This is Not A Talk About Autonomous Vehicles

Presentation by **Ed Combs, Steve Walsh**
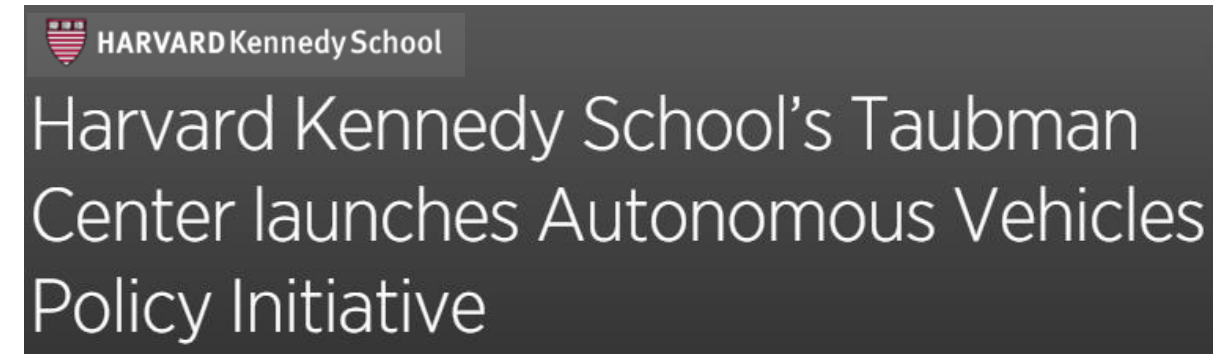May 2019

pwc △ AVINEW

Summary

- Autonomous Vehicles attract significant hype, along with disillusionment

- However, existing Advanced Driver Assistance Systems (ADAS) show meaningful loss frequency reductions

- ADAS and external factors will "Shrink and Shift" traditional Personal Auto Insurance that will evolve into different coverage

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Autonomous Vehicle Hype

You've certainly heard about autonomous vehicles...

THE WALL STREET JOURNAL.

How Autonomous Cars Will Reshape Our World

HARVARD Kennedy School

Harvard Kennedy School's Taubman Center launches Autonomous Vehicles Policy Initiative

The New York Times

Wielding Rocks and Knives, Arizonans Attack Self-Driving Cars

"

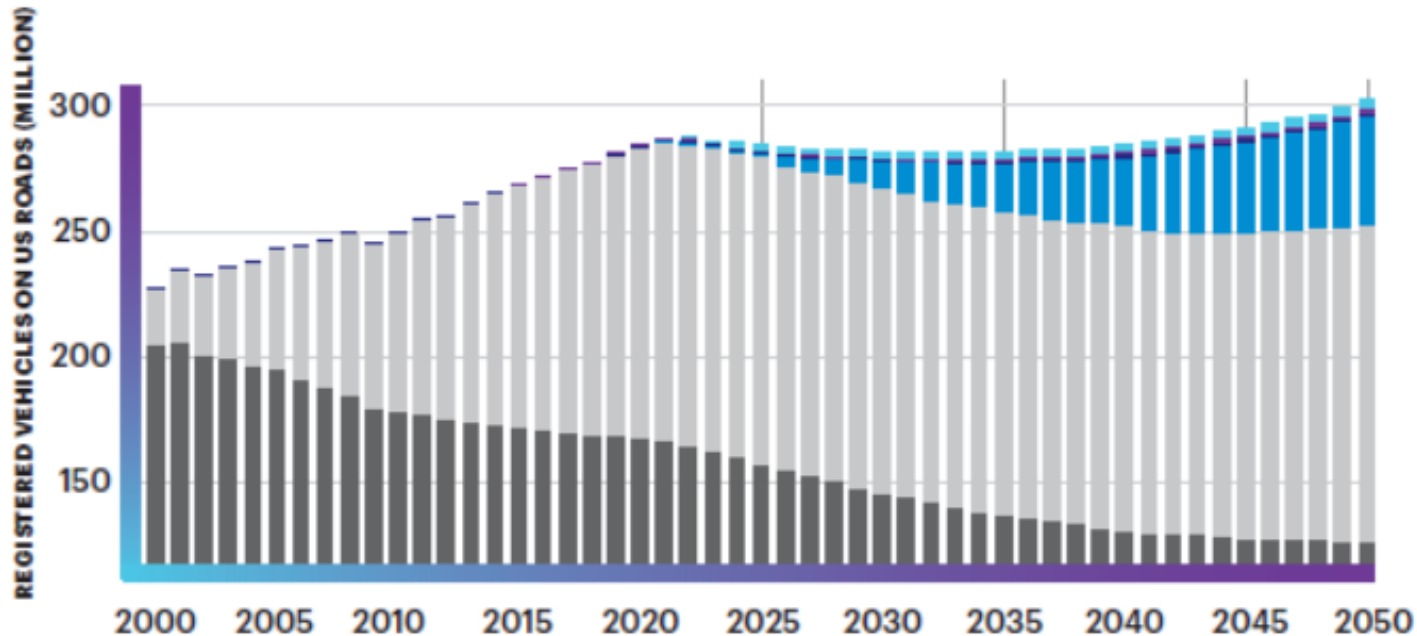# So, where's *MY* flying robo-taxi?!?

