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

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by
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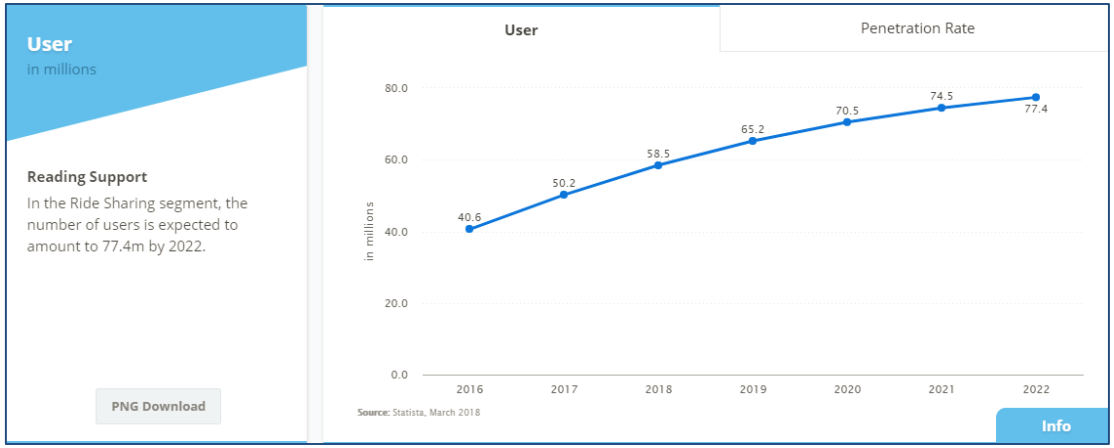
Outline

- 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);
  - Projected 28% annual growth from 2015 – 2030 (McKinsey, 2017).



Sources: The Economists (left); Statistia.com (right)

Research on Rideshare: System Efficiency

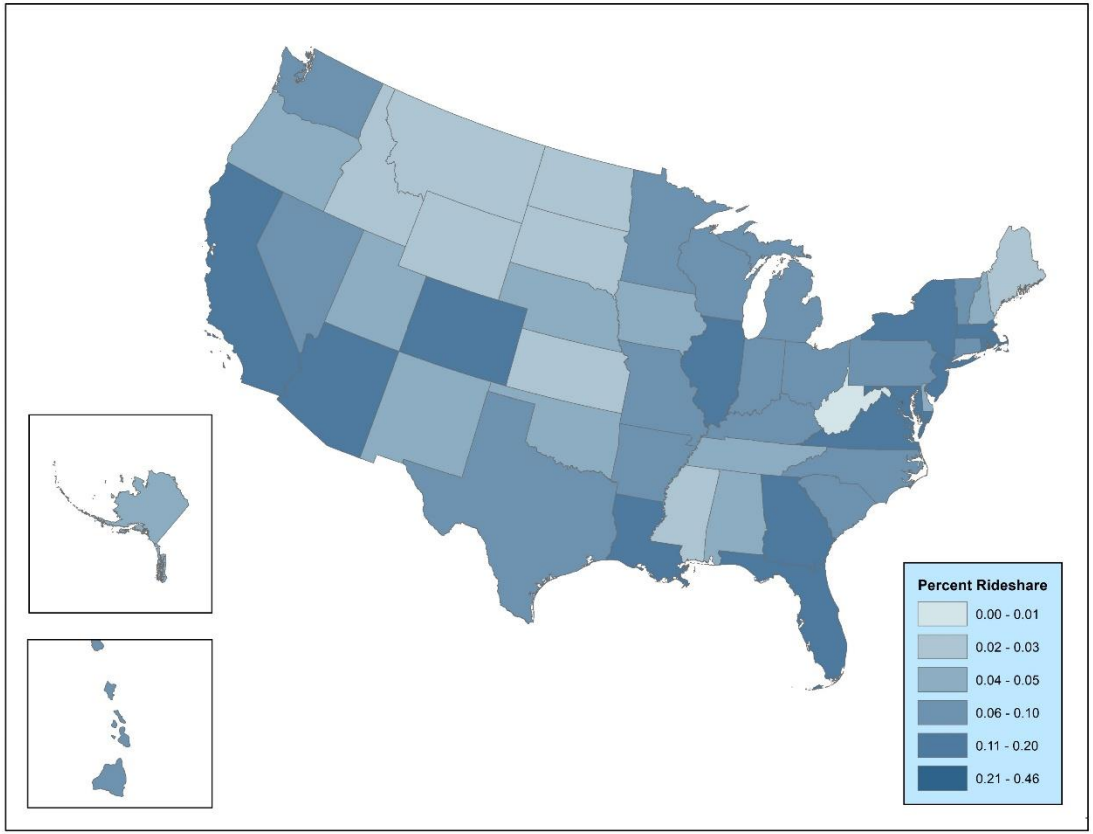
- Operational efficiency
  - Rideshare improves vehicle capacity utilization (Cramer and Krueger, 2016).
  - Dynamic rideshare optimization (Xu et al., 2015)
- Environmental efficiency
  - Rideshare and auto ownership/emission (Hampshire et al., 2017)
- Land use efficiency
  - Rideshare decreases demand 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%)



