Moving to Opportunity: Can Short-Term Transportation Subsidies Help Low-Income Trainees Move to Better Jobs?

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One Paragraph Summary: The Department of Transportation (DOT) places a strong emphasis on equity and on the use of transportation investments to foster the socioeconomic mobility of low-income individuals and historically disadvantaged communities. The degree to which these investments may generate large increases in socioeconomic mobility may vary widely across individuals. A growing stream of recent experimental studies strongly suggests very limited effects (or no effect) of free/discounted mass transit passes (Brough et al., 2022, 2023) or heavily subsidized access to new transportation technologies (such as ridehailing or electric micro-mobility) on low-income populations in general. However, it may still be the case that the impact of transportation subsidies on socioeconomic mobility could be much larger for some subgroups, like individuals who are currently engaged in job training programs or are otherwise actively seeking opportunities for socioeconomic advancement (Franklin, 2017; Philips, 2014). This project will engage with job training providers in the Pittsburgh region who provide valuable opportunities to low-income trainees. The research team will work with these training providers to identify transportation-constrained students whose full participation in the program and/or job search possibilities might be constrained by the lack of access to a personal vehicle. These individuals will then be invited to participate in a randomized controlled trial in which a treatment group receives access to discounted bus passes, a limited number of free rides on a local ridehailing service, and free access to electric micro-mobility services while a control group receives cash payments for filling out surveys. Administrative data on income and employment will be used to track the impact of this bundle of transportation resources on income and employment in the short and medium run. Funding from the NBER will be combined with additional funding from a local foundation to implement the RCT. Smartphone apps will be used to track and compare the geographic mobility of treatment and control groups.

Introduction: Decades of research by economists and other social scientists have pointed to spatial mismatch as a barrier to employment in American cities. Recent research suggests that spatial mismatch can substantially lengthen spells of unemployment, especially for females, African Americans, and older workers (Andersson et al., 2018). Will more generous subsidies for mass transportation lower the barriers generated by spatial mismatch? A recent series of well-executed large-scale RCTs suggests the answer may be no (Brough et al., 2022, 2023). Recent large-sample experiments have shown that large subsidizes to conventional mass transit raise the geographic mobility of low-income populations (Bull et al., 2021), but do not appear to raise their socioeconomic mobility. In other words, evidence that these transportation subsidies lead to higher income or employment is weak at best (Philips, 2014).

The suburbanization of poverty has changed the dynamics of spatial mismatch in American cities, and it is possible that these null results reflect the limitations of conventional mass transit. Policies seeking to connect lower income and lower skilled workers living in the urban core to jobs may no longer work as these lower income populations move to the suburbs (Frey 2016). As the poor become more geographically dispersed along the urban periphery, the traditional hub and spoke model of most city mass transit systems becomes less useful. Disadvantaged residents need to move from one suburban area to another to pursue employment opportunities, but mass transit systems provide fewer links along the periphery. Some parts of the community are served by a single bus line that runs infrequently, making it challenging to secure employment, particularly third shift jobs or jobs in other suburban neighborhoods.

In recent years, a range of smartphone-enabled transportation options have diffused rapidly through American cities, offering more flexible and convenient methods of transport that do not require incurring the fixed costs of private vehicle ownership, such as ridehailing and various versions of electric micro-mobility, such as e-scooters and e-bikes. Could subsidized provision of these new transportation options to the poor enable better access to employment, training, and social services? Evidence on this point is more limited, but recent RCTs undertaken by our CMU-based research team suggest that neither reasonably generous ridehailing subsidies nor free access to electric micro-mobility have a statistically significant impact on the income or employment of study participants. Many low-income residents do not appear to be inclined to make significant use of electric micro-mobility resources, even when weather is favorable, and access is made available at zero cost.

