Are Consumers Willing to Pay to Let Cars Drive for Them?
The Demand for Self-Driving Vehicles

Benjamin Leard
Self-driving cars

Picture credit: CBS
Possible benefits of self-driving cars

- **Improved Safety**: Self-driving cars are predicted to significantly reduce vehicle accidents and increase bike and pedestrian safety.

- **Reduced Congestion**: Vehicles will be able to drive closer together, resulting in fewer back-ups and optimized speeds.

- **Reliable Travel Times**: At optimal speeds, commutes can be predicted in real-time.

- **Improved Mobility**: Seniors, disabled, transit dependent populations, and those not able to drive a vehicle will have greater personal mobility with AVs and CVs.

- **Increased Productivity**: Lost productivity from commuting is estimated at $160 billion per year in the US. People can make productive use of time that would have been spent driving.

- **Positive Environmental Impacts**: AVs and CVs could reduce energy consumption through: more efficient driving, efficient infrastructure. Fewer traffic jams result in less idling and reduced greenhouse gases.

- **Reduced Infrastructure Needs**: Parking concerns are a major factor that limit urban development. Self-driving technology can reduce the need to expand roadways and build parking structures.

- **Multimodal Connectivity**: AVs provide the greatest benefit when they are connected, transit can operate more reliably, people walking and biking are safer when vehicles can communicate with them through smartphones or other devices.

*Picture credit: San Diego Association of Governments*
Cost estimates for full self-driving technology range from around $10,000 to $100,000 but are expected to fall over time.
Will self-driving cars become widespread?

People must want self-driving cars (or self-driving car services) for the technology to be adopted.

Purchase decision: Buy self-driving vehicle if

Willingness to pay for technology > technology cost
Do people want self-driving cars?

1. Discrete choice experiment

2. Demand estimation

3. Estimation results

4. Additional survey results
Qualtrics survey

Qualtrics US-based survey from in September 2014

Sample size = 1,260 respondents

Sample criteria: must have a driver’s license

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (S.D.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household size</td>
<td>2.717 (1.32)</td>
</tr>
<tr>
<td>Age of respondent</td>
<td>47.565 (13.55)</td>
</tr>
<tr>
<td>Number of children</td>
<td>1.41 (1.36)</td>
</tr>
<tr>
<td>Household income (2014$)</td>
<td>61,226 (42,135)</td>
</tr>
<tr>
<td>Years respondent has held license</td>
<td>25.409 (9.98)</td>
</tr>
<tr>
<td>Number of household members with license</td>
<td>1.914 (0.74)</td>
</tr>
<tr>
<td>Number of vehicles held by household</td>
<td>1.592 (0.79)</td>
</tr>
<tr>
<td>Respondent daily one-way commute (miles)</td>
<td>13.903 (12.72)</td>
</tr>
</tbody>
</table>
Defining levels of automation

Based on pre-survey focus group results, to make automation more straightforward to understand, we defined three levels of automation:

No automation

Some automation: automated crash avoidance

Full automation: the google car
Discrete choice experiment

<table>
<thead>
<tr>
<th></th>
<th>Hybrid Vehicle HEV</th>
<th>Plug-in Hybrid Electric PHEV</th>
<th>Electric Vehicle BEV</th>
<th>Gasoline Vehicle GAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost to Drive 100 Miles</td>
<td>$8.80</td>
<td>$5.50</td>
<td>$3.20</td>
<td>$15.20</td>
</tr>
<tr>
<td>Price</td>
<td>$25,000</td>
<td>$37,000</td>
<td>$26,000</td>
<td>$20,000</td>
</tr>
<tr>
<td>Driving Range</td>
<td>590 miles</td>
<td>15 miles / 520 miles</td>
<td>150 miles</td>
<td>550 miles</td>
</tr>
<tr>
<td>Refueling Time</td>
<td>5 minutes</td>
<td>2 hours / 5 minutes</td>
<td>8 hours</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Driverless Package</td>
<td>Some Automation</td>
<td>Full Automation</td>
<td>No Automation</td>
<td>No Automation</td>
</tr>
</tbody>
</table>
Vehicle attributes ranged around individual stated interests of each respondent.

