US Autos & Industrial Tech

BEV growth rates likely to remain well ahead of broader industry; prefer stocks of auto tech enablers

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

EVs remain one of the fastest growing markets in autos. YTD EV (BEV) sales are up nearly 50% in the US, 34% in select European countries, and 25% in China. BEVs account for about 8% of sales in the US, a mid teens percent of sales in select European countries, and 25-30% in China.

We also recognize that some OEMs are struggling with EV sales/profits and will slow their ramp cadence, in particular in the US per comments from Ford and GM (with both companies delaying investments and articulating plans to be more flexible on the timing of new capacity). While we generally hadn't been expecting OEMs to reach 100% of their medium-term EV growth targets, we now believe the US EV market will grow more slowly in the medium term than we had previously expected. In certain categories like pickup trucks we believe this 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). However, we'd note that crossovers and sedans are already very affordable vs. ICE vehicles when factoring in government credits and savings on operating costs.

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 adjust our expectations for US EV share of new light vehicle sales to 7.75% in 2023 (from 8%), 9.25% in 2024 (from 13%) and 13.5% in 2025 (from 20%), and maintain our 50% assumption for 2030.

For the market more broadly, we expect modest volume growth in 2024 in both sales and production. This is consistent with both our latest auto leading indicators analysis and consumer sentiment surveys, which are up yoy.

We continue to see the best investment opportunities among the tech enablers in our broader 'supplier' coverage, and we note that a handful have both higher content on EVs vs. ICE vehicles and sell to a majority of EV OEMs (thus being relatively agnostic to the EV market share wars among OEMs). TEL and APTV best fit these criteria.

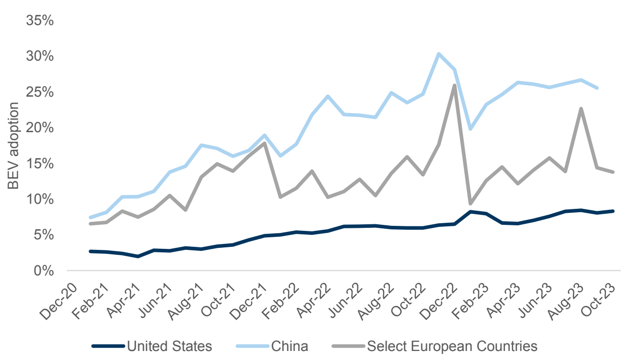
We note that a few of the companies that we see as well positioned for the EV transition have been overly impacted by what we believe is EV risk-off investor sentiment, with APTV and VC underperforming the market despite what we believe were solid 3Q results.

For active safety and ADAS, we believe MBLY, APTV, MGA and INVZ will benefit from increased levels of ADAS penetration going forward. Finally, KEYS and FLEX continue to benefit from their increased exposure to next-gen automotive applications.

We continue to expect strong electric vehicle adoption, albeit at a slower pace

BEV vehicle sales as a percentage of total new vehicle sales has been trending higher in the US, Europe, and China over time. YTD EV (BEV) sales are up nearly 50% in the US, 34% in select European countries, and 25% in China. BEVs account for about 8% of sales in the US, a mid teens percent of sales in select European countries, and 25-30% in China.

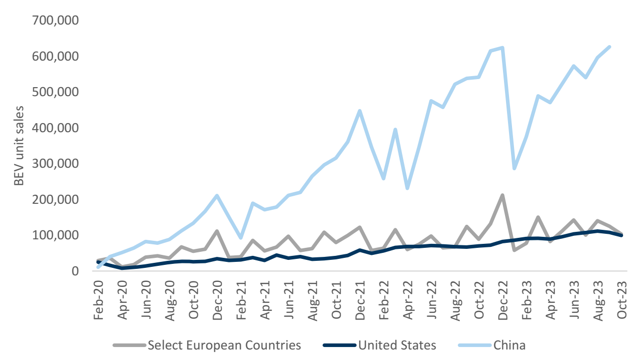
Exhibit 1: BEV adoption has grown in recent years
Monthly BEV mix by geography



