Valuing private car ownership and use in the United States

MIT Energy Initiative Webinar
Tuesday, November 10

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Motivation

Persistent reality of car ownership and use:
• Over 90% of US households own at least one car (BTS, 2017)
• 91% of adults commute to work using private car (BTS, 2017)

Despite the private car being:
• **An underutilized asset:** average car in the U.S. is parked 95% of the time
• **Expensive:** average household spends ~$9,200/year on a car (AAA, 2019)

And hopes for demographics and new technologies to supplant the existing car ownership and use paradigm
Motivation

How do we explain this ‘paradox’?

• Consumers underestimate the cost of car ownership and use
• Consumers derive value from car ownership and use greater than the costs, some of which is “option value”

What are its implications for growing interest in mobility-as-a-service (MaaS) as a potential transition from private car ownership to shared, multimodal mobility?
Research questions

1. What is the value of the personal car? Can we separate the value of owning a car from the value of its use?

2. If mobility options other than the personal car were ubiquitous and had high service quality, how might the attractiveness of car ownership and use change?

3. What is the impact of COVID-19 on the value of the personal car?
Data collection

• Online survey deployed from June 10 through July 2, 2020
• Respondents recruited by profession panel company, Qualtrics
• Cleaned sample size of 4,022 responses in 4 metropolitan areas chosen to capture different geographic regions and levels of car dependence; established ride-hailing markets
  • Washington, D.C. (1,017); Chicago, IL (1,006); Seattle, WA (1,001); Dallas, TX (998)
• Samples were quota controlled to be representative of the population in each metro area in terms of:
  • Age
  • Household income
  • Household car ownership
Main findings

1. On average, private cars are valued more than they cost and the majority of that value comes from ownership rather than use
   • Individuals who travel less by car and more by alternative modes are more willing to give up private car ownership and use
   • The value of private car ownership and use is lower for urban areas no matter the city

2. During the COVID-19 pandemic, the value of car ownership increased dramatically but the value of car use did not

3. The value of car ownership and use is orders of magnitude higher than the value of other urban transportation options
Finding 1 (overall):
On average, private cars are valued more than they cost *and* the majority of that value comes from ownership rather than use.
Single binary discrete choice (SBDC)

• 2-option choices designed to measure willing to accept compensation (WTAC) for giving up access to a transportation mode:

  Given <scenario>, which would you prefer?
  
  - Keep access to <transportation mode> and receive no money
  - Give up access to <transportation mode> for one year and receive <$C>

• Multiple scenarios covering valuation of different transportation modes: ridehailing, car ownership, and car use

• For each scenario, respondents answer 4 choices with randomized compensation amounts <$C>

• Repeated for both one year pre-COVID (2019) and one month during COVID
SBDC scenarios

• **Scenario 1.** Given all your travel needs and options in a typical year, choose whether to give up access to ride-hailing.

• **Scenario 2.** Given all your travel needs and options in a typical year, choose whether to give up access to your primary car.

• **Scenario 3.** You are given access to a new, free, and ubiquitously available ride-hailing service that can serve all of the trips that you currently make by your primary vehicle without any additional inconvenience. Choose whether to give up access to your primary car.

Value of ridehailing access

Value of car ownership and use

Value of car ownership only
SBDC estimation: base model

• Logistic regression where dependent variable is:
  • 1 if respondent chooses to give up access to the transportation option at compensation $C$, and
  • 0 otherwise (chooses to keep access and forgo money)

• Estimate base model which explains choices using only a random intercept and $\log(C)$:
  \[
  \log \left( \frac{p}{1-p} \right) = \beta_o + \beta_c \log(C')
  \]

• Calculate the median willingness to accept compensation (WTAC) at $p = 0.5$: the compensation amount where respondents are equally likely to giving up or keep the transportation option for a year
## SBDC results: base model

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Estimated median WTAC</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ridehailing *</td>
<td>$123</td>
<td>[$98, $149]</td>
</tr>
<tr>
<td>2. Car ownership and use**</td>
<td>$11,197</td>
<td>[$9,908, $12,648]</td>
</tr>
<tr>
<td>3. Car ownership only**</td>
<td>$6,496</td>
<td>[$5,706, 7,377]</td>
</tr>
<tr>
<td>Difference between 2 and 3. Car use**</td>
<td>$4,701</td>
<td>--</td>
</tr>
</tbody>
</table>

WTAC = willingness to accept compensation

* = only calculated for individuals who have used ridehailing before (n = 2,821)
** = only calculated for individuals whose household owns at least one car (n = 3,787)

value > cost (~$9,200 per year)

58% of value comes from ownership
Reasons for reluctance to give up car

- Control over my own travel schedule that my own car provides
- Certainty and reliability of being able to use my own car at any time, any place
- The flexibility the car provides
- Comfort with using my own car compared to using other modes
- The privacy that using my car provides
- The safety and security from using my own car compared to using other modes
- My car is the fastest alternative for me
- Need to transport other people (children, elderly relatives, etc.)
- My car is the cheapest alternative for me
- Need to transport goods or equipment
- Cleanliness of my car compared to other modes
- Sentimental attachment
- Need for storage space
- Communication of status or values
- Other

Number of respondents who select each reason as important
Finding 1 (overall):
On average, private cars are valued more than they cost and the majority of that value comes from ownership rather than use

