Examining the Rideshare Market in the U.S. Using NHTS 2017

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by
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Outline

• Background: research on ridesharing
• A general look at rideshare market in the U.S.
• Rideshare user characteristics
  – Descriptive Statistics from the NHTS 2017
  – Principle Component Analysis & Regression Analysis
  – Clustering Analysis
• Implications to planning and next steps
Growing Rideshare Market

- Niche Market to Mainstream
  - 1% of total VMT in the U.S. in 2016 (McKinsey, 2017);

Sources: The Economists (left); Statistia.com (right)
Research on Rideshare: System Efficiency

– Operational efficiency
  • Rideshare improves vehicle capacity utilization (Cramer and Krueger, 2016).
  • Dynamic rideshare optimization (Xu et al., 2015)

– Environmental efficiency
  • Rideshare and auto ownership/emission (Hampshire et al., 2017)

– Land use efficiency
  • Rideshare decreases demand for off-street parking (Mandle and Box, 2017).

– Economic efficiency
  • Surge pricing to reflect real-time demand and supply for rideshare (Banerjee et al., 2015).
Research on Rideshare: Travel Behavior

– User characterization (e.g. Rayle et al., 2016; Henao, 2017; Crewlow and Mishra, 2017; Kooti et al., 2017)
  - Demographic characteristics (age, race, income, education, household vehicle ownership)
  - Trip characteristics (time of day, length, purpose, cost)
  - Attitudinal characteristics (reasons to prefer rideshare over other modes).

– Equity impact (e.g. Hughes and MacKenzie, 2016)
  - Low income/minority/disabled individuals

– Mode choice (e.g. Contreras and Paz, 2018; Fischer-Baum and Bialik, 2015, Crewlow and Mishra, 2017; Feigon and Murphy, 2018)
  - Substitute to taxicab
  - Substitute or complement to transit
A First Look: Rideshare by State

- Based on frequency of rideshare
  - U.S. population above age 16: 25.1 million (9.81%)
  - Top states (D.C. 45.74%; MA 17.85%; CA 16.27%)
  - Bottom states (WY 1.22%; SD 1.19%; WV 0.21%)
Rideshare User Characteristics
Rideshare Users by Age

- Rideshare is Millennials’ mobility choice.
• Rideshare is not as popular among black population in DMV.
Rideshare Users: by Education and Income

- Rideshare is popular among educated, high income groups.
• Rideshare provides automobility to households without cars.
Rideshare Users by Transit Use

- Rideshare is positively correlated with transit use.
Rideshare Users by Online Delivery Use

• Rideshare is positively correlated with online delivery.
Principal Component Analysis & Regression Analysis
Reduce the # of dimensions to consider

- User Pearson’s correlation test & PCA to reduce dimensionalities from 21 variables to 12 variables (DMV subsample).

Correlation Test & Principal Component Analysis

age group, Hispanic, Gender, MSA category, MSA size, Rail availability, education, primary activity, medical condition, health, physical activity, work status, homeownership, household size, vehicle count, driver count, income, life cycle, # of walks, # of transit rides, # of online deliveries

age group, Hispanic, MSA category, physical activity, work status, vehicle count, education, income, life cycle, # of walks, # of transit rides, # of online delivery
Regression Analysis on Rideshare Frequency

- A zero-inflated negative binomial (ZINB) model is applied to capture two decisions associated with rideshare (DMV subsample): to use rideshare or not and frequency of rideshare.
Interestingly, transit use is correlated with the decision of rideshare or not, but the frequency of rideshare does not affect the number of transit rides (DMV subsample).

- **To ride or not to ride**
  - Education (+), Income (+), Age (-), Physically active (+), household vehicle count (-), with a kid or not (-), MSA category (-), # of walks (+), # of transit rides (+), # of deliveries (+)

- **# of rides**
  - Education (-), Age (-), Hispanic (-), household vehicle count (-), with a kid or not (-), MSA category (-), # of walks (+), # of deliveries (+)
Clustering Analysis
K-Means Clustering to Segment Users/Non-Users

Two groups are identified:

- user group (young, educated Millennial urbanites)
- non-user group (retired suburban seniors) were identified (DMV subsample).

<table>
<thead>
<tr>
<th>Clusters</th>
<th>rideshare</th>
<th>age</th>
<th>edu</th>
<th>work</th>
<th># vehicle</th>
<th>income</th>
<th>MSA</th>
<th># transit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.38</td>
<td>24.7</td>
<td>3.06</td>
<td>70%</td>
<td>2.26</td>
<td>6.46</td>
<td>1.80</td>
<td>1.35</td>
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<tr>
<td>2</td>
<td>0.41</td>
<td>43.2</td>
<td>3.79</td>
<td>84%</td>
<td>2.24</td>
<td>7.51</td>
<td>1.77</td>
<td>1.31</td>
</tr>
<tr>
<td>3</td>
<td>10.77</td>
<td>32.1</td>
<td>4.54</td>
<td>94%</td>
<td>1.07</td>
<td>8.47</td>
<td>1.06</td>
<td>2.29</td>
</tr>
<tr>
<td>4</td>
<td>0.28</td>
<td>60</td>
<td>3.52</td>
<td>60%</td>
<td>2.23</td>
<td>6.97</td>
<td>1.98</td>
<td>1.27</td>
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<tr>
<td>5</td>
<td>0.08</td>
<td>75.7</td>
<td>3.34</td>
<td>15%</td>
<td>1.83</td>
<td>5.93</td>
<td>2.08</td>
<td>1.14</td>
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Implications & Next Steps
<table>
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<tr>
<th>Rideshare Users</th>
<th>Implications</th>
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<tbody>
<tr>
<td>Millennial</td>
<td>Equity implications (How to guarantee rideshare access to low-income, tech-illiterate, disabled individuals and minorities?)</td>
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<tr>
<td>Educated &amp; High-income Urbanites</td>
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<tr>
<th>Rideshare &amp; Alternative Modes</th>
<th>Implications</th>
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<tbody>
<tr>
<td>Low car ownership in the household</td>
<td>Link rideshare with car ownership model</td>
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<tr>
<td>Walking &amp; biking (positive correlation)</td>
<td>Impact on auto modes travel VMT (car, taxi, and rideshare)</td>
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<tr>
<td>Online delivery</td>
<td></td>
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<th>Rideshare and Public Transit</th>
<th>Implications</th>
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<td>Rideshare is associated with higher probability of transit use.</td>
<td>Rideshare does not replace transit, especially for transit-captive users.</td>
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<td>Rideshare frequency does not correlate with transit frequency.</td>
<td>Trip level analyses are needed to understand substitute and complementary effects.</td>
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Next Steps

• Link stated preference surveys on rideshare with NHTS.
• Link rideshare use with the car ownership model.
• Trip level details from NHTS add-on data & regional travel survey (e.g. MWCOG regional travel survey 2018).
• Separate taxi from rideshare in NextGen NHTS.
• Thanks!

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References


