Impact of Car Sharing, Automated Driver Assistance, Autonomous Cars on Insurance

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Innovation Lead – PwC Analytics
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Ridesharing, Automated Driver Assistance Systems, Autonomous Vehicles and Electric Vehicles are disrupting the auto industry ecosystem.
Car sharing & Ride sharing
Younger, urban dwellers are increasingly shifting towards sharing as opposed to owning assets – including cars

30%
Annual growth of car and ride sharing globally

$5.2 Billion
Revenue from car sharing globally by 2020

1 Million
Number of Uber drivers worldwide in June 2015

300
Number of cities with Uber as of June 2015
Urbanization, rising cost of ownership, technology, and convenience of use, are fueling the rise of car and ride sharing

- **Efficiency**: Sharing makes life more affordable - 86%
- **Ownership**: Less expensive to share than own - 81%
- **Provider Demographic**: Providers aged 18 to 44 years - 62%
- **Car Sharing Participation**: Participated in Car Sharing - 8%
- **Car Sharing Preference**: Like auto sharing because of better pricing - 56%

44% of US adults are familiar with the “sharing economy” and 19% have participated in it.

Sources: PwC Analysis, Roland Berger (2014)
## Car & Ride Sharing

<table>
<thead>
<tr>
<th>Urbanization</th>
<th>Ownership Costs</th>
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<tbody>
<tr>
<td><strong>Car Sharing Attractiveness</strong></td>
<td><strong>Rising fuel prices, insurance, and parking fees in congested urban centers are making car ownership impractical for most urban dwellers</strong></td>
</tr>
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### Congestion and higher car ownership costs are exposing potential owners to viable alternatives to car ownership

### Technology

Penetration of mobile devices and mobile coverage, and improved sensor adoption and security have created a foundation for reliable and convenient sharing

### Convenience

City congestion, traffic, limited parking, and minimal vehicle use make car ownership less convenient than public transit and other alternatives
Owning a Car vs Ride Share vs Taxi

Your Driving Costs 2015

- **FUEL** $1,581.50/year 19.3%
- **DEPRECIATION** $3,654/year 42%
- **INSURANCE** $1,115/year 12.8%
- **MAINTENANCE** $766.50/year 8.8%
- **TIRES** $147/year 1.7%
- **LICENSE, TAXES & REGISTRATION** $665/year 7.7%
- **FINANCE CHARGES** $669/year 7.7%

$8,698 is the average annual cost to own and operate a vehicle in the U.S., which is down 2% from 2014.

Williamsburg to East Village
- **uberX** $15
- **old uberX** $19
- **taxi** $16

Nolita to Lincoln Center
- **uberX** $20
- **old uberX** $26
- **taxi** $22

Grand Central to Financial District
- **uberX** $22
- **old uberX** $28
- **taxi** $24
### Automated Driver Assistance Systems (ADAS)

Variety of sensors, automotive technologies, artificial intelligence and machine learning techniques are driving growth of ADAS

<table>
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<tr>
<th>Metric</th>
<th>Value</th>
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<tr>
<td>Cost to society from distracted driving</td>
<td>$230 bn/yr</td>
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<tr>
<td>% of Premium car customers who will definitely or probably purchase emergency stop assist for $800</td>
<td>31%</td>
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<tr>
<td>Compound Annual Growth Rate of ADAS Globally from 2014-2020</td>
<td>23%</td>
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<tr>
<td>Size of ADAS market by 2020 globally</td>
<td>$60 Billion</td>
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Sensors, Radar, LIDAR, Cameras, and other technologies coupled with Analytics is driving the era of Automated Driver Assistance.
**ADAS technologies**

will reduce both frequency and severity of accidents paving the way for increased safety and reduced claims

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<thead>
<tr>
<th>Feature</th>
<th>Frequency</th>
<th>Severity</th>
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<tr>
<td>Forward Collision</td>
<td>-3.2%</td>
<td>-1.1%</td>
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<tr>
<td>Adaptive Headlights</td>
<td>-2.3%</td>
<td>-5.5%</td>
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<td>Lane Departure</td>
<td>-0.4%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Blind Spot Detection</td>
<td>-6.1%</td>
<td>-20.0%</td>
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<tr>
<td>Park Assist</td>
<td>-1.8%</td>
<td>-1.1%</td>
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Source: PwC Analysis based on Highway Loss Data Institute reports on predicted availability of safety features and initial results of collision avoidance features, 2011 - 2012
Autonomous Vehicles or Self-driving Cars

Falling costs of radar technology and advances in machine learning are already resulting in autonomous, self-driving vehicles

1,268,108
Number of autonomous miles driven by Google Car as of October 2015

$9,200
Cost to operate driverless Uber cars annually instead of current $43,500 per year

$400 bn
Accident related savings with self-driving cars in US alone

2017-2020
Fully autonomous cars will be released (Audi – 2017; Tesla – 2018, Toyota – 2020)
Autonomous Vehicles

Autonomy of driving is defined by NHTSA across five levels with Level 4 signifying autonomous driving under all conditions with no human involvement.

