Are Consumers Willing to Pay to Let Cars Drive for Them?

The Demand for Self-Driving Vehicles

Benjamin Leard

RESOURCES
FOR THE FUTURE

Self-driving cars

Picture credit: CBS

Possible benefits of self-driving cars

IMPROVED SAFETY

Driver error is a factor in **94%** of accidents

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**

Reduced vehicle collisions will result 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
Estimate from the Texas Transportation Institute

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 will 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**

UNDER CONSTRUCTION

AVs and CVs could transform the urban landscape
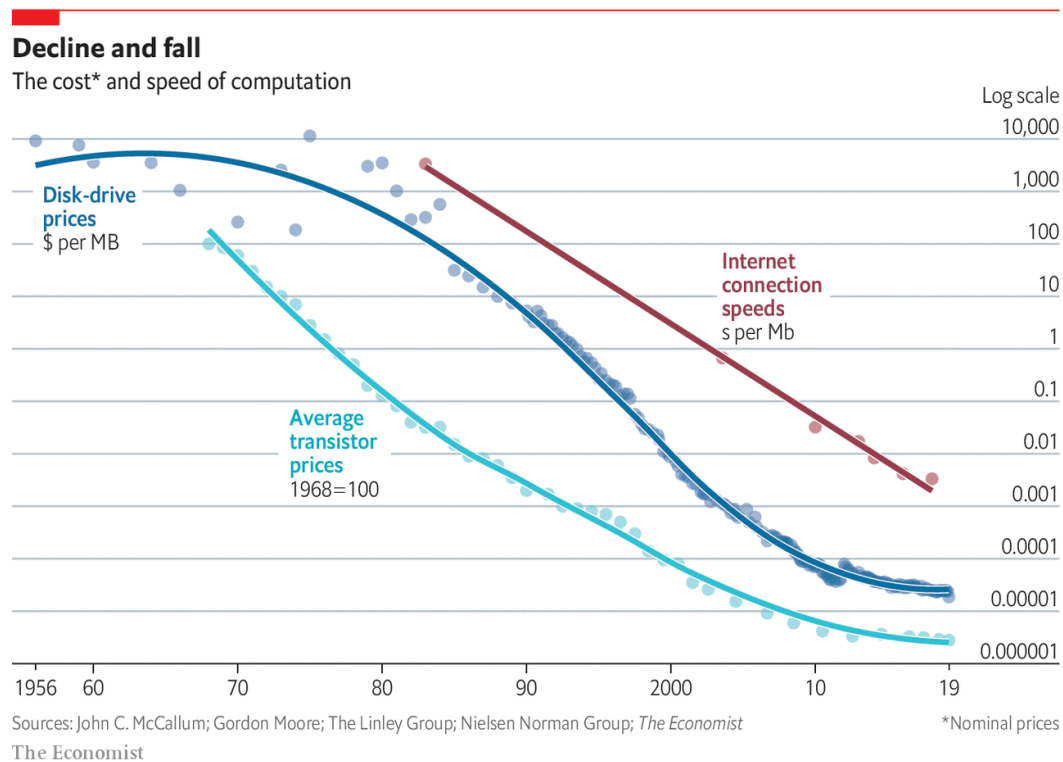
MULTMODAL CONNECTIVITY

- **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

3

Costs of self-driving cars

Cost estimates for full self-driving technology range from around $10,000 to $100,000 but are expected to fall over time.

Decline and fall
The cost* and speed of computation

Log scale

Disk-drive prices $ per MB

Internet connection speeds s per Mb

Average transistor prices 1968=100

Sources: John C. McCallum; Gordon Moore; The Linley Group; Nielsen Norman Group; *The Economist*   *Nominal prices

The Economist

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

Roadmap

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

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

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

	Hybrid Vehicle **HEV** Gasoline	Plug-in Hybrid Electric **PHEV** Gasoline-Electricity	Electric Vehicle **BEV**	Gasoline Vehicle **GAS**
Cost to Drive 100 Miles	$8.80	$5.50	$3.20	$15.20
Price	$25,000	$37,000	$26,000	$20,000
Driving Range	590 miles (Gasoline)	15 miles / 520 miles (Gasoline Only)	150 miles (Electricity)	550 miles (Gasoline)
Refueling Time	5 minutes	2 hours / 5 minutes (electricity) (gas)	8 hours	5 minutes
Driverless Package	Some Automation	Full Automation	No Automation	No Automation

