# Public Transit and Private Car Ownership: How to Best Help Low-Income, Urban Workers

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## Abstract

This paper seeks to understand how to best support low-income, urban employment mobility through transportation. While scholars have studied the effects of urban planning, access to a private vehicle and public transportation for low-income residents, there is no consensus in the academic community for which method of transportation is most effective. Utilizing responses from the 2004 General Social Survey, the study measures perceived access to public transit, car ownership and employment mobility — the ability to switch to an equally desirable job — among low-income residents. I utilize two multivariate regression analyses for the survey data. The study finds a positive relationship between car ownership and employment status, but no relationship between either car ownership or transit access on perceptions of employment mobility. This analysis and future studies have important implications for transit policy, as it can help inform how to better fund public transit to help low-income individuals and may lead to experimental policy like low-income car subsidies.

## Introduction

As the effects of the Great Recession fade and unemployment decreases, the Federal Reserve is able to focus on one of its lesser known responsibilities — community development and urbanization. Patrick Harker of the Philadelphia Fed recently highlighted one of these issues of urban development. "Many individuals don't have cars. Public-transport options are limited. We absolutely have to work hard to bring people from the sidelines into the workforce. Not only for those communities and individuals, but for the economy as a whole" (Costa 2018). The Federal Reserve's statement represents a larger question of how policymakers can best address issues like employment in a rapidly-changing metropolitan environment. Transportation can be a defining factor in conversations regarding policy solutions to help alleviate the burdens that accompany low-incomes and unemployment. Two questions arise when considering this problem: does access to transportation have any discernible effect on employment mobility and, if so, what type of transportation has the strongest positive effect on employment outcomes?

Over the past two decades, scholars have continued to examine commuting times and methods in order to help achieve better conditions for those in need of a job, or to help increase economic mobility (Ong 2002, Ong 2002, Sanchez, Shen and Peng 2004, Sanchez 1999, Cervero, Sandoval and Landis 2002, Baum 2009). There is intuitive support for the claim that if a low-income person is able to access a larger physical area, their job opportunities should increase. While researchers posit access to public transit as a solution to physical access to employment and a means of helping low-income people, there is not a consensus among policymakers and the public regarding transit's effectiveness.

In addition to the discussion surrounding public transportations effect on employment, there is significant debate regarding the comparative efficiency of public and private transportation. Several programs have used different methods of transportation to alleviate difficulties in employment. Current car ownership programs offer a possible solution to employment issues for individuals who receive Temporary Assistance for Needy Families (TANF). Other public agencies instead offer low-income people a greater and more connected network of buses, trams and trains. Population increase and urbanization are causing the steady dispersal of employment opportunities into more suburban areas, providing less access to low-income people living in the inner-city who need it most (Kasarda 1989). In the face of this significant job dispersal to the suburbs and debate surrounding public transit, discussion regarding efficient methods of transportation for employment is vital.

In this paper, I empirically assess the relationship between employment and two key factors regarding transportation: access to public transit or car ownership. I examine the effect of these assets on employment mobility though individual data from the General Social Survey of 2004 regarding perceived access to public transportation and car ownership. This study should be of significant importance to policymakers as they seek to address increasing income inequality within large cities. The narrative of public transit helping the impoverished find work may not withstand empirical scrutiny, and experimental policies like car ownership programs or subsidized car insurance premiums may yield more effective outcomes (Ong 2002). There may also be more effective ways of implementing and funding public transit to better help low-income, urban workers. Positive relationships between car ownership/use of public transportation and employment mobility would signal the need for possible innovations in public policy decisions that seek to systematically combat unemployment.

# Public or Private? The Spatial Mismatch Hypothesis and How Commuting Affects Employment Mobility

## Employment Mobility

Employment mobility is essential to understanding economic movement of low-income people and how earnings are distributed. Studies show a relationship between higher job earnings and higher employment mobility. Therefore, information regarding mobility will help better inform public policy decisions regarding low-skilled and low-income workers. (Leonardi 2013).