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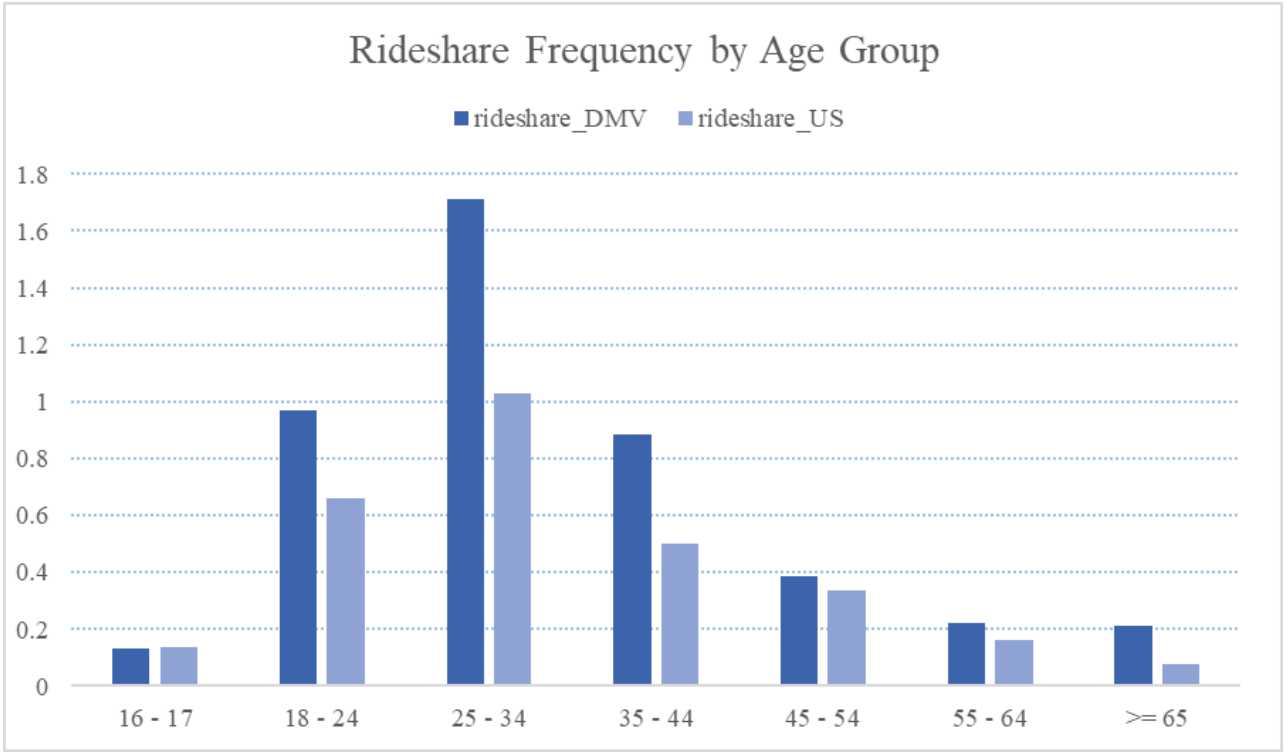
Rideshare User Characteristics

