

Tesla Inc. (TSLA)

Contextualizing Tesla's AI and FSD opportunities

Neutral

| | | | |
|-------------|-----------------------------------|------------------------|---------------------|
| TSLA | 12m Price Target: \$235.00 | Price: \$223.71 | Upside: 5.0% |
|-------------|-----------------------------------|------------------------|---------------------|

Tesla's opportunity from AI has recently received increased interest from investors, and it's been a focus of the company for several years (recall Tesla held one AI day in August 2021 and another in October 2022, with a key goal of those events to help with employee recruitment). As we have written previously, we believe Tesla is well positioned to be a leader in AI related technologies given the breadth and depth of its resources and engineering talent, including in chip design, software, hardware, and data.

In this note, we update our framing of the medium term addressable market for FSD (Full Self Driving, which is the name of Tesla's automated driving product), compare FSD and D1/Dojo to other ADAS/AV and AI training products, and discuss implications for valuation.

The bottom line is that we believe Tesla is among the leaders in AI technology, and we expect that this will help it to expand businesses like FSD in particular for Tesla's own fleet of vehicles. While we believe that it's too early to ascribe material market cap to AI licensing/services businesses (either selling/licensing FSD to other auto OEMs or providing Dojo as an AI training tool for other companies) given the high degree of competition (Nvidia in particular in AI training, and multiple OEMs and tech companies are pursuing other options for ADAS/AVs) these businesses could be a source of upside depending on how well Tesla executes.

We believe that our current \$235 price target gives Tesla future credit for growing in new high-margin areas albeit primarily for its own fleet (as we detail later in this note). We'd look for more product traction vis-a-vis other alternatives before potentially ascribing more valuation for FSD licensing and/or providing Dojo as a service. To the extent Tesla is able to capitalize on those

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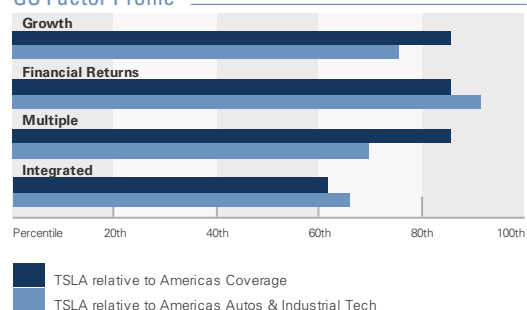
Key Data

Market cap: \$781.4bn
Enterprise value: \$764.5bn
3m ADTV: \$28.6bn
United States
Americas Autos & Industrial Tech
M&A Rank: 3

GS Forecast

| | 12/22 | 12/23E | 12/24E | 12/25E |
|---------------------|----------|----------|-----------|-----------|
| Revenue (\$ mn) | 81,462.0 | 96,800.0 | 118,592.1 | 149,704.4 |
| EBITDA (\$ mn) | 19,213.0 | 16,811.7 | 22,422.2 | 31,387.7 |
| EBIT (\$ mn) | 13,656.0 | 8,891.8 | 13,197.6 | 20,451.8 |
| EPS (\$) | 3.63 | 2.64 | 3.70 | 5.55 |
| P/E (X) | 72.5 | 84.7 | 60.5 | 40.3 |
| EV/EBITDA (X) | 42.1 | 41.2 | 30.7 | 21.5 |
| FCF yield (%) | 0.9 | 0.7 | 1.3 | 2.8 |
| Dividend yield (%) | 0.0 | 0.0 | 0.0 | 0.0 |
| Net debt/EBITDA (X) | (0.8) | (1.0) | (1.2) | (1.5) |
| | 9/23 | 12/23E | 3/24E | 6/24E |
| EPS (\$) | 0.53 | 0.61 | 0.68 | 0.82 |

GS Factor Profile



Source: Company data, Goldman Sachs Research estimates.
See disclosures for details.

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Neutral

Tesla Inc. (TSLA)

Rating since Jun 25, 2023

Ratios & Valuation

| | 12/22 | 12/23E | 12/24E | 12/25E |
|--------------------------|--------|--------|--------|--------|
| P/E (X) | 72.5 | 84.7 | 60.5 | 40.3 |
| EV/EBITDA (X) | 42.1 | 41.2 | 30.7 | 21.5 |
| EV/sales (X) | 9.9 | 7.2 | 5.8 | 4.5 |
| FCF yield (%) | 0.9 | 0.7 | 1.3 | 2.8 |
| EV/DACF (X) | 43.7 | 46.2 | 35.2 | 24.8 |
| CROCI (%) | 68.2 | 35.8 | 35.9 | 42.4 |
| ROE (%) | 33.6 | 18.2 | 20.5 | 24.2 |
| Net debt/EBITDA (X) | (0.8) | (1.0) | (1.2) | (1.5) |
| Net debt/equity (%) | (33.4) | (29.7) | (36.6) | (49.8) |
| Interest cover (X) | 71.5 | 65.9 | 82.5 | 127.8 |
| Inventory days | 56.0 | 64.7 | 61.9 | 56.3 |
| Receivable days | 10.9 | 12.4 | 14.0 | 14.8 |
| Days payable outstanding | 76.1 | 75.4 | 69.7 | 64.6 |

Growth & Margins (%)

| | 12/22 | 12/23E | 12/24E | 12/25E |
|----------------------|-------|--------|--------|--------|
| Total revenue growth | 51.4 | 18.8 | 22.5 | 26.2 |
| EBITDA growth | 84.5 | (21.7) | 39.9 | 44.6 |
| EPS growth | 121.8 | (27.2) | 40.1 | 50.1 |
| DPS growth | NM | NM | NM | NM |
| Gross margin | 25.6 | 18.3 | 19.4 | 20.6 |
| EBIT margin | 16.8 | 9.2 | 11.1 | 13.7 |

Price Performance



Source: FactSet. Price as of 13 Nov 2023 close.

