The Car of the Future

Center for Automotive Research: Understanding the North American Auto Industry

Colin Langan, CFA
US Autos Analyst
Tel: +1 212-713-9949
colin.langan@ubs.com

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Agenda: *The Car of the Future*

- Electric Car Teardown
- Rideshare 1.0
- Autonomous Cars
Will traditional automakers be disrupted by EVs?

US Automaker Market Caps ($b)

- Ford: 35
- GM: 57
- Tesla: 53

Global Unit Sales (m)

- Ford: 6.0
- GM: 8.5
- Tesla: 0.2

Source: FactSet; closing price March 2, 2019
The podium of the **UBS Teardown Race**

**Tesla won our three-lap teardown race...**

1. **Tesla Model 3**
2. **Chevy Bolt**
3. **BMW i3**

...but it takes much more to **win the championship**

Source: Tesla, GM, BMW, UBS
Areas in which the Model 3 is better...

The Model 3 has a moderate cost advantage, mainly because of the cheaper battery pack design.

Source: UBS Evidence Lab  
Note: Battery costs normalized to 60 kWh capacity.
Areas in which the Model 3 is worse...

Build quality is the main weakness, though some issues can be fixed with a 12-24 month view.

Source: UBS Evidence Lab
Tesla's lead could be **competed** away over time …

Price tags of key EV launches vs. (expected) battery range

… so we will be monitoring **upcoming launches**

Source: UBS estimates
Will auto suppliers be disrupted by EVs?

ICE Specific Content vs. BEV Specific Content

- **TSLA Powertrain (53 kWh)**: 12,300
  - ICE: 5,900
  - BEV: 8,500
  - Less: -2,600

- **Luxury ICE**: 6,500
  - ICE: 1,900
  - BEV: 4,400
  - Less: -2,500

- **Mass Market ICE**: 4,500
  - ICE: 4,500
  - BEV: 3,600
  - Less: -800

Source: UBS estimates, UBS Evidence Lab
How does the teardown change our view on auto suppliers?

We estimate that the average tier-1 content share shrinks to 42% in upcoming EVs, or by $1k vs. a comparable ICE car …

Source: UBS estimates

UBS
Will autos be disrupted by Rideshare 1.0?

Modes of transport used less now used less often due to increased usage of "ride-on-demand"

- Public Transportation: 38%
- Private Car: 37%
- Public City Taxi: 35%
- Bicycle: 28%
- Car Rental: 22%
- Car Pooling: 21%
- Walking: 18%
- Car Sharing: 13%

Source: UBS Evidence Lab
Will autos be disrupted by autonomous vehicles?

Our AV expert interviews give answers about Sensors, Maps, Strategy, Leaders and Followers …

The UBS AV expert panel – our 22 interview partners

**Americas**
- Anne Widera – founder and managing director at Tycho Partners, and former Waymo executive
- Bryan Reimer – research scientist in the MIT AgeLab and associate director of The New England University Transportation
- Dan Galves – senior VP, chief communications officer at Mobileye – an Intel company
- Evangelos Simoudis – founder and managing director at Synapse Partners
- Jason Doran – council member at GIG, and former senior strategy and operations manager at GM
- Marco Pavone – assistant professor of Aeronautics & Astronautics at Stanford University
- Sasha Ostojic – former senior vice president, engineering at Cruise Automation, Inc
- Sertac Karaman – associate professor of Aeronautics & Astronautics at MIT
- Seval Oz – former head of global strategic partnerships of Waymo

**APAC**
- Zhang Kai – head of vehicle intelligence R&D institute at Great Wall Motor
- Liang Fenhua – head of vehicle intelligence department at Chang’an Auto
- Kiana Shi – former deputy general manager of the autonomous driving unit at Baidu
- Shaoshan Liu – founder of PerceptIn and former Baidu senior architect
- Baidu Apollo – discussion with executives at Apollo 2.5 version launch ceremony
- A senior analyst in the autonomous driving department of a global OEM China unit, who prefers to stay anonymous
- Tsuguo Nobe – director and chief advanced service architect at Intel
- Naoki Suganuma – head of Kanazawa University’s Autonomous Vehicle Research

**Europe**
- BMW – answered via e-mail from the AV expert team
- Dr Miklos Kes – head of Pre-Development Driver Assistance Systems at Audi
- Hans Adlkofor – vice president Automotive System Group at Infineon
- Ralf Herrtwich – head of the HERE maps Automotive Business Group
- Wilko Stark – vice president Daimler and Mercedes-Benz Cars Strategy, and head of CASE

... and are based on a structured questionnaire.

