

# The Car of the Future

## Center for Automotive Research: Understanding the North American Auto Industry

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## Agenda: *The Car of the Future*

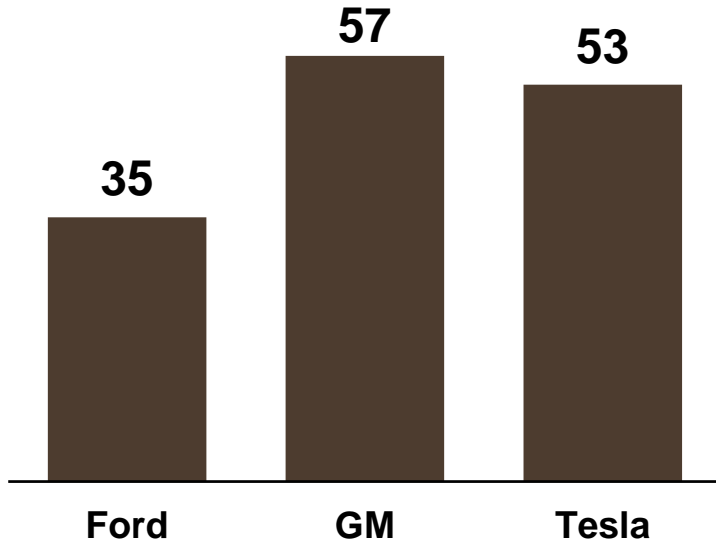
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- Electric Car Teardown
- Rideshare 1.0
- Autonomous Cars

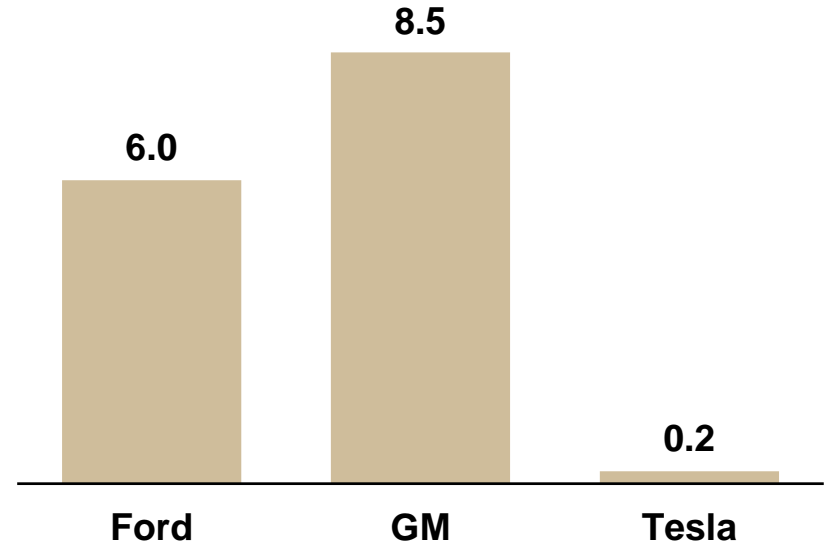
# Will traditional automakers be **disrupted** by EVs?

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US Automaker Market Caps (\$b)



Global Unit Sales (m)