RFF

Vehicle attributes ranged around individual stated interests of each respondent.
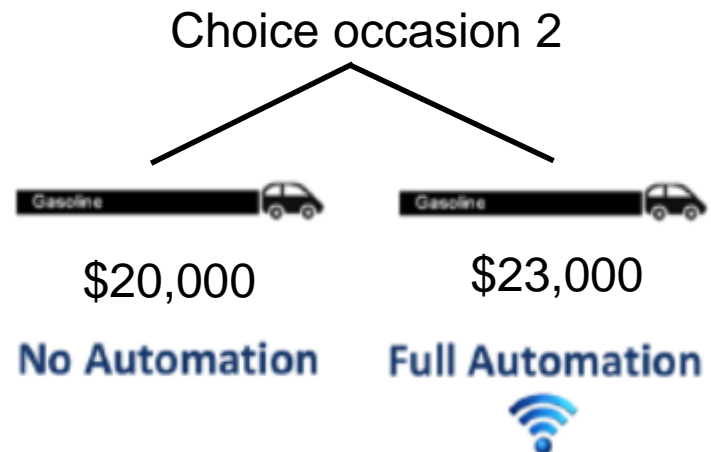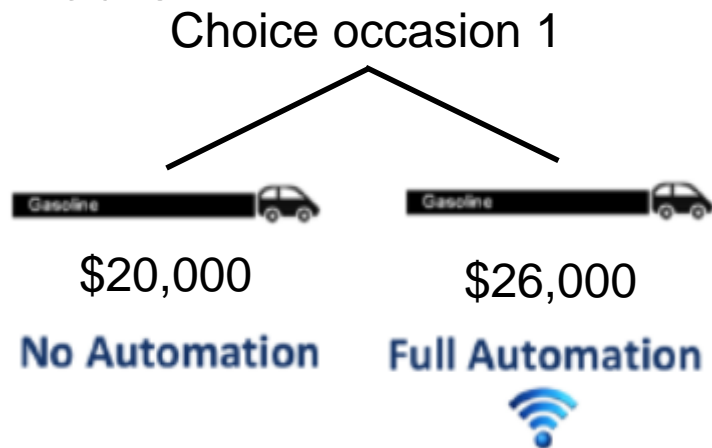
Q15: How much would you spend on buying your next vehicle?
- ○ less than $10,000 (1)
- ○ $10,001 - $15,000 (2)
- ○ $15,001 - $20,000 (3)
- ○ $20,001 - $25,000 (4)
- ○ $25,001 - $30,000 (5)
- ○ $30,001 - $35,000 (6)
- ○ $35,001 - $40,000 (7)
- ○ $40,001 - $45,000 (8)
- ○ $45,001 - $50,000 (9)
- ○ $50,001 - $55,000 (10)
- ○ $55,001 - $60,000 (11)
- ○ more than $60,000 (12)

Experiment details

Each respondent made 8 choices under different levels of vehicle attributes.

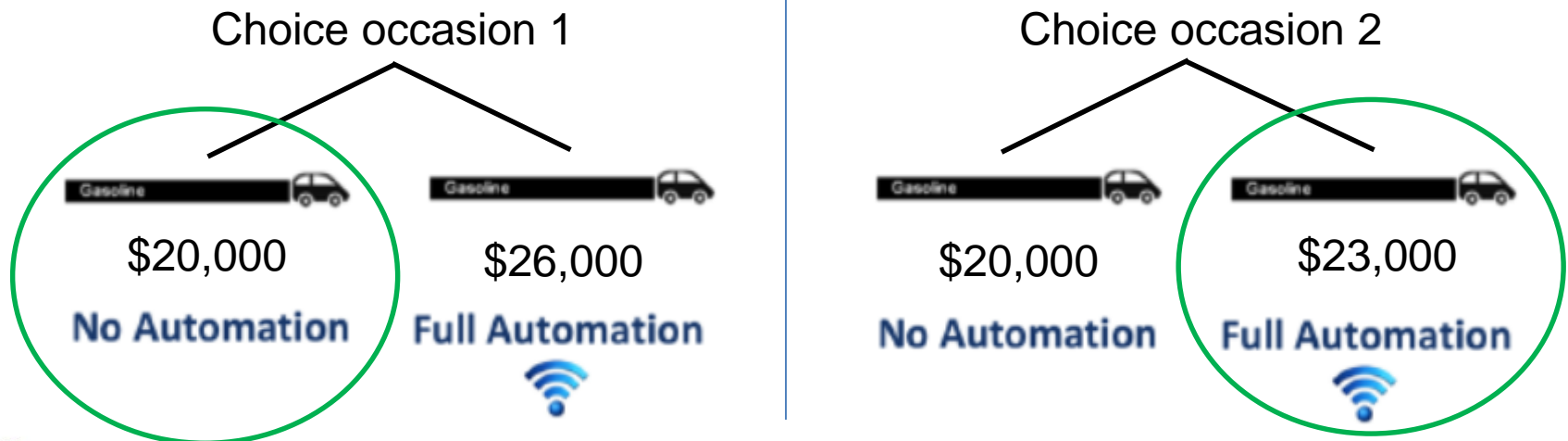Vehicle attributes varied across choice occasions to pin down how much respondents value changes in each attribute.