*Select European countries include: UK, Germany, Norway, France, Italy, Spain

Source: Goldman Sachs Global Investment Research, IHS, CPCA

Exhibit 2: BEV unit sales by region



*Select European countries include: UK, Germany, Norway, France, Italy, Spain

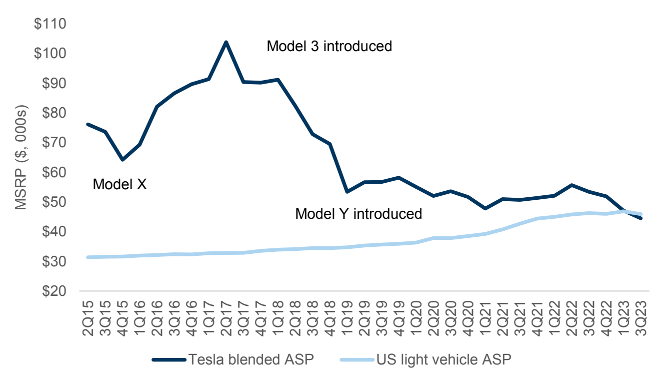
Source: Autodata, CPCA

We expect that EV adoption will continue to increase over time driven by regulations (and EV incentives), improving EV economics, and over time rising consumer preference for EVs (especially as EVs become more affordable, more models come to market, and charging coverage improves). We believe that OEMs will need to continue to invest for EVs as we view them as critical to long-term global competitiveness, in part due to government mandates for EVs to be 100% of new sales by 2035 in some regions.

However, given reduced consumer demand for certain models and profit pressure, some OEMs are planning to slow the pace of new EV investments. Specifically: 1) Ford stated that the company will push out $12 bn in capex, direct investments, and expenses related to EVs as it tries to better match supply to demand, and it may not invest the full $12 bn should the demand environment not materialize; 2) GM mentioned that it has pushed out $1.5 bn in capex related to its Orion plant investment. In addition, GM removed its interim targets of 100k EV production in 2H23 and 400k in total between the end of CY2022 and 1H24 and now plans to have 1 mn units of capacity exiting 2025 in North America, compared to 1 mn by 2025 prior; 3) Tesla implied on its 3Q23 earnings call that there may be only so much growth ahead for certain models, with Model Y already the best selling vehicle globally.

We believe part of the profit pressure was the reduced pricing from Tesla. We show Tesla's blended ASP over time in Exhibit 3, and note that a standard range Model Y (starting at $44K prior to any subsides) is now slightly less expensive than the average starting price for a new vehicle in the US.

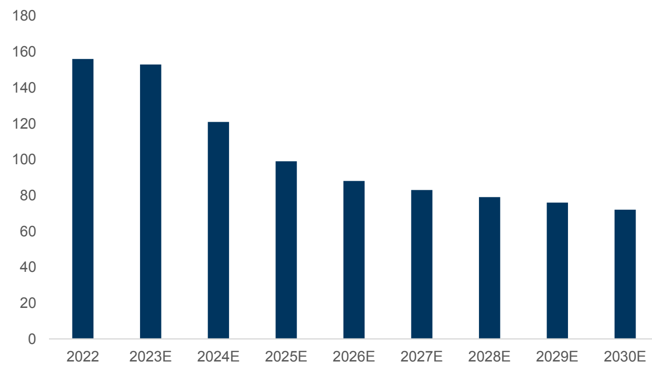
Exhibit 3: Tesla's blended ASP is now below the US light vehicle ASP



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

As Ford and GM develop new EV products and improve their cost structure (and if input costs such as battery prices decline as we expect), we believe their EV margins could improve. Our GS colleagues estimate that battery pricing for the industry could fall by about 35% from 2023 to 2025. We believe this could both help OEM profitability and consumer EV economics.