Level 0
No Automation

Level 1
Function-specific Automation

Level 2
Combined Function Automation

Level 3
Limited Self-Driving Automation

Level 4
Full Self-Driving Automation

Google Cars are already approaching Level 3 and Level 4 capability under normal road conditions

Google car video & Mercedes Truck video
Tesla announced a software upgrade that allows autonomous highway driving.

Tesla car video
Autonomous Vehicles

Autonomous buses, trucks, pods and convoys are also being built and piloted across the world

Milton Keynes – Autonomous Pods unveiled in Sep 2015

CitiMobil2 – Cities demonstrating automated road passenger transport (European Union)
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**Personal Mobility**

*Convergence of car sharing, ADAS, and Autonomous Vehicles will result in Personal Mobility as a Service (PMaaS)*

1. Car share convenience and lower costs will increase car share attractiveness and usage.

2. ADAS technology will increase safety and reduce severity and frequency of accidents. Will also promote familiarity with AV.

3. Autonomous cars will match supply and demand better increasing convenience of car sharing and improving the economics of car sharing.

4. Fully autonomous car sharing will eliminate range anxiety and assist in increased electric vehicle adoption.

- Increased Safety
- Cost of Ride per Mile
- Car Share Attractiveness
- Car Share Convenience
- Car Share Usage
- Car Share Expansion
- Range Anxiety
- Payback Period
- Electric Vehicle Attractiveness
- Vehicle Utilization
- Decreased Car Parc
- Household Vehicle Sharing
- Technology Advances
- Autonomous Adoption
- ADAS Adoption

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**PMaaS will lead to increased vehicle utilization, shifting driving behaviors, better cost efficiencies, increased safety, and reduced road congestion**

**Personal Mobility As A Service**

- **Shorter wait times**
  - Shared vehicles could serve most trips within the city with average wait time of 1 to 4 minutes

- **Falling cost per mile**
  - Shared vehicles can cut cost of the average trip from $7.80 to $1 due to automation of labor

- **Greater utilization**
  - Shared vehicles can average 26 trips a day over 8 hours, versus 3 trips a day over 1 hour for conventional vehicles

- **Increased Safety**
  - ADAS technology decreases frequency and severity of accidents (up to 20% on some technologies) and saves lives

- **Lower cost of ownership**
  - Increased utilization and lower costs per mile compared to ICEs will make EVs economically attractive

- **Reduced Range Anxiety**
  - Sharing and automated charging can provide consumers with fully charged vehicles, minimizing trip range anxiety

- **More miles driven**
  - Household car will travel 76% more miles and shared vehicles can travel 174 miles a day to fill a greater volume of trips

- **Smaller car parc**
  - Each shared vehicle can replace 9.3 conventional vehicles, and one family vehicle can replace 2 conventional vehicles

**Personal Mobility**
The ability to share vehicles in a pool or in a household while maintaining transportation convenience levels will make PMaaS very attractive.

- On average, vehicles are only used 56 minutes (4% utilization) a day, and 83.7% of family trips do not overlap making family autonomous vehicles very attractive.
- As fully autonomous vehicles reach 100% penetration, the number of cars owned per household will be reduced by nearly 50% and the total car parc will reduce by the same amount.

http://orfe.princeton.edu/~alaink/SmartDrivingCars/PDFs/Brian_Johnson_DisruptiveMobility.072015.pdf
Autonomous vehicles are better able to match demand for vehicle usage, offer convenience that is on par with personal car ownership and make PMaaS a viable proposition.

Without autonomous vehicles, car sharing sees a total penetration of 1% of all vehicle trips (3 to 4 trips per month) at the end of a 30 year period.

When autonomous cars are introduced, we see adoption reach up to 25%-30% due to the increasing convenience and service attractiveness.