Disillusioned skeptic

Gartner Hype Cycle:
You are entering the Trough of Disillusionment
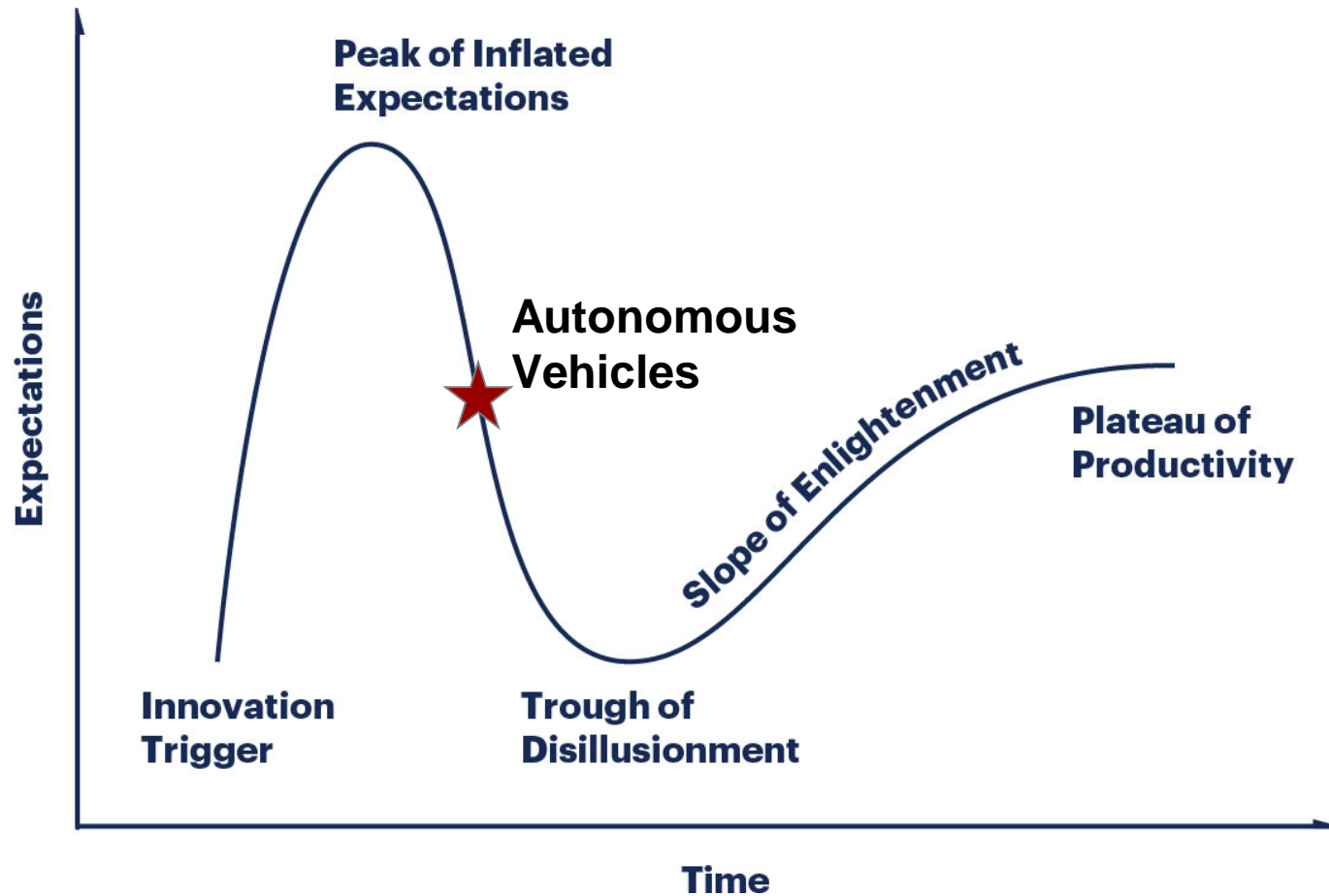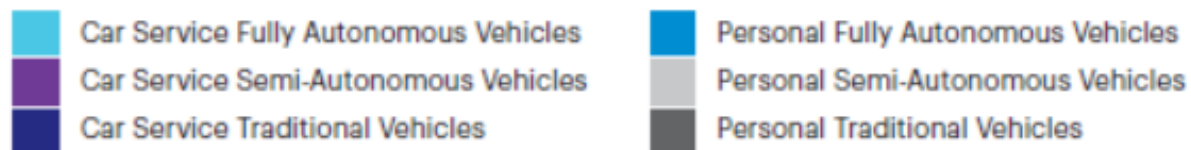

- **Innovation Trigger**: … proof-of-concept stories and media interest trigger significant publicity. …
- **Peak of Inflated Expectations**: … a number of success stories — often accompanied by scores of failures…
- **Trough of Disillusionment**: … experiments and implementations fail to deliver. Producers of the technology shake out or fail. …
- **Slope of Enlightenment**… benefit … start to crystallize … Second- and third-generation products appear…
- **Plateau of Productivity**: Mainstream adoption starts to take off. … broad market applicability and relevance are clearly paying off.

Before autonomy, semi-autonomous vehicles with Advanced Driver Assistance Systems (ADAS) will dominate the market

REGISTERED VEHICLES ON US ROADS (MILLION)

300
250
200
150

2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050

CAR TECHNOLOGY SEGMENTS

- Car Service Fully Autonomous Vehicles
- Car Service Semi-Autonomous Vehicles
- Car Service Traditional Vehicles
- Personal Fully Autonomous Vehicles
- Personal Semi-Autonomous Vehicles
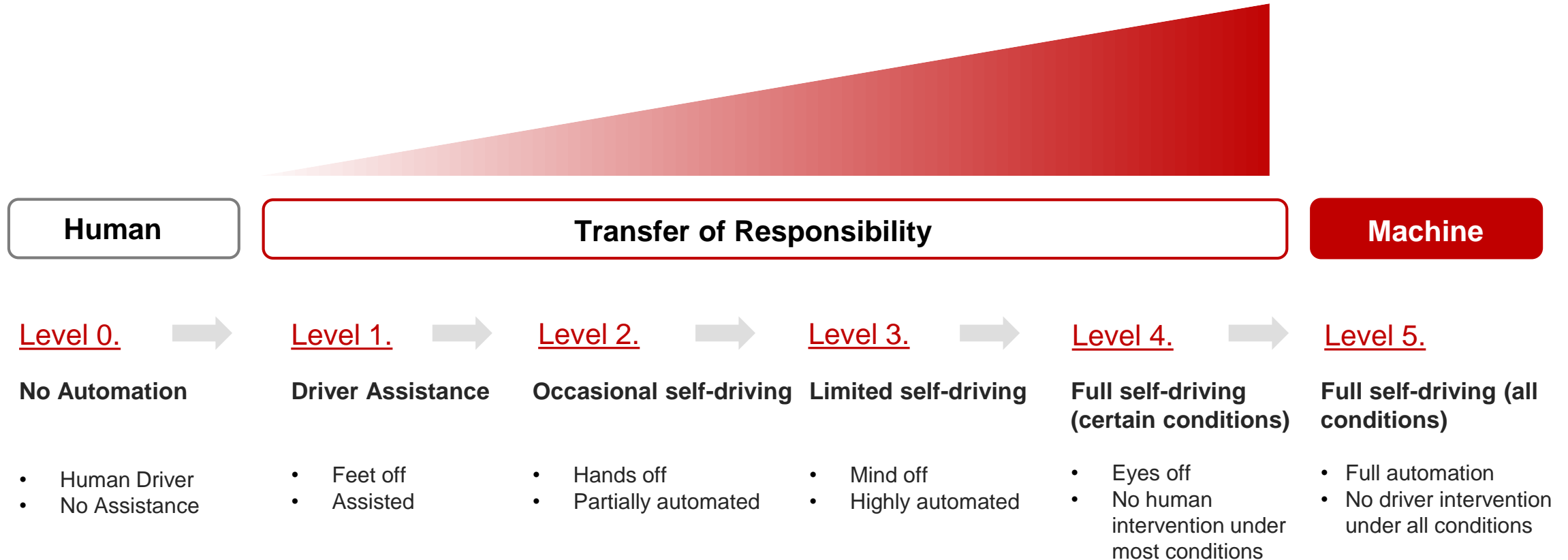- Personal Traditional Vehicles

Stevens Institute of Technology & Accenture

By 2035, of US registered vehicles:

- Fewer than 10% will be fully autonomous

- *Almost two-thirds will be semi-autonomous*

Source: Accenture & Stevens Institute, *Insuring Autonomous Vehicles, an $81B Opportunity*

SAE – Levels of Autonomy

From Human to Machine

Human	Transfer of Responsibility	Machine

Level 0. ➡ **Level 1.** ➡ **Level 2.** ➡ **Level 3.** ➡ **Level 4.** ➡ **Level 5.**

Level 0.	Level 1.	Level 2.	Level 3.	Level 4.	Level 5.
No Automation	**Driver Assistance**	**Occasional self-driving**	**Limited self-driving**	**Full self-driving (certain conditions)**	**Full self-driving (all conditions)**
• Human Driver • No Assistance	• Feet off • Assisted	• Hands off • Partially automated	• Mind off • Highly automated	• Eyes off • No human intervention under most conditions	• Full automation • No driver intervention under all conditions

2 ADAS Risk Score

In some examples, ADAS tracked by *trim levels* has no impact on carrier pricing

Example: Audi Safety Features by Trim Level

	Premium	Premium +	Prestige
Backup Camera	✓	✓	✓
Forward Collision Warning	✓	✓	✓
Auto Emergency Braking	✓	✓	✓
Blind-spot Monitor		✓	✓
Rear Cross-traffic Alert		✓	✓
Lane Departure Warning			✓
Adaptive Cruise Control			✓

No difference in factors by trim level

Large Carrier 2018 Vehicle Group Rating Factor

	BI	PD	Med	Coll	Comp
A3 2.0T					
PREMIUM	1.042	0.862	0.954	1.740	1.032
PREM +	1.042	0.862	0.954	1.740	1.032
PRESTGE	1.042	0.862	0.954	1.740	1.032
A3 Quattro 2.0T					
PREMIUM	0.932	0.781	0.901	1.740	0.989
PREM +	0.932	0.781	0.901	1.740	0.989
PREST	0.932	0.781	0.901	1.740	0.989
A5 Quattro					
PREMIUM	0.957	0.790	0.825	1.774	1.011
PREMIUM +	0.957	0.790	0.825	1.774	1.011
PRESTIGE	0.957	0.790	0.825	1.774	1.011

OEMs only offer many ADAS features as *options*, so that decoding a VIN is not definitive

OEMs that represent 99% of the US market will make FCW and AEB standard by Model Year 2022.