This disappointing lack of measured impact on socioeconomic mobility may reflect the fact that the typical participant in our RCTs has reached an equilibrium in terms of their interaction with the labor market before participation begins, and a provision of additional transportation resources alone is unable to shift that equilibrium. The results could be quite different for the subset of individuals who are in the process of actively investing in the acquisition of skills to increase income and employment opportunities. These individuals could be in the process of moving from one

equilibrium to another, and modest social investments in additional mobility could lead to measurably better outcomes for this subgroup. Recent evidence on samples of job seekers provides some support for this view (Philips, 2014; Franklin, 2017). We consider the case of a participant in a workforce training program who has absorbed useful skill but must now match with a new employer. Lack of access to a personal vehicle and limited access to other transportation options could constrain the set of interview options and limit the scope of the job search. Alternatively, the training program may require transportation to different training sites or an "externship" with a prospective employer that is located at a distance from the participant's residence. Without access to adequate transportation, even the ability of the trainee to complete all aspects of the training program will be called into question. On the other hand, provision of limited transportation resources over short periods of time could have significant and lasting effects by enabling completion of a training program and/or additional job search opportunities that lead to a better long-term match.

The wide diffusion of smartphones (even among the urban poor) and the relative ease with which user-friendly "apps" can be created and disseminated have worked together to provide researchers with new, often low-cost platforms through which experimental interventions can be directed and implemented. The same technologies also create important new opportunities for data collection and measurement, often to a degree of granularity and temporal frequency that would have been unimaginable to earlier generations of empirical researchers. As an example, Figure 1 illustrates the anonymous location trajectory recorded by smartphone of a low-income mother during one day in one of our recent pilot studies in Pittsburgh. Different colors represent different times of the day, with the transition from bright yellow to dark red corresponding to the movement from early morning to late night. Such granular location data can enable us to learn a great deal about the movements and transportation choices of low-income populations. Combined with detailed administrative data on employment, income, and the utilization of social services, we can create a rich statistical portrait of how geographic and socioeconomic mobility co-evolve.

Figure 1. An Example of Location Trajectory Recorded by Smartphone of a Low-Income Mom During One Day



Research Questions/Data/Methods/Partners: This section of the proposal identifies the research questions we will pursue, along with the key data sources and methods we will use to answer them. At the end of this section, we describe the partnerships with Pittsburgh-based training providers that will aid in this research.

Research Question 1. *Does access to additional transportation resources significantly expand the* ***geographic mobility*** *of low-income participants in workforce training programs?* As already noted, widespread diffusion of smartphones has enabled a proliferation of new transportation options that offer some of the flexibility of personal vehicles without the fixed costs of vehicle ownership. Smartphone diffusion even among poor families is now quite extensive, raising the possibility that modest subsidies for the new transportation options could allow low-income citizens greater access to them, substantially enhancing their geographic mobility. The GPS capabilities embedded in those smartphones allow for the detailed tracking and measurement of individual mobility patterns (Macha et al., 2021). Our research team has already acquired extensive experience creating and deploying iOS and Android-compatible smartphone apps that gather detailed GPS location data several times per hour, in a way that achieves a good balance between mobility measurement and

battery drain on users' phones. Through experience, we have identified robust approaches to mobility measurement that can contend with the noise in GPS data. Working together with CMU's Institutional Review Board, we have developed data anonymization protocols that allow us to analyze these rich data and link them to survey responses from the same individuals, while also protecting the privacy of our participants. We can also make deidentified versions of these data available to the broader research community. Finally, by implementing the best practices of a randomized controlled trial (RCT), we can experimentally manipulate participants' access to particular transportation options and make causal inferences about the impact of this on mobility outcomes. We note some estimates of the impact of randomly assigned access to transportation resources on various measures of individual mobility in the "Prior Research Efforts" section below. Of particular interest in the context of the current study will be an assessment of *the degree to which additional transportation resources allow trainees to travel to specific geographically distant training sites and interview with geographically distant potential employers*. Survey and GPS data can be combined to focus on this particular dimension of geographic mobility.

