exhibit 8: GS battery analysts expect battery prices to fall over time
Global average battery pack prices



Source: Company data, Goldman Sachs Global Investment Research, Wood Mackenzie, SNE Research, BNEF

We also note that charging agreements amongst major OEMs in North America could support increased EV adoption (i.e., Tesla opening parts of its Supercharger network to other EV customers including those of Ford, General Motors, and Rivian).

We believe that companies in our coverage that are best positioned for the EV transition include TEL and APTV, with both companies having higher content on a BEV vs. an ICE vehicle (about 2X for TEL and 2-3X more for APTV) as well as broad-based OEM exposure (including selling to Tesla and BYD). As we show in Exhibit 9, several companies have been impacted by EV risk-off market sentiment, in particular APTV and VC.

Exhibit 9: Tier 1 suppliers in our coverage (APTV, VC) are laggards when comparing relative stock performance and EPS revisions

	Change in consensus EPS estimates since 3Q report	Stock performance relative to S&P 500			Estimate changes vs. stock performance	3Q EPS Result vs. consensus		*CY23 Guidance vs. consensus at the mid-point	
Tier 1 Suppliers	2023	1 trading session post 3Q report	1 trading session post 3Q report-Current	Before 3Q report-Current	Dif between relative stock performance and EPS revision	% dif	Beat/Miss	% dif	Beat/Miss
BWA	-0.7%	-15.0%	-5.3%	-20.9%	-20.2%	4%	Beat	-4%	Miss
VC	2.7%	4.1%	-18.5%	-14.3%	-17.1%	22%	Beat	1%	Beat
APTV	0.4%	-12.2%	-3.3%	-16.3%	-16.7%	5%	Beat	0%	In line
LEA	3.6%	4.1%	-14.6%	-10.4%	-14.0%	10%	Beat	2%	Beat
GNTX	0.3%	-6.9%	-3.6%	-11.2%	-11.5%	2%	Beat	-1%	Miss
MGA	4.1%	8.2%	-5.4%	2.9%	-1.2%	9%	Beat	5%	Beat
Tier 1 average	**1.7%**	**-2.9%**	**-8.4%**	**-11.7%**	**-13.4%**	**8.8%**		**0.4%**	
Tier 1 median	**1.5%**	**-1.4%**	**-5.3%**	**-12.8%**	**-15.3%**	**7.3%**		**0.7%**	
**Electronic Components									
ST	-2.3%	-7.2%	-2.9%	-10.8%	-8.5%	1%	Beat	-11%	Miss
TEL	0.0%	3.2%	1.2%	4.8%	4.7%	1%	Beat	0%	In line
APH	1.1%	1.9%	8.2%	10.5%	9.4%	5%	Beat	0%	In line
Electronic components average	**-0.4%**	**-0.7%**	**2.2%**	**1.5%**	**1.9%**	**2.6%**		**-3.6%**	
Electronic components median	**0.0%**	**1.9%**	**1.2%**	**4.8%**	**4.7%**	**1.3%**		**-0.2%**	

*BWA, APTV, MGA use adj. EPS; LEA and GNTX use adj. EBIT; VC uses adj. EBITDA for CY23 guidance
**ST, TEL, APH use 4QCY23 EPS guidance

Source: FactSet, Company data

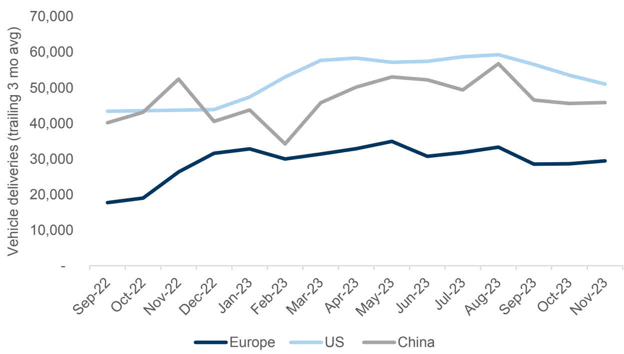
Tesla 4Q deliveries preview - expect about 480K

We believe that Tesla will report 4Q23 deliveries of about 480K (up about 10% qoq), roughly in line with Visible Alpha Consensus Data at 483K, although we believe deliveries will be back-end weighted. Tesla will likely report deliveries on or about January 2nd.

