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Project: The Impacts of Emerging Mobility Options and Vehicle Technologies on Travel Behavior

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Summary

Today's world is deeply influenced by the way new technology evolves. Rapidly emerging mobile apps have contributed to the quick expansion of car sharing, ridesourcing, and various other on-demand services around the world. Similarly, connected and autonomous vehicle technologies are expected to bring a paradigm shift in how we define mobility. It is essential to incorporate ridesourcing and automated vehicle (AV) considerations into current long-range transportation planning efforts, which usually extend to the next 20 to 30 years. There are a lot of uncertainties with respect to technology development, regulations, and user acceptance that make it challenging to draw a clear picture of how shared mobility and AVs may affect our daily travel and the potential effects on the society as a whole. To address these challenges, this report presents a study investigating potential travel behavior changes in light of automated, connected, electric, and shared-use vehicle (ACES) technologies. Particularly, this study focuses on exploring the roles of attitudes in individuals' travel choice behavior. Data collected through a stated preference (SP) survey were used for this study. The survey targeted 10 metropolitan areas in the nation and the state of Florida. Three main aspects of choice behavior were investigated: AV adoption and willingness to pay (WTP), shared mobility adoption, and mode choice. Various modeling techniques were employed to identify influential factors and examine the impacts of attitudes, including error component models, structural equations model, and support vector machine method.

The survey results revealed that the plurality of the respondents were either willing to maintain basic vehicle utilization (36%) or at most add some advanced features (37%) such as adaptive cruise control. Only 12% of the respondents expected themselves to be riding in a fully autonomous vehicle in the next ten years. The average WTP increased along with the level of adoption, ranging from $652 for basic vehicles to $1,192 for advanced features, $1,542 for partial automation, and $1,769 for fully automated alternatives. In terms of the role of attitudes, those who enjoy driving would be the hardest to persuade toward AV adoption or to pay for automated features. Technology-savvy people revealed a higher tendency toward AV adoption. The results also showed that people might be willing to pay more for automated features if they believe that these features provide them better utility, in terms of time and cost saving, convenience, etc. Individuals with trust issues also showed higher WTP, which might indicate that strategies or services that address privacy issues may be worthwhile even at a higher cost for some groups of users.

This analysis focused on what it takes or what will convince travelers to adopt ridesourcing instead of private mobility. Survey results indicated that a monthly transportation cost increase of $100 would persuade 60% of the drivers to switch to ridesourcing services. The average cost of driving was about $9,300 annually, or about $773 per month according to AAA 2019 driving cost study. This shows promising potential for ridesourcing options. On the other hand, a 25-minute time saving was needed to

achieve the same magnitude of effect, which would be unrealistic considering that the average trip length was about 24 minutes.

This analysis also focused on daily mode choice between private vehicles and ridesourcing (including exclusive rides and shared rides) for a regular trip. In general, the models showed positive influences of high income and full employment toward exclusive rides, mid-income toward shared rides, and a negative association between lower education and retirees and ridesourcing options. It also showed that social and school trips had a higher propensity of being made with exclusive ride services than other trips. In terms of age, it seems that college students or young graduates (age between 18- 24) or those aged between 50 and 54 were more likely to take shared rides, and people between 30-34 were more likely to use ondemand services (both exclusive and shared), compared to other age groups. Habit associated with private vehicles, either as a driver or passenger, had strong negative impacts on the probability of using ridesourcing services, either as an exclusive ride or shared ride. This indicates that if a person frequently drives for regular trips, the probability of shifting to alternative options significantly decreases, despite the desirable level of service of the alternative modes.

Students and lower education groups (high school of less) showed a strong inclination to use shared rides compared to transit. As expected, low-income groups (less than $50k annually) were more likely to use transit than ridesourcing. Very high-income groups ($200K or above) were less likely to use shared services. Those in between generally showed a higher tendency to use exclusive rides compared with transit as income levels increased. In view of attitudes, technology savviness, on-demand service and travel time advantage are positive factors toward the choice of ridesourcing (both exclusive and shared forms) instead of transit. Interestingly, those who desire the utility of private vehicles or prefer alternative modes are more likely to stay with transit.

Positive associations were observed between the tendency to use shared rides and the interest in full automation, technology and efficiency. Individuals who seek efficiency and technology were interested in using shared ride services, presumably because shared travel modes are cost-efficient. Moreover, those who cared about mobility for non-drivers were inclined to use exclusive services. This may indicate the preference for those who are not able to drive themselves but prefer a private and exclusive travel experience. For auto users, students showed a positive tendency to use on-demand services, both exclusive and shared ride service, probably because students are usually more open and eager to experience new technologies. Income showed mixed results. In general, low-income individuals were less likely to use exclusive rides, and high-income individuals were less likely to use shared rides. In view of attitudes, tech-savvy individuals, choice reasoning users, and those who desire on-demand services would choose ridesourcing over transit services.

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