BMW 3 Series – ADAS Availability

Model	FCW	AEB	BSW	ACC	LDW	LKA	CTA	RCTA	RR Camera	RR Parking Sensors	Package Info
330i Sedan	S	S	O-1, 9	O-6, 5	S	O-6	O-6		S	O-4, 8, 12	1. Driving Assistance Package 2. Driving Assistance Plus Package 3. Executive Tier
330i Xdrive Sedan	S	S	O-1, 9	O-6, 5	S	O-6	O-6		S	O-4, 8, 12	4. Parking Assistance Package 5. ACC 6. Driving Asst. Pro Package
330i Xdrive Sports Wagon	S	S	O-13	O-5	S			S	S	S	7. Premium Package 8. Exec. Package 9. Convenience Package 10. Convenience Tier
330i Xdrive Gran Turismo	S	S	O-13	O-5	S			S	S	S	11. Technology + Driving Asst. Package 12. Park Distance Control 13. Active Blind Spot Detection

S - Standard   *O - Option*

Long-term, OEM's may use blockchain to track vehicles, which would help insurance carriers reflect ADAS features

VIN does not help insure ADAS

- First 11 digits do not decode ADAS
- Serial number details known only to OEM

Consumer data is intermittent

- CarFax does not track ADAS
- Several startups failed with ICO funding (CarFix Vehicle Lifecycle Blockchain, CarBlox, UService)
- Some startups remain (VinChain, CarVertical)

"Automotive Track and Trace" could be long-term success

Supports core OEM operations

- Product recalls
- Inventory control
- Supply chain management

Mobility Open Blockchain Initiative (MOBI) includes many OEMs

Raw materials → Supplies → Automaker → Dealer → Customer
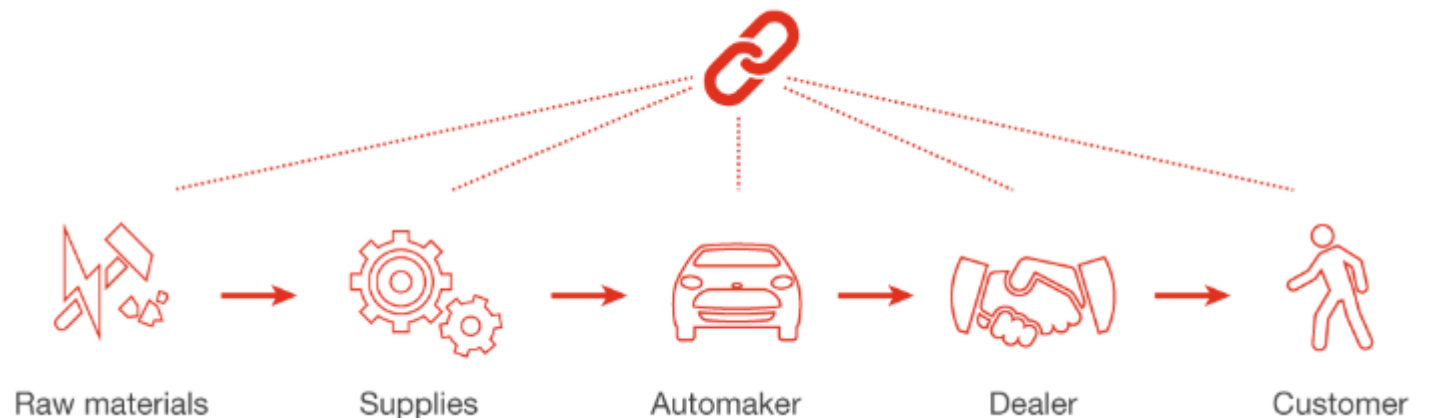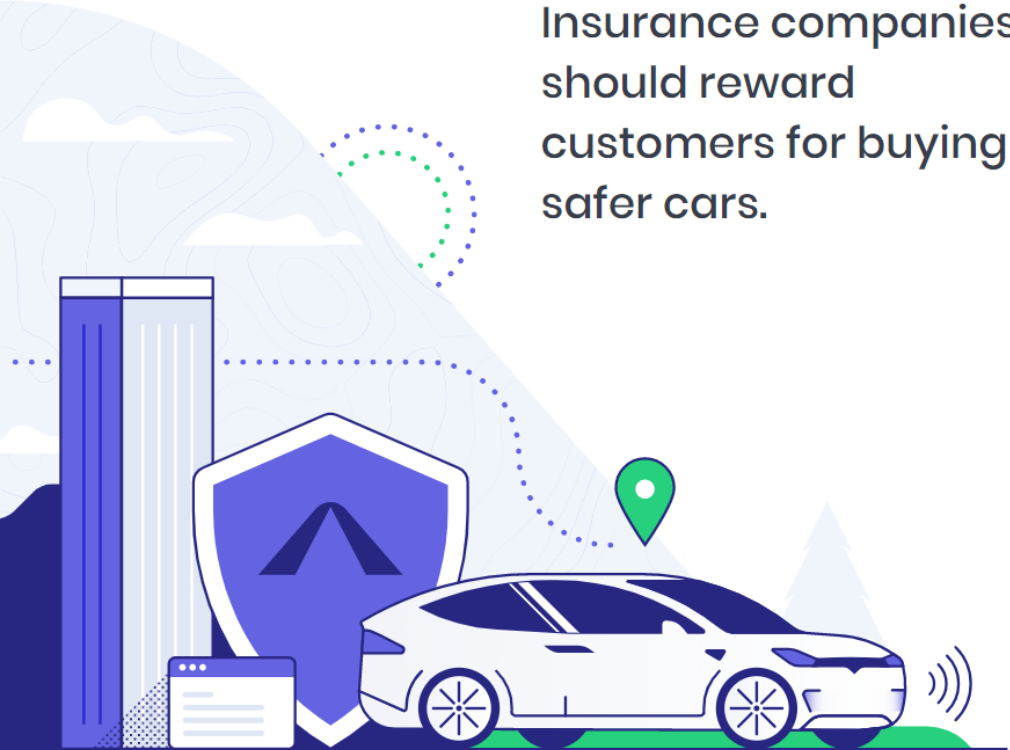
Some insurtechs see opportunity in refining insurance of ADAS-equipped vehicles

AVINEW

WE BELIEVE · · · · · ·

Insurance companies should reward customers for buying safer cars.

Root Insurance Co

MARCH 9, 2017

ANNOUNCEMENT: New discount for Tesla® drivers!