Source: UBS AV expert interviews
Who is leading the autonomous car race?

Who is best positioned – expert panel view: 3 points for first place, 2 points for second place, 1 point all others

Source: UBS expert interviews
What is needed for an autonomous car?

LiDAR and HD map-based system (includes camera and radar as well)

We expect the prevailing sensor suite to include up to 12 cameras, 6 LiDARs and 6 radars … … and see the AV system cost below $10,000 in 2025, versus $100,000 today

The camera-only (and AI) AV system is cheaper, but has less redundancy. Regulators’ approval could be an issue – potentially negative for Tesla

Source: Infineon, UBS
Note: Excludes ultrasonic sensors for near-distance object detection (parking) – a minor cost item. Green – lidar, blue – radar, brown –
What is our **timeline** for autonomous?

- **Fully Autonomous** (Level 5) as **Decades Away**

- **Level 4 Coming Soon**
  - Geo-fenced, range bound **niche** applications

- **Challenges**
  - Almost perfect technology needed
  - Precedent in aerospace and space travel
  - Ethical, legal, & regulatory risks
What does Rideshare 2.0 mean for demand?

- **Negatives:**
  - Shared-Autonomous Fleet ~60% Smaller
  - Potential longer vehicle life

- **Positives:**
  - ~30% increase in miles travelled with sharing
  - Demand from young, old, and disabled
  - Demand from lower price of travel

Source: UBS
Thank You

If you have any questions, please reach out!

Colin Langan, CFA, CPA
colin.langan@ubs.com
Valuation Method and Risk Statement

Our F, GM, and supplier price targets are based on an EBITDA multiple, relative to the local market. Our TSLA price target is based on a DCF.

The global auto industry is highly cyclical, vulnerable to sudden shifts in consumer sentiment, employment, interest rates, available lending, and general economic activity. Parts suppliers are further exposed to customer pricing pressure, shifts in OEM market share, volatile production schedules, and unforeseen changes in technology.

Company-specific risks for Ford Motor Co. include their continued liquidity concerns. Both also faced risks associated with the impact of discount rates and asset values on legacy obligations. Auto companies face high fixed costs, and therefore earnings and cash flows can dramatically change with sudden shifts in vehicle demand. GM and Ford’s North American operations are particularly dependent on light truck sales, and therefore the continued shifts toward cars will remain a headwind. For Tesla, an overall slowdown in the global economy and discretionary spending remains a key risk to automotive production and, as such, to TSLA stock. Other major risks include a slower rate of electric vehicle adoption, inability to deliver on battery cost reduction and performance, supply risks related to battery active materials (cobalt and nickel), failure to expand capacity rapidly, regulatory risks related to safety, warranty and disputes with franchised dealers, and above-average overall execution risk.
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<th>Definition</th>
<th>Coverage</th>
<th>IB Services</th>
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<tr>
<td>Buy</td>
<td>FSR &gt; 6% above the MRA.</td>
<td>49%</td>
<td>26%</td>
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<tr>
<td>Neutral</td>
<td>FSR is between -6% and 6% of the MRA.</td>
<td>38%</td>
<td>23%</td>
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<tr>
<td>Sell</td>
<td>FSR &lt; 6% below the MRA.</td>
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<table>
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<th>Short-Term Rating</th>
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<td>Stock price expected to rise within three months from the time the rating was assigned because of a specific catalyst or event.</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
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<tr>
<td>Sell</td>
<td>Stock price expected to fall within three months from the time the rating was assigned because of a specific catalyst or event.</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
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<tr>
<th>Company Name</th>
<th>Reuters</th>
<th>12-month rating</th>
<th>Short-term rating</th>
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<th>Price date</th>
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<td>Aptiv PLC</td>
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<td>N/A</td>
<td>US$84.27</td>
<td>01 Mar 2019</td>
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<td>Baidu, Inc.</td>
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<td>Buy</td>
<td>N/A</td>
<td>US$162.09</td>
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<td>N/A</td>
<td>€74.75</td>
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<td>Bosch</td>
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<td>Won 122,000</td>
<td>04 Mar 2019</td>
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<td>Porsche</td>
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<td>N/A</td>
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<td>Renault</td>
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<td>Tesla, Inc.</td>
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<td>Volkswagen</td>
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<td>€154.18</td>
<td>01 Mar 2019</td>
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UBS Securities LLC
1285 Avenue of the Americas
New York, NY 10019

Tel: +1-212-713-2000

www.ubs.com

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