How Does Ride-hailing Service Hit Household Vehicle Ownership? Evidence from National Microdata

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Abstract

The ride-hailing (RH) service is trending up in the most recent decade. The growing popularity of the RH service changes the landscape of the mobility market. Using data from the 2017 National Household Travel Survey (NHTS), we examine the impacts of using RH services on the vehicle ownership for households from 43 metropolitan areas across the United States (US).

Our results show the probabilities of possessing different numbers of vehicles do not vary significantly across respondents who use RH services no more than twice a week and that highly frequent users (i.e., who use RH services more than twice a week) are more willing to reduce their vehicle holdings in contrast to others. Extrapolating the results from sampled respondents to the population in the corresponding areas, we find if all regular users convert to highly frequent users, their average vehicle holdings would reduce by 8.61 percent and the total decrease is up to 190,000 vehicles, accounting for 1 percent of new vehicle sales in 2017.

Introduction

The RH market has surged in the past decade. The increasing popularity of RH services has made a splash in the mobility market.
- By 2017, there was about 10 percent of the United States (US) population, on average, using RH services at least once a month.
- A Pew Research Center survey also finds the share of the US adults using RH services more than doubled, increasing from 15 percent in 2015 to 36 percent in 2018, while the share of the US adults not hearing of RH services dropped to 3 percent, which was one tenth of its level in 2015.
- Uber and Lyft, the two giant Transportation Network Companies (TNCs) had reached 14 and 3.6 billion dollars in revenue by the end of 2019, respectively.

How customers would change their vehicle ownership according to their usage of RH services?

Data

Our data are primarily from the 2017 NHTS and include a sample of primary respondents from 9543 households in 43 large core-based statistical areas (CBSAs) across the US.
- There are 750 respondents not possessing any vehicle and 3438, 3575, and 1780 respondents owning one, two, and three or more vehicles, respectively.
- There are 1686 respondents using RH services via apps in the past 30 days, accounting for 18 percent of respondents in our sample.
- Over 30 percent of respondents without a vehicle used RH services more than once in the past 30 days, which is about 12, 15, and 19 percentage points higher than that of respondents with one, two, and three or more vehicles, respectively.

Figure 1. Cumulative Distributions of Usage of RH Services
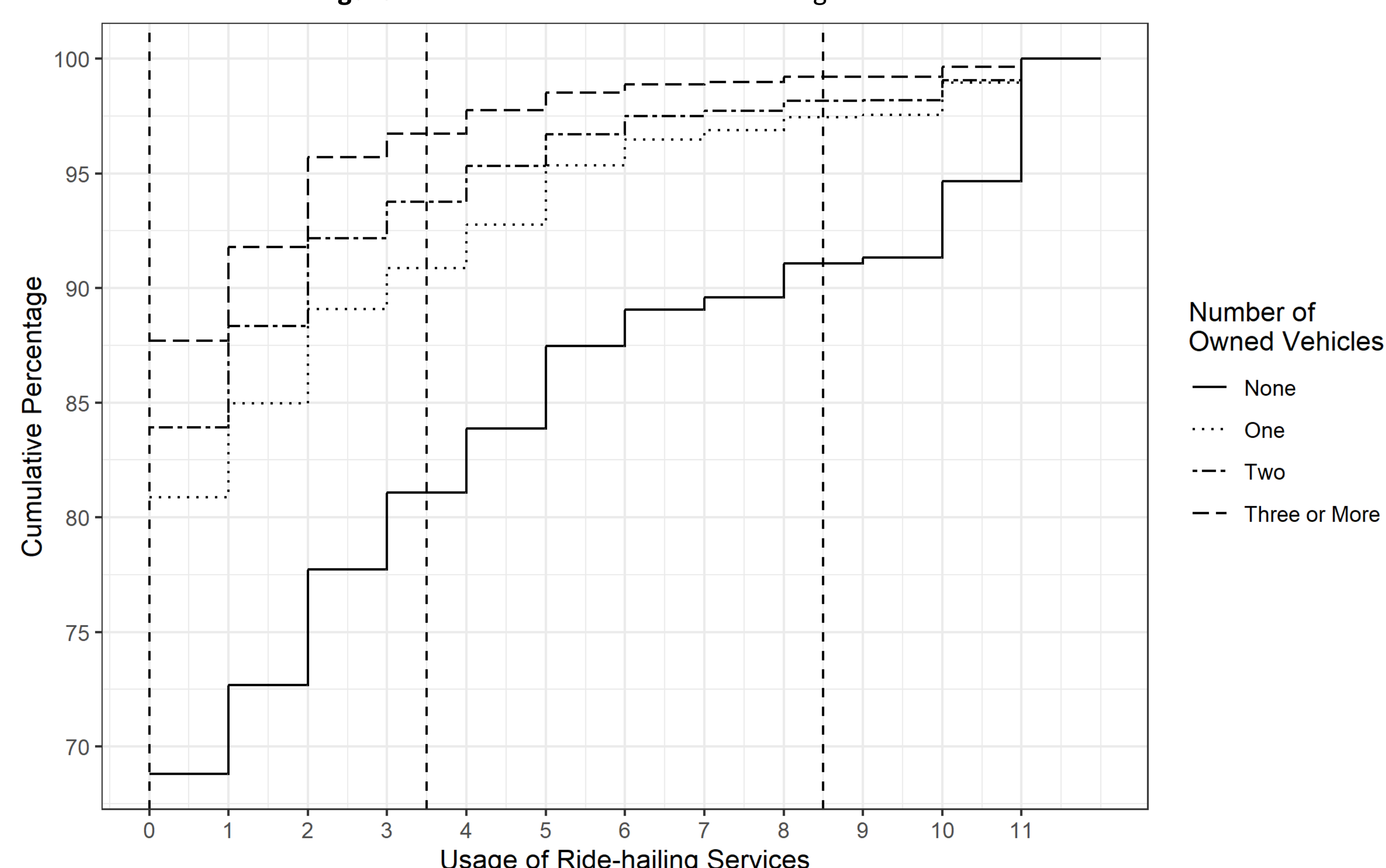
Model and Estimation