While trailing 3-month sales in Europe, China (per the CPCA) and the US (per Motor Intelligence) are relatively flat sequentially (Exhibit 10), November production in China reached over 90K units per CPCA data (and a new high; Exhibit 11) which we believe implies Tesla is preparing for a stronger December. In addition, Tesla insurance registrations in China have ranged between 15-18K in recent weeks implying a solid 4Q for China.

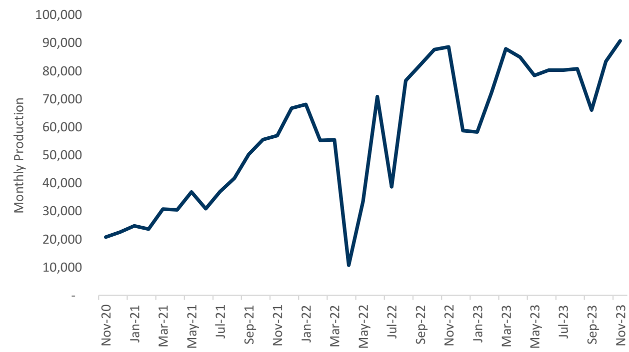
We also expect a strong close in Europe, with some of the China production for exports to Europe. Sales in European countries that report daily registrations through the first week of December are up a mid single digit percent vs. the first week of September (i.e. comparing the last month of each quarter).

Exhibit 10: Tesla vehicle deliveries by region (trailing 3 month average)



Source: Autodata, CPCA

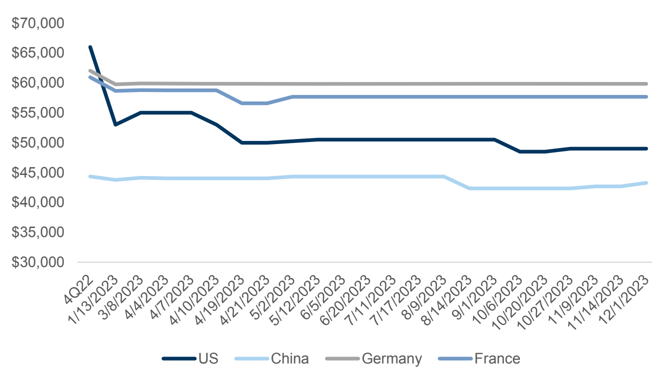
Exhibit 11: Tesla's monthly production in China hit an all-time high in November



Source: CPCA

We believe the recent slight increases to Model Y list pricing in China is also a positive sign for near-term momentum in that region. However, we note that Tesla has used discounts and incentives on new vehicles acquired out of inventory, including in the US for Models 3 and Y. We believe this suggests a more measured 4Q in the US.

Exhibit 12: Tesla Model Y Long Range prices have come down YTD in the US, China, and France



Source: Company data, Goldman Sachs Global Investment Research

We are Neutral-rated on Tesla shares. Our 12-month price target remains $235 and is still based on 45X Q5-Q8 EPS including SBC. Key downside/upside risks to our view relate to increase competition in the EV space, key person risk, delays/earlier releases with products/capabilities, and a larger/earlier impact from AI-enabled products.

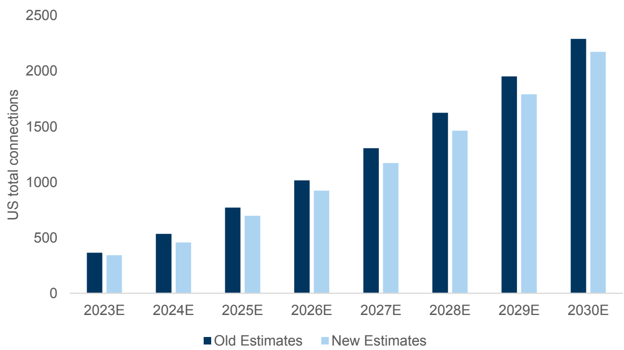
Charging forecast update

We are adjusting our EV charging forecast reflecting the changes we made to our BEV volume forecast on 11/13, with the total outlook relatively similar but with slower growth in the US offset by modestly higher global deployments.