Choice occasion 1		Choice occasion 2	
Gasoline	Gasoline	Gasoline	Gasoline
$20,000	$26,000	$20,000	$23,000
No Automation	Full Automation	No Automation	Full Automation

Estimating demand for self-driving technology

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

Gasoline
$20,000
No Automation

Gasoline
$26,000
Full Automation

Choice occasion 2

Gasoline
$20,000
No Automation

Gasoline
$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.

Discussion

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 survey

MaritzCX surveys about 200,000 new vehicle buyers each year.

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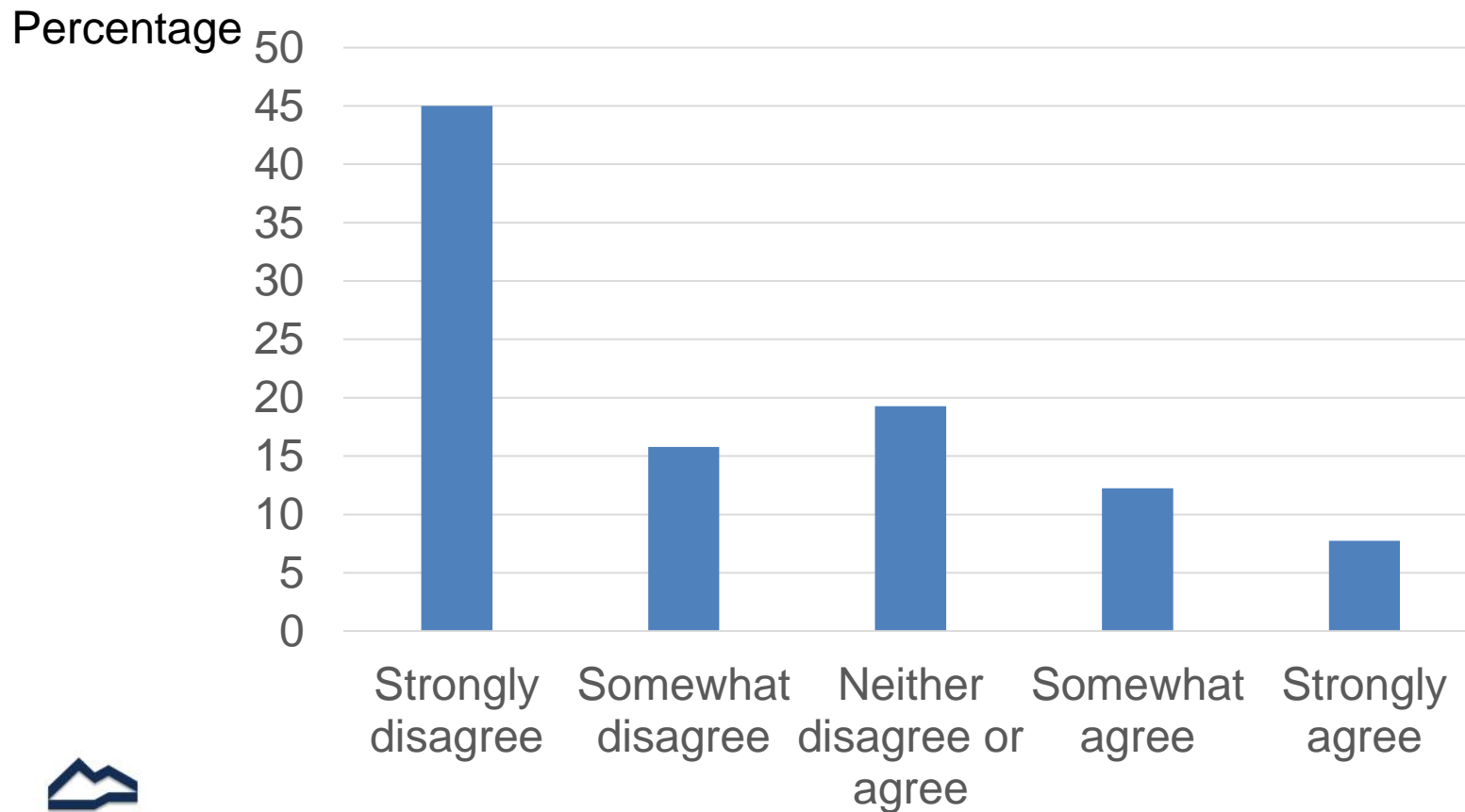
SELF-DRIVING VEHICLES . . .