We develop an ordered probit model of household vehicle ownership with endogenous treatments of using RH services. Our estimation approach proceeds by maximizing the likelihood function. The endogeneity of the RH usage has been addressed using the nonlinear functional form and an instrument variable of the status of being a netizen.
- Ordered Probit Model of Vehicle Ownership:
$$y = j \text{ if } \tau_{j-1} < x'\beta + \bar{R}'\gamma + u \leq \tau_j, j = 0,1,2,3$$
- Treatment Equation of RH Services Usage:
$$R = k \text{ if } \xi_{k-1} < x'\beta + z\alpha + v \leq \xi_k, k = 0,1,2,3$$
- Treatment Effects of a respondent's probability of possessing j vehicles as the degree of using RH service increases from l to k:
$$TE_{kl}^j = \Pr(y = j \mid R = k) - \Pr(y = j \mid R = l) \text{ for } k,l = 0,1,2,3 \text{ and } k > l.$$

Results and Discussions

We find there is no significant difference in possessing vehicles between nonusers (no weekly ride), occasional users (weekly ride < 1), and regular users (weekly ride 1 ~ 2). In contrast, highly frequent users (weekly ride > 2) are more likely to own fewer vehicles. For example, compared to occasional users and regular users, highly frequent users are 2.23 and 1.99 percentage points less likely to own two vehicles but 2.51 and 2.21 percentage points more likely not to possess vehicles.

Also, we evaluate the percentage change in the number of vehicle holdings by CBSA as an average regular user converts to an average highly frequent user. On average, switching from a regular user to a highly frequent user, a respondent will reduce his or her vehicle holdings by 0.1152 unit, corresponding to 8.61 percent.

Table 1. Average Treatment Effects of Weekly Rides on Probability of Possessing Vehicles

	Weekly Ride = 0		Weekly Ride < 1		Weekly Ride = 1~2	
	Estimate	Std. Err.	Estimate	Std. Err.	Estimate	Std. Err.
Panel A. Endogenous Weekly Ride						
Probability of not Possessing Vehicles						
Weekly Ride < 1	0.47	(0.37)				
Weekly Ride = 1~2	0.77	(0.54)	0.30	(0.57)		
Weekly Ride > 2	2.98***	(1.05)	2.51**	(1.04)	2.21**	(1.07)
Probability of Possessing One Vehicle						
Weekly Ride < 1	0.71	(0.71)				
Weekly Ride = 1~2	1.26	(1.00)	0.55	(1.03)		
Weekly Ride > 2	4.70***	(1.42)	3.99***	(1.43)	3.44**	(1.52)
Probability of Possessing Two Vehicles						
Weekly Ride < 1	−0.24	(0.30)				
Weekly Ride = 1~2	−0.48	(0.45)	−0.24	(0.45)		
Weekly Ride > 2	−2.47**	(1.02)	−2.23**	(1.00)	−1.99**	(1.01)
Probability of Possessing Three or More Vehicles						
Weekly Ride < 1	−0.94	(0.79)				
Weekly Ride = 1~2	−1.55	(1.10)	−0.61	(1.15)		
Weekly Ride > 2	−5.21***	(1.45)	−4.27***	(1.49)	−3.66**	(1.60)