Exhibit 4: GS analysts expect battery prices to fall going forward
Global battery prices (USD/kWh)



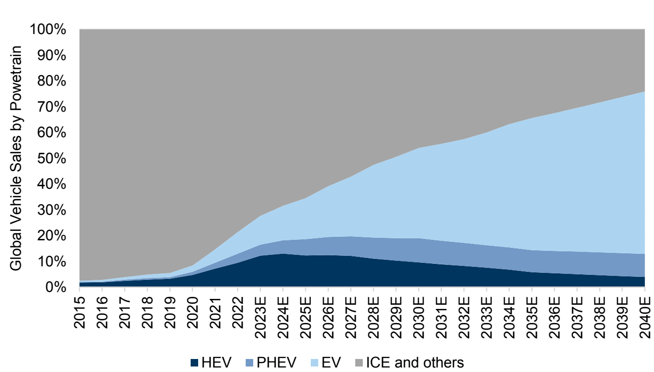
Source: SNE Research, Goldman Sachs Global Investment Research

On a total cost of ownership basis, EV economics are already very attractive in certain categories such as sedans. For example an entry Model 3 with $7,500 of potential IRA credits has a cost of about $31.5K, compared for example to a Honda Accord with a starting MSRP of $27.9K, and EVs if charging at home can save on the order of $1k per year on fuel vs. a typical ICE vehicle.

We see some particular drivers to still solid EV volume growth in the US in 2024 (about 25% yoy), albeit slower than in 2023. One factor is that IRA credits will be deductible at the time of sale. 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). Over time, new models and lower EV price points should help support further EV adoption, in our view.

Overall, we adjust our expectations for US EV share of new light vehicle sales to 7.75% in 2023 (from 8%), 9.25% in 2024 (from 13%) and 13.5% in 2025 (from 20%), and maintain our 50% assumption for 2030. Globally we now expect 13% in 2024, 16% in 2025, 35% in 2030, 51% in 2035, and 63% in 2040.

Exhibit 5: We expect a continued increase in adoption of EVs
Global Vehicle Sales by Powertrain



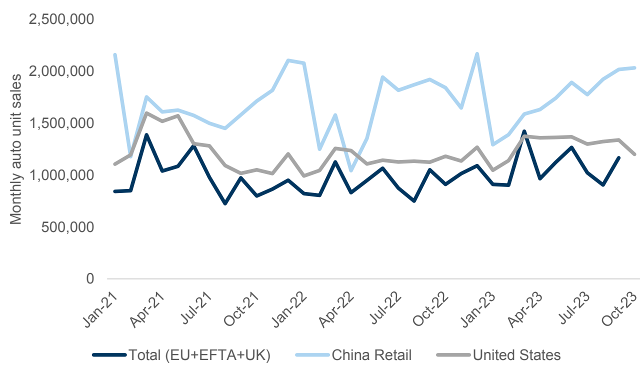
Source: Goldman Sachs Global Investment Research

Automotive supply and demand trends

Auto sales have increased YTD

Auto sales have improved YTD. The US SAAR is tracking to the mid 15 mn range, with sales up 13% YTD, but SAAR is still below the historical average of 16-16.5 mn. Similarly, European sales are up 17% YTD, and China passenger car sales are up 4% YTD per the CPCA.