Source: FactSet; closing price March 2, 2019

# The podium of the **UBS Teardown Race**

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



**Chevy Bolt**

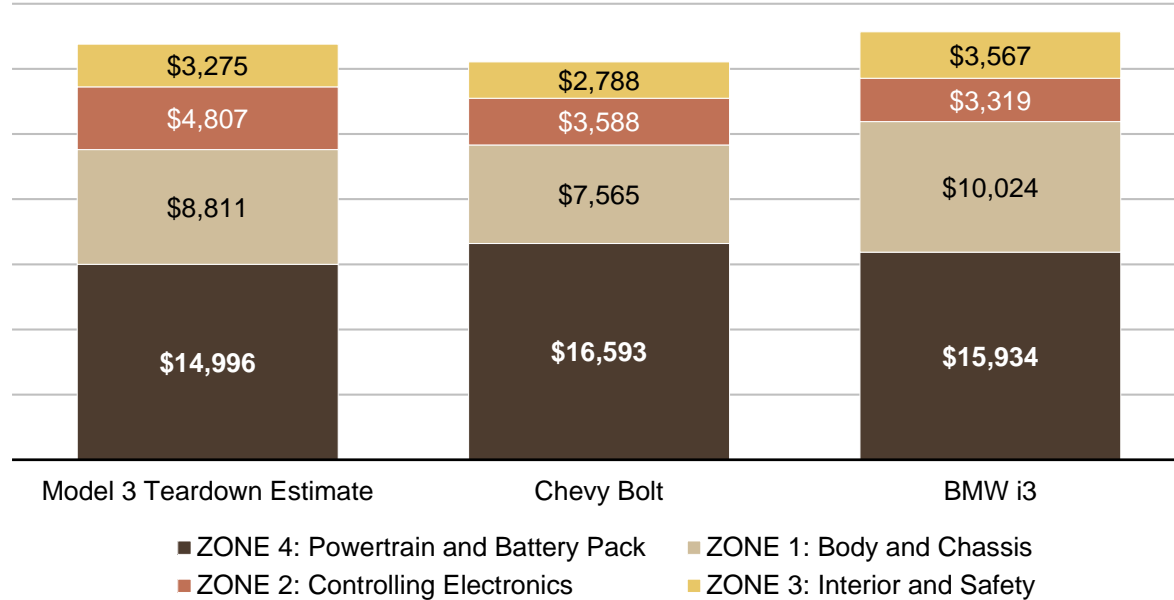
**Tesla Model 3**

**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**

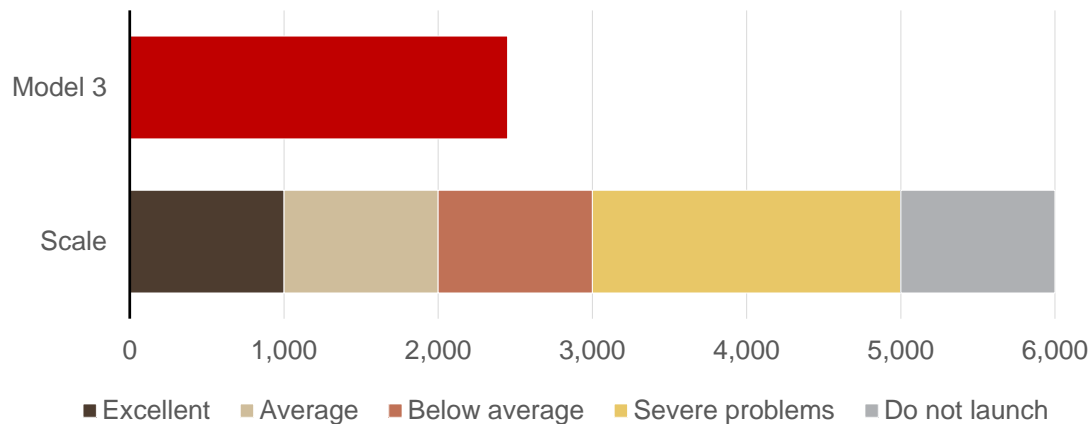
Source: UBS Evidence Lab

Note: Battery costs normalized to 60kWh capacity.

# Areas in which the Model 3 is **worse**...

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## Fit & Finish Quality Audit Penalty Summary