Q15: How much would you spend on buying your next vehicle?

- less than $10,000 (1)
- $10,001 - $15,000 (2)
- $15,001 - $20,000 (3)
- $20,001 - $25,000 (4)
- $25,001 - $30,000 (5)
- $30,001 - $35,000 (6)
- $35,001 - $40,000 (7)
- $40,001 - $45,000 (8)
- $45,001 - $50,000 (9)
- $50,001 - $55,000 (10)
- $55,001 - $60,000 (11)
- more than $60,000 (12)
Each respondent made 8 choices under different levels of vehicle attributes.

Vehicle attributes varied across choice occasions to pin down how much respondents value changes in each attribute.

Choice occasion 1

- Gasoline: $20,000 (No Automation)
- Gasoline: $26,000 (Full Automation)

Choice occasion 2

- Gasoline: $20,000 (No Automation)
- Gasoline: $23,000 (Full Automation)
Demand for self-driving technology: the most money a respondent would be willing to pay to add self-driving capability to their vehicle.

Willingness to pay is revealed from choices.

Choice occasion 1
- $20,000 (No Automation)
- $26,000 (Full Automation)

Choice occasion 2
- $20,000 (No Automation)
- $23,000 (Full Automation)

=> Willingness to pay is between $3,000 and $6,000.
Results

Mean willingness to pay (WTP) for

Some automation: $3,500
Full automation: $4,900

These are comparable to the cost of Tesla’s base autopilot package ($3,000) and upgrade autopilot package ($8,000).

Respondents vary considerably in their demand for full automation:

Some have zero WTP.
Others have WTP exceeding $10,000.
The experiment was run six years ago when people were just becoming aware of self-driving cars.

Have preferences changed over time?

What underlying factors (e.g., income) explain preferences for self-driving technology?
MaritzCX surveys about 200,000 new vehicle buyers each year.

The 2016-2018 surveys include questions about self-driving cars.

### SELF-DRIVING VEHICLES...

A self-driving vehicle uses artificial intelligence, vehicle sensors, and global positioning system coordinates to drive itself without the active intervention of a human operator.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Somewhat Agree</th>
<th>Neither Agree or Disagree</th>
<th>Somewhat Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I would buy a self-driving vehicle if one were available today</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>I would not buy a self-driving vehicle because of safety concerns</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Self-driving vehicles will lead to fewer accidents</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
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</tbody>
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Demand for self-driving cars

I would buy a self-driving vehicle if one were available today.

Sample size = 527,357 new vehicle buyers
Safety concerns

I would not buy a self-driving vehicle because of safety concerns.

Sample size = 527,357 new vehicle buyers
Self-driving vehicles will lead to fewer accidents.

Sample size = 527,357 new vehicle buyers
Strong correlation between demand and safety concerns

I would buy a self-driving vehicle if one were available today.

Self-driving vehicles will lead to fewer accidents.
Factors besides safety

Other factors that increase stated interest in self-driving cars:

• Car leasing
• Miles driven
• Rideshare use
• Younger age of respondent
• Larger household size
• Urban
• Higher income
Demand for self-driving cars over time

I would buy a self-driving vehicle if one were available today.

Percentage

- Strongly disagree
- Somewhat disagree
- Neither disagree or agree
- Somewhat agree
- Strongly agree

2016 2017 2018
Conclusions

People are willing to pay an *average* of $4,900 for self-driving technology.

Demand varies considerably across population: many have no demand and some are willing to pay over $10,000.

Perceived safety of self-driving cars explains a lot (but not all) of the variation in demand for self-driving technology.
Thank you!