Exhibit 6: Monthly regional auto sales

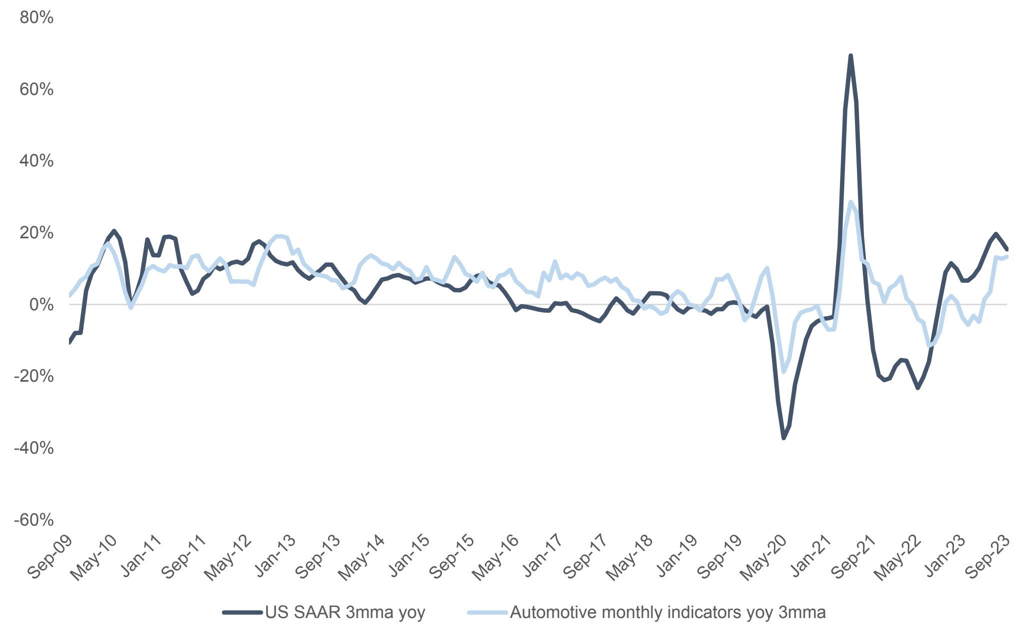


Source: Goldman Sachs Global Investment Research, IHS, CPCA

Demand indicators point to modest growth ahead

Our auto monthly indicators index tracks key inputs including Google search traffic, housing starts, and consumer sentiment. It has recently shown signs of improvement (Exhibit 7) with consumer surveys on plans to buy a car, and consumer sentiment, up yoy in the past several months.

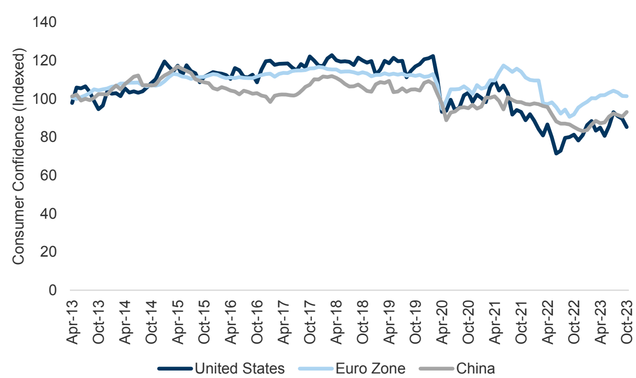
Exhibit 7: Auto monthly indicators have shown signs of improvement
US SAAR vs. Auto Monthly Indicators



Source: Company data, Goldman Sachs Global Investment Research, University of Michigan, The Conference Board, St. Louis Federal Reserve

Consumer confidence has improved off of the bottom, but is still at lower levels vs. history in key regions.

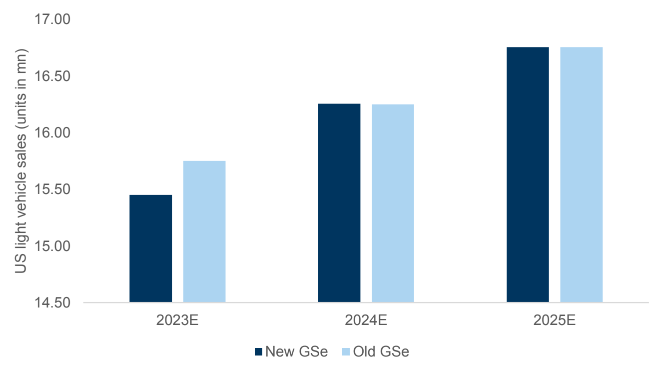
Exhibit 8: Consumer confidence remains low in key regions but has improved yoy
Consumer Confidence Indexed to 100



Source: FactSet

We adjust our US SAAR forecast for 2023 to 15.45 mn from 15.75 mn to reflect the UAW strike and slightly slower YTD sales than we had previously expected. Our forecast assumes that SAAR for November and December remains in the mid 15 mn range. We maintain our 2024/2025 estimates of 16.25 mn/16.75 mn. Our estimates do not assume any additional labor disruptions/strikes in the US.