Root's app measures Autosteer-eligible highway miles.

Today, an ADAS Risk Score to quantify safety benefits of *options* per vehicle requires proprietary OEM partnerships

Structuring a partnership

OEM

- Provides vehicle-specific component information
- Provides engineering expertise
- Receives support marketing features and offsetting feature cost with premium reductions

(Re-)Insurer

- Provides analytical and domain expertise
- Receives an ADAS risk score for an individual vehicle to factor into rating model

BMW/Swiss Re Example ADAS Risk Score Algorithm

Three Data Sources

- Historical accident frequencies and severities of individual vehicles with/out certain ADAS
- Engineering simulation of ADAS effect
- Test track experiments

Scope

- Expected release 2019
- BMW vehicles only, for now
- Implied European focus (Germany, Italy, etc.)

3

Personal Auto Insurance
Trend #1: Shrink

(frequency, relatively…)

Recent Advanced Driver Assistance Systems (ADAS) have the potential for significant future improvements in vehicle safety

ADAS Feature & Reduction in Crashes with Injuries (HLDI)

Automatic Braking	Front-to-Rear Backing Crashes	56% 62%
Lane Departure Warning	Single-vehicle, side-swipe, & head-on	21%
Blind Spot Detection	Lane-change	21%
Rear Cross-Traffic Alert	Backing crashes	22%
Rearview cameras	Backing crashes	17%
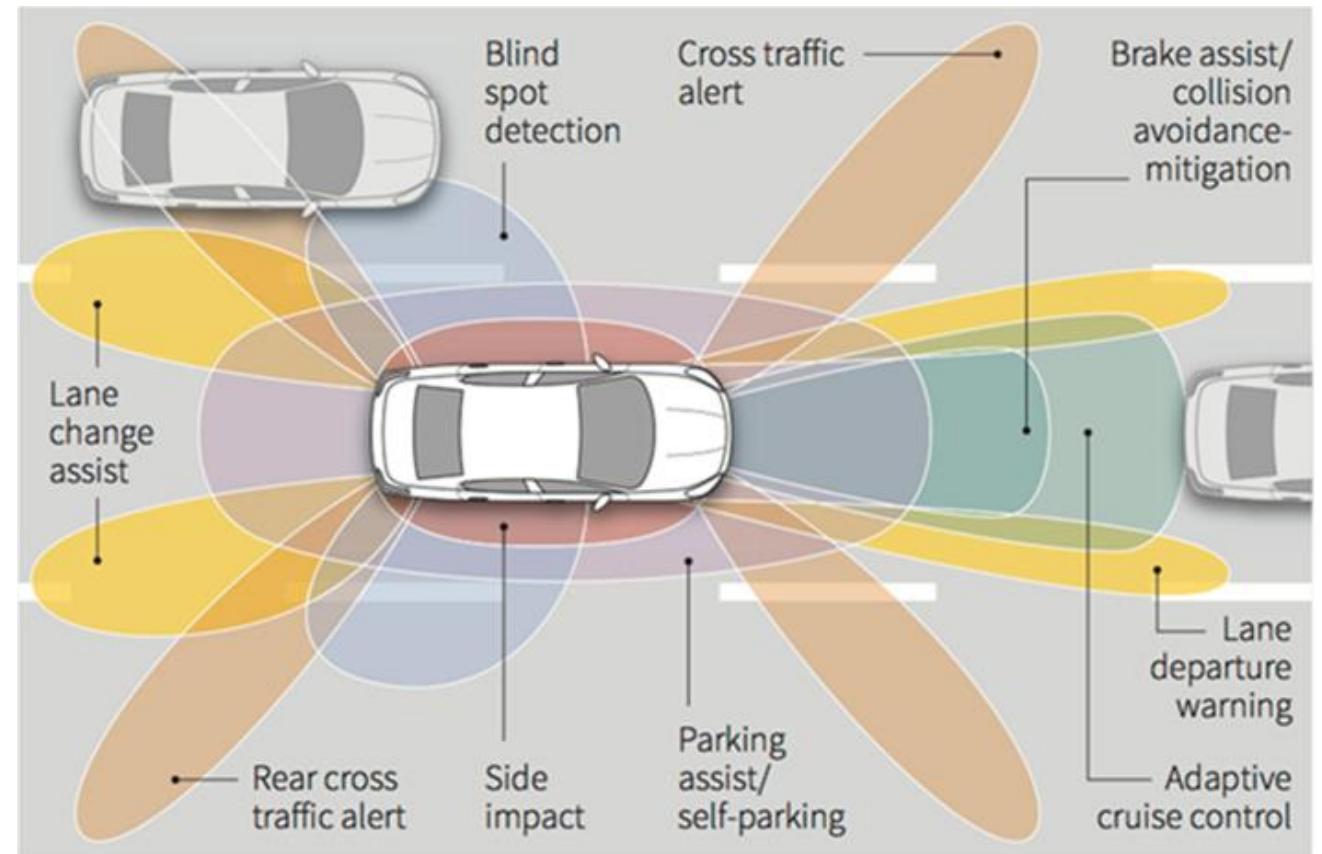
ADAS – Alert/Assist/Assume

Different types of ADAS functionality

Type	Alerts Driver		Assists – Responds in place of Driver	Assumes – Autonomous Operation
Collision Avoidance	Rear Camera	Cross Traffic Alert	Rear Autobraking	
	Blind Spot Warning		Auto Lane Change Steering	SAE Levels II/III e.g. GM Super Cruise (No Level IV or V cars are in production).
	Front Collision Warning		Auto Emergency Braking	
Active Driving			Adaptive Cruise Control	
	Lane/Lateral Departure/Drift Warning		Lane Keeping Steering	