Income Statement (\$ mn)

| | 12/22 | 12/23E | 12/24E | 12/25E |
|-------------------------------------|-----------------|-----------------|-----------------|-----------------|
| Total revenue | 81,462.0 | 96,800.0 | 118,592.1 | 149,704.4 |
| Cost of goods sold | (60,609.0) | (79,119.8) | (95,606.2) | (118,798.4) |
| SG&A | (4,122.0) | (4,779.7) | (5,073.0) | (5,383.6) |
| R&D | (3,075.0) | (4,008.7) | (4,715.3) | (5,070.7) |
| Other operating inc./exp.) | — | — | — | — |
| EBITDA | 17,403.0 | 13,622.7 | 19,062.2 | 27,572.7 |
| Depreciation & amortization | (3,747.0) | (4,731.0) | (5,864.6) | (7,120.9) |
| EBIT | 13,656.0 | 8,891.8 | 13,197.6 | 20,451.8 |
| Net interest inc./exp.) | 106.0 | 898.0 | 1,380.0 | 1,890.0 |
| Income/(loss) from associates | — | — | — | — |
| Pre-tax profit | 13,746.0 | 10,129.8 | 14,597.6 | 22,341.8 |
| Provision for taxes | (1,132.0) | (951.0) | (1,450.0) | (2,325.0) |
| Minority interest | (31.0) | 13.0 | (125.0) | (175.0) |
| Preferred dividends | — | — | — | — |
| Net inc. (pre-exceptionals) | 12,583.0 | 9,191.8 | 13,022.6 | 19,841.8 |
| Net inc. (post-exceptionals) | 12,583.0 | 9,191.8 | 13,022.6 | 19,841.8 |
| EPS (basic, pre-exception) | 4.02 | 2.90 | 4.08 | 6.15 |
| EPS (diluted, pre-exception) | 3.63 | 2.64 | 3.70 | 5.55 |
| EPS (ex-ESO exp., dil.) (\$) | -- | -- | -- | -- |
| DPS (\$) | — | — | — | — |
| Div. payout ratio (%) | 0.0 | 0.0 | 0.0 | 0.0 |
| Wtd avg shares out. (basic) (mn) | 3,129.8 | 3,171.7 | 3,194.0 | 3,224.0 |
| Wtd avg shares out. (diluted) (mn) | 3,468.8 | 3,480.0 | 3,502.2 | 3,572.5 |

Balance Sheet (\$ mn)

| | 12/22 | 12/23E | 12/24E | 12/25E |
|---------------------------------------|-----------------|------------------|------------------|------------------|
| Cash & cash equivalents | 16,924.0 | 19,375.4 | 28,807.7 | 49,182.7 |
| Accounts receivable | 2,952.0 | 3,599.1 | 5,496.3 | 6,625.6 |
| Inventory | 12,839.0 | 15,227.1 | 17,221.8 | 19,435.1 |
| Other current assets | 8,579.0 | 12,394.0 | 12,394.0 | 12,394.0 |
| Total current assets | 41,294.0 | 50,595.7 | 63,919.8 | 87,637.3 |
| Net PP&E | 26,111.0 | 32,101.1 | 35,308.5 | 37,267.5 |
| Net intangibles | 409.0 | 425.0 | 353.0 | 273.0 |
| Total investments | 0.0 | 0.0 | 0.0 | 0.0 |
| Other long-term assets | 14,901.0 | 17,118.0 | 17,218.0 | 17,318.0 |
| Total assets | 82,338.0 | 100,040.8 | 116,600.3 | 142,296.9 |
| Accounts payable | 15,255.0 | 17,442.0 | 19,053.9 | 22,968.7 |
| Short-term debt | — | — | — | — |
| Current lease liabilities | 1,502.0 | 1,967.0 | 1,967.0 | 1,967.0 |
| Other current liabilities | 9,952.0 | 10,736.0 | 10,736.0 | 10,736.0 |
| Total current liabilities | 26,709.0 | 30,145.0 | 31,756.9 | 35,671.7 |
| Long-term debt | 1,597.0 | 2,426.0 | 2,426.0 | 2,426.0 |
| Non-current lease liabilities | — | — | — | — |
| Other long-term liabilities | 8,134.0 | 10,380.0 | 10,380.0 | 10,380.0 |
| Total long-term liabilities | 9,731.0 | 12,806.0 | 12,806.0 | 12,806.0 |
| Total liabilities | 36,440.0 | 42,951.0 | 44,562.9 | 48,477.7 |
| Preferred shares | — | — | — | — |
| Total common equity | 44,704.0 | 56,060.8 | 71,008.4 | 92,790.1 |
| Minority interest | 1,194.0 | 1,029.0 | 1,029.0 | 1,029.0 |
| Total liabilities & equity | 82,338.0 | 100,040.8 | 116,600.3 | 142,296.9 |
| BVPS (\$) | 12.89 | 16.11 | 20.17 | 25.97 |