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.

64. How much do you agree or disagree with the following statements regarding self-driving vehicles:

	Strongly Agree	Somewhat Agree	Neither Agree or Disagree	Somewhat Disagree	Strongly Disagree
I would buy a self-driving vehicle if one were available today sdv_buy	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
I would not buy a self-driving vehicle because of safety concerns sdv_notbuy	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
Self-driving vehicles will lead to fewer accidents sdv_acc	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐

RFF
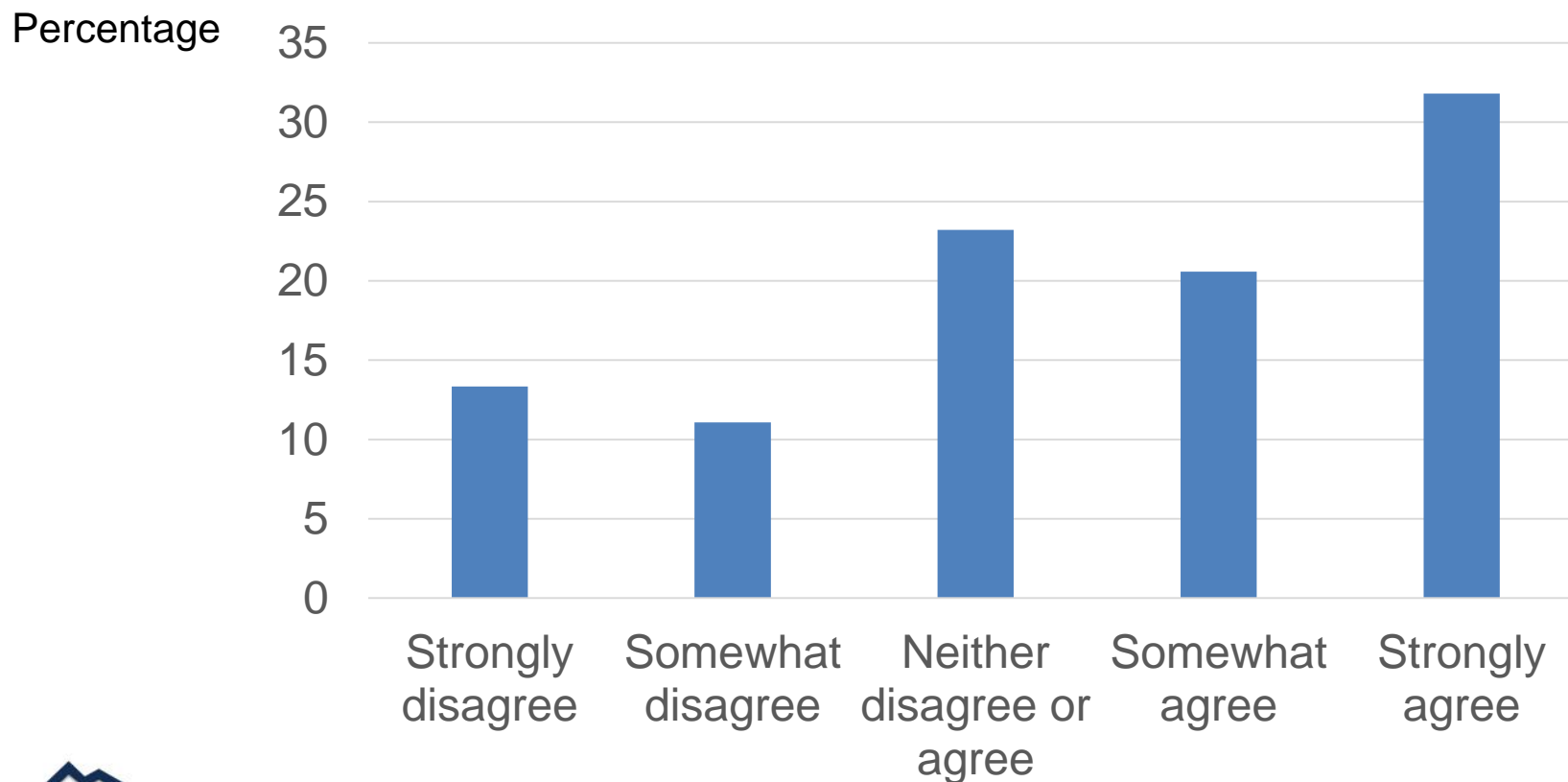
Demand for self-driving cars