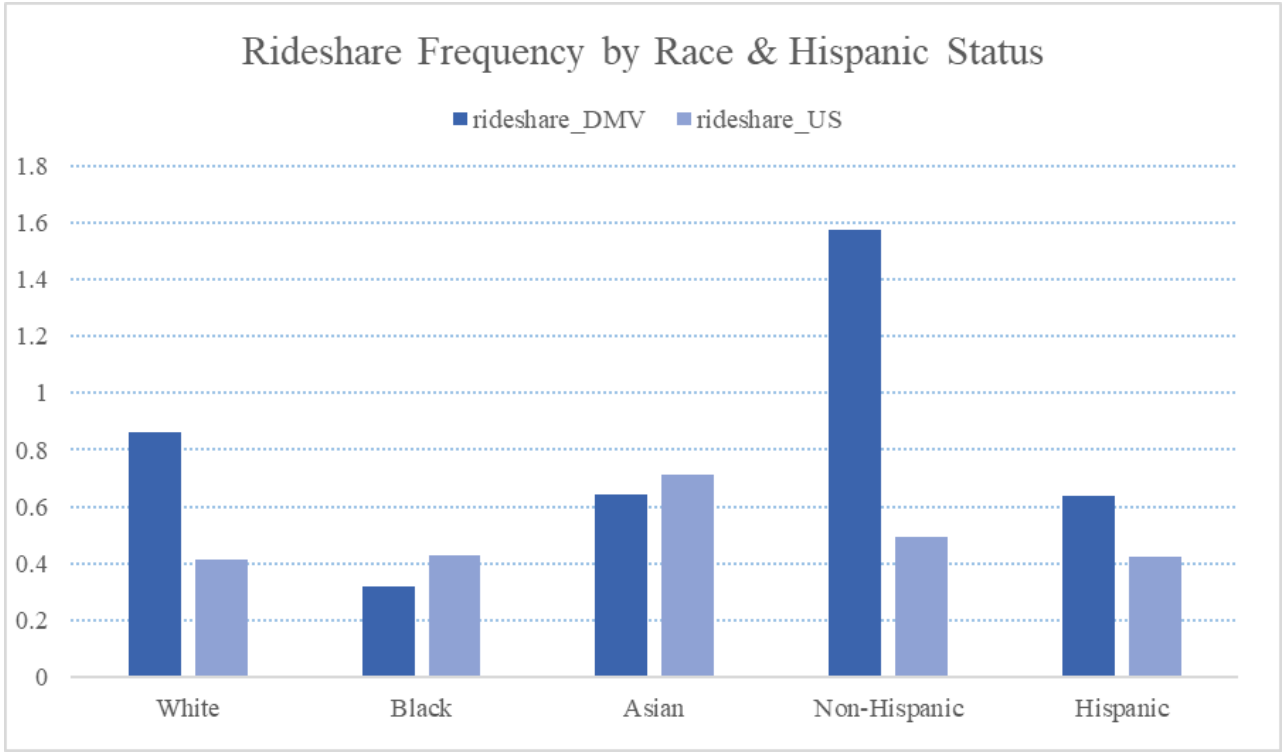
Rideshare Users by Age

- Rideshare is Millennial's mobility choice.