Cash Flow (\$ mn)

| | 12/22 | 12/23E | 12/24E | 12/25E |
|---------------------------------------|-------------------|-------------------|------------------|------------------|
| Net income | 12,587.0 | 9,150.8 | 13,022.6 | 19,841.8 |
| D&A add-back | 3,747.0 | 4,731.0 | 5,864.6 | 7,120.9 |
| Minority interest add-back | — | — | — | — |
| Net (inc)/dec working capital | (3,908.0) | (2,126.3) | (2,279.9) | 572.3 |
| Others | 2,298.0 | 1,941.0 | 1,925.0 | 1,940.0 |
| Cash flow from operations | 14,724.0 | 13,696.4 | 18,532.3 | 29,475.0 |
| Capital expenditures | (7,158.0) | (8,592.0) | (9,000.0) | (9,000.0) |
| Acquisitions | (4,810.0) | (4,188.0) | — | — |
| Divestitures | — | — | — | — |
| Others | (5.0) | (25.0) | (100.0) | (100.0) |
| Cash flow from investing | (11,973.0) | (12,805.0) | (9,100.0) | (9,100.0) |
| Dividends paid | — | — | — | — |
| Share issuance/(repurchase) | — | — | — | — |
| Inc/(dec) in debt | (3,364.0) | 1,511.0 | 0.0 | — |
| Others | (105.0) | 271.0 | — | — |
| Cash flow from financing | (3,971.0) | 1,560.0 | 0.0 | 0.0 |
| Total cash flow | (1,220.0) | 2,451.4 | 9,432.3 | 20,375.0 |
| Free cash flow | 7,566.0 | 5,104.4 | 9,532.3 | 20,475.0 |
| Free cash flow per share (basic) (\$) | 2.26 | 1.54 | 2.98 | 6.35 |

Source: Company data, Goldman Sachs Research estimates.

opportunities though, we believe the market opportunity would be large (we believe in an upside case FSD could be \$50-100 bn a year of revenue from Tesla's fleet by 2030, up from what we believe is \$1-3 bn per year presently, and the overall automotive software & services industry TAM in the long-term could be >\$1 tn annually to the extent the global installed base of more than 1 bn vehicles on the road transitions to being connected and software defined over the next 10-20 years).

As we wrote in our June 2023 report lowering our rating on the stock to Neutral, to the extent we thought that the company was closer to a catalyst as meaningful as the ramp of the third generation platform, or if Tesla made faster progress with FSD/AI products than we anticipate, then we could be more positive on the stock. We'll also look to monitor progress more generally, including with new products such as Model 3 Highland and Cybertruck.

This report has four sections:

- 1) What FSD can do, and gauging progress over time*
- 2) Summary of ADAS and AV efforts around the globe*
- 3) Digging into D1/Dojo and AI training*
- 4) Framing the FSD TAM, and Tesla's valuation*

What FSD can do, and gauging progress over time

FSD is Tesla's automated driving assistance technology, and with driver supervision has features including automated highway lane changes, traffic light/stop sign controls, and in some geographies point-to-point navigation on both highways and city streets. Tesla's FSD technology is being developed in-house, including running on custom silicon in the vehicle. On its 3Q23 EPS call, Tesla commented that its vehicles have now driven over 500 mn miles with FSD beta.

Tesla has enabled the most autonomous driving features in North America where it has >400K users of FSD beta, and there are different regulatory and/or geopolitical factors to consider for FSD in international locations. In China, there are requirements and restrictions related to mapping and data storage that require local partners.

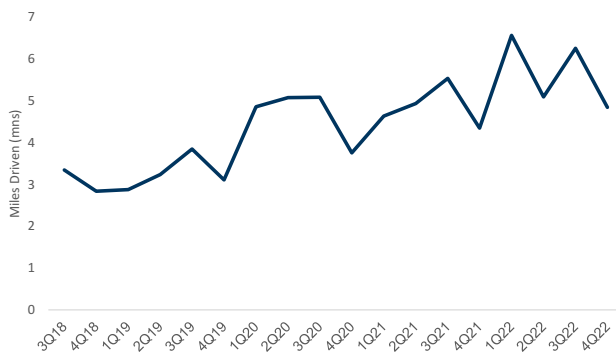
While FSD is an L2/L2+ system (meaning the driver is responsible to monitor the vehicle and take over if necessary), we consider it to be one of the leading technology efforts given the ability to operate without a geofence and with a sensor/compute stack that is affordable enough to be placed on every vehicle. We note that there are already L4 offerings in the US (e.g. Waymo), although AV deployments are currently limited to certain cities/neighborhoods (we discuss the global ADAS and AV competitive landscape later in this note, but we believe that ADAS/AV capabilities will proliferate over time with ADAS systems working in more situations and AVs expanding the locations/conditions they work in).

According to Tesla's safety reports and investor presentations, the performance of both

its standard autopilot ADAS technology and more advanced FSD offering are improving and safer than a human driver in terms of accidents per mile traveled. Per Tesla, statistics for the typical US driver come from NHTSA.

