

Adoption of Ridehailing in California and Impacts on the Use of Other Travel Modes

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Abstract— The availability and popularity of ridehailing services are quickly growing. So do their impacts on transportation demand and traffic congestion in cities. For example, a recent study of ridehailing services in the City of San Francisco showed that the share of total trips made with these services (approximately 170,000 trips per day) exceeds 15% of all trips inside the city of San Francisco on a typical weekday [1], which is equivalent to 20% of the total vehicle miles traveled (VMT) inside the city of San Francisco, and 6.5% of total VMT including both intra- and inter-city trips. Similar to other new shared mobility services, ridehailing services (also known as on-demand ride services, or transportation network companies, or TNCs) such as Uber and Lyft - i.e. the two largest providers of these services in the U.S. market - can expand the set of mobility options available to most users. They separate access to transportation (and automobility) from the fixed cost of auto ownership, and increase the number of reliable, comfortable and affordable options available for a trip [2]. As a result, the adoption of ridehailing can increase the attractiveness and feasibility of living in a zero-/lower-vehicle owning household, and/or can generate important impacts (either through substitution or complementarity) on the use of other travel modes. The goal of this paper is to investigate the relationships between the use of ridehailing and the use of other means of transportation.

Keywords— *Shared Mobility, Ridehailing, Uber, Lyft, Latent Profile Analysis*

I. RESEARCH OBJECTIVES

Research on the overall impacts that ridehailing services have on other components of travel behavior is still limited, largely because of the lack of longitudinal data or robust analytical approaches that capture the causal relationships among the use of on-demand ride services and other components of travel behavior. Most studies in this area, to date, are based on the analysis of descriptive statistics and self-reported behavioral changes, or rely on the analysis of convenience samples. Accordingly, it is often difficult to extrapolate the findings from these studies and apply them to the entire population. Additional difficulties associated with these studies include the eventual maturation of the impacts of ridehailing use over time, and the heterogeneity in behavioral changes across different segments of the population.

Recent studies indicate that the impact of shared-mobility services on other means of transportation may vary based on the type of services available, the local context, and the characteristics of the users [2-3]. For example, 40% of TNC users in San Francisco reported that they reduced their driving due to the adoption of on-demand ride services [4]. Further, depending on local circumstances, travelers may use on-demand ride services as a substitute for or as a complement to the use of public transit. For example, a survey of 4,500 users of shared-mobility services revealed that frequent users of shared mobility tend to use public transit more often and are more multimodal than non-users. Some of this relationship may be due to the correlation of both behaviors with third-party variables such as low car ownership or living in more accessible locations. A study carried out by the Shared-Use Mobility Center [5] found that the majority of trips made by on-demand ride services occurs between 10 pm and 4 am, when public transportation either runs very infrequently or does not run at all. On the other extreme of the spectrum, public transit may lose its riders as the share of ridehailing services increases: a study of seven large U.S. metro areas showed that these services tend to substitute 6% and 3% of the trips that would have been otherwise made by bus and light rail, respectively [6]. Nevertheless, there is no study that confirms the causal relationships among the use of on-demand ride services and different components of travel behavior, including multimodality, vehicle ownership and vehicle-miles traveled. Specifically, it is not yet clear the extent to which the adoption of shared-mobility services causes an increase in public transportation use (for example), as opposed to both of those conditions being caused by other variables (such as residential location, age/stage in lifecycle, and vehicle ownership), and large uncertainty exists on how these relationships vary among different sociodemographic groups and in different geographic contexts. This paper attempts to fill this research gap.

II. METHODOLOGICAL APPROACH

In this paper, we investigate the relationships between the adoption of ridehailing services and other components of travel behavior using the California Millennial Dataset, a rich dataset collected in fall 2015 as part of the first round of data

collection in a panel study of the emerging transportation technologies and trends in California. As part of the study, the research team designed a comprehensive online survey and administered it to a sample of 2400 California residents, including millennials (i.e. young adults, 18-34 in 2015) and members of the preceding Generation X (i.e. middle-age adults, 35-50). The data collection is part of a longitudinal study of the emerging transportation trends in California, designed with a rotating panel structure, with additional waves of data collection planned in spring 2018. We used a quota sampling approach to recruit respondents from each of the six major regions of California and three dominant neighborhood types (urban, suburban and rural), while controlling for sociodemographic targets including household income, gender, race and ethnicity, and presence of children in the household. For additional information on the survey content and data collection, see [3].

In addition to the questions about the adoption and frequency of use of on-demand ride services, the survey included two additional questions that focused on how the use of ridehailing affects the use of other means of transportation. The first question asked the effect of the most recent trip made by Uber/Lyft on the use of other travel modes. The second asked how the respondent would have traveled (if at all) if these services were not available. In previous stages of the research, we analyzed the adoption and frequency of use of ridehailing services among various groups of individuals and in different geographic contexts [7], and estimated adoption and frequency models for the use of Uber/Lyft, evaluating the impacts of several different groups of explanatory variables on the use of these services [8-9]. In this study, we focus on the impacts that the use of ridehailing services has on the use of other travel modes, and expand the analysis of the self-reported behavioral changes in response to the adoption of ridehailing through the application of latent class analysis.

III. (EXPECTED) RESULTS

The analysis of the information available in the dataset shows that the use of on-demand ride services tends to reduce the amount of driving (alone) among both frequent and non-frequent Uber/Lyft users, and among most sociodemographic groups. It also substitutes for some trips that would have otherwise been made by public transportation or active modes, especially among some users such as younger adults (millennials) and urban residents. This impact is more common among frequent users of on-demand ride services, those who live in zero-/lower-vehicle owning households and those who are more multimodal.

Three rather well-defined latent classes are identified in our preliminary latent class analysis. We find that the use of Uber/Lyft more likely reduces the use of public transportation and walking/biking among urban dwellers, those who live in a neighborhood with higher public transportation access and quality (based on the transit quality and performance indices) and those who are more likely to live in the zero-/very-low-

vehicle owning households. This latent class is by far the largest one (it includes the largest portion of cases) in our dataset. In contrast, the use of Uber/Lyft is found to mainly substitute for the use of a private vehicle for the members of a second latent class, which is mainly composed of suburban individuals who live with their families and children and have good access to private vehicles (i.e. a higher number of vehicles per household driver). Finally, ridehailing tends to increase the use of public transportation (e.g. through providing an access mode to connect to/from public transportation terminals or stations) among a small group of suburban dwellers, who tend to live in lower-vehicle owning households (compared to the second latent class) and who are more attracted by the use of public transit but often live in areas that are poorly served by public transportation; however, the members of this class tend to be among the least frequent users of ridehailing. This is an on-going research, and we expect to have final results ready to be presented by the time of the conference.

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