Exhibit 9: We lower our 2023 SAAR forecast to 15.45 mn and maintain 2024/25 forecasts at 16.25 mn and 16.75 mn



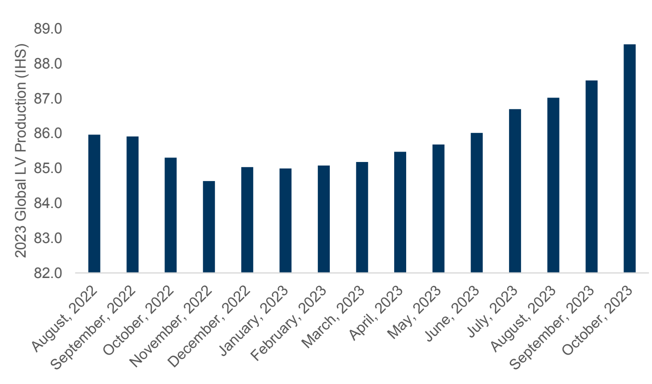
Source: Goldman Sachs Global Investment Research

Auto production higher yoy

In 3Q23 North America production was up 9% yoy, Europe was up 6% yoy, and China was flat yoy, per IHS. We attribute this strength in part to easing supply chain constraints.

IHS has increased its global auto production outlook for 2023 in each month since the start of 2023 with some variation by region. Additionally, IHS is now forecasting that 2023 auto production will be up 6% yoy in North America, up 12% yoy in Europe, and up 6% yoy in China vs. its September 2023 outlook of +6%/+13%/+2% in North America/Europe/China. IHS now expects 2023 global production to be +8% yoy (to 88.6 mn units), compared to +6% as of its September update, and 2024 to be 89.1 mn.

Exhibit 10: 2023 IHS production estimates have increased throughout the year
2023 Global LV production



Source: IHS

We are increasing our 2023/2024/2025 global production estimates to 88.9 mn/90.3 mn/92.7 mn from 85.0 mn/88.4 mn/91.7 mn. While we lower our North American production estimate for 4Q23 to reflect the UAW strike (we estimate the strike will impact 175-250K units of production for 2023, assuming no further labor disruptions), North America volume was stronger than we expected in 3Q even with a small strike impact, and international regions have been stronger YTD.

Stock trading recap from 3Q results so far

3Q earnings reports have been mixed so far for our covered companies. Street estimates for auto OEM stocks were generally revised lower, while estimates for auto suppliers were about unchanged on average. Consensus estimates for companies with datacenter exposure (e.g. VRT and APH) had consensus estimates move higher.

Exhibit 11: 2023 and 2024 estimate revisions since 3Q reports and YTD

	Change in consensus EPS estimates			
	2023		2024	
	Since 3Q report	YTD	Since 3Q report	YTD
Auto OEMs				
GM	-0.1%	28.9%	-3.6%	11.9%
F	-6.8%	8.8%	-1.8%	-2.5%
TSLA	-5.5%	-44.0%	-12.8%	-44.5%
Tier 1 Suppliers				
BWA	-0.7%	-11.5%	-2.0%	-12.0%
LEA	3.0%	-5.8%	0.6%	-8.9%
GNTX	0.3%	-2.0%	-1.0%	-2.3%
MGA	3.3%	-7.0%	2.3%	-12.0%
APTV	0.1%	2.2%	-3.4%	-5.8%
VC	2.0%	-9.0%	-1.7%	-6.3%
Electronic Components				
APH	1.1%	-3.3%	0.5%	-5.9%
TEL	0.2%	-3.3%	-1.3%	-6.4%
ST	-2.1%	-0.8%	-3.3%	-7.0%
BDC	-6.8%	0.3%	-17.4%	-19.3%
Lidar & Autonomy				
MBLY	8.2%	14.4%	-2.2%	-2.6%
EMS				
FLEX	3.4%	4.6%	7.4%	10.5%
Power & Thermal Management				
VRT	6.6%	55.8%	9.4%	53.5%

Source: FactSet

In the first trading session following 3Q reports, stocks in our coverage were down 3% at the median relative to the S&P 500. Many stocks have continued to lag, and from the time companies have reported through the 11/13/23 close, stocks are down 8% relative to the S&P 500.