Research Question 2*. Does access to new transportation options increase the* ***socioeconomic mobility*** *of low-income participants in training programs?* The same smartphone apps that collect high-frequency GPS data can also send and receive short surveys that capture aspects of the mobility experience which cannot be measured by GPS data alone. We have already used these tools to measure *self-reported* employment and income in earlier studies. However, we can also utilize the ongoing partnership between the Allegheny County Department of Human Services (ACDHS) and CMU to measure the impact of experimentally induced increases in geographic mobility on the short-and long-term *socioeconomic mobility* of our study participants. ACDHS is a national leader in efforts to link the various administrative data sets generated by the major social assistance programs, local schools, police departments, and courts into a single integrated data warehouse, in which a unique identifier code links individual county residents' data records across data sets. The data warehouse provides comprehensive coverage on the recent income, employment, and social services utilization of most low-income residents of Allegheny County. While CMU researchers will not have direct access to sensitive individual-level records, cleared data analysts inside ACDHS can perform statistical analyses on those records and share the results with CMU researchers. This collaboration gives our team an unusual degree of insight into the short- and medium-run effects of additional geographic mobility on a broad range of socioeconomic outcomes. In particular, it will allow us to determine whether *the additional geographic mobility conferred by the transportation resources provided to our treatment group allowed members of that group to more successfully complete training programs and/or obtain better jobs offering higher wages upon graduation.*

Enabling Partnerships with Training Providers. The CMU research team has engaged in extensive prior collaboration with the Community College of Allegheny County (CCAC) and the Manchester Bidwell Corporation. CCAC is the largest provider of community college education in the Pittsburgh region and runs several highly regarded training programs in the health care domain that have been demonstrated to secure well-paying jobs for hundreds of graduates per year. Many trainees come from disadvantaged groups, have low incomes, and face significant transportation challenges in traveling to offsite clinics and other training sites during the program, due to the lack of access to a personal vehicle. These transportation constraints can also constrain the job searches of students as they seek job placements at the end of the program. CCAC is limited in its ability to provide these students with additional transportation resources and is open to cooperation with our proposed research project as a way of providing additional transportation resources to these students. CCAC will help us identify transportation-constrained students and share (appropriately anonymized) information with us on program performance and completion. An existing data-sharing agreement between CCAC and ACDHS will facilitate analysis of the impact of additional transportation resources on job market outcomes after program completion. Manchester Bidwell Corporation runs a nationally recognized portfolio of training programs for disadvantaged adults based in Pittsburgh's North Side. All programs require externships with offsite employers, and many Manchester Bidwell students face transportation constraints in getting to their various training sites. We will cooperate with Manchester Bidwell in a similar fashion, working with their staff to identify transportation-constrained students, providing additional transportation resources to a randomly selected subset of these students, and using (appropriately anonymized) Manchester Bidwell student records to the measure the impact of these resources on program performance and completion. An existing data sharing relationship between Manchester Bidwell and ACDHS will facilitate analysis of the impact of additional transportation resources on job market outcomes after graduation.

1. Prior Research Efforts/ Research Findings

Step 1 -- The "Uber Project": Prior funding from the National Science Foundation, the Hillman Foundation, CMU's Traffic21 research center, and the NBER-DOT program allowed us to examine the impact of subsidized access to one smartphone-enabled transportation option, ridehailing, on the income and employment of low-income mothers in the Pittsburgh region. This project, undertaken in partnership with Allegheny County DHS, provided us with the resources to develop smartphone apps (compatible with both iOS and Android operating systems) that gather GPS data and provide a platform through which we can send and receive short surveys to participants that enable us to measure aspects of our participants' experience not captured by administrative data sets. Our results suggest a causal impact of our treatment on the geographic mobility of our participants that is statistically significant and economically meaningful. The measured

impact varies widely depending on the exact specification (e.g., daily distance traveled, daily distance from home, radius of gyration), but appears to lie in the range of 90-130%. In addition, transit times can be reduced by as much as 67 percent relative to a counterfactual trip using only public transportation. However, this increase in geographic mobility does not appear to lead to an increase in socioeconomic mobility. While preliminary findings indicated a positive impact on employment and income, more recent analysis provides no evidence of a statistically significant effect on either outcome. More details about this study are available upon request.