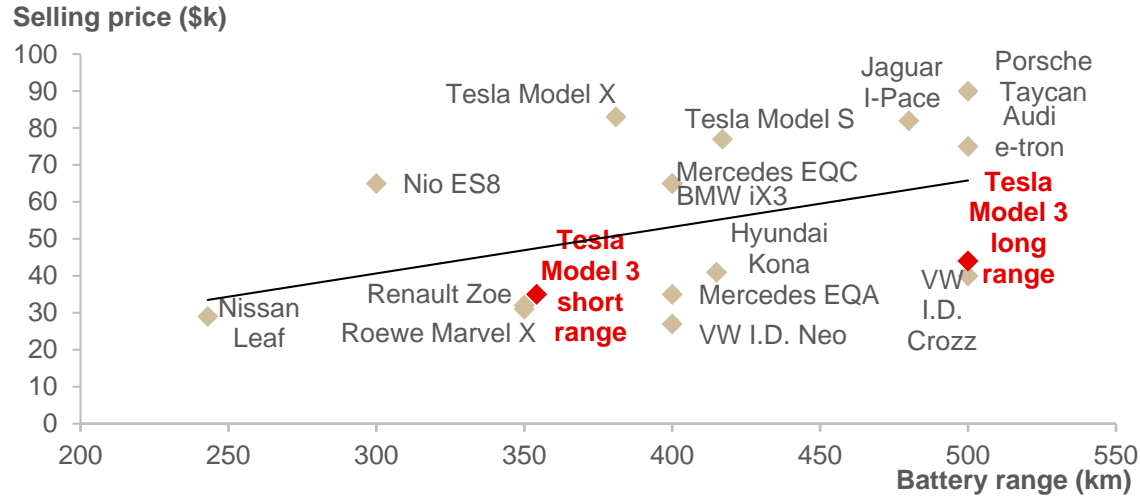


**Build quality is the main weakness**, though some issues can be fixed with a 12-24 month view

Source: UBS Evidence Lab

# Tesla's lead could be **competed** away over time ...

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

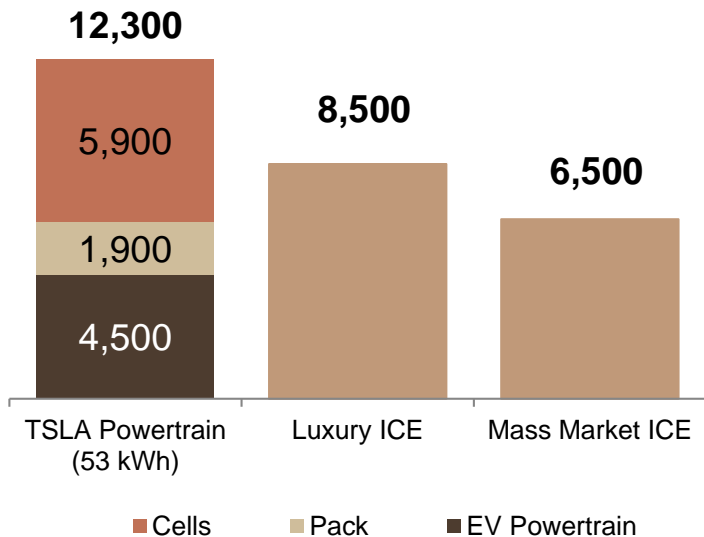


... so we will be monitoring **upcoming launches**

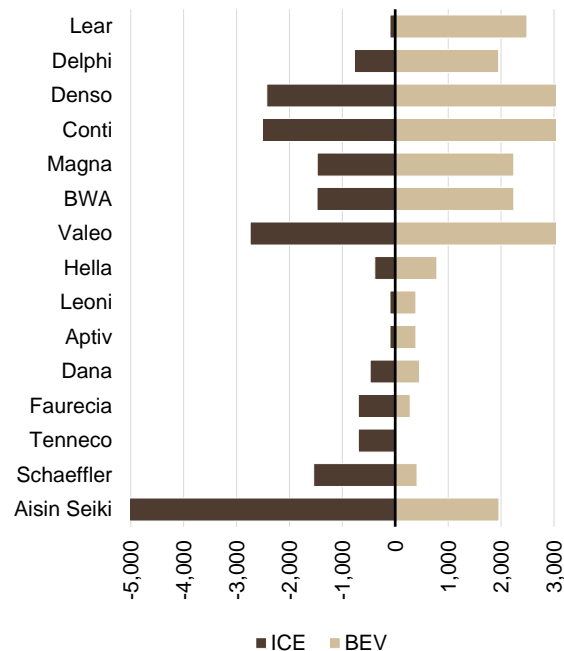
Source: UBS estimates

# Will auto suppliers be **disrupted** by EVs?

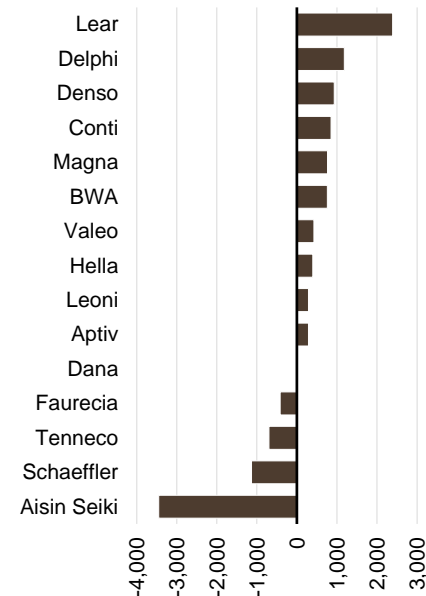
## ICE Specific Content vs. BEV Specific Content