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

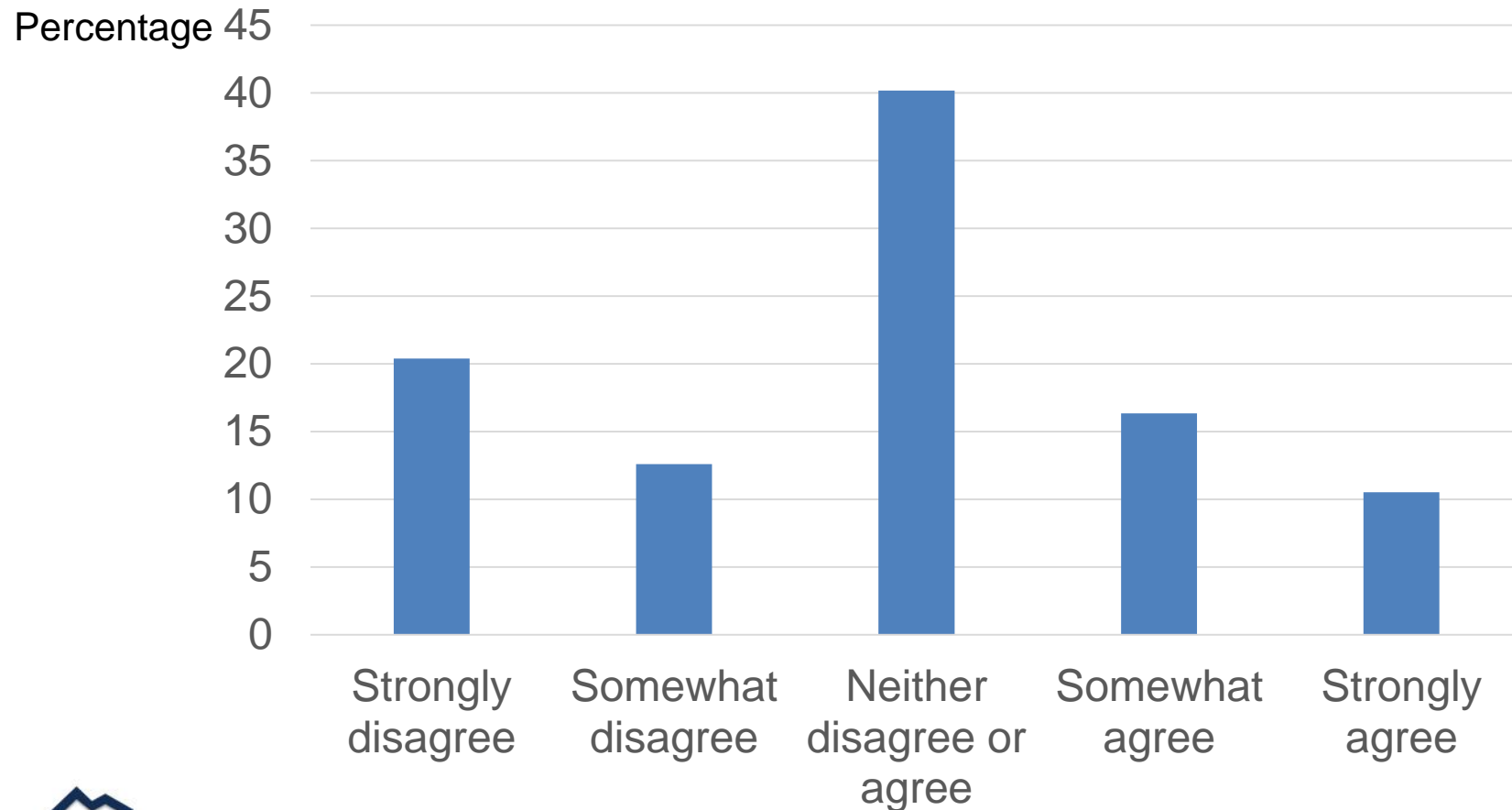

Percentage

Sample size = 527,357 new vehicle buyers

Safety concerns

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

Percentage

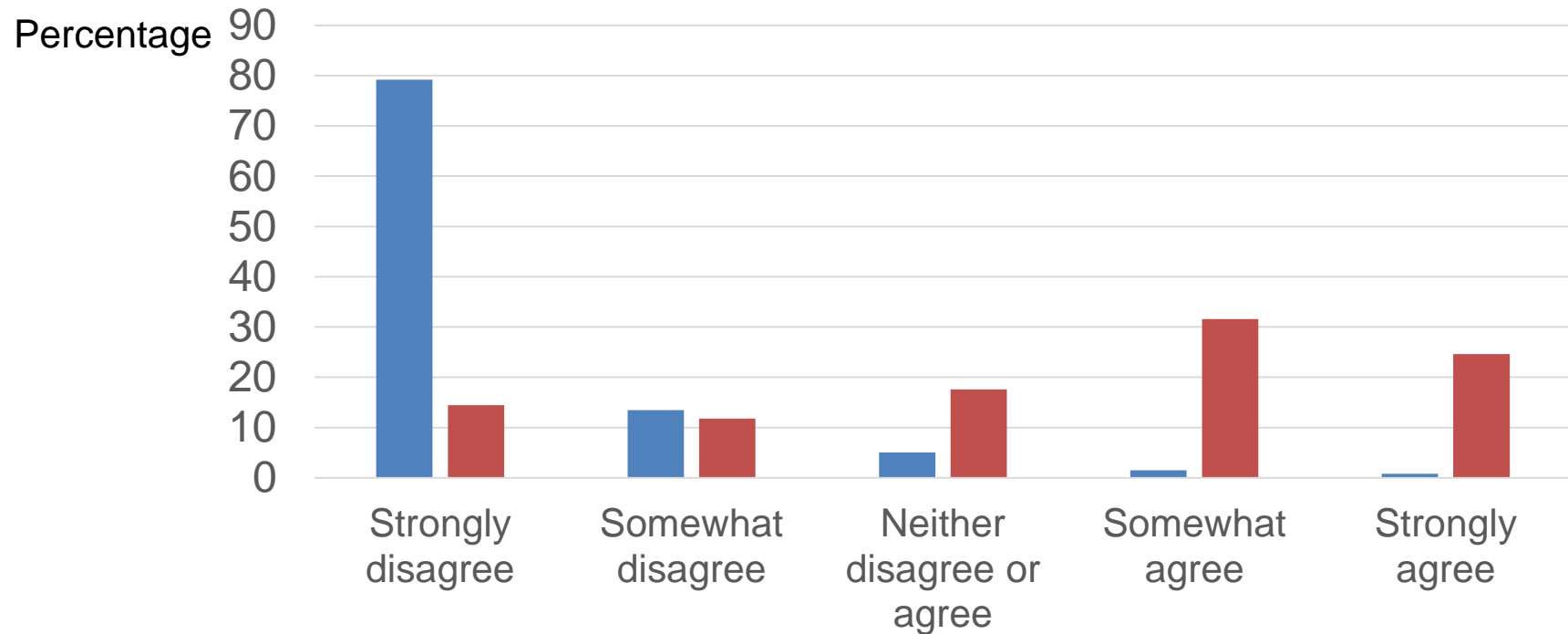Sample size = 527,357 new vehicle buyers

Accidents

Self-driving vehicles will lead to fewer accidents.