Many methods have been implemented to measure employment mobility, most utilizing work status as either unemployed or employed as a dependent measure. Some studies also utilize dependent coding, meaning respondents are asked questions from month to month in the Current Population Survey to demonstrate if occupational duties or jobs have changed (Farber 2008, Fallick and Fleischman 2004, Moscarini and Thomsson 2007). Additionally, other studies use longitudinal data to see if the unemployed are able to find jobs in a given time period (Cervero, Sandoval and Landis 2002, Sanchez, Shen and Peng 2004). For the purposes of this study, I utilize a respondent's perceived ability to find an equally good job compared to their current situation.

Researchers have shown several factors that affect trends in these measures of employment mobility. Gender is one defining aspect of mobility trends in employment, mainly due to disparities in job tenure, labor behavior and wages that women face (Farber 2008, Gottschalk and Moffitt 1999, Keith and Mcwilliams 1997). Additionally, as later discussed in regard to Spatial Mismatch theory, studies show race to have negative and systematic ties with measures of employment mobility due to employment discrimination (McBrier and Wilson 2004, Raphael and Riker 1999, Rosenfeld 1992). Education also affects employment mobility. Research convincingly demonstrates that someone with more education tends to have more resources, social capital and overall better ability to find a job than someone who does not (Stiglitz 1973).

## Public Transit Access and the Spatial Mismatch Hypothesis

One prominent explanation for the variance in transportation access and its relationship with employment mobility is the Spatial Mismatch Hypothesis (SMH). The SMH contends that there is an increasing difference in where low-skilled jobs and low-skilled employees are located. John Kain's seminal (1968) paper, "Housing Segregation, Negro Employment, and Metropolitan Decentralization" posits and develops this idea by emphasizing structural disadvantages for Black employment due to location. Because of housing discrimination and dispersal of employment opportunities, Kain explains that Black people living in segregated areas face higher costs to employment and fewer resources regarding possible jobs.

Since the publishing of Kain's paper, notable studies contributed to this body of literature (Harrison 1972, Shen 2001, Taylor and Ong 1995). While some studies find little evidence for the SMH, the majority of evidence supports Kains original findings (Blackley 1990, Cervero, Sandoval and Landis 2002, Easley 2018, Gobillon, Selod and Zenou 2007, Holzer 1991, Ihlanfeldt and Sjoquist 1998). The SMH provides a backdrop to understand why a policy solution regarding transportation could help alleviate unemployment and reduce inequality. If poorer residents are located in cities and are unable to access jobs that are increasingly outsourced to suburbs, reverse commute patterns and public transit policy will affect large numbers of low-skilled workers. Longer and more expensive commutes can only be accepted by workers if the benefits offset the costs of the job's location, and low-skill and low-paying jobs often do not meet that condition.

More recent studies find similar evidence for other racial groups. Utilizing 2010 Census and

Business Pattern data, Easley finds that the average Vietnamese or Cuban worker experiences SMH at a higher rate than their Black counterparts (2018). Additionally, this theory has been extended beyond race and shown to affect all low-income individuals or welfare recipients (Blackley 1990, Cervero, Sandoval and Landis 2002, Sanchez, Shen and Peng 2004, Taylor and Ong 1995).

## Car Ownership

Overcoming potential spatial mismatch requires effective transportation methods. Car ownership is not an affordable option for all workers, but much like public transportation, this may have an impact on employment mobility. Research has shown that those in urban areas are more sensitive to changes in motoring costs (Dargay 2002). The results demonstrate that, although price changes would burden those in rural areas, urban residents can more easily switch to modes of transit outside of car ownership.

Income is an obvious determinant of car ownership, and previous studies demonstrate a positive relationship between the two factors (Dargay 2001, Nolan 2010). Other influences, such as household composition and lifestyle effects were observed by Nolan to have discernible effects on whether an individual has access to a car (2010). Age may also have an additional effect. For instance, millennials are less likely to own cars than other generations,and if these trends persist they will shape future transportation policy (Klein and Smart 2017, Polzin, Chu and Godfrey 2014). While literature examining the relationship between car ownership and employment mobility has discussed factors that affect people's access to vehicles, a more salient topic stems from the comparative effectiveness of car ownership and public transit when examining how to address these issues in policy making.