## ICE Specific Content vs. BEV Specific Content



## ICE Specific Content Less BEV Specific Content

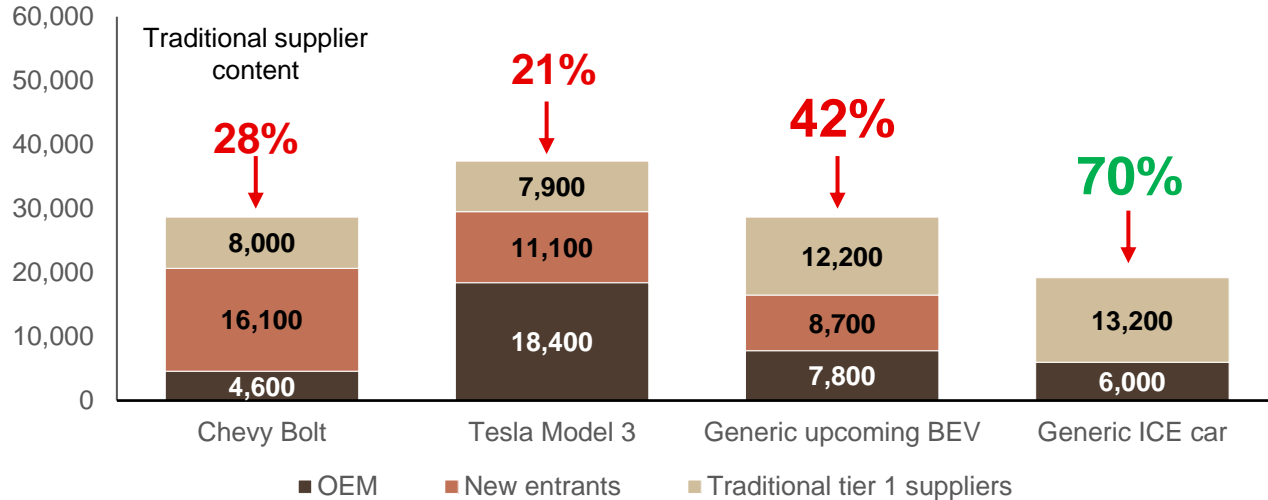


Source: UBS estimates, UBS Evidence Lab



# How does the teardown change our view on **auto suppliers**?

## Tier-1 content share in BEVs vs. ICE cars



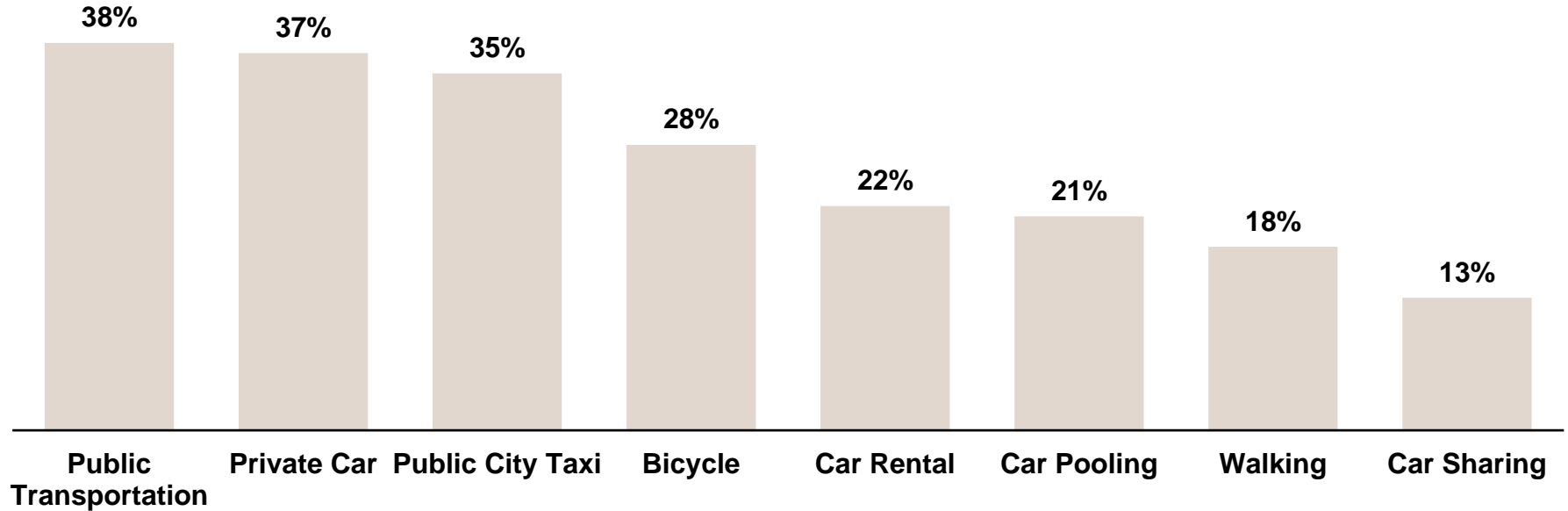
We estimate that the **average tier-1 content share shrinks to 42%** in upcoming EVs, or by \$1k vs. a comparable ICE car ...