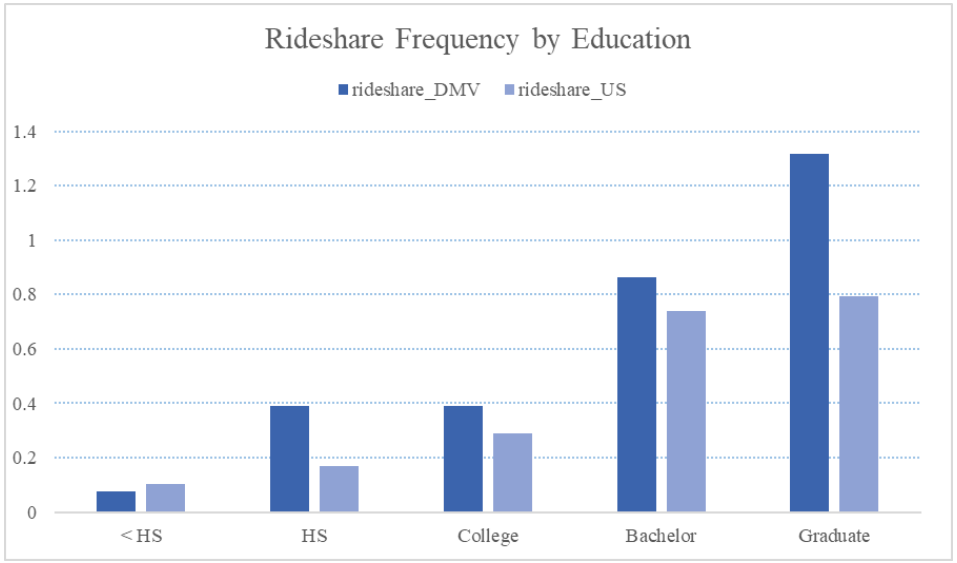
Rideshare Users by Race

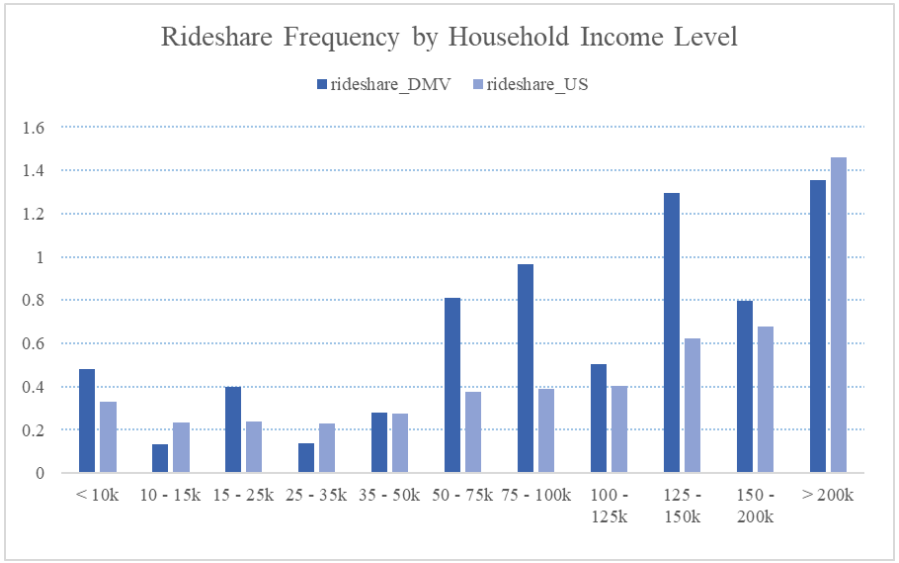
- Rideshare is not as popular among black population in DMV.