Reducing the consumer acceptance rate by 50% significantly slows autonomous adoption, postponing car sharing adoption growth by 10 years.

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**Car Sharing Share of Vehicle Trips**

- **Autonomous Car Share**
- **Autonomous Car Share Perception Constraint**
- **Traditional Car Share**

**Table:**

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<thead>
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<th>Percentage of Total Vehicle Trips</th>
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<td>0.2</td>
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<table>
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<td>29</td>
<td>0.65</td>
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<tr>
<td>31</td>
<td>0.70</td>
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Personal Mobility as a Service (PMaaS)

**Types of Car Sharing**

**P2P**
A fleet of cars is owned by a community. The marketplace matches owners of cars that are available to other drivers to rent.

- RelayRides
- Whirli
- Wheelz
- Getaround

**B2C**
A company owns a fleet of cars and facilitates the sharing amongst members.

- BMW
- Peugeot
- Daimler
- Hertz
- WeCar

**NFP**
A local organization or community that facilitates car sharing with the goal of changing driving habits over making a profit.

- City Car Share
- Philly Car Share
- I-GO Chicago
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Impact on Insurance - ADAS

ADAS will reduce severity and frequency of accidents thereby reducing overall losses as ADAS adoption increases.

Reduction in losses from ADAS alone is ~11% by 2025

Total Projected Losses, 2025*

Baseline Without Driver Assist Technology
- Bodily Injury Claims: $22.68
- Collision Claims: $24.06
- Comprehensive Claims: $12.41
- Personal Injury Protection Claims: $5.89
- Property Damage Claims: $18.28

Baseline With Driver Assist Technology
- Bodily Injury Claims: $18.28
- Collision Claims: $15.84
- Comprehensive Claims: $12.41
- Personal Injury Protection Claims: $4.84
- Property Damage Claims: $18.39

Source: PwC Analysis based on Highway Loss Data Institute reports on predicted availability of safety features and initial results of collision avoidance features, 2011 - 2012
As penetration of ADAS increases, the projected losses will decrease by 31% by 2035.

**Impact on Insurance - ADAS**

**Total Projected Losses, 2035**

<table>
<thead>
<tr>
<th></th>
<th>Baseline Without Driver Assist Technologies</th>
<th>Baseline With Driver Assist Technologies</th>
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</thead>
<tbody>
<tr>
<td>Bodily Injury Claims</td>
<td>$28.28</td>
<td>$15.66</td>
</tr>
<tr>
<td>Collision Claims</td>
<td>$29.27</td>
<td>$22.84</td>
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<tr>
<td>Comprehensive Claims</td>
<td>$6.17</td>
<td>$2.72</td>
</tr>
<tr>
<td>Personal Injury Protection Claims</td>
<td>$15.66</td>
<td>$15.66</td>
</tr>
<tr>
<td>Property Damage Claims</td>
<td>$22.28</td>
<td>$12.78</td>
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</table>

**Source:** PwC Analysis based on Highway Loss Data Institute reports on predicted availability of safety features and initial results of collision avoidance features, 2011 - 2012
Car Sharing & AV will reduce car parc and combined with ADAS could result in a reduction in projected losses by 31% by 2025.

Reduction in losses from ADAS & AV is ~31% by 2025

Impact on Insurance – ADAS & AV

Total Projected Losses, 2025*

Source: PwC Analysis based on Highway Loss Data Institute reports on predicted availability of safety features and initial results of collision avoidance features, 2011 - 2012
As penetration of AVs increase over time the reduction in losses could be as much as 52% by 2035.

Impact on Insurance – ADAS & AV

Reduction in losses from ADAS & AV is ~52% by 2035

Total Projected Losses, 2035*

Baseline Without ADAS
- Bodily Injury Claims: $22.28
- Collision Claims: $29.27
- Comprehensive Claims: $15.66
- Personal Injury Protection Claims: $5.02
- Property Damage Claims: $28.28

Baseline With ADAS & AV
- Bodily Injury Claims: $10.74
- Collision Claims: $14.36
- Comprehensive Claims: $6.98
- Personal Injury Protection Claims: $4.09
- Property Damage Claims: $12.80

Source: PwC Analysis based on Highway Loss Data Institute reports on predicted availability of safety features and initial results of collision avoidance features, 2011 - 2012
Our conservative estimates are based on historical adoption and penetration rates of new technologies and no regulatory interventions.