Sample size = 527,357 new vehicle buyers

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

Percentage

Self-driving vehicles will lead to fewer accidents.

■ Disagree   ■ Agree

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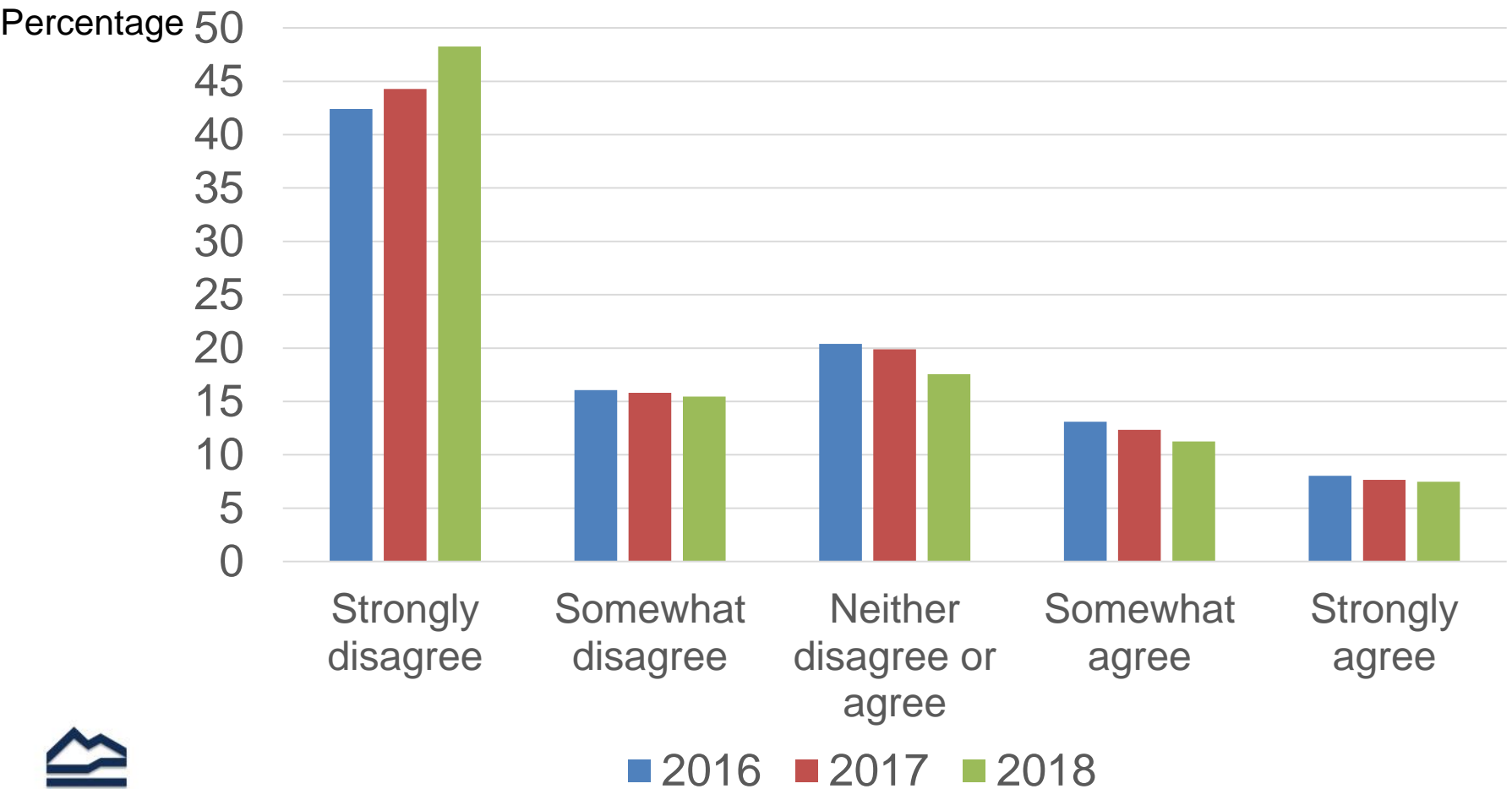
Other factors that increase stated interest in self-driving cars:

- 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.

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!