Wheels on the Bus: Impact of Vaccine Rollouts on Demand for Public Transportation

1. Introduction

Public transit ridership plunged rapidly as the COVID-19 pandemic emerged (Sylvers 2020), contributing to enormous budget deficits and prompting slashed or eliminated service offerings across the United States. These service cuts are feared to trigger a vicious cycle—inadequate public transit offerings lead certain riders to switch to private vehicles, which further depresses ridership and justifies even more limited offerings—and end up hurting socio-economically disadvantaged groups, including low-income essential workers, who depend on public transportation and cannot afford to switch to other options (Glaeser et al. 2008). Experts believe the rollout of COVID-19 vaccines will eventually lead to the recovery of the public transportation sector (Vesoulis 2020). However, the near-term impact of vaccination *progress* on the demand for public transportation is not immediately clear (Yen and Weber 2021). In this paper, we estimate the impact of COVID-19 vaccination progress on the demand for public transportation.

2. Data and Methodology

We leverage unique features of the COVID-19 vaccination process to identify an instrumental variable. Traditionally, estimating the causal effect of vaccination progress is a daunting task mainly because of the potential endogeneity concerns in estimating the effect of vaccinations. Fortunately, the process of rolling out COVID-19 vaccines provides a novel instrumental variable (IV): the number of weekly allocated doses for each state. In fact, the weekly vaccine allotments have little to do with population movements but directly drive vaccine distribution. Therefore, their effect on population movements is purely through vaccine distribution. By merging the U.S. COVID-19 vaccination data with several sources of mobility and transportation data, we construct a sample connecting vaccination rates with the demand for public transportation and use the proposed IV to estimate the impact. In addition, we also use the proposed IV approaches to estimate the vaccination's impact on trip destination, trip distance, and trip modality.

3. Results

Using our IV approach, we estimate a one-percentage-point increase in the fully vaccinated population led to a 0.676% increase in the mobility in public transit centers. The result means that as more people are vaccinated, they are more likely to use public transportation. Our further analysis confirms vaccination led to a significant increase in the mobility in bus stations, railway stations, and airport terminals. For example, a one-percentage-point increase in the vaccination rate led to a 0.8% increase in the mobility in bus stops. We also analyze the effect of vaccine rollouts on population mobility in terms of the travel distance. We show vaccine rollouts led to a significant increase across trips of all distance ranges; the effect of vaccine rollouts on long-distance (i.e., over 50 miles) trip is higher than on short- (i.e., 0–25 miles) and medium-distance (i.e., 25–50 miles) trips. In addition, our analysis shows a one-percentage-point increase in the vaccination rate led to a 0.418% increase in the mobility in grocery and pharmacy stores, a 0.859% increase in the mobility in parks, and a 0.736% increase in the mobility in retail and recreation facilities.

4. Conclusion

COVID-19 vaccinations are expected to lead to a widespread economic recovery, yet its near-term impact on the demand for public transportation is difficult to estimate, mainly due to potential endogeneity concerns. In this paper, we introduce an IV to overcome these concerns and draw from multiple data sources that connect vaccination progress to population mobility. Besides, our paper provides a compelling empirical basis for governments and public transit agencies to revitalize public transportation options in view of progress in COVID-19 vaccination and in advance of demand recovery. Furthermore, due to uncertainty in the future development of COVID-19, variant-specific boosters might be needed and our methodology and findings would provide a convenient way to help public transportation agencies to anticipate the demand recovery in view of the ongoing efforts in administering vaccine boosters.

References

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