Point of Impact – Insured Losses

Collision
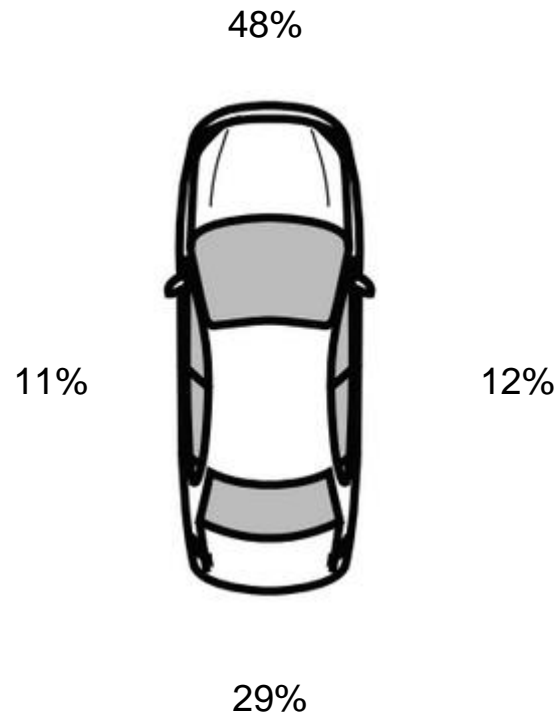
Property Damage Liability

48%

11%   12%

29%

25%

12%   9%

54%
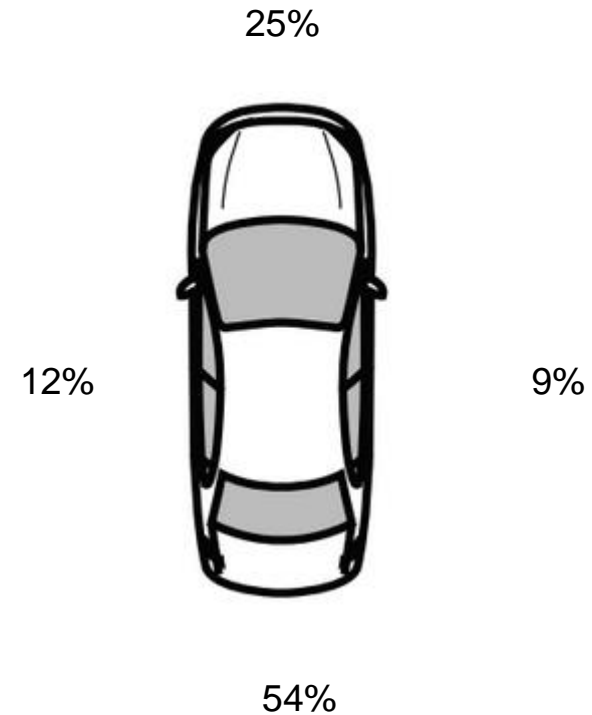
Scenarios Before Police Reported Incidents

- **Single Vehicle**
  - Control Loss (28%)
  - Depart Road Edge (20%)
  - Animal Crash (18%)

- **Two Vehicle**
  - Stopped or Decelerating Lead Vehicle (29%)
  - Turn without Signal (11%)
  - Changing Lanes (8%)
  - Intersection (8%)

- **More than Two Vehicles**
  - Stopped or Decelerating Lead Vehicle (63%)

HLDI studies show differing effectiveness, for example, Automatic Emergency Braking
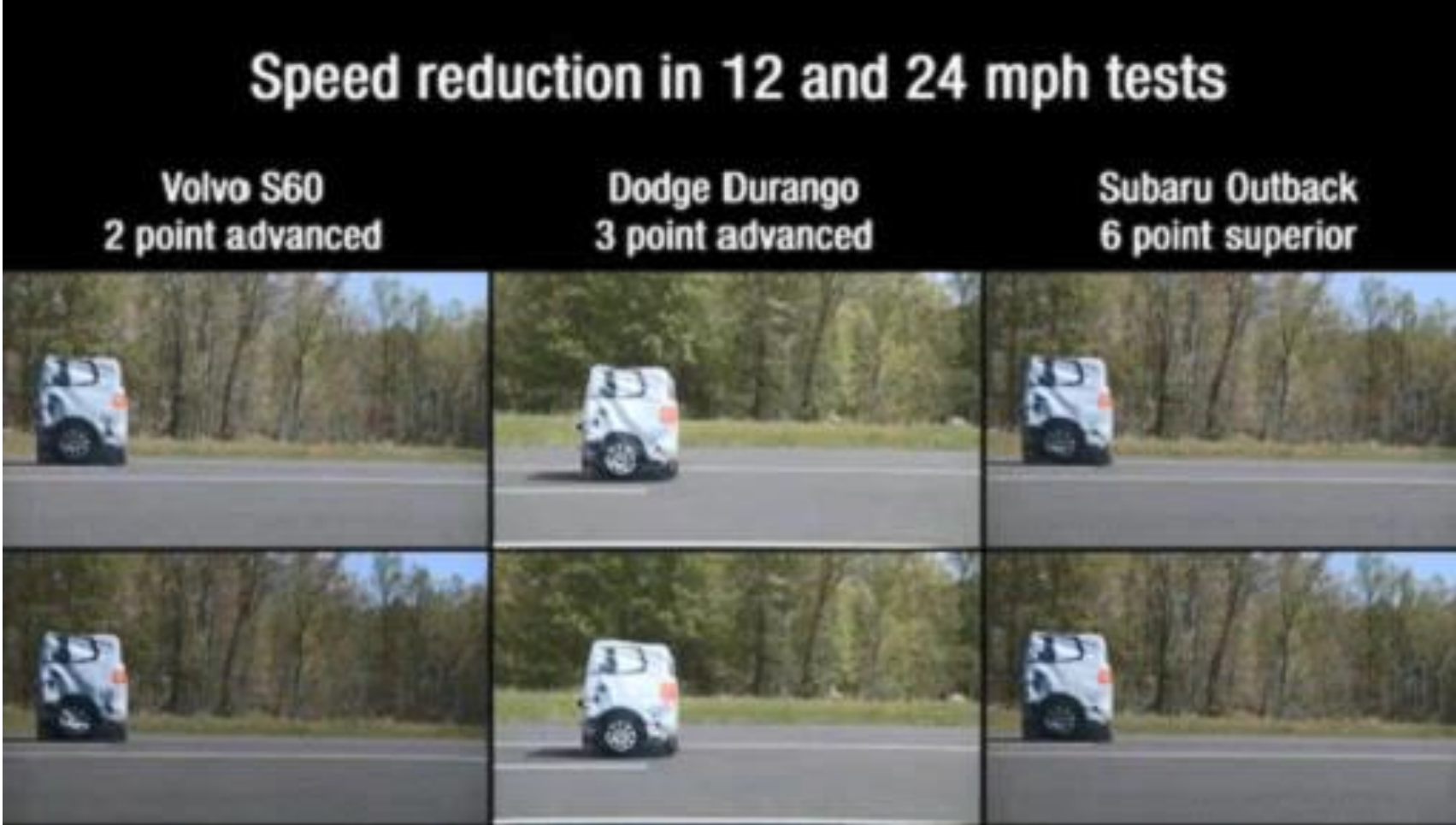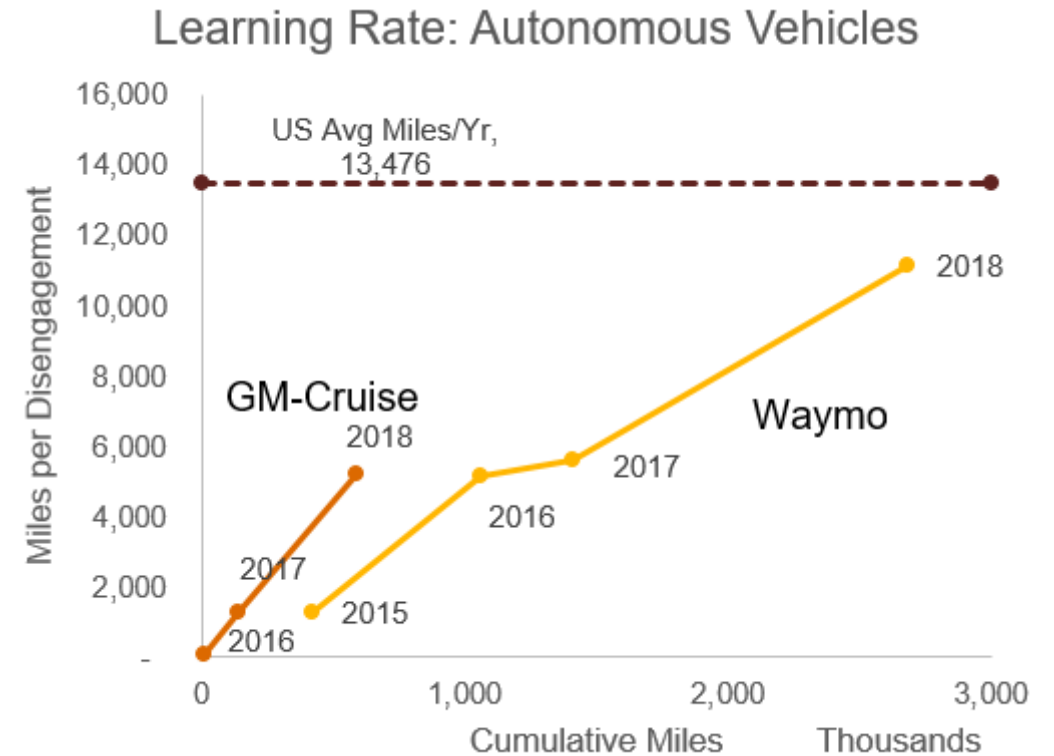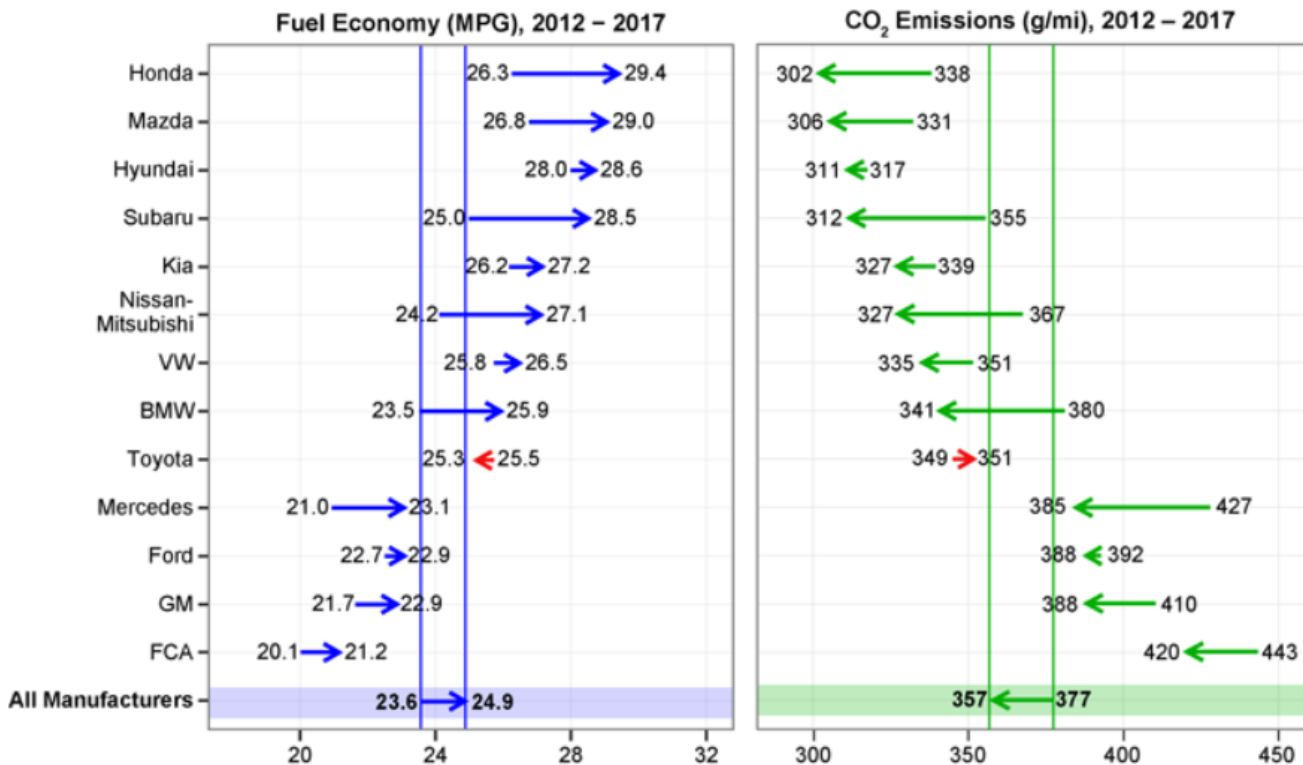
ADAS – Lots of Runway to improve