Source: UBS estimates

# Will autos be **disrupted** by Rideshare 1.0?

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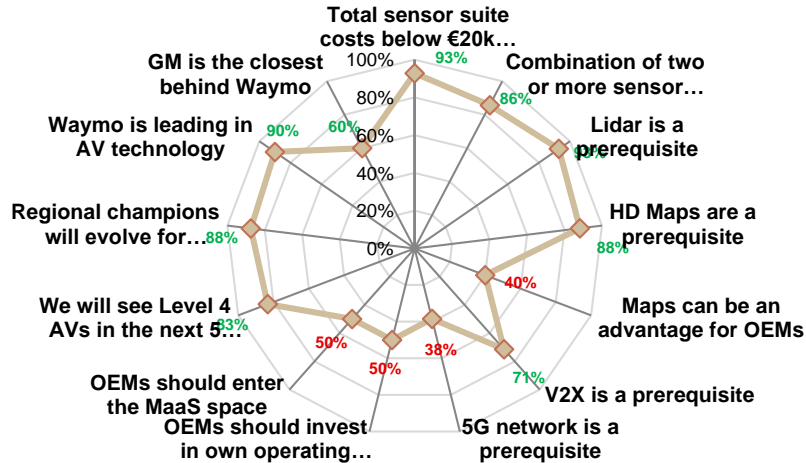
Modes of transport used less now used less often due to increased usage of "ride-on-demand"



Source: UBS Evidence Lab

# Will autos be **disrupted** by autonomous vehicles?

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



... and are based on a **structured questionnaire**.