Rideshare Users: by Education and Income

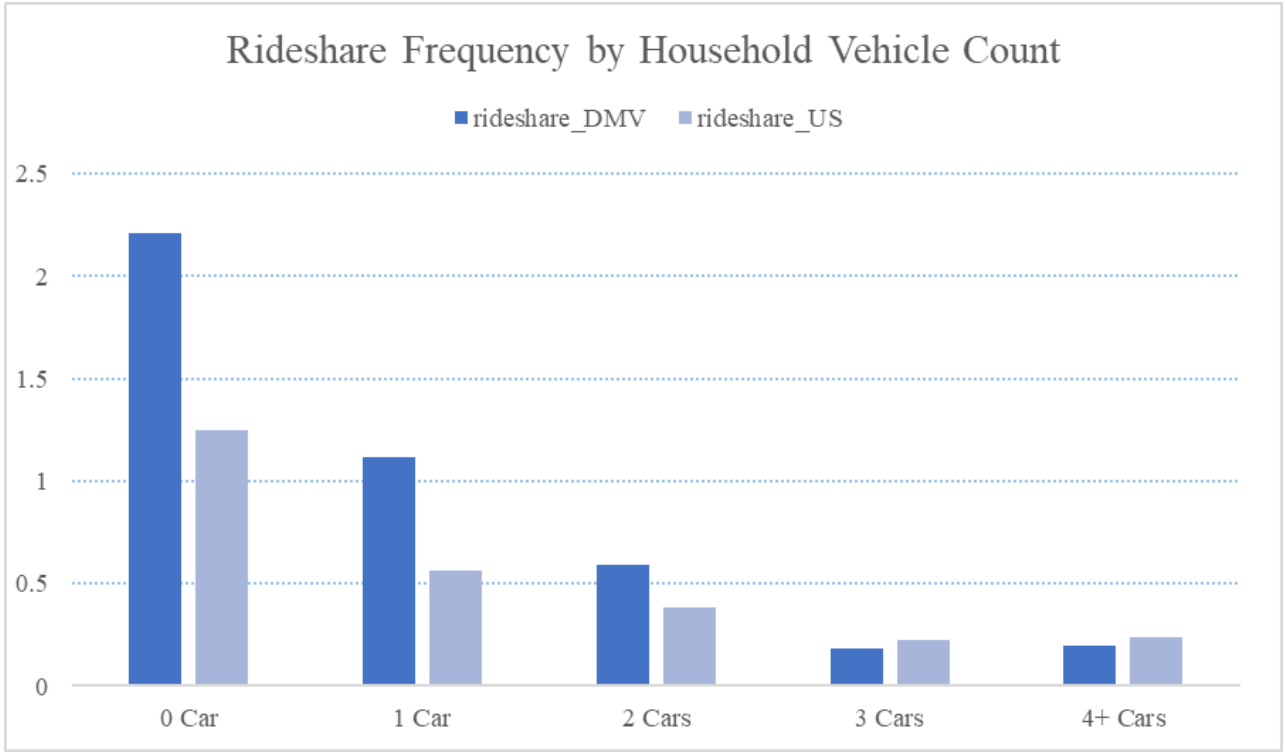
- Rideshare is popular among educated, high income groups.





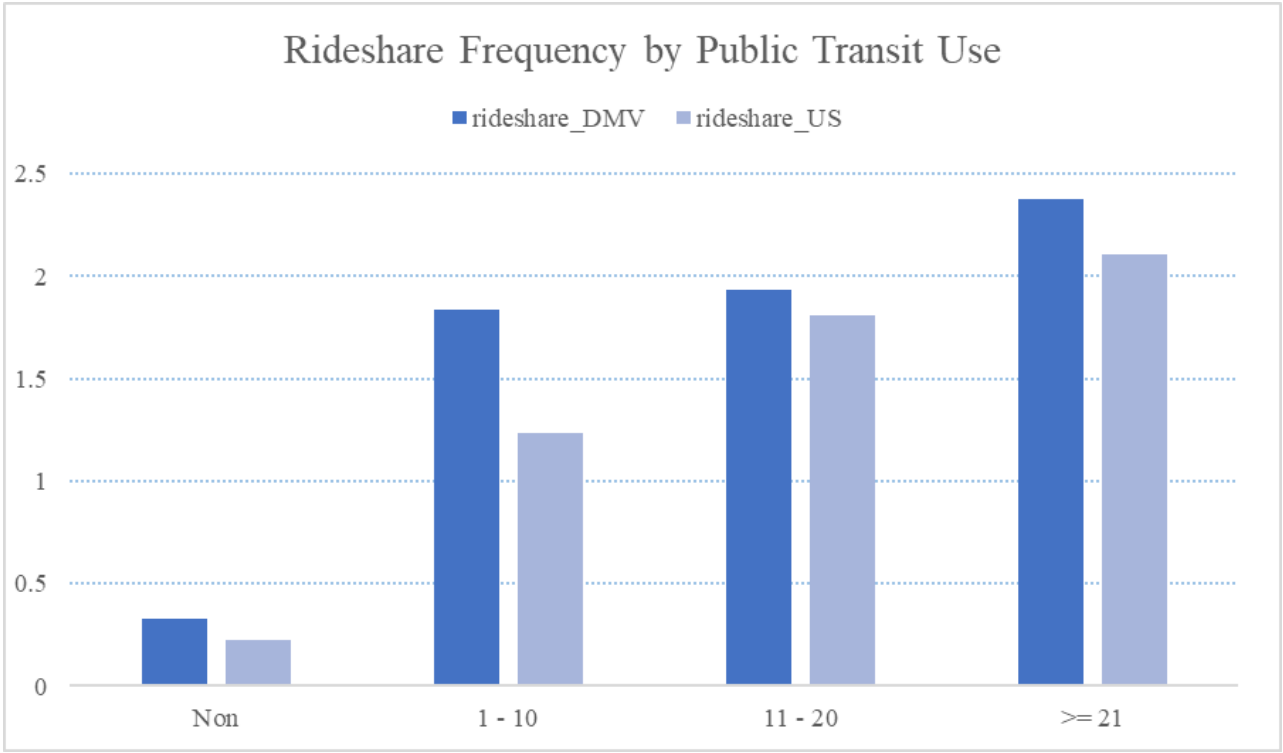
Rideshare Users by Vehicle Count

- Rideshare provides automobility to households without cars.