Function	Uses Hazards Current Location				Uses Hazards Predicted Path			
	🚗	🚶	🚴	⚠️	🚗	🚶	🚴	⚠️
Alert	✓	✓	✓	✓	✓	✗	✗	✗
Assist	✓	✓	✓	✓	✗	✗	✗	✗
Assume	✓	✗	✗	✗	✗	✗	✗	✗

Auto Safety Technology will continue to improve effectiveness; learning rates could vary widely

MPG & CO$_2$ = 1.04% & 1.1% CAGR

Autonomous Vehicles = 107.7% CAGR

Rate of ADAS performance improvement will vary by current maturity and update cycle and scope

ADAS Selection	Maturity (current fitment)	Update cycle and scope	Comparable Example	Comparable Improvement CAGR
n/a: autonomous	n/a	Continuous	Waymo AV	107.7%
Automatic Emergency Braking	4%	5-yr cycle with learning from other fields	GM ADAS 2nd Gen vs. 1st Gen	5.7%
Adaptive Headlights Blind Spot Warning Lane Departure Warning	4-12%	5-yr cycle, auto-specific	Industry MPG, Emissions	1.04%
Parking Sensors Rear-view Camera	24-35%	5-yr cycle, auto-specific	n/a: mature tech	0%

Source: CA DMV, US EPA, HLDI, PwC Analysis

As ADAS fitment and effectiveness increase, the frequency of losses could be 26% lower by 2038 than without ADAS

Includes

- Rate of vehicles equipped with six ADAS features
- Impact on frequency of five coverages
- Effectiveness improvements over time
- Benefits of packages of features
- Consolidated impact across coverages

Excludes

- Change in market size of exposures (vehicle miles traveled, unemployment rate, fuel costs, etc.)
- Autonomous vehicles
- Additional safety features (night vision, curve assist, 5G V2V or V2X, post-crash, etc.)
- Impact on severity