## Public v. Private Transportation

A significant quantity of research has focused on the debate between public or private transportation and the effect of these transit options on employment. Most studies find a positive relationship between car ownership and employment levels, often relying on data from welfare recipients (Cervero, Sandoval and Landis 2002, Ong 2002, Sanchez, Shen and Peng 2004, Waller and Hughes 1999). These studies use longitudinal data to track effects of car ownership on employment over a period of multiple years. Other studies using longitudinal data for specific groups, like single-mothers with low educational attainment found that vehicle ownership increased chances for employment in all locations, but the effects did not hold for individuals of higher socioeconomic status (Baum 2009).

The effect of public transportation on economic outcomes is much more contested. When controlling for car ownership, some studies find a positive relationship between access to public transportation and employment (Kaufman et al. 2014, Yi 2006, Kawabata 2003). Others use natural experiments, like Hurricane Sandy, to observe whether the effects of reduced access to public transportation in specific areas decreases employment opportunities(Tyndall 2017) or the Geographic Information System to actually track distance and frequency of public transit

stations and their effects on employment (Sanchez, Shen and Peng 2004). Both analyses found a positive relationship between access to public transit and employment attainment. Another notable study found that public transportation in Portland and Atlanta can help alleviate nonwhite workers transportation issues and the systematic employment discrimination they face (Sanchez, Shen and Peng 2004). Many studies, however, also find that there is no relationship between public transit access and employment outcomes (Cervero, Sandoval and Landis 2002, Sanchez 1999, Waller and Hughes 1999). Sanchez (1999) found a moderate relationship between employment and public transportation, but also found different results with new methodology. In this later study, he and his coauthors again used TANF data for individuals who qualify for the welfare program, but focused on more metropolitan areas and considered quality of transit stops in their analysis (Sanchez, Shen and Peng 2004). Additionally, they created an index for entry-level jobs to compare employment status for those with cars and those that rely on public transportation. They found no significant effect of regional employment access or transit mobility on TANF recipients ability to change their welfare status. The debate in academia regarding modes of transportation is not settled, and conclusive statements have yet to have been made about which is most effective.

## Contribution to the Literature

This research utilizes new measures to examine the importance of both public transportation and private car ownership on employment opportunities. Although many have studied the subject, they often use longitudinal data tracking individuals gaining employment. The General Social Survey provides a different dependent measure than most transportation studies employ – an individuals perceived ability to find an equally good job. Additionally, the independent measure of employment mobility is based on individuals' perceptions and subjective answers to survey questions, which I argue is a more valid measure of socioeconomic conditions like mobility. Both indicators have their merits and disadvantages when applied to labor and transportation research, which will be later discussed.

The research also has broader effects when considering car ownership and subjective measures of employment mobility. The current literature oversimplifies the relationship between mobility and car ownership, reducing the relationship to the literal aspects of employment - meaning that owning a car physically increases the distance an individual is able to commute to work. In other words, previous methods neglects non-quantifiable and psychological effects of car ownership in addition to public transit. This may skew results because, although car ownership and public transit access may both physically and logistically increase employment mobility, unmeasured and negative psychological effects of public transit may be affecting behavior. Although I base most of my theory on the literal aspects of transportation, these psychological effects may make it more difficult to prove public transit is affecting perceived employment mobility.

Additionally, many studies focus solely on the unemployed attempting to find employment. I replicate previous studies and use a logit model to measure the effect of public and private

transit on employment. In addition, I also employ multivariate analysis to examine respondents' psychological views of their own employment mobility based on their transit access. Mobility is an important indicator of economic security and the situation of those with low incomes, and accounts for a broader set of measurements regarding job searching than simply unemployment and employment. Studies obscure whether individuals are taking jobs that are better or worse than their current situations by looking at solely employment. By observing job perceptions of those in low-income positions through the GSS, the population of people who may be employed, but are in a job-insecure situation, are included in analysis and testing.

## Hypotheses

Most employment necessitates a method of transportation. Any increase in transportation should have a direct effect on the ability of low-income people to apply for and get jobs; however, the situation may be more complicated when considering the Spatial Mismatch Hypothesis, which posits that those living in the urban areas require reverse commuting patterns in public transportation.