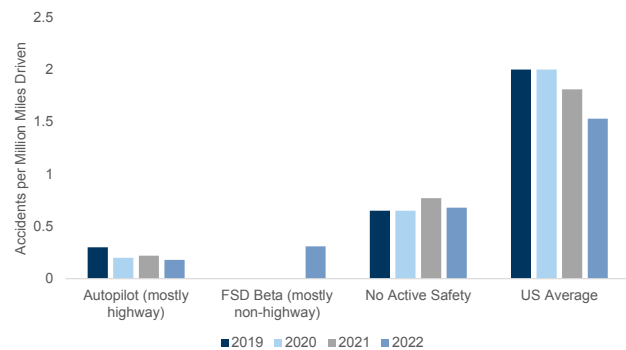
Tesla said in its 2022 safety report that there are 0.31 accidents per million miles traveled with FSD beta engaged (mostly non-highway miles), compared to 0.68 for its vehicles without active safety being used and US government data implying 1.5-2 crashes per million miles traveled overall. We recognize that this data is imperfect, and that there are more ways to measure driving performance than crash rates. Similar to many autonomous development efforts, Tesla is meaningfully behind its original target schedule. However, we believe this data shows that Tesla is making progress. A recent month-long test of FSD beta from Baron's suggested that the technology is both highly impressive but also still requires driver interventions at times, and that it has room for improvement for driving behavior (e.g., general handling, navigating uneven road terrain like potholes, and unusual traffic scenarios).

Exhibit 1: Tesla miles driven prior to an accident occurring with Autopilot engaged 2018-2022



Source: Company data

Exhibit 2: Accidents per million miles driven for Tesla vs US average



Source: Company data

Given the past rate of progress and very high bar for performance (and consistency of performance) needed for an L3/4 system (e.g., eyes off and hands off, with the OEM having responsibility for crashes the vehicle may cause) in a wide geographic area, we believe it will take time (we assume >12 months) before Tesla could widely offer FSD beta as an L3 system in North America. Over time, however, we think Tesla will meet this goal.

Other ADAS and AV efforts around the globe

United States

In the US, there is an AV/robotaxi set of efforts (e.g., Waymo and Cruise) and passenger car set of efforts that generally require driver supervision such as from Tesla (FSD), GM (Super Cruise), Ford (BlueCruise) and Mercedes (Drive Pilot). We believe that the situations that these technologies can be used in, and their overall capabilities, will improve over time. Moreover, as these technologies progress, the business models will likely increasingly be a focus for the market.

- In the AV space, both Waymo and Cruise provided studies that state their AVs are safer than human drivers. Waymo shared that over its first million driverless miles it had only 2 collisions that met government standards for a crash and 18 minor contact events with no injuries reported in any of the incidents. In 55% of these events, a human driver collided with a stationary Waymo vehicle and all incidents involved road rule violations and/or dangerous behavior by the human driver in the non-Waymo vehicle. Cruise stated that its AVs got into 65% fewer collisions overall, 94% fewer collisions where it is the primary contributor, and 74% fewer collisions with meaningful risk of injury compared to a human-driven vehicle in San Francisco across its first million miles (per its [safety report](#)). Similar to our commentary on FSD, we recognize there are other important ways to measure performance such as handling construction zones and unusual scenarios that crash data doesn't capture.
- Waymo currently operates driverless robotaxis in a 225+ sq. mi. area of Metro Phoenix and all of San Francisco 24/7. In addition, Waymo announced on [3/31/23](#) that it began testing in Austin, and the company also expanded to LA, with rider-only drives in LA with select customers that attend Waymo events and are on the waitlist already having started. Waymo has a permit for 250 robotaxis in San Francisco and deploys about 100 at any given time as of August 2023, per [media reports](#). The company crossed 1 million driverless miles in January 2023. Research conducted by Swiss Re, a reinsurer that Waymo began partnering with in 2022, shows that in the over 3.8 mn miles that Waymo drove without a human driver across SF and Phoenix, Waymo's fully autonomous driving technology reduced the frequency of property damage claims by 76% (a decrease from 3.26 to 0.78 claims per million miles) when compared to human drivers. Furthermore, it eliminated bodily injury claims by 100% (i.e. zero claims) compared to the Swiss Re human driver baseline of 1.11 claims per million miles, per a [9/6/23](#) press release.
- On 10/23, the [California DMV](#) suspended Cruise's permit for autonomous driving, although Cruise is still able to test with safety drivers. NHTSA has also opened a probe into Cruise following two pedestrian injuries that involved Cruise vehicles in recent months, per [press releases](#). Cruise is currently testing in 15 cities, and GM stated that Cruise had eclipsed > 5mn driverless miles as of its 3Q23 earnings call.
- For ADAS, GM offers Super Cruise which allows for hands-free driving on 400k+ miles of highways and automatic lane changes on select vehicle models. As of June 2023, GM planned to make Super Cruise available on 22 vehicles in North America

and China by the end of 2023 into early 2024. Super Cruise was equipped on about 80K vehicles as of June 2023, per [media reports](#). Beyond Super Cruise, Ultra Cruise is the next step in GM's ADAS strategy, and it is designed to ultimately enable hands-free driving in 95% of all driving scenarios, although this has been delayed.