Exhibit 12: Stock performance

	Stock Performance							
	1 trading session post 3Q report		1 trading session post 3Q report-Current		Before 3Q report-Current		YTD	
	Absolute	Relative to S&P 500	Absolute	Relative to S&P 500	Absolute	Relative to S&P 500	Absolute	Relative to S&P 500
Auto OEMs								
GM	-2.3%	-3.0%	-5.8%	-9.7%	-7.9%	-12.6%	-20.0%	-34.9%
F	-12.2%	-11.8%	-1.4%	-8.6%	-13.5%	-20.1%	-15.6%	-30.5%
TSLA	-9.3%	-8.5%	1.6%	-1.5%	-7.8%	-10.1%	81.6%	66.7%
RIVN	-2.4%	-2.5%	-4.8%	-5.4%	-7.1%	-7.8%	-12.2%	-27.1%
Tier 1 Suppliers								
BWA	-13.1%	-15.0%	0.8%	-1.4%	-12.4%	-16.5%	-8.1%	-23.0%
LEA	2.9%	4.1%	-4.1%	-10.7%	-1.3%	-6.6%	3.2%	-11.7%
GNTX	-7.4%	-6.9%	5.5%	-1.6%	-2.3%	-8.9%	8.8%	-6.1%
MGA	9.1%	8.2%	-1.9%	-3.1%	7.0%	4.8%	-6.6%	-21.5%
APTV	-10.3%	-12.2%	-2.3%	-4.5%	-12.4%	-16.5%	-19.0%	-33.9%
VC	2.9%	4.1%	-11.8%	-18.5%	-9.3%	-14.6%	-13.8%	-28.7%
Electronic Components								
APH	0.5%	1.9%	8.4%	3.1%	9.0%	5.1%	13.4%	-1.5%
TEL	4.3%	3.2%	1.7%	-2.4%	6.0%	0.8%	8.9%	-6.0%
ST	-6.5%	-7.2%	-2.5%	-7.7%	-8.9%	-14.8%	-23.1%	-38.0%
BDC	-12.7%	-14.5%	3.6%	1.4%	-9.6%	-13.7%	-9.7%	-24.6%
Lidar & Autonomy								
AUR	6.1%	4.2%	-4.2%	-6.3%	1.7%	-2.4%	52.1%	37.2%
LAZR	-14.9%	-14.1%	-3.5%	-5.0%	-17.9%	-18.6%	-39.0%	-53.9%
INVZ	10.8%	10.7%	6.5%	5.9%	18.1%	17.3%	-50.1%	-65.0%
MBLY	7.2%	8.4%	5.4%	-1.3%	13.0%	7.6%	9.4%	-5.5%
EMS								
FLEX	11.0%	12.2%	0.9%	-5.7%	12.0%	6.6%	21.2%	6.3%
Power & Thermal Management								
VRT	-4.2%	-2.8%	13.1%	7.7%	8.4%	4.5%	209.6%	194.7%
EV Battery								
QS	-7.0%	-5.8%	5.9%	-0.7%	-1.4%	-6.8%	-2.5%	-17.4%

Source: FactSet

Notably, 2023 EPS estimates for tier 1 suppliers in our coverage are up 1% at the median while the stocks are down 12% since reporting 3Q results (all tier 1s in our coverage beat consensus EPS estimates for 3Q23).

We note that a few of the companies that we see as well positioned for the EV transition have been overly impacted by what we believe is EV risk-off sentiment, with APTV and VC underperforming the market materially (by ~16 percentage points and ~15 percentage points respectively since they reported through 11/13/23) despite having solid earnings reports.

Exhibit 13: We note 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 2023 EPS revision	% dif	Beat/Miss	% dif	Beat/Miss
APTV	0.1%	-12.2%	-4.5%	-16.5%	-16.5%	5%	Beat	0%	In line
BWA	-0.7%	-15.0%	-1.4%	-16.5%	-15.8%	4%	Beat	-4%	Miss
VC	2.0%	4.1%	-18.5%	-14.6%	-16.6%	22%	Beat	1%	Beat
GNTX	0.3%	-6.9%	-1.6%	-8.9%	-9.2%	2%	Beat	-1%	Miss
LEA	3.0%	4.1%	-10.7%	-6.6%	-9.6%	10%	Beat	2%	Beat
MGA	3.3%	8.2%	-3.1%	4.8%	1.5%	9%	Beat	5%	Beat
Average	**1.3%**	**-2.9%**	**-6.6%**	**-9.7%**	**-11.0%**	**8.8%**		**0.4%**	
Median	**1.1%**	**-1.4%**	**-3.8%**	**-11.8%**	**-12.7%**	**7.3%**		**0.7%**	

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

Source: FactSet, Company data

We show upside/downside valuation scenarios for established companies in our coverage in Exhibit 14.