26% lower Frequency by 2038 from ADAS alone
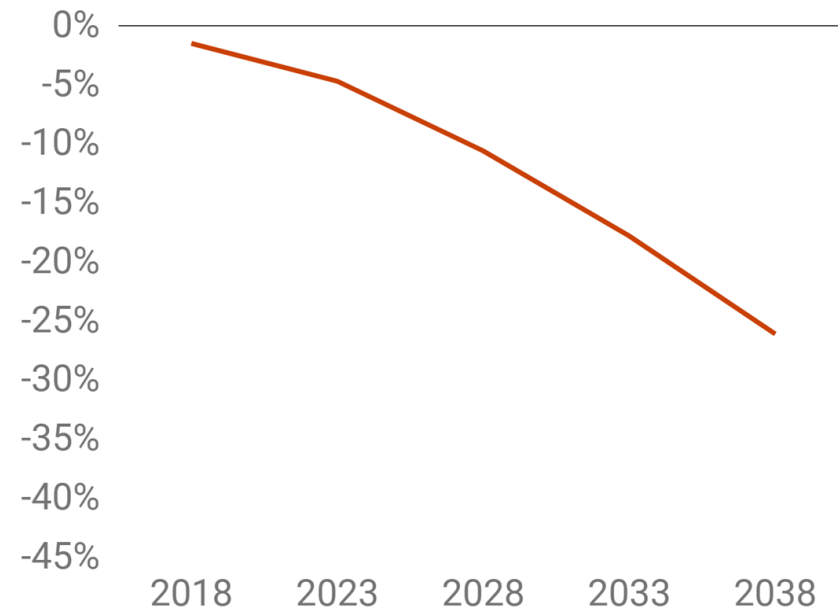
ADAS currently increases average severity but fitment rates will shift towards reducing high severity accidents
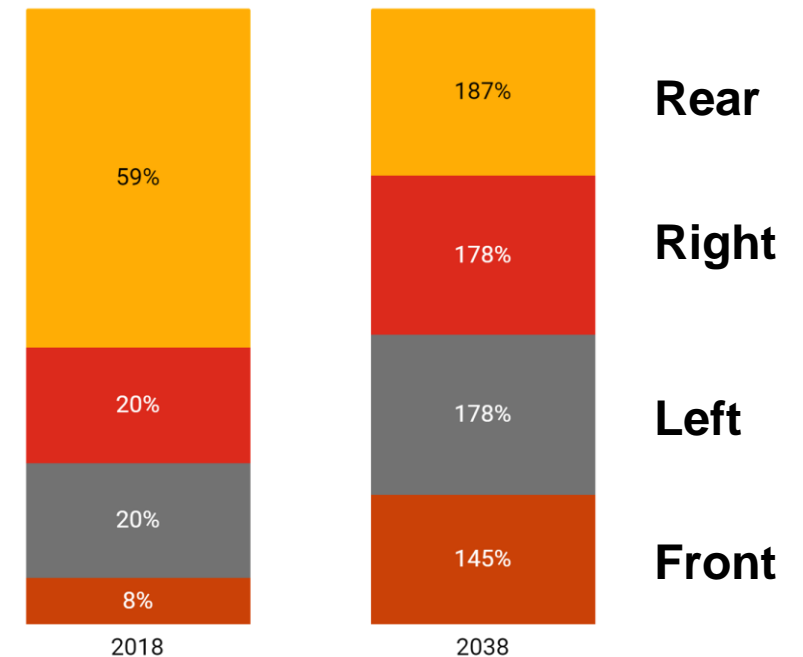
Collision Claim Severity by Point of Impact
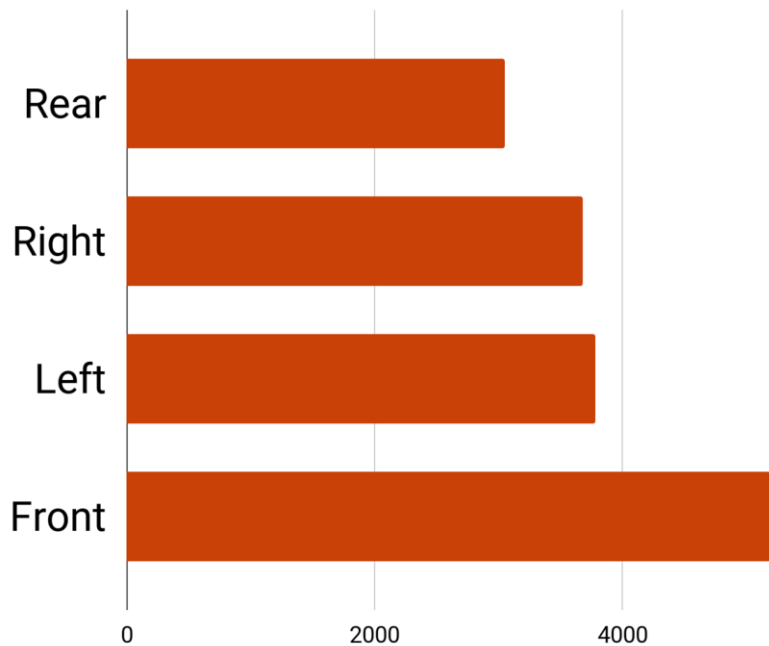
Related ADAS

- Rear Camera
  Parking Sensors

- Lane Departure Warn
  Blind Spot Monitor

- Lane Departure Warn
  Blind Spot Monitor

- AEB
  Adaptive Headlights

ADAS Fitment Rate Sum

Rear

Right

Left

Front

Source: HLDI, PwC Analysis

2019-05-21

4

Personal Auto Insurance
Trend #2: Shift

Tesla is launching traditional personal auto insurance, while other OEM's shift personal auto to commercial auto fleets

"

...we are creating a **Tesla insurance product** and we hope to **launch** that **in about a month** ... information arbitrage opportunity ... "
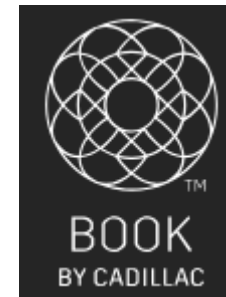
Elon Musk
TSLA Chief Executive Officer, 4/25/2019

Details:

- MGA on Markel/State National paper in CA

- Based on Nationwide Private Client Group (Clearbrook)

- Discount on vehicle's SAE Level of Autonomy with max of 30% for Level 5; essentially an ADAS Risk Score

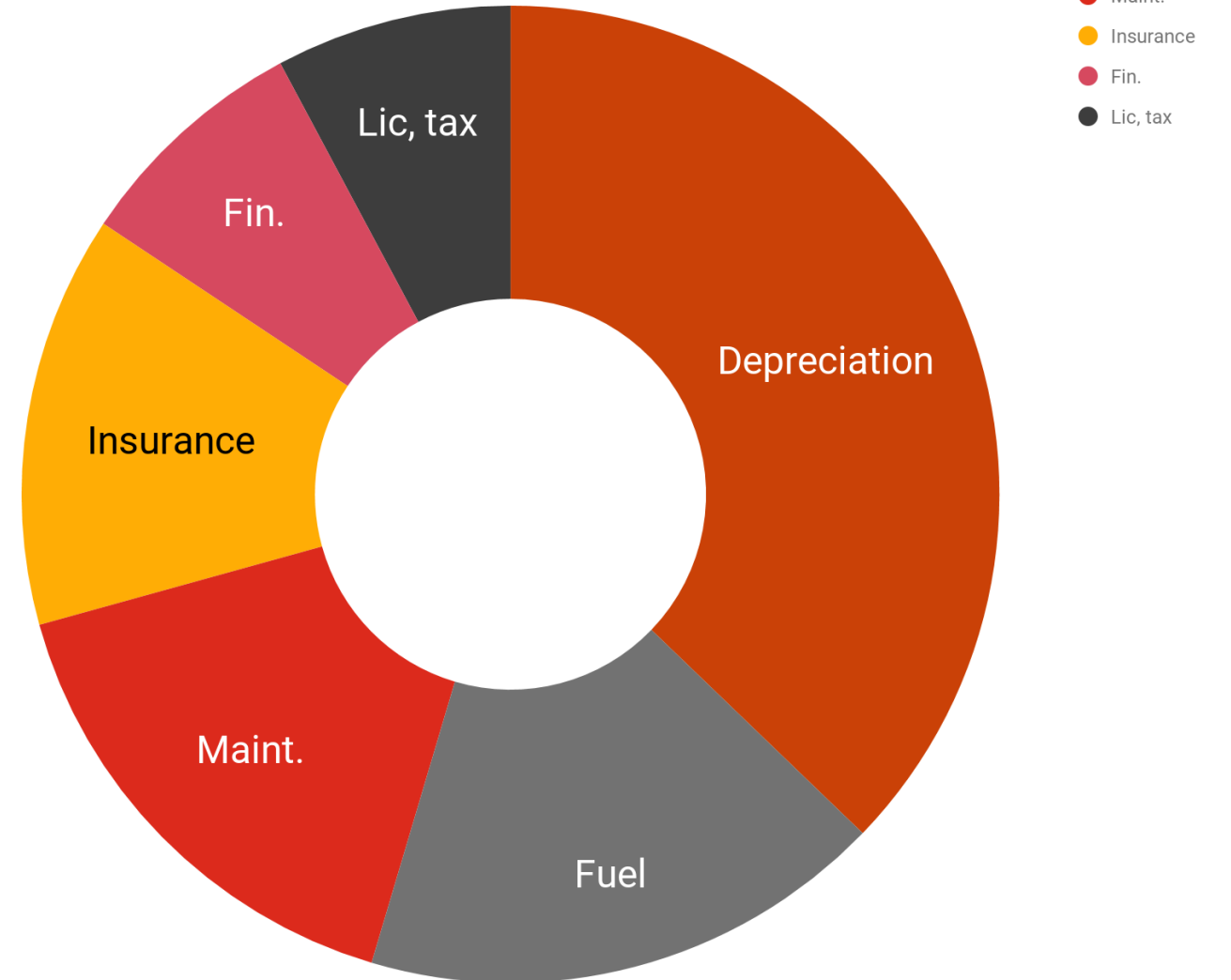**Today, OEM's piloting subscriptions including insurance**