- Ford BlueCruise was announced in April 2021 and allows for hands-free driving on prequalified sections of divided highways (>130k miles in North America). The system builds upon available intelligent adaptive cruise control with stop-and-go as well as lane centering and speed sign recognition. BlueCruise can do hands-free driving on 97% of controlled access highways across the US and Canada. On its 3Q23 EPS call, Ford commented that it recently launched version 1.3 of BlueCruise, which helps customers stay engaged longer in hands-free mode by improving performance, with greater ability to navigate narrow lanes and curves, per the company. Additionally, Ford commented in [October](#) that there are more than 260K BlueCruise-equipped Ford and Lincoln vehicles on the road globally and customers have driven 125+ mn hands-free miles. Moreover, Ford continues to expand BlueCruise in Europe and has approval in Spain, Great Britain, and Germany so far. Importantly, in October 2022, Ford announced it was winding down Argo (an AV focused company that it had a large minority stake in) to focus on higher level ADAS solutions instead.
- Mercedes DRIVE PILOT is certified as an L3 vehicle in the US (e.g., hands and eyes off, and with the OEM liable for accidents the system could cause), but with meaningful restrictions (e.g., select highways, clear weather, at speeds of less than about 40 mph, and cannot execute lane changes) that suggest real world use will be in traffic jam scenarios. Per a [September press release](#), Drive Pilot will be available in the U.S. market as an option for model year 2024 Mercedes-Benz S-Class and EQS sedan models, with the first cars delivered to customers in late 2023. The system has been approved in Nevada and California, and the company plans to expand its availability in the future. The company also commented that it is focused on SAE L3 conditionally automated driving with the ultimate goal of reaching speeds of up to 80 mph (130 km/h) in its final iteration. Mercedes plans to leverage its partnerships (e.g., with NVIDIA and Luminar) to achieve this.

China

There are multiple ADAS and AV efforts in China, and some of the fastest tech development is occurring in this geography.

- Apollo Go (Baidu's AV arm) has completed over 3.3 mn rides total (around 714k of those were in 2Q23) per a company [press release](#). The company is currently able to provide unmanned rides in Wuhan, a 188 sq. km. area of Shenzhen from 7 am to 10 pm and recently expanded to part of Beijing. In July 2023, they received permits to conduct fully driverless testing in the Shanghai Pudong area. The company plans to add 200 driverless robotaxis in 2023 and already has over 500 vehicles operational.
- The Geely Group's ZEEKR brand announced in September the roll out of a major OTA for the Navigation ZEEKR Pilot (NZP) on the ZEEKR 001 EV, which as an L2+ system allows for hands-free (but eyes-on) driving on highways including

point-to-point automated highway navigation, lane changes, automated on/off-ramp assist and intelligent traffic safety functions in identified operational design domains. Per a [press release](#), NZP utilizes Mobileye Supervision's 11 cameras in addition to a front radar.

- Nio's NOP+ ADAS system, which covers 95% of China's core highways and expressways, allows for hands-free driving on those highways and is able to execute overtakes. It recently expanded to select urban areas for which the company has commented it is targeting 60k kilometers of urban roads covered by 4Q23, 200k kilometers by 1Q24, and 400k kilometers by 2Q24. Within the mapped urban areas, the car would be able to navigate traffic lights, execute overtakes, make turns and react to hazards. In all cases, the driver still needs to keep eyes on the road and take over if needed. Nio's Aquila sensing platform utilizes 33 sensing units, including a long-range, high-resolution lidar, cameras, a driver monitoring system, and radars, per the company's [website](#). Nio leverages Nvidia silicon.
- Xpeng's City and Highway Navigation Guided Pilot (NGP) allows for hands-free driving on all highways and expressways and on urban roads in Guangzhou, Shenzhen, Shanghai, and Beijing. Within the urban coverage areas, the car can perform overtakes, get around obstacles, make turns, and react to traffic lights. In all cases, the driver still needs to keep eyes on the road and take over if needed. In 2H23, Xpeng plans to gradually release its ADAS functions for Chinese cities or urban areas without HD map coverage, per a [press release](#) from June.

Europe

Some companies in Europe have recently received approval for hands-off and eyes-off driving, albeit in a limited operating domain. There are more regulatory approvals needed to operate these systems in Europe than in the US.

- Mercedes debuted their Drive Pilot (the company's L3 system) in Germany in 2022 at speeds up to 60 km/h on over 8K miles of highway in Germany and seeks to expand this to 90 km/h (~55 mph) in 2024. Per [the company](#), Mercedes-Benz became the first automotive company in the world to meet the demanding legal requirements of the international UN-R157 for a Level 3 system enabling conditionally automated driving. Drive Pilot builds on the surround sensors of the Driving Assistance Package and comprises additional sensors, including lidar, a camera in the rear window and microphones, which are used for detecting blue lights and other signals from emergency vehicles. Mercedes also leverages data from a digital HD map in its technology.
- BMW has a Highway Assistant with Automatic Lane Assist that allows for hands-free driving on select highways at speeds up to ~130 kph currently and can change lanes upon driver indication. Importantly, BMW will [offer L3 capability](#) on the new 7 series as an optional package in Germany starting from [the spring 2024 timeframe](#) with limits to the ODD (e.g., maximum speed of about 40 mph and on select highways). BMW is leveraging partners (including Innoviz for the lidar).