Car ownership and public transit may be important to employment mobility for one main reason: logically, the area of possible employment extends beyond what walking or other methods of transit may cover. Low-income people living in the city have limited job prospects as high-skill jobs move into urbanized areas. City dwellers are faced with a difficult choice regarding which method of transportation to rely on, given their limited resources.[1]

Often, low-income people are too poor to afford a car for themselves, thus public transit is often viewed as a way of linking unemployed, carless people to more job opportunities. A positive relationship between public transportation and employment mobility would help demonstrate this relationship. A positive relationship between public transit and employment mobility would also weaken support for the Spatial Mismatch Hypothesis, which posits that urban, low-income people face reverse commuting obstacles to inaccessible job areas. It would demonstrate that the current needs of low-skilled workers are being served by the system of public transportation currently in place, and the employee-skill mismatch that is theoretically occurring does not have a substantial effect on employment mobility for inner-city, low-income employees. Observing no relationship would help support the idea that due to urbanization, Spatial Mismatch is a significant barrier for employment that this population is forced to address. An observation of no relationship does not imply that public transportation cannot be used to affect substantive change in employment mobility, only that the current state of public transportation systems does not lend itself to supporting these workers specifically.

[1] In terms of temporal priority, public transportation must precede employment mobility, since once someone receives a job, there is no reason their physical access to public transportation would increase. Private car ownership may have a difference in temporal effect — someone may buy a car after they have been employed for long enough to save up for it, but this will not necessarily affect the casual relationship. There will still be access to a car which would directly affect employment mobility; if the person found it that necessary to have car, it would probably have advantages when going to and from their jobs.

For those who are able to own a car, there should be a significant positive relationship between employment mobility and private transportation if the SMH were true. A car would grant previously immobile, low-skilled workers an ability to overcome the Spatial Mismatch by utilizing their own commuting patterns, rather than the preset routes that public transportation provides.

As much of the literature provides compelling evidence for the SMH, I predict low-income individuals will find no help in public transit that mainly aids high-income earners in their job flows from suburban to downtown areas, and instead will better utilize a car to increase employment opportunities.

*Hypothesis 1: Car ownership will have a positive relationship with employment status/perceived mobility.*

*Hypothesis 2: Public transit will have no relationship with employment status/perceived mobility.*

# Data

**General Social Survey** The study utilizes data from the General Social Survey of 2004. This yearly, nationally representative survey is conducted by the National Opinion Research Center at the University of Chicago with funding from the National Science Foundation. Each year, the survey asks respondents questions regarding behavior, stigmas, demographics and other attributes contributing to their daily life. There are also special issues that may only be present in certain surveys and years, such as access to public transportation. The survey of 2004 is of particular interest, as it asks questions regarding transit, employment and car ownership. There is one other year that asks respondents about their transit access, and it was only completed with a small subsection of the sample in 1994. For the purposes of this study, 2004 will be the singular time period of analysis.

This study will focus on individual respondents in the survey. The population of interest represents those who made less than $60,000 a year and who live in what the General Social Survey defines as the four largest city sizes. The choice of $60,000 per year was made for several reasons. First, this is very close to the United State's median household income. Second, this batch of individuals maximizes variation and sample size while not going beyond the population of study. This selection process is additionally utilized to quantify the Spatial Mismatch Hypothesis and target a more specific sample. Although those at the higher range of the income batch may not qualify as low-skilled, low-income individuals, the results may still be valuable.

I created two datasets to measure two effects of transportation. The first focuses on a population that is made up of both unemployed and employed low-income workers who live

in the city. The sample size of 340 from an original sample of 2814 occurs when selecting for respondents who answered questions regarding income, public transportation, car ownership and work status, and when selecting for those who are below the income threshold and reside in the selected geographic areas. The second dataset measures perceived employment mobility. This represents only employed, low-income residents who live in the city, and the sample size comes to 213.

Both datasets capture different populations with differing characteristics, but the overlap between the populations is unknown. The main difference is that the first dataset includes unemployed respondents, who may face very different constraints and situations from their employed counterparts. The second dataset focuses solely on employed workers, as they are able to respond to whether they could find an equally good job to the one they currently reside in, the main question that measures perceived employment mobility.