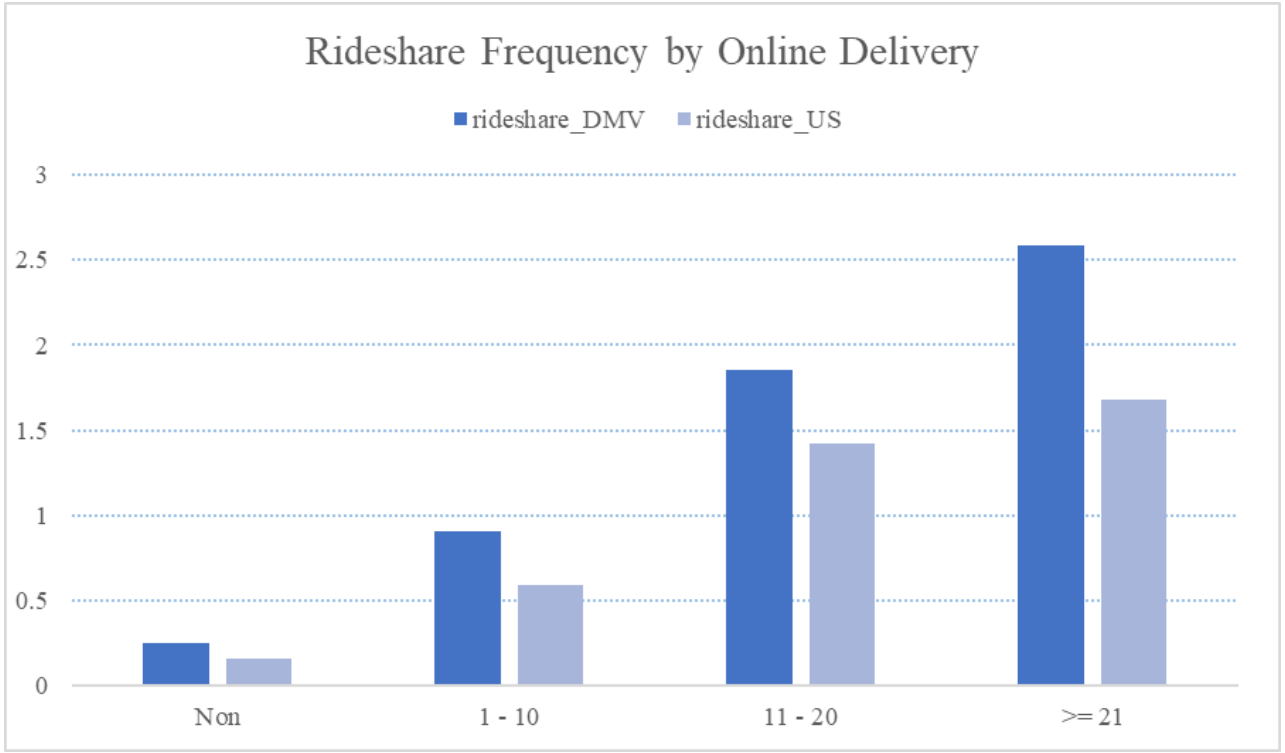
Rideshare Users by Transit Use

- Rideshare is positively correlated with transit use.



Rideshare Users by Online Delivery Use

- Rideshare is positively correlated with online delivery.



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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).