Exhibit 14: Upside/downside scenarios for select stocks in our coverage

	Current Price (11/13/2023)	Trough Multiple (NTM P/E)	NTM EPS (GSe)	Downside Valuation (Trough Multiple on NTM EPS)	Downside %	Upside Multiple (NTM P/E)	FY2025 EPS (GSe)	Upside Valuation (Trailing Typical Median Multiple on FY25 EPS)	Upside %
	Upside/Downside Scenario								
Tier-1 Suppliers									
BWA	$33	7X	$3.90	$27	**(16%)**	12X	$4.65	$56	**72%**
GNTX	$30	12X	$1.90	$23	**(23%)**	17X	$2.40	$40	**33%**
LEA	$128	7X	$14.25	$100	**(22%)**	12X	$20.00	$230	**80%**
MGA	$52	7X	$6.00	$42	**(20%)**	11X	$8.00	$84	**60%**
VC	$113	12X	$9.10	$109	**(3%)**	23X	$12.50	$285	**152%**
APTV	$75	13X	$5.75	$75	**(1%)**	24X	$8.00	$191	**153%**
Component Suppliers									
APH	$86	19X	$3.10	$59	**(32%)**	33X	$3.35	$111	**28%**
BDC	$65	7X	$5.20	$36	**(44%)**	15X	$7.50	$113	**73%**
ST	$31	8X	$3.70	$30	**(5%)**	12X	$4.40	$53	**70%**
TEL	$125	14X	$7.50	$105	**(16%)**	23X	$8.75	$201	**61%**
EMS									
* FLEX	$26	6X	$2.70	$16	**(38%)**	13X	$2.85	$37	**43%**
Test & Measurement									
* KEYS	$123	15X	$7.40	$111	**(10%)**	22X	$9.00	$198	**61%**
Power & Thermal Management									
VRT	$42	7X	$1.90	$13	**(69%)**	25X	$2.25	$56	**33%**

* EPS estimates exclude SBC

	Current Price (11/13/2023)	Downside Multiple	NTM GSe	Downside Valuation	Downside %	Upside Multiple	2025 GSe	Upside Valuation	Upside %
	Upside/Downside Scenario								
Auto OEMs		Trough NTM P/E	NTM EPS	Trough Multiple on NTM EPS		Upside P/E View	2025 EPS	Upside Multiple on 2025 EPS	
F	$10	4X	$1.20	$5	**(51%)**	8X	$2.00	$15	**54%**
GM	$27	4X	$5.60	$22	**(17%)**	8X	$7.45	$60	**122%**
TSLA	$224	25X	~$3.10-$3.75	~$75-$95	**~(65%)-(55%)**	55X	~$5.55-$6.10	~$305-$340	**~35%-55%**