Impact on Insurance

1. **Estimate availability and penetration curves of each technology based on prior technology take-up rates.**
   
   Historical data demonstrates a ~15 year span between initial introduction and 95% new vehicle availability. The total car population takes ~30 years to reach 95% penetration.

2. **Use industry data to estimate impact on frequency and severity across loss categories.**
   
   Loss categories include Bodily Injury (-14% to -55%), Collision (-11% to -51%), Comprehensive (-14% to -55%), Property Damage and Protection (-12% to 52%), and Personal Injury Protection (-5% to -34%).

3. **Project total impact on frequency, severity, and total loss.**
   
   We calculate a linear baseline projection using 2009 – 2013 claims data. Based on expected penetration and impact of each technology, we estimate the total effect by 2025.

**Source:** PwC Analysis based on Highway Loss Data Institute reports on predicted availability of safety features and initial results of collision avoidance features, 2011 - 2012.
With increased autonomous shared vehicles the sale will be to PMaaS providers as opposed to individual customers.

**Impact on Insurance**

Note: The model introduces basic assumptions regarding average vehicle cost, cost curve for autonomous technology, tradeoffs between price and convenience for transportation choice, autonomous car efficiencies, and consumer vehicle usage behaviors. The model is calibrated to an average annual vehicle trips and miles traveled and projected monthly trips taken using traditional car sharing services of 3 to 4 trips per month (a metric that is commonly seen in car sharing markets and through other market penetration studies).

**Car Sharing Share of Vehicle Trips**

Up to 25%-30% of the insurance sales will be to PMaaS providers within the next 10-30 years.
In addition, the overall insurance demand for vehicles would come down; number of miles driven will go up.

Overall car parc would be smaller; although vehicle miles driven might go up, accident costs will still be low due to advanced technologies.

Impact on Insurance

http://orfe.princeton.edu/~alaink/SmartDrivingCars/PDFs/Brian_Johnson_DisruptiveMobility.072015.pdf
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The impact on insurance will be small at first, but would accelerate once AV adoption reaches a tipping point substantially reducing consumer auto insurance market.

Only 4 states have passed legislation to address autonomous vehicles; 16 are considering, and 9 have failed to pass measures.¹

Autonomous technology is projected to add $10,000² to the cost of the car; this is expected to decline to $3,000 by 2035.

46% of consumers feel that autonomous cars will not be safe and 28% believe that they will never own one.³

Convenience and Safety

Regulation

Investment Costs

Public Trust and Perception

Transportation and service Efficiencies

Reduced Transportation Costs

Autonomous cars will remove variability and improve driving conditions.

Commute times will drop due to decreasing congestion; public transit and car sharing will cover larger areas, increasing availability and reducing wait times.

Autonomous adoption can reduce transportation costs of car ownership through alternative transportation solutions.
Four possible scenarios over the next two decades ranging from small impact to potentially a massive consolidation

**Case for Action**

**A** Slow Adoption  
(Loss reduction offset by premium growth)

**B** Shrinking Premium  
(Moderate adoption fuelled by regulators)

**C** Bundled Insurance  
(Insurance included with Cars – self insured)

**D** Death of Auto Insurance  
(Elimination of losses with fully self-driving cars)
Insurers need to be prepared to innovate with their offering and be able to target new business customers and eventually seek alternative growth areas.
**Case for Action**

**Insurers who want to survive and thrive in the long-term should start acting now to innovate and better understand the changing ecosystem**

<table>
<thead>
<tr>
<th>Short-term (3-7 yrs)</th>
<th>Medium-term (8-15 yrs)</th>
<th>Long-term (15+ yrs)</th>
</tr>
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<tbody>
<tr>
<td>• Embrace alternative forms of insurance (e.g., MetroMile)</td>
<td>• Shift primary focus towards auto-manufacturers and PMaaS providers for marketing, distribution and product development</td>
<td></td>
</tr>
<tr>
<td>• Partner with auto manufacturers to collect data on ADAS and AV technologies</td>
<td>• Consolidate underwriting capacity as premiums start shrinking</td>
<td>• Explore alternative revenue streams including commercial auto logistics, becoming a PMaaS provider etc.</td>
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<tr>
<td>• Build capabilities on usage-based underwriting and risk slicing</td>
<td>• Tighten UW guidelines for individual consumers</td>
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<tr>
<td>• Develop innovative products – bundled insurance, ‘self-drive’ mode insurance</td>
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Authors

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<thead>
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Thank You