## 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 GLG, 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 Fenghua – 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

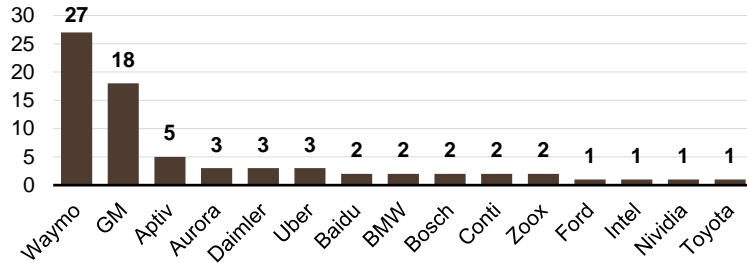
### Europe

- BMW – answered via e-mail from the AV expert team
- Dr Miklos Kiss – head of Pre-Development Driver Assistance Systems at Audi
- Hans Adlkofer – 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

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



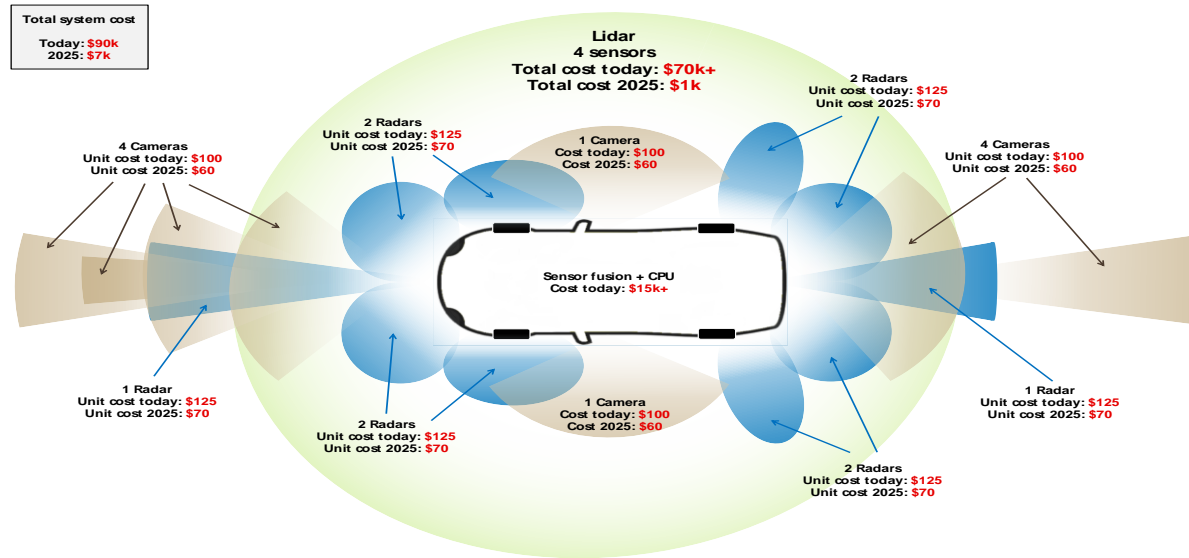
**UBS AV expert interview word cloud**



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 = camera

# What is our **timeline** for autonomous?

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- **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

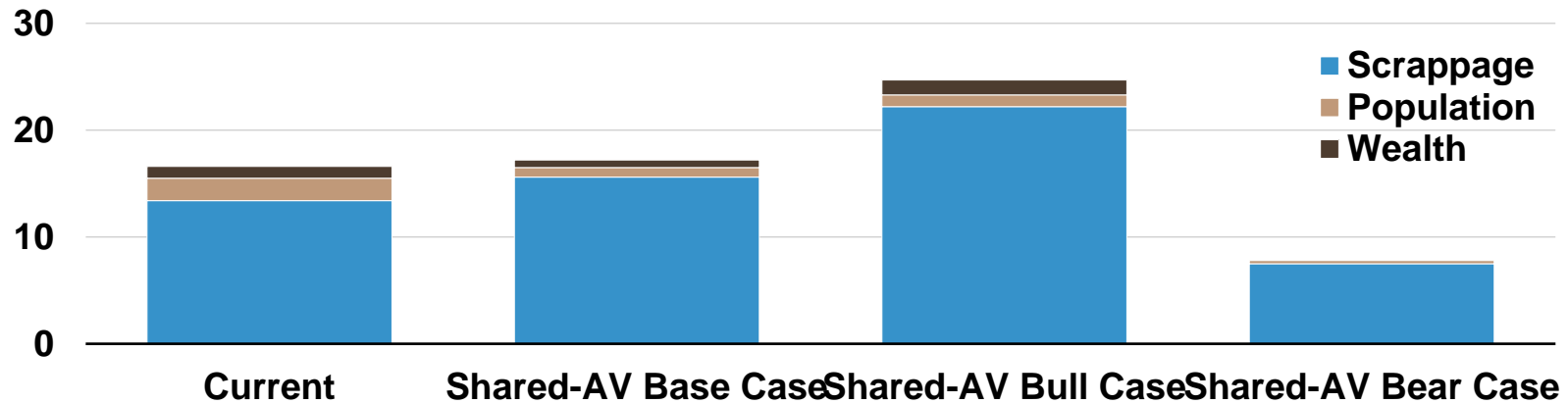
# What does **Rideshare 2.0** mean for demand?