Source: FactSet, Goldman Sachs Global Investment Research

Price targets and key risks

Exhibit 15: Price targets and key risks

Company	Ticker	GS Rating	Price Target	PT Methodology	Target Multiple	Key upside/downside risks
Auto OEMs						
Tesla	TSLA	Neutral	$235	Q5-Q8 EPS	45X	EV adoption, margins, market share, the auto cycle, operational execution, key person risk
General Motors	GM	Buy	$42	Norm. EPS	6X	The auto cycle, market share, margins, FCF, and the ability to pivot to growth areas such as EVs and AVs
Ford	F	Neutral	$12	Norm. EPS	7X	The auto cycle, market share, margins, and the ability to pivot to growth areas such as EVs and AVs
Rivian	RIVN	Neutral	$25	Q5-Q8 Sales	2X	Pre-orders/sales volumes, production ramp, market share, margins, software/services mix, the auto cycle, and EV adoption
Tier 1 Suppliers						
BorgWarner	BWA	Neutral	$42	Norm. EPS	10X	Revenue growth including ability to outgrow market due to EV portfolio, diesel exposure, the auto cycle, margins, and market share
Gentex	GNTX	Neutral	$31	Norm. EPS	14X	Revenue growth, margins, and multiple expansion
Lear	LEA	Buy	$180	Norm. EPS	10X	The auto cycle, ability to benefit from increasing EV industry mix, margins, market share
* Magna	MGA	Buy	$73	Norm. EPS	10X	The auto cycle, market share, ability to outgrow production and capitalize on secular growth themes, capital allocation, and FCF
Visteon	VC	Buy	$198	Norm. EPS	18X	Ability to capitalize on EVs and AVs, margins, revenue, market share, general macroeconomic risk, multiple expansion/contraction
Aptiv	APTV	Buy	$128	Norm. EPS	18X	Ability to grow CPV, the auto cycle, market share, margins, debt
Electronic Components						
Amphenol	APH	Buy	$98	Norm. EPS	30X	Sales trends, margins, capital allocation
** TE Connectivity	TEL	Buy	$175	Norm. EPS	20X	Revenue growth and auto demand, margins, and M&A
Belden	BDC	Buy	$91	Norm. EPS	13X	Industrial/macro trends, margins, leverage, and M&A
Sensata	ST	Buy	$48	Norm. EPS	12X	Auto production, margins, leverage, tax rate, FX, and ability to increase CPV in EVs and hybrids
Lidar and Autonomy						
Aurora	AUR	Neutral	$1.75	2027 Sales (Discounted)	3.5X	Time to market, industry pricing per mile, ability to expand geographic reach, competition, balance sheet
Innoviz	INVZ	Buy	$3.00	2025 Sales (Discounted)	2.0X	Lidar adoption and ASPs, margins, market share, M&A, balance sheet
Luminar	LAZR	Sell	$3.00	2025 Sales (Dicounted)	3X	Lidar adoption and ASPs, margins, market share, M&A, balance sheet
Mobileye	MBLY	Buy	$46	Q5-Q8 EBITDA	35X	ADAS/AV adoption, competition, geopolitics, market share, supply constraints and supplier/partner readiness
EMS						
Flex	FLEX	Buy	$34	Q5-Q8 EPS	13X	Tariff and geopolitical uncertainty, global macroeconomic demand, and margin and cash flow trends
Test and Measurement						
Keysight	KEYS	Buy	$164	Norm. EPS	21X	Revenue growth (especially in 5G), margins, M&A, and the impact the US/China trade relations on fundamentals
Power and Thermal Management						
Vertiv	VRT	Buy	$46	Q5-Q8 EBITDA	15X	Revenue growth, margins, leverage
Voice Technology						
Cerence	CRNC	Neutral	$28	Q5-Q8 Sales	3.5X	Industry and macro environment, competition, margins, natural ASP degradation, mature contract with Toyota
EV Battery						
QuantumScape	QS	Sell	$4.50	2028 Sales (Discounted)	2X	Ability to hit its targeted battery specs and ramp production, technological breakthroughs in today's lithium-ion batteries
Warehouse Automation						
Symbotic	SYM	Neutral	$36	FY2026 EBITDA (Discounted)	35X	Customer concentration, industry competition, warehouse automation investment trends, revenue growth

*Our 12-month PT for MG.TO listed in Canada is 100 CAD
**TEL is on the GS Americas Conviction List
Base case multiples shown for AUR, LAZR, QS, and SYM

Source: Goldman Sachs Global Investment Research

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

Financial advisory disclosures

Goldman Sachs and/or one of its affiliates is acting as a financial advisor in connection with an announced strategic matter involving the following company or one of its affiliates: Flex Ltd

The rating(s) for Amphenol Corp., Aptiv Plc, Aurora Innovation Inc., Belden Inc., BorgWarner Inc., Cerence 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 and Visteon Corp. 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

Compendium report: please see disclosures at https://www.gs.com/research/hedge.html. Disclosures applicable to the companies included in this compendium can be found in the latest relevant published research

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)

Compendium report: please see disclosures at https://www.gs.com/research/hedge.html. Disclosures applicable to the companies included in this compendium can be found in the latest relevant published research

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.