Disruptive Mobility: AV Deployment Risks and Possibilities

20 July 2015
1920 was Peak Horse

U.S. Horse Population 1850-2000 (mn of equines)

Equines (mn)

Source: USDA, Kentucky Equine Research, Barclays Research
Current plant footprint: 30 plants in North America

Ford and GM combined operate 30 assembly plants in North America

Source: IHS Automotive, Barclays Research
Future plant footprint: 17 plants in North America

Ford/GM capacity would need to be cut sharply for our new paradigm

Source: IHS Automotive, Barclays Research estimates

20 July 2015
Cars, like horses, used for different “jobs to be done”

Source: Barclays Research estimates
Some traditional vehicles remain for work and rural use

Four types of vehicles in the future

- limited self-driving capabilities
- work or personal use
  - work: pickups, large SUVs, commercial vans
  - personal: cars/CUVs, performance

Flow: Family with two vehicles

- Home → Work (1)
- Work → Social (2)
- Social → Home (3)
- Home → School (4)
- School → Home (5)

Rural areas are ~24% of vehicles in use

- 0-50: 19%
- 50-250: 19%
- 250-1,000: 24%
- 1,000-3,000: 29%
- 3,000-5,000: 6%
- >5,000: 3%

Source: NHTS
Performance/status evolves to family autonomous vehicles

Four types of vehicles in the future

<table>
<thead>
<tr>
<th>Family Autonomous Vehicles (FAVs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicles/household</td>
</tr>
<tr>
<td>2.1 vehicles</td>
</tr>
<tr>
<td>1.2 vehicles</td>
</tr>
</tbody>
</table>

Flow: one vehicle shared by multiple family members


Source: Daimler AG, used with permission

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SAVs – “Uber without the Dude”

Four types of vehicles in the future

**Shared Autonomous Vehicles (SAVs)**

<table>
<thead>
<tr>
<th>Traditional vehicles displaced per SAV</th>
<th>Annual miles/vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:1</td>
<td>12,000</td>
</tr>
<tr>
<td>8% additional VMT due to empty trips</td>
<td>64,000 miles</td>
</tr>
</tbody>
</table>

Sedan: $0.44 mile ride cost to consumers per SAV

Two seater: $0.16 mile ride cost to consumers per SAV

Flow: “robot taxis” with average wait time of 1 min


Source: 40 Fires Foundation, used under a Creative Commons license, attribution 3.0 from http://www.40fires.org/
PSAVs “Uberpool without the dude”

Four types of vehicles in the future

<table>
<thead>
<tr>
<th>Pooled Shared Autonomous Vehicles (PSAVs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-18:1 traditional vehicles displaced per PSAV</td>
</tr>
<tr>
<td>40-50% reduced VMT due to shared rides</td>
</tr>
<tr>
<td>Annual miles/vehicle: 12,000 miles</td>
</tr>
<tr>
<td>64,000 miles</td>
</tr>
<tr>
<td>• Only solution to reduce VMT</td>
</tr>
<tr>
<td>• Greatest cost savings</td>
</tr>
<tr>
<td>• Can car pooling be cool?</td>
</tr>
</tbody>
</table>

Car parc falls by 60% and SAAR by 40%

Future U.S. fleet vehicles and sales

<table>
<thead>
<tr>
<th>Vehicles in use</th>
<th>Current</th>
<th>Pro Forma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Truck</td>
<td>46</td>
<td>70</td>
</tr>
<tr>
<td>Cars/CUVs</td>
<td>182</td>
<td>22</td>
</tr>
<tr>
<td>Luxury</td>
<td>28</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>256 (million current total)</td>
<td>103 (million pro forma total)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual U.S. light vehicle sales</th>
<th>Current</th>
<th>Pro Forma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>16.5</td>
<td>9.5</td>
</tr>
</tbody>
</table>

Therefore we see...

- Vehicles in use falling by ~60%
- Light vehicle sales falling by ~40%

Model is based on the following conservative assumptions:
- Vehicle sharing only feasible outside of rural areas
- Some cars are bought for reasons other than functional transportation
- No growth in population

Source: LMC Automotive, Wards AutoloInfoBank, Barclays Research estimates
Disruptors emerge in new structure

Will OEMs be Kodak or Verizon?

Disruptive Mobility Industry Structure

- Suppliers
- Traditional OEMs
- New OEMs
- Transportation Network Companies
- Fleet managers
- FAV, Work Trucks
- SAVs

Source: Barclays Research

20 July 2015
Barriers to our vision

• Accuracy of algorithms in diverse conditions

• Cost of lidar (Q: can cameras displace lidar)

• Regulatory framework for liability

• Insurance framework given the items above

• Consumer the least barrier?
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Avis Budget Group Inc. (CAR, 17-Jul-2015, USD 44.20), Equal Weight/Negative, A/C/D/F/J/K/L/M/N
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