In the US market, we believe that charging builds have been more measured due to macroeconomic headwinds (with corporations/enterprises deferring capex), work-from-home (allowing some companies with workplace charging for employees to invest more slowly), and reduced EV investment plans (including car dealerships adjusting to slower EV investment ramp plans from OEMs like Ford and GM).

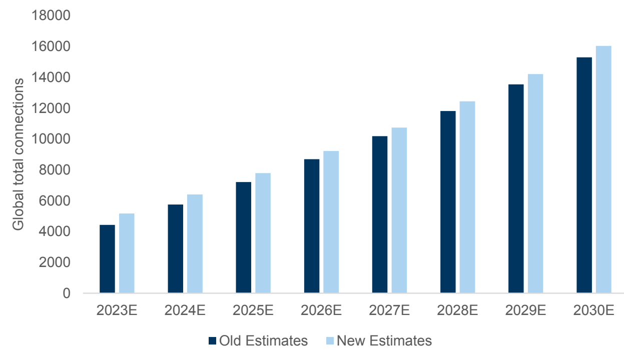
However, we still expect the total number of public charging points to grow at a roughly 20% CAGR over the next five years globally, and at a more than 30% CAGR in the US.

Exhibit 13: Old vs. new US total connections GS estimates



Source: Goldman Sachs Global Investment Research

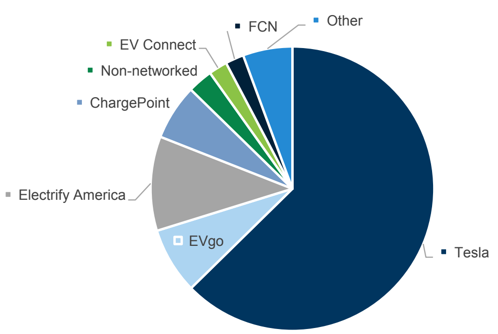
Exhibit 14: Old vs new gloabl total connections GS estimates



Source: Goldman Sachs Global Investment Research

In the US market, Tesla remains the leader in DC charging with about 2/3 of the connection points according to the Alternative Fuels Data Center (AFDC).

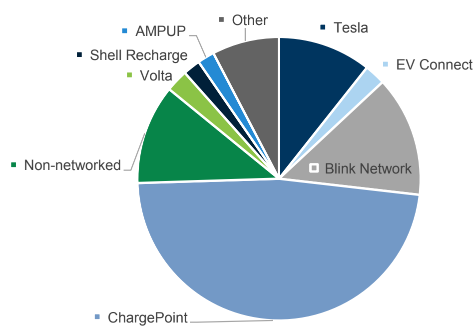
Exhibit 15: Tesla is a leader in the US DCFC market
US DCFC market share



December 2023

Source: AFDC

Exhibit 16: ChargePoint has nearly 50% of the US L2 charging market
US L2 market share



December 2023

Source: AFDC

Price targets and key risks

We are Buy-rated on TEL shares. Our 12-month price target of $175 is based on 20X our normalized EPS estimate. Key downside risks to our thesis relate to auto demand, margins, CPV growth, and the macro environment.

We are Buy-rated on APTV shares. Our 12-month price target of $128 is based on 18X our normalized EPS estimate. Key risks to our view relate to Aptiv's ability to grow its content per vehicle ahead of industry production, the auto cycle, Aptiv's market share, margins, Aptiv's net debt position, and component shortages in the auto supply chain.