Digging into D1/Dojo and AI training

Tesla is one of the few companies in the world capable of developing leading AI training technology, including its own chip (D1 made on 7 nm technology) and compute hardware (Dojo). Importantly, this is an AI training tool specific for video intensive workloads and geared toward real-world AI. Tesla commented at its AI Day #2 that some neural nets could take over one month to train, and they were seeking to improve on this to speed product development. Tesla's technology is designed for very high bandwidth and scalability, and we believe it uses a unique packaging approach for its chips. The company is able to put 25 D1 chips onto a tile and combine multiple tiles (along with disaggregated memory, high bandwidth/low latency connectivity, and custom power/cooling capabilities) into an ExaPOD with just over 1 exaflop of compute. Tesla is beginning to use D1/Dojo this year per recent company commentary.

We believe that it can be difficult to compare chips on overall technical specs alone given the benefits that purpose built silicon can provide (whereas a general purpose product needs to support a wide-range of use-cases), our industry discussions suggest that Nvidia is in a leadership position (although Google, AMD and others are planning to grow materially in 2024). As Tesla suggested during the AI Day sessions, a key barometer for Dojo will be if the AI software development team would prefer to use Dojo instead of other options. Tesla suggested on its 2Q23 earnings call that Nvidia remains the market leader.

Importantly, chip development cycles can be 18-24 months or more, and the hurdle Tesla will need to clear to establish a position in the AI training market is a moving target. While the A100 built on 7 nm technology (which is compared to the D1 in Tesla's AI Day presentations) had been Nvidia's leading product historically, the H100 on 4 nm is now Nvidia's leading product (and Nvidia plans to start shipping the next generation B100 late next year).

Tesla said it is due to invest north of \$1 bn on Dojo over the next year on its 2Q23 results call.

Exhibit 3: Tesla D1 chip vs. sample of other AI training capable chips

| | Tesla D1 | Google TPU v4 | AMD MI250x | Nvidia A100 | Nvidia H100 |
|-----------------------------|----------|---------------|------------|-------------|-------------|
| Die Size (mm ²) | 645 | <600 | 700-800 | 826 | 814 |
| FP32 Performance (TFLOPS) | 22.6 | N/A | 47.9 | 19.5 | 67 |
| BF16 Performance (TFLOPS) | 362 | 275 | 383 | 312 | ~1,000 |
| Transistors (billion) | 50 | 22 | 58.2 | 54.2 | 80 |
| Max TDP (W) | 400 | N/A | 560 | 400 | 700 |
| Line width (nm) | 7 | 7 | 6 | 7 | 4 |

Uses Nvidia H100 SXM performance without sparsity

Source: Company data, Goldman Sachs Global Investment Research

We note that Google announced its custom Tensor Processing Unit in May 2016, after several years of development, stating it had been in use for internal workloads for over a year. Per that announcement, the chip was optimized for machine learning. In August 2023, to help customers with AI, Google discussed both its fifth generation TPU, but also that VMs using H100 GPUs from Nvidia would be available the next month. We

believe that TPUs are an interesting case study as we believe this suggests: 1) a path (albeit one that takes time) for custom silicon for AI; 2) Nvidia remains a leader in the space. We believe from our industry discussions that Nvidia will continue to account for the majority of AI training silicon volume in 2024.

Framing the FSD TAM and Tesla's valuation

We believe that Tesla's FSD revenue is currently \$1-3 bn per year, mostly from up-front license sales (currently \$12K per year in the US market) that is generally a license attached to that vehicle for the life of the car. Tesla also offers a subscription of \$199 per month.

We believe that Tesla's software related revenue could be tens of billions of dollars per year by 2030 (mostly from FSD), and we show what the TAM could be with either a monthly subscription, or a one-time upfront purchase, although it could be a blend of both. These scenarios suggest that in an upside case FSD could account for tens of billions of revenue per year (and more if we consider licensing of Dojo or selling FSD to other OEMs).

We recognize there are scenarios beyond the range we show (e.g., upside cases given that Tesla aspires to sell 20 mn vehicles a year and could license FSD to other OEMs, and downside cases that are less positive from factors including regulatory constraints and/or software development challenges).

To illustrate how big a licensing business could be, note that Nvidia's datacenter business is tracking to over \$50 bn of revenue in 2024, and AWS to more than \$100 bn in 2024, per GS analyst estimates.