Figure 2. Simulated Percentage Decrease in The Number of Vehicle Holdings for Average Regular Users by CBSA
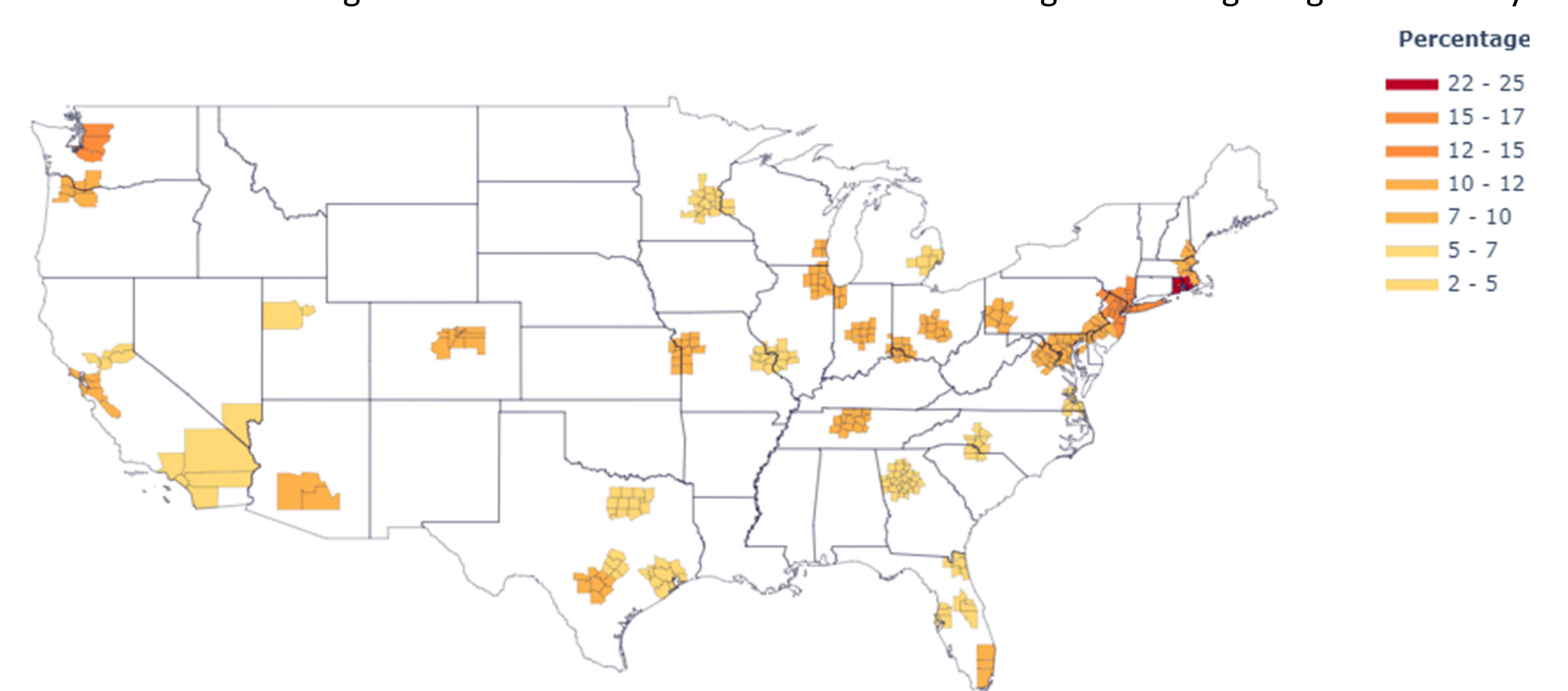
Conclusions

- Grouping respondents by their degrees of using RH services, we find highly frequent users are less likely to retain the ownership of two or more vehicles than other users.
- As more occasional users become regular users and regular users come to be highly frequent users, the RH service would play a significant role in the auto market, though its impact on the aggregated number of vehicle holdings is negligible due to the small population size of regular users.

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