Step 2 – "Guaranteed Mobility" for Pittsburgh's Low-Income Residents: More recently, our CMU team has begun a pilot study in cooperation with the City of Pittsburgh's Department of Mobility and Infrastructure, the Hillman Foundation, and other local nonprofits. Rather than provide low-income residents with subsidized access to a single smartphone-enabled transportation option, such as ridehailing, this pilot is providing access to a *menu* of transportation options, including standard mass transit (through monthly transit passes), Pittsburgh's POGOH ebike-sharing service, and the Zipcar internet-enabled car rental service. Low-income Pittsburgh residents have been recruited into a randomized controlled trial in which the treatment group gets 12 months of generously subsidized access to the full menu of transportation options described above. Members of the demographically equivalent control group receive modest payments in return for downloading our GPS apps and responding to surveys over the same period. Use of our smartphone apps by members of both groups allows for precise measurement of the magnitude and nature of any impact of the treatment on geographic mobility. This information is supplemented with detailed user-specific information on utilization of the transportation options described above. As in Step 1, ongoing cooperation with Allegheny County DHS will allow comprehensive measurement of the impact of treatment on socioeconomic mobility.

This new step in our research program provides a broader and far more generous menu of transportation options to participants than our first study. In principle, participants in the treatment group could have access to total transit resources worth more hundreds of dollars per month for up to one year. More generous, broader support could lead to larger measured increases in geographic and socioeconomic mobility, in principle. This project is ongoing and scheduled to run through the end of June 2024. So far, however, we see little evidence that the intervention is having statistically significant effects on income or employment. We also see very little take-up of transportation resources other than the city bus service. Very few participants have made any use of electric micro-mobility or Zipcar's car rental services, despite the generous subsidies. While Pittsburgh's challenging weather and topography can limit the appeal of electric micro-mobility, we see little evidence of take-up even in very favorable weather conditions. So far, we still find evidence of a positive impact on geographic mobility (a more than 100% increase in some specifications relative to the control), but it is not yet translating into socioeconomic mobility. Again, one interpretation of this disappointing outcome is that participants have already reached a hard-to-shift equilibrium in their interaction with the labor market, one that is constrained by skills, family responsibilities, location choice, and other factors. A modest infusion of transportation resources, maintained over what participants understand to be a limited window, may be insufficient to shift that equilibrium. This strengthens the case for focusing the provision of transportation resources on those who are undertaking investments to shift their equilibrium, as we suggest in this proposal.

Research Team: PI Lee Branstetter is an expert on the economics of innovation and technology diffusion. His work has been published in leading journals including the *American Economic Review*, the *Quarterly Journal of Economics*, the *RAND Journal of Economics*, the *Review of Economics and Statistics*, and the *Economic Journal*. Professor Branstetter is a research associate of the NBER, and he served as a senior economist on the staff of President Barack Obama's Council of Economic Advisers in 2011-2012. As a member of the faculty leadership team of the Future of Work Initiative at CMU's Block Center for Technology and Society, an interdisciplinary research center based in Carnegie Mellon's Heinz College, Professor Branstetter also brings to the project strong ties with social service agencies and nonprofits in the Pittsburgh region that regularly interact with the population this project is designed to help. Branstetter was the PI for NSF grant "Driving Low-Income Mothers to Greater Success: The Impact of Ride-hailing on Employment and Income" (SBE- #1851862), $285,080, the NSF grant "City of Bridges: Using New Transportation Options to Drive Low-Income Mothers to Greater Success in Pittsburgh" (SCC-CIVIC-PG 2043634), $50,000,

Co-PI Beibei Li has extensive experience at leveraging both observational data analytics and experimental analysis in analyzing large-scale individual user behavior and mobility data across online, offline and mobile channels for decision support and user interface design. Her background in computer science and doctoral training in information systems will enable her to provide effective leadership of the technical aspects of this project, including the development of information collection systems and improvement of smartphone aps. As a professor in one of North America's leading professional degree programs in analytics and information systems management, Professor Li has access to a broad away of talented and experienced doctoral and masters students, with strong programming and data analysis skills, ensuring that we can recruit outstanding graduate research assistants for this project. Professor Li's research skills are evidenced by her publication record and by her receipt of the Anna McCandless Career Development Professorship. Li was co-PI on the two NSF grants named above.

Conflict of Interest Statement: Neither PI has any significant financial investment, corporate board seat, consulting arrangement, or any other relationship that might impact the conduct of the research described this proposal.

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