Exhibit 4: Tesla's potential annual revenue opportunity from monthly FSD subscription
revenue in \$US mn

| Annual revenue in mns from monthly FSD subscription | | | | | | | |
|---|-------------|-------------------|--------|--------|--------|--------|--------|
| Monthly ASP | Attach Rate | Install Base (mn) | | | | | |
| | | 25 | 30 | 35 | 40 | 45 | 50 |
| \$100.0 | 10% | 3,000 | 3,600 | 4,200 | 4,800 | 5,400 | 6,000 |
| | 20% | 6,000 | 7,200 | 8,400 | 9,600 | 10,800 | 12,000 |
| | 30% | 9,000 | 10,800 | 12,600 | 14,400 | 16,200 | 18,000 |
| | 40% | 12,000 | 14,400 | 16,800 | 19,200 | 21,600 | 24,000 |
| | 50% | 15,000 | 18,000 | 21,000 | 24,000 | 27,000 | 30,000 |
| \$150.0 | 10% | 4,500 | 5,400 | 6,300 | 7,200 | 8,100 | 9,000 |
| | 20% | 9,000 | 10,800 | 12,600 | 14,400 | 16,200 | 18,000 |
| | 30% | 13,500 | 16,200 | 18,900 | 21,600 | 24,300 | 27,000 |
| | 40% | 18,000 | 21,600 | 25,200 | 28,800 | 32,400 | 36,000 |
| | 50% | 22,500 | 27,000 | 31,500 | 36,000 | 40,500 | 45,000 |
| \$200.0 | 10% | 6,000 | 7,200 | 8,400 | 9,600 | 10,800 | 12,000 |
| | 20% | 12,000 | 14,400 | 16,800 | 19,200 | 21,600 | 24,000 |
| | 30% | 18,000 | 21,600 | 25,200 | 28,800 | 32,400 | 36,000 |
| | 40% | 24,000 | 28,800 | 33,600 | 38,400 | 43,200 | 48,000 |
| | 50% | 30,000 | 36,000 | 42,000 | 48,000 | 54,000 | 60,000 |
| \$250.0 | 10% | 7,500 | 9,000 | 10,500 | 12,000 | 13,500 | 15,000 |
| | 20% | 15,000 | 18,000 | 21,000 | 24,000 | 27,000 | 30,000 |
| | 30% | 22,500 | 27,000 | 31,500 | 36,000 | 40,500 | 45,000 |
| | 40% | 30,000 | 36,000 | 42,000 | 48,000 | 54,000 | 60,000 |
| | 50% | 37,500 | 45,000 | 52,500 | 60,000 | 67,500 | 75,000 |
| \$300.0 | 10% | 9,000 | 10,800 | 12,600 | 14,400 | 16,200 | 18,000 |
| | 20% | 18,000 | 21,600 | 25,200 | 28,800 | 32,400 | 36,000 |
| | 30% | 27,000 | 32,400 | 37,800 | 43,200 | 48,600 | 54,000 |
| | 40% | 36,000 | 43,200 | 50,400 | 57,600 | 64,800 | 72,000 |
| | 50% | 45,000 | 54,000 | 63,000 | 72,000 | 81,000 | 90,000 |

Source: Company data, Goldman Sachs Global Investment Research

Exhibit 5: Tesla's potential revenue opportunity from one-time upfront FSD purchase

revenue in \$US mn

| Revenue in mns from upfront FSD purchase | | | | | | | |
|--|-------------|----------------------|--------|--------|--------|--------|---------|
| ASP | Attach Rate | 2030 Unit Sales (mn) | | | | | |
| | | 5 | 6 | 7 | 8 | 9 | 10 |
| \$5,000.0 | 10% | 2,500 | 3,000 | 3,500 | 4,000 | 4,500 | 5,000 |
| | 20% | 5,000 | 6,000 | 7,000 | 8,000 | 9,000 | 10,000 |
| | 30% | 7,500 | 9,000 | 10,500 | 12,000 | 13,500 | 15,000 |
| | 40% | 10,000 | 12,000 | 14,000 | 16,000 | 18,000 | 20,000 |
| | 50% | 12,500 | 15,000 | 17,500 | 20,000 | 22,500 | 25,000 |
| \$7,500.0 | 10% | 3,750 | 4,500 | 5,250 | 6,000 | 6,750 | 7,500 |
| | 20% | 7,500 | 9,000 | 10,500 | 12,000 | 13,500 | 15,000 |
| | 30% | 11,250 | 13,500 | 15,750 | 18,000 | 20,250 | 22,500 |
| | 40% | 15,000 | 18,000 | 21,000 | 24,000 | 27,000 | 30,000 |
| | 50% | 18,750 | 22,500 | 26,250 | 30,000 | 33,750 | 37,500 |
| \$12,000.0 | 10% | 6,000 | 7,200 | 8,400 | 9,600 | 10,800 | 12,000 |
| | 20% | 12,000 | 14,400 | 16,800 | 19,200 | 21,600 | 24,000 |
| | 30% | 18,000 | 21,600 | 25,200 | 28,800 | 32,400 | 36,000 |
| | 40% | 24,000 | 28,800 | 33,600 | 38,400 | 43,200 | 48,000 |
| | 50% | 30,000 | 36,000 | 42,000 | 48,000 | 54,000 | 60,000 |
| \$15,000.0 | 10% | 7,500 | 9,000 | 10,500 | 12,000 | 13,500 | 15,000 |
| | 20% | 15,000 | 18,000 | 21,000 | 24,000 | 27,000 | 30,000 |
| | 30% | 22,500 | 27,000 | 31,500 | 36,000 | 40,500 | 45,000 |
| | 40% | 30,000 | 36,000 | 42,000 | 48,000 | 54,000 | 60,000 |
| | 50% | 37,500 | 45,000 | 52,500 | 60,000 | 67,500 | 75,000 |
| \$20,000.0 | 10% | 10,000 | 12,000 | 14,000 | 16,000 | 18,000 | 20,000 |
| | 20% | 20,000 | 24,000 | 28,000 | 32,000 | 36,000 | 40,000 |
| | 30% | 30,000 | 36,000 | 42,000 | 48,000 | 54,000 | 60,000 |
| | 40% | 40,000 | 48,000 | 56,000 | 64,000 | 72,000 | 80,000 |
| | 50% | 50,000 | 60,000 | 70,000 | 80,000 | 90,000 | 100,000 |

Source: Company data, Goldman Sachs Global Investment Research

We believe that our current \$235, 12-month price target (based on 45X Q5-Q8 EPS including SBC) implicitly gives Tesla future credit for growing in new high-margin areas mostly to support its own customers, such as with FSD.