OEM subscription services will be motivated by costs other than insurance

Annual Cost Car Ownership

- Small SUV
- 15,000 miles per year
- Total = $7,869 per year

OEM Interest

- Depreciation captures manufacturing costs
- Maintenance & Financing often through dealer channels
- Insurance is only 14% of annual cost
- Tesla owns/influences <u>almost</u> all vehicle costs
  - *Insurance is the missing piece*

Legend:
- Depreciation
- Fuel
- Maint.
- Insurance
- Fin.
- Lic, tax

Pie chart segments: Depreciation, Fuel, Maint., Insurance, Fin., Lic, tax

OEMs will have greater insurable exposure through Product Liability for increasingly sophisticated features

> " Volvo would "accept full liability whenever one of its cars is in autonomous mode."
>
> **Håkan Samuelsson**
> Volvo's President and Chief Executive

- Product Liability has higher exposure than traditional auto
  - Higher/no limits
  - No deductibles
  - "Deeper Pockets"
- CAS Autonomous Vehicle Task Force analyzed scenario if OEM provides fully autonomous vehicles
- Total insurance premium would increase until frequency reduction approaches 75%

Frequency Reduction	Market Premium Change
10%	148%
25%	107%
50%	38%
75%	-31%
90%	-72%

Source: Forbes, Casualty Actuarial Society Autonomous Vehicle Task Force, PwC Analysis

OEM insurance would be further simplified if auto liability and medical components shift to federal Medicare-For-All

S. 1804

To establish a Medicare-for-all national health insurance program.

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IN THE SENATE OF THE UNITED STATES

SEPTEMBER 13, 2017

Mr. SANDERS (for himself, Ms. BALDWIN, Mr. BLUMENTHAL, Mr. BOOKER, Mr. FRANKEN, Mrs. GILLIBRAND, Ms. HARRIS, Mr. HEINRICH, Ms. HIRONO, Mr. LEAHY, Mr. MARKEY, Mr. MERKLEY, Mr. SCHATZ, Mrs. SHAHEEN, Mr. UDALL, Ms. WARREN, and Mr. WHITEHOUSE) introduced the following bill; which was read twice and referred to the Committee on Finance

_____

A BILL

To establish a Medicare-for-all national health insurance program.

SEC. 107. PROHIBITION AGAINST DUPLICATING COVERAGE.

(a) IN GENERAL.—Beginning on the effective date described in section 106(a), it shall be unlawful for—

(1) a private health insurer to sell health insurance coverage that duplicates the benefits provided under this Act; or

(2) an employer to provide benefits for an employee, former employee, or the dependents of an employee or former employee that duplicate the benefits provided under this Act.

5 Summary

Personal Auto insurance will evolve over time

Short term (now: 2020)

ADAS Impact

- Lower frequency, higher severity already happening and affecting claims, reserving, pricing, etc.

- Refined pricing opportunity

Medium term (2030)

Different players

- Increasing product liability exposure for OEMs from ADAS

    - Note: AEB standard in 2022

- Wildcard U.S. election and Medicare-for-All (2021 inauguration, 2023 law?, 2026 effective?)
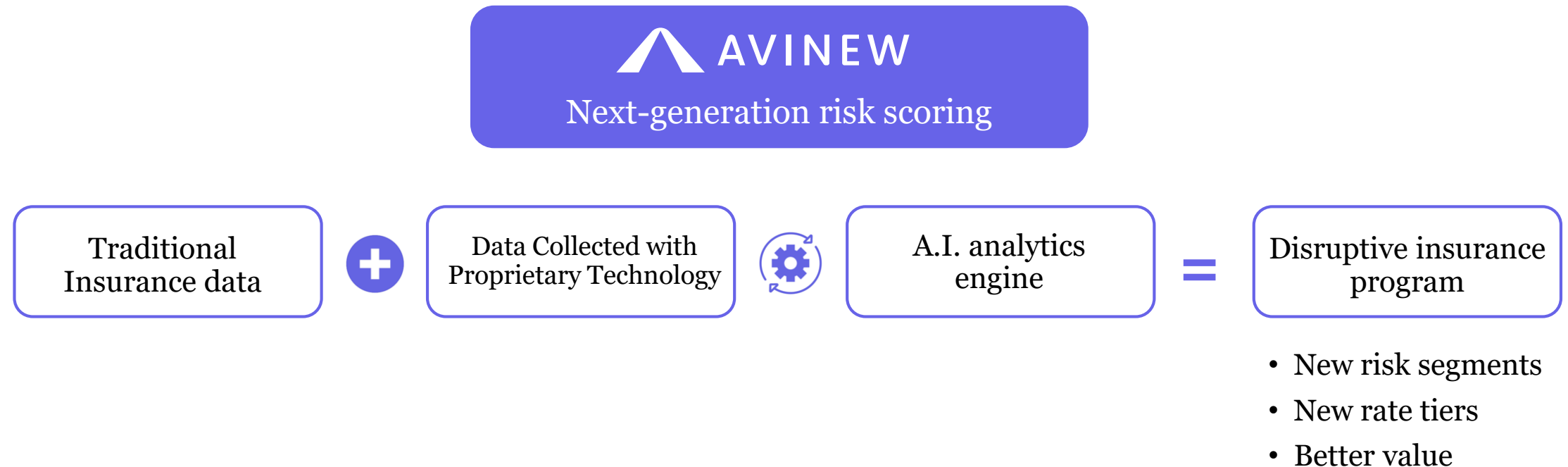
Long term (2040)

Fundamentally different product

- Lower percentage of privately owned vehicles with much lower frequency of accidents and higher severity borne by GL

- Higher percentage of fleet-owned vehicles, increasingly driven autonomously covered by commercial auto, and GL, and Cyber, and …

Avinew's plan to spark an auto insurance evolution

Insurtech that works with auto tech

- Proprietary technologies monitor ADAS usage, including autonomous usage, to improve underwriting <u>and</u> the customer experience
- Rating plans that reflect the loss reduction impact of these new technologies.

⋀ AVINEW
Next-generation risk scoring

| Traditional Insurance data | ➕ | Data Collected with Proprietary Technology | ⚙ | A.I. analytics engine | = | Disruptive insurance program |

- New risk segments
- New rate tiers
- Better value

Thank you

Ed Combs
Ed.Combs@avinew.com

Steve Walsh
Steve.Walsh@pwc.com

pwc.com