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Shared Autonomous Mobility Services Show Promise for Increasing Access to Employment in Southern California

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Issue

Workers in Southern California currently face transportation-related challenges accessing employment opportunities, including but not limited to high parking costs and/or limited parking availability in dense employment and residential areas; long commute distances between residential areas and employment opportunities; and poor transit service quality in many areas. These challenges are particularly burdensome for low-income households that may not have access to a personal vehicle and/or live in job-poor neighborhoods, as having a personal vehicle may be the only viable way to get to work.

Opportunity

The advent of automated vehicles and potential for Shared Autonomous Mobility Services (SAMS) may help address employment accessibility challenges. SAMS are similar to existing mobility services provided by companies such as Uber and Lyft[1], except SAMS vehicles are driverless. While still in the conceptual phase, SAMS may greatly reduce the cost of travel by reducing the need to park in high parking cost areas and allowing travelers to enjoy the mobility and accessibility benefits of private vehicle travel without bearing the upfront and ongoing cost of vehicle ownership.

While several studies have examined the impact of SAMS on the transportation system (e.g., congestion, induced travel), land-use (e.g., effects on development patterns), and the environment,[1,2,3,4] few studies have examined the impacts of SAMS on employment accessibility. To fill this gap, a new study from the Institute of Transportation Studies at UC Irvine (ITS-Irvine) analyzed a future transportation system with three existing commute modes (i.e., personal vehicle, transit, and walking) alongside two new SAMS commute modes – a SAMS-only mode that transports workers directly from home to work, and a SAMS+Transit mode where a SAMS vehicle transports workers from home to a transit station, thus solving the so-called first-mile problem. Specifically, the study measured the employment accessibility difference between this future five-mode transportation system and the existing transportation system with three main commute modes (i.e. personal vehicle, transit, and walking) using a logsum-based approach, which measures consumer surplus, to obtain a monetary measure of accessibility[5,6].

Key Research Findings

Low-density areas are likely to receive the largest employment accessibility benefits from SAMS (Figure 1). In suburban (low-density) areas, residences are typically farther away from employment locations, walking to work is often not a viable option, and transit service is often poor or nonexistent. Therefore, workers in these areas would significantly benefit from a fast and relatively affordable travel mode like SAMS. Conversely, workers living in high-density urban areas are typically close to employment opportunities and can either walk or take transit to their jobs. Hence, having additional commute modes like SAMS and SAMS+Transit would provide less value to them. This

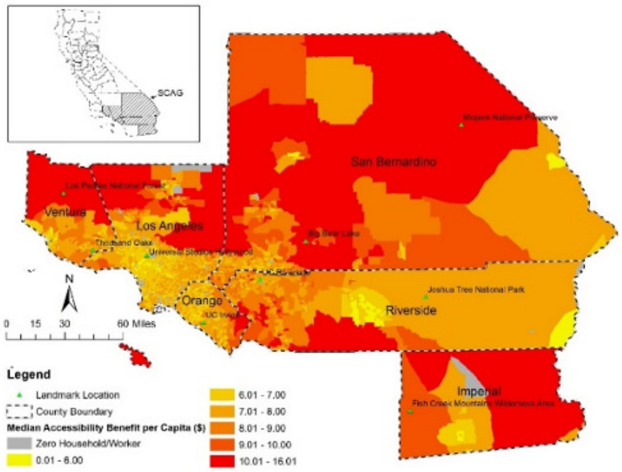

Figure 1: Spatial Distribution of Employment Accessibility Benefits from SAMS Modes in Southern California

finding holds even when accounting for the fact that high-density areas are likely to receive better service quality (e.g. shorter wait times) from SAMS than low-density areas.

SAMS benefits will increase as the future price of the service goes down. There is considerable uncertainty surrounding automated vehicles and in turn SAMS, including future costs and service prices. With this uncertainty in mind, the ITS-Irvine study finds that SAMS can provide accessibility benefits even at a price of $0.50/mile (approximately the current cost per mile of a personal vehicle) with benefits increasing as prices decrease. For low-income workers, the average consumer surplus associated with SAMS increases from $7.54 to $9.57 per commute trip, as the SAMS price drops from $0.50/mile to $0.10/mile

The SAMS+Transit option is unlikely to generate significant employment accessibility benefits or improve commute-based transit ridership in Southern California. For commute trips in Southern California, SAMS provide little benefit as a first-mile service to transit and would be unlikely to increase commute-based transit ridership without major changes and/or transit network re-designs, such as those proposed in Pinto et al. (2019).[7]

Young and low-income workers may gain the most employment accessibility benefits from SAMS. The median benefit per capita for young workers is $9.09 per commute trip and is $8.48 for those from low-income households, compared with $6.34 for high-income (and higher education attainment) workers and $6.86 for middle-income workers. Low-income and younger workers appear to be relatively more sensitive to factors like travel cost, travel time, and other factors when choosing work locations.

More Information

This policy brief is drawn from the UC ITS report "Assessment of the Employment Accessibility Benefits of Shared Autonomous Mobility Services" available at: ucits.org/research-project/2019-32. For more information about the findings presented in this brief, please contact Michael Hyland at hylandm@uci.edu.

[1] Fagnant, D.J., Kockelman, K.M., 2014. The travel and environmental implications of shared autonomous vehicles, using agent-based model scenarios. Transp. Res. Part C Emerg. Technol. 40, 1–13. https://doi.org/10.1016/j.trc.2013.12.001

[2] Truong, L.T., De Gruyter, C., Currie, G., Delbosc, A., 2017. Estimating the trip generation impacts of autonomous vehicles on car travel in Victoria, Australia. Transportation (Amst). 44, 1279–1292. https://doi.org/10.1007/s11116-017-9802-2

[3] Wadud, Z., MacKenzie, D., Leiby, P., 2016. Help or hindrance? The travel, energy and carbon impacts of highly automated vehicles. Transp. Res. Part A Policy Pract. 86, 1–18. https://doi.org/10.1016/J.TRA.2015.12.001

[4] Zhang, W., Guhathakurta, S., 2018. Residential Location Choice in the Era of Shared Autonomous Vehicles. J. Plan. Educ. Res. 0739456X1877606. https://doi.org/10.1177/0739456X18776062

[5] Niemeier, D.A., 1997. Accessibility: an evaluation using consumer welfare. Transportation 24, 377–396. doi:10.1023/A:1004914803019

[6] Train, K., 2009. Discrete choice methods with simulation. Cambridge University Press.

[7] Pinto, H.K.R.F., Hyland, M.F., Mahmassani, H.S., Verbas, I.Ö., 2019. Joint design of multimodal transit networks and shared autonomous mobility fleets. Transp. Res. Part C Emerg. Technol. https://doi.org/10.1016/j.trc.2019.06.010

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