As we have previously written, given that PEG ratios for tech and industrial stocks often range from ~1.25-2X, Tesla would need to grow at a ~20-40% EPS CAGR to warrant a 40-50X P/E target multiple. We show scenarios of what Tesla's EPS could look like in 2030, assuming automotive vehicle revenue of \$200-\$400 bn, software (with FSD the largest component) at \$10-\$75 bn, as well as Services & Other (\$75-100 bn; note the humanoid robot market could be \$5-10 bn in 2030 per a report from our colleagues) and Energy (\$30-50 bn). Taken together, we believe that these scenarios suggest that a 20-40% EPS CAGR is achievable for 2025-2030 for Tesla.

Exhibit 6: 2030 EPS scenarios

| 2030 EPS scenarios | | | |
|--------------------|--------|---------|---------|
| | Low | Mid | High |
| Revenue | | | |
| Vehicles | 200 | 300 | 400 |
| Software | 10 | 40 | 75 |
| Energy | 30 | 40 | 50 |
| Services & Other | 75 | 85 | 100 |
| Total | 315 | 465 | 625 |
| EBIT Margin | 13.0% | 16.5% | 22.0% |
| EPS | \$9.84 | \$18.08 | \$31.91 |
| CAGR from 2025 | 12% | 27% | 42% |

Source: Goldman Sachs Global Investment Research

We note that when considering valuation on a DCF basis, we believe Tesla would need to reach ~\$800 bn- \$1 trn of revenue in steady state (we assume around 2040) with a mid to high teens EBIT margin to support our \$235 price target. We have argued that if the auto market is >100 mn units per year by 2040 (implying a low single digit CAGR) and Tesla's share is similar to current leaders (Toyota and VW) then it could sell 15 mn vehicles. This could account for ~\$525-600 bn of revenue. We believe services could be >\$150 bn as Tesla's installed base grows (and from opening its charging network and insurance). We believe energy, software and robotics would make up the balance (or provide upside).

For every incremental \$50 bn of high margin software & services revenue, we believe this would equate to roughly \$25 to \$50 of equity value per share (depending on margin and discount rate assumptions).

Our 12-month price target remains \$235 and is based on 45X Q5-Q8 EPS including SBC. We believe an upside scenario over the next 12 months could be ~\$300-350 using multiples of roughly 50X-60X applied to EPS scenarios of \$5.50-\$6.50 (note that we model 2025 EPS including SBC of \$5.55 and excluding SBC of \$6.10. We believe a downside scenario could be ~\$100 using multiples of 25-35X applied to EPS scenarios of \$3.00-\$4.25 (note that we model 2024 EPS at \$3.70 including SBC and \$4.25 ex. SBC).

On valuation, we note that TSLA shares trade at ~2X the multiple as NVDA on 2024 P/E on GS estimates including SBC (Tesla at approximately 60X vs. Nvidia at about 30X). We see this as illustrative of our view that Tesla is already getting credit for a degree of success from AI.

Key downside risks to our view relate to potentially larger vehicle price reductions than we expect, increased competition in EVs, delays with products/capabilities like FSD/the third-generation platform/4680, key person risk, the internal control environment, margins, and operational risks associated with Tesla's high degree of vertical integration. Upside risks include faster EV adoption and/or share gain from Tesla, a stronger macroeconomic environment for new vehicle sales more generally, earlier new product launches than we expect (e.g., a vehicle using the third generation platform), and an

earlier/larger impact from AI-enabled products (e.g., FSD and Optimus) than we currently anticipate.

Disclosure Appendix

Reg AC

We, Mark Delaney, CFA, Toshiya Hari, Bruce Lu, 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.

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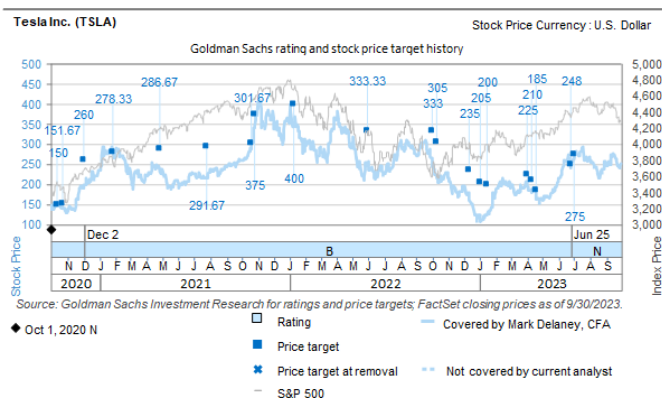
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