Disclosure Appendix

Reg AC

We, Mark Delaney, CFA, Will Bryant, Morgan Leung and Aman Gupta, hereby certify that all of the views expressed in this report accurately reflect our personal views about the subject company or companies and its or their securities. We also certify that no part of our compensation was, is or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

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

GS Factor Profile

The Goldman Sachs Factor Profile provides investment context for a stock by comparing key attributes to the market (i.e. our coverage universe) and its sector peers. The four key attributes depicted are: Growth, Financial Returns, Multiple (e.g. valuation) and Integrated (a composite of Growth, Financial Returns and Multiple). Growth, Financial Returns and Multiple are calculated by using normalized ranks for specific metrics for each stock. The normalized ranks for the metrics are then averaged and converted into percentiles for the relevant attribute. The precise calculation of each metric may vary depending on the fiscal year, industry and region, but the standard approach is as follows:

Growth is based on a stock's forward-looking sales growth, EBITDA growth and EPS growth (for financial stocks, only EPS and sales growth), with a higher percentile indicating a higher growth company. **Financial Returns** is based on a stock's forward-looking ROE, ROCE and CROCI (for financial stocks, only ROE), with a higher percentile indicating a company with higher financial returns. **Multiple** is based on a stock's forward-looking P/E, P/B, price/dividend (P/D), EV/EBITDA, EV/FCF and EV/Debt Adjusted Cash Flow (DACF) (for financial stocks, only P/E, P/B and P/D), with a higher percentile indicating a stock trading at a higher multiple. The **Integrated** percentile is calculated as the average of the Growth percentile, Financial Returns percentile and (100% - Multiple percentile).

Financial Returns and Multiple use the Goldman Sachs analyst forecasts at the fiscal year-end at least three quarters in the future. Growth uses inputs for the fiscal year at least seven quarters in the future compared with the year at least three quarters in the future (on a per-share basis for all metrics).

For a more detailed description of how we calculate the GS Factor Profile, please contact your GS representative.

M&A Rank

Across our global coverage, we examine stocks using an M&A framework, considering both qualitative factors and quantitative factors (which may vary across sectors and regions) to incorporate the potential that certain companies could be acquired. We then assign a M&A rank as a means of scoring companies under our rated coverage from 1 to 3, with 1 representing high (30%-50%) probability of the company becoming an acquisition target, 2 representing medium (15%-30%) probability and 3 representing low (0%-15%) probability. For companies ranked 1 or 2, in line with our standard departmental guidelines we incorporate an M&A component into our target price. M&A rank of 3 is considered immaterial and therefore does not factor into our price target, and may or may not be discussed in research.

Quantum

Quantum is Goldman Sachs' proprietary database providing access to detailed financial statement histories, forecasts and ratios. It can be used for in-depth analysis of a single company, or to make comparisons between companies in different sectors and markets.

Disclosures

The rating(s) for Aptiv Plc, TE Connectivity Ltd. and Tesla Inc. is/are relative to the other companies in its/their coverage universe: Amphenol Corp., Aptiv Plc, Aurora Innovation Inc., Belden Inc., BorgWarner Inc., Cerence Inc., ChargePoint Holdings, Fisker Inc., Flex, Ford Motor Co., General Motors Co., Gentex Corp., Innoviz Technologies, Keysight Technologies Inc., Lear Corp., Luminar Technologies Inc., Magna International Inc., Mobileye Global Inc., QuantumScape Corp., Rivian Automotive Inc., Sensata Technologies Holding, Symbotic Inc., TE Connectivity Ltd., Tesla Inc., Vertiv Holdings, View Inc., Visteon Corp.

Company-specific regulatory disclosures

The following disclosures relate to relationships between The Goldman Sachs Group, Inc. (with its affiliates, "Goldman Sachs") and companies covered by Goldman Sachs Global Investment Research and referred to in this research.