- **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



# Thank You

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**If you have any questions, please reach out!**

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# Valuation Method and Risk Statement

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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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<b>Buy</b>	FSR is > 6% above the MRA.	49%	26%
<b>Neutral</b>	FSR is between -6% and 6% of the MRA.	38%	23%
<b>Sell</b>	FSR is > 6% below the MRA.	14%	14%
Short-Term Rating	Definition	Coverage <sup>3</sup>	IB Services <sup>4</sup>
<b>Buy</b>	Stock price expected to rise within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%
<b>Sell</b>	Stock price expected to fall within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%

Source: UBS. Rating allocations are as of 31 December 2018.

1: Percentage of companies under coverage globally within the 12-month rating category.

2: Percentage of companies within the 12-month rating category for which investment banking (IB) services were provided within the past 12 months.

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<b>Baidu, Inc.</b> <sup>4, 6a, 16</sup>	BIDU.O	Buy	N/A	US\$162.09	04 Mar 2019
<b>BMW</b> <sup>7</sup>	BMWG.DE	Neutral	N/A	€74.75	01 Mar 2019
<b>Bosch</b>	BOSH.BO	Sell	N/A	Rs18,749.30	01 Mar 2019
<b>Continental</b> <sup>7</sup>	CONG.DE	Neutral	N/A	€146.15	01 Mar 2019
<b>Ford Motor Co.</b> <sup>7, 16</sup>	F.N	Buy	N/A	US\$8.79	01 Mar 2019
<b>General Motors Company</b> <sup>6b, 7, 16</sup>	GM.N	Buy	N/A	US\$39.53	01 Mar 2019
<b>Hyundai Motor</b> <sup>4, 5, 13</sup>	005380.KS	Buy	N/A	Won122,000	04 Mar 2019
<b>Intel Corp.</b> <sup>4, 6a, 6b, 6c, 7, 16, 26</sup>	INTC.O	Buy	N/A	US\$53.30	01 Mar 2019
<b>NIO Inc.</b> <sup>7, 4, 5, 6a, 13, 16</sup>	NIO.N	Neutral	N/A	US\$10.06	04 Mar 2019
<b>Nissan Motor</b>	7201.T	Sell	N/A	¥962.5	04 Mar 2019
<b>NVIDIA Corp.</b> <sup>16</sup>	NVDA.O	Buy	N/A	US\$156.45	01 Mar 2019
<b>Porsche</b> <sup>13, 27</sup>	PSHG_p.DE	Buy	N/A	€59.94	01 Mar 2019
<b>Renault</b> <sup>7, 13</sup>	RENA.PA	Neutral	N/A	€60.65	01 Mar 2019
<b>Tesla, Inc.</b> <sup>16</sup>	TSLA.O	Sell	N/A	US\$294.79	01 Mar 2019
<b>Toyota Motor</b> <sup>7, 16</sup>	7203.T	Neutral	N/A	¥6,628	04 Mar 2019
<b>Volkswagen</b> <sup>7, 13</sup>	VOWG_p.DE	Buy	N/A	€154.18	01 Mar 2019

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