Implications:
• People are not “irrationally” buying cars (even if people systematically underestimate car costs)
• If we want to provide a “real” alternative to private car ownership and use, we need to understand why people want cars
• The value of car use is not why people own cars; we cannot just focus on cost-per-mile when considering the appeal of different modes
Finding 1 (individual):

• Individuals who travel less by car and more by alternative modes are more willing to give up private car ownership and use
• The value of private car ownership and use is lower for urban areas no matter the city
SBDC estimation: covariates model

• Add covariates \((\bar{x}_i)\) that account for each respondent’s:
  • Socio-demographic characteristics
  • Household composition and car ownership
  • Typical travel behavior
  • City and urban environment

\[
\log \left( \frac{p}{1-p} \right) = \beta_o + \beta_c \log(C') + \beta_x \bar{x}_i
\]

• Solve for each individual’s *indifference compensation* \((C_i)\): the monetary amount at which he/she is equally likely to give up or keep access to the transportation option for a year
## SBDC results: covariates model

<table>
<thead>
<tr>
<th>Socio-demographics</th>
<th>Increase likelihood to give up car</th>
<th>Decrease likelihood to give up car</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male***</td>
<td></td>
<td>Age***</td>
</tr>
<tr>
<td>Hispanic**</td>
<td></td>
<td>White***</td>
</tr>
<tr>
<td>Unable to use car**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White***</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Typical travel behavior (# weekly trips by mode)
- Ride-hailing**
- Public transit**
- Walking/biking***
- Car***

### Household car ownership and composition
- Owns one car***

### City environment
- Urban zip code*

### Employer benefits
- Carpool program*
- Subsidized transit**

Results statistically different from zero at the * 10%, ** 5%, or *** 1% level
Finding 1 (individual):
• Individuals who travel less by car and more by alternative modes are more willing to give up private car ownership and use
• The value of private car ownership and use is lower for urban areas no matter the city

Implications:
• Transitioning from car dependence will require the provision of high-quality, high-value alternatives to the car:
  • Medium-term service and infrastructure improvements to support public transit, walking, and biking + employer programs
  • Long-term land use planning matters for shaping any transition from car-dependence
Finding 2:  
During the COVID-19 pandemic, the value of car ownership increased dramatically but the value of car use did not
<table>
<thead>
<tr>
<th>Scenario</th>
<th>Median WTAC for a month of COVID</th>
<th>Median WTAC for a typical month (year / 12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ridehailing*</td>
<td>$10</td>
<td>$10</td>
</tr>
<tr>
<td>2. Car ownership and use**</td>
<td>$3,361</td>
<td>$933</td>
</tr>
<tr>
<td>3. Car ownership only**</td>
<td>$2,960</td>
<td>$541</td>
</tr>
<tr>
<td>Difference between 2 and 3. Car use**</td>
<td>$401</td>
<td>$392</td>
</tr>
</tbody>
</table>

WTAC = willingness to accept compensation
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** = only calculated for individuals whose household owns at least one car (n = 3,787)

Valuation of car is 3x higher during COVID
Higher proportion of value (88%) is from ownership
Finding 2: During the COVID-19 pandemic, the value of car ownership increased dramatically but the value of car use did not.

Implications:
- Car ownership is a security blanket
- The more risk averse we are or the more uncertain our travel needs, the more attractive the option value of car ownership is
Finding 3: The value of car ownership and use is orders of magnitude higher than the value of other urban transportation options
Best-worst scaling (BWS)

- 3-option choices asking respondents to choose the best and worst option to give up for a year out of a mobility good, non-mobility good, and monetary amount
- Respondents answered 10 choices with randomized options
- Half sample randomly allocated to pre-COVID (2019); the other to during COVID

<table>
<thead>
<tr>
<th>Worst option</th>
<th>Best option</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>♦</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>♦</td>
<td>○</td>
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Imagine that you have to give up access to a service or amenity for one year. Considering the options below, which would be the best option and which would be the worst option to give up for one year?

Worst option: <earning $E less>

Best option:

- Mobility good
- Other good

- Mobility good
- Other good
- Earning $E less
- Mobility good
- Other good
- Earning $E less
- Mobility good
- Other good
- Earning $E less
Valued at > $10,000 per year
- No toilets in the home
- Earning $20,000 less
- No access to personal car
- Earning $10,000 less
- Earning $15,000 less
- No access to a smart phone
- No access to a personal computer or laptop
- No access to all e-mail services
- Earning $5,000 less
- No meeting with friends in person
- Earning $2,000 less
- Earning $1,000 less
- No TVs in the home
- Earning $500 less
- No access to online maps
- Earning $200 less
- No access to airline travel

Valued at < $100 per year
- No access to car rental or car sharing
- No access to pooled ride-hailing services
- No access to exclusive ride-hailing services
- No access to buses
- No access to personal bike
- No access to train
- No access to bike or scooter share
Finding 3:
The value of car ownership and use is orders of magnitude higher than the value of other urban transportation options

Implications:
• For the majority of U.S. residents, there are few “real” substitutes for the private car
• The challenges for future urban mobility systems is finding a package of alternatives that, together, provide value that rivals that of the car
Main findings

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  • Long-term land use planning matters for shaping any transition from car-dependence
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• The challenges for future urban mobility systems is finding a package of alternatives that, together, provide value that rivals that of the car