Goldman Sachs has received compensation for investment banking services in the past 12 months: Aptiv Plc ($81.58), TE Connectivity Ltd. ($137.89) and Tesla Inc. ($239.29)

Goldman Sachs expects to receive or intends to seek compensation for investment banking services in the next 3 months: Aptiv Plc ($81.58), TE Connectivity Ltd. ($137.89) and Tesla Inc. ($239.29)

Goldman Sachs has received compensation for non-investment banking services during the past 12 months: Tesla Inc. ($239.29)

Goldman Sachs had an investment banking services client relationship during the past 12 months with: Aptiv Plc ($81.58), TE Connectivity Ltd. ($137.89) and Tesla Inc. ($239.29)

Goldman Sachs had a non-investment banking securities-related services client relationship during the past 12 months with: Aptiv Plc ($81.58), TE Connectivity Ltd. ($137.89) and Tesla Inc. ($239.29)

Goldman Sachs had a non-securities services client relationship during the past 12 months with: Aptiv Plc ($81.58), TE Connectivity Ltd. ($137.89) and Tesla Inc. ($239.29)

Goldman Sachs makes a market in the securities or derivatives thereof: Aptiv Plc ($81.58), TE Connectivity Ltd. ($137.89) and Tesla Inc. ($239.29)

Goldman Sachs is a specialist in the relevant securities and will at any given time have an inventory position, "long" or "short," and may be on the opposite side of orders executed on the relevant exchange: Aptiv Plc ($81.58)

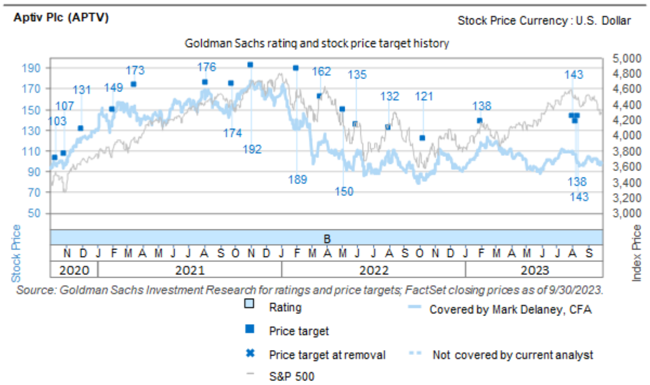
Distribution of ratings/investment banking relationships

Goldman Sachs Investment Research global Equity coverage universe

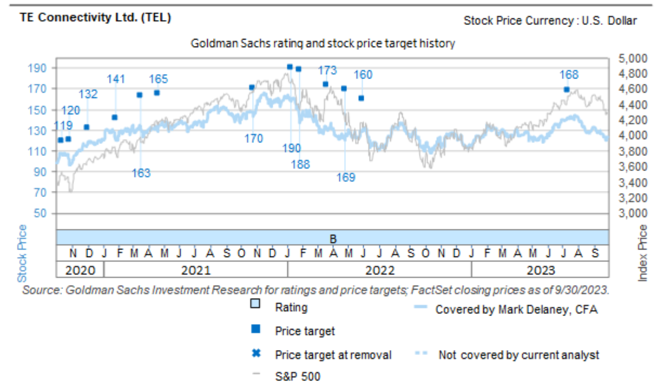
	Rating Distribution			Investment Banking Relationships		
	Buy	Hold	Sell	Buy	Hold	Sell
Global	48%	36%	16%	62%	56%	44%

As of October 1, 2023, Goldman Sachs Global Investment Research had investment ratings on 2,960 equity securities. Goldman Sachs assigns stocks as Buys and Sells on various regional Investment Lists; stocks not so assigned are deemed Neutral. Such assignments equate to Buy, Hold and Sell for the purposes of the above disclosure required by the FINRA Rules. See 'Ratings, Coverage universe and related definitions' below. The Investment Banking Relationships chart reflects the percentage of subject companies within each rating category for whom Goldman Sachs has provided investment banking services within the previous twelve months.