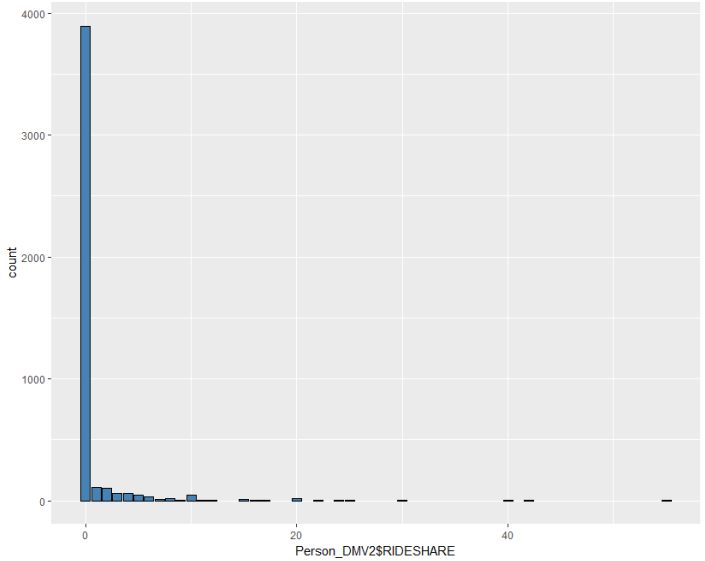
age group, Hispanic, Gender, MSA category, MSA size, Rail availability, education, primary activity, medical condition, health, physical activity, work status, homeownership, household size, vehicle count, driver count, income, life cycle, # of walks, # of transit rides, # of online deliveries

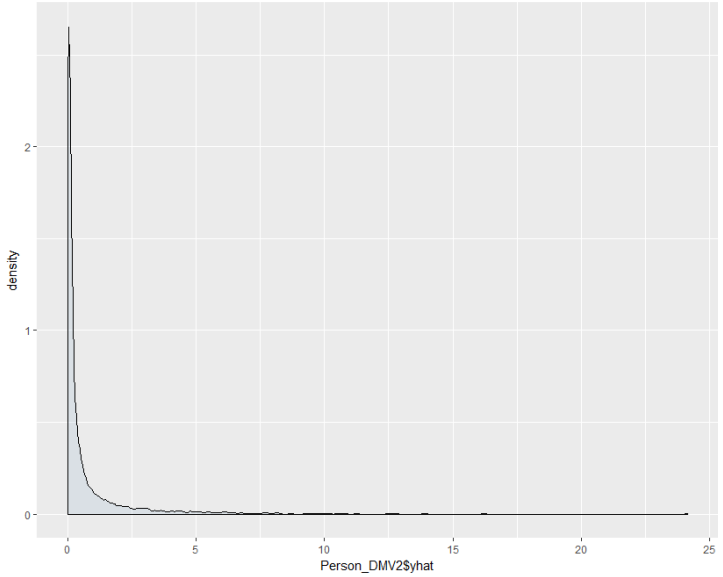
Correlation Test & Principal Component Analysis

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.





The two-stage regression results for ZINB model

- 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 (+)

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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).

Clusters	rideshare	age	edu	work	# vehicle	income	MSA	# transit
1	0.38	24.7	3.06	70%	2.26	6.46	1.80	1.35
2	0.41	43.2	3.79	84%	2.24	7.51	1.77	1.31
3	**10.77**	**32.1**	**4.54**	**94%**	**1.07**	**8.47**	**1.06**	**2.29**
4	0.28	60	3.52	60%	2.23	6.97	1.98	1.27
5	**0.08**	**75.7**	**3.34**	**15%**	**1.83**	**5.93**	**2.08**	**1.14**

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Implications & Next Steps

Implications on Transportation Planning

Rideshare Users	Implications
Millennial Educated & High-income Urbanites	Equity implications (How to guarantee rideshare access to low-income, tech-illiterate, disabled individuals and minorities?)
Rideshare & Alternative Modes	**Implications**
Low car ownership in the household Walking & biking (positive correlation) Online delivery	Link rideshare with car ownership model Impact on auto modes travel VMT (car, taxi, and rideshare)
Rideshare and Public Transit	**Implications**
Rideshare is associated with higher probability of transit use. Rideshare frequency does not correlate with transit frequency.	Rideshare does not replace transit, especially for transit-captive users. Trip level analyses are needed to understand substitute and complementary effects.

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.

Q & A

- Thanks!

- Contact: zhenpeng@umd.edu

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