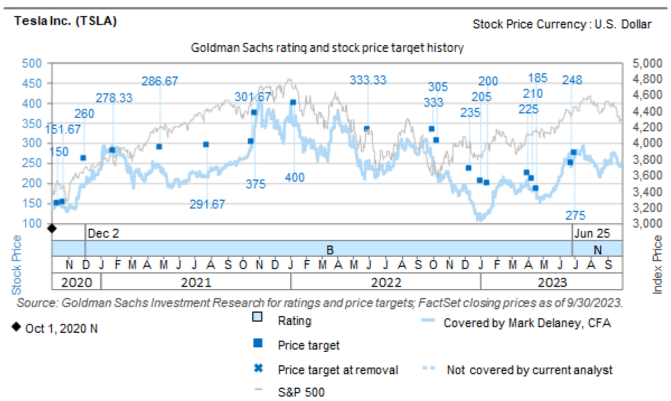
Price target and rating history chart(s)



The price targets shown should be considered in the context of all prior published Goldman Sachs research, which may or may not have included price targets, as well as developments relating to the company, its industry and financial markets.



The price targets shown should be considered in the context of all prior published Goldman Sachs research, which may or may not have included price targets, as well as developments relating to the company, its industry and financial markets.



The price targets shown should be considered in the context of all prior published Goldman Sachs research, which may or may not have included price targets, as well as developments relating to the company, its industry and financial markets.

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.

Distribution of ratings: See the distribution of ratings disclosure above. **Price chart:** See the price chart, with changes of ratings and price targets in prior periods, above, or, if electronic format or if with respect to multiple companies which are the subject of this report, on the Goldman Sachs website at https://www.gs.com/research/hedge.html.

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 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. 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. Compliance Officer: Anil Rajput |Tel: + 91 22 6616 9000 | Email: 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.

Ratings, coverage universe and related definitions

Buy (B), Neutral (N), Sell (S) Analysts recommend stocks as Buys or Sells for inclusion on various regional Investment Lists. Being assigned a Buy or Sell on an Investment List is determined by a stock's total return potential relative to its coverage universe. Any stock not assigned as a Buy or a Sell on an Investment List with an active rating (i.e., a stock that is not Rating Suspended, Not Rated, Coverage Suspended or Not Covered), is deemed Neutral. Each region manages Regional Conviction lists, which are selected from Buy rated stocks on the respective region's Investment lists and represent investment recommendations focused on the size of the total return potential and/or the likelihood of the realization of the return across their respective areas of coverage. The addition or removal of stocks from such Conviction lists are managed by the Investment Review Committee or other designated committee in each respective region and do not represent a change in the analysts' investment rating for such stocks.

Total return potential represents the upside or downside differential between the current share price and the price target, including all paid or anticipated dividends, expected during the time horizon associated with the price target. Price targets are required for all covered stocks. The total return potential, price target and associated time horizon are stated in each report adding or reiterating an Investment List membership.

Coverage Universe: A list of all stocks in each coverage universe is available by primary analyst, stock and coverage universe at https://www.gs.com/research/hedge.html.

Not Rated (NR). The investment rating, target price and earnings estimates (where relevant) are not provided or have been suspended pursuant to Goldman Sachs policy when Goldman Sachs is acting in an advisory capacity in a merger or in a strategic transaction involving this company, when there are legal, regulatory or policy constraints due to Goldman Sachs' involvement in a transaction, when the company is an early-stage biotechnology company, and in certain other circumstances. **Rating Suspended (RS).** Goldman Sachs Research has suspended the investment rating and price target for this stock, because there is not a sufficient fundamental basis for determining an investment rating or target price. The previous investment rating and target price, if any, are no longer in effect for this stock and should not be relied upon. **Coverage Suspended (CS).** Goldman Sachs has suspended coverage of this company. **Not Covered (NC).** Goldman Sachs does not cover this company. **Not Available or Not Applicable (NA).** The information is not available for display or is not applicable. **Not Meaningful (NM).** The information is not meaningful and is therefore excluded.

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 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.

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 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 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.

The analysts named in this report may have from time to time discussed with our clients, including Goldman Sachs salespersons and traders, or may discuss in this report, trading strategies that reference catalysts or events that may have a near-term impact on the market price of the equity securities discussed in this report, which impact may be directionally counter to the analyst's published price target expectations for such stocks. Any such trading strategies are distinct from and do not affect the analyst's fundamental equity rating for such stocks, which rating reflects a stock's return potential relative to its coverage universe as described herein.

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 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 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.