The data is limited in several ways. First, due to the nature of national surveying methodologies and the selection of the study's criterion, the sample size is smaller than an ideal sample to analyze the population of interest. Second, as will be discussed in regard to the perceived employment mobility dataset, lack of variation and low sample size in both independent variables makes it more difficult to identify statistically significant results. This is compounded by the lack of variation in measure gauging the the options for employment mobility.

While some previous studies analyze survey data, either longitudinally or with singular years (Leonardi 2013, Farber 2008, Thomsson and Moscarini 2007, Fallick and Fleischman 2004, Dargay 2002, Ong and Blumenberg 1998, Keith and Mcwilliams 1997), the General Social Survey has not yet been utilized by researchers in this field. This may be due to its function as a gauge for societal norms, but the survey holds valuable data regarding perceptions of personal job mobility and transportation access.

# Variables

## Dependent Variable

I created the first dataset with previous literature in mind. The dependent variable is work status for this subset, and individuals who were retired, in school or keeping house were excluded from analysis. The respondents in the sample include people who unemployed, working fulltime, working parttime or temporarily not working. Unemployment was coded as a 0 while all other employed statuses were coded as a 1.

The second dataset utilizes a more specific and unique dependent measure. This variable, employment mobility, is measured by one survey question, "Could respondent find equally good job" in the GSS. Responses come in a categorical form ranging from "Not easy" to "Fairly easy" to "Very easy." Finding an equally good job presents an indicator of employment mobility and availability. If the respondent is confident in their abilities to find another job, it is reasonable to conclude that the region they have access to has job opportunities at similar skill levels.

In other words, if a low-income individual feels as though they could find an "equally good"

job, they must have the physical access to areas with low-skilled jobs that are readily available. If the SMH holds, then poor and low-skilled people should have less employment mobility, especially when transportation options are limited. Controlling for other variables, the study attempts to measure the effect of each independent variable on how respondents feel about their current employment status and the availability of jobs around their skill-level.

Additionally, the response as *perceived* access to find another job is unique from other studies examining employment mobility. Previous studies often measure distances to transit stops, commute times and job-to-job transfers. The psychological perception of job availability, though, can account for several life factors that may affect availability on one question.

For the dataset, I coded "Not easy" as a 0, "Somewhat easy" as a 1 and "Very easy" as a 2. This results in employment mobility as a scale from 0 to 2.

## Independent Variables

The independent variables for both datasets come from two key questions in the survey. First, "Need but unable to use public transport." This question asks the respondent if, in the last 12 months, they needed, but were unable to use, public transportation to get to work, shop, etc. This variable is a categorical, dichotomous variables with responses of either "Yes" or "No."

Rather than use local data to form indices or measure distances from respondents to their nearest bus station, I found this measure to be both simpler and more accurate to gauge accessibility. Many studies measure transit accessibility using GIS or other methods to measure distance and transit frequency (Cervero, Sandoval and Landis 2002, Sanchez, Shen and Peng 2004). Additionally, the use of TANF recipients may have confounding effects on the study as that subset of the population faces unique concerns that other low-income people may not and who should still be represented in studies of employment and transportation. Fredrikkson and Johannson have demonstrated that job creation or training programs have a negative relationship with both employment and the probability of finding a job outside of the "home region" (2003). Perceived access takes into account what most objective measures of transit availability do not - possible economic constraints, knowledge of bus routes, age, disability and, perhaps most importantly, whether the public transit system in place currently serves the respondents individual needs. It does not matter if a bus route or tram is constantly running if an impoverished person needs to get to an employment opportunity in the opposite direction of the commuting lines. If a person feels that they need public transportation but is unable to use it, it indicates a failure on public transportations ability to serve the needs of the needs of people that wish to utilize it.

It is important to note that this question does not solely encapsulate public transportation as a commute to work, but also to go about other daily needs. Even so, it is the best measure to understand public transportation access in general, in order to then use it as a proxy for public transit access to work. The measure is also a more general indicator of transit access and effectiveness, as perceived by the individuals it is meant to serve. Additional limitations come from the lack of respondent's variation with inadequate access to public transportation.

Answering "No" to the question, meaning that respondents have never needed but were unable to use public transit, was coded as a 0. "Yes," meaning there was a demonstrable need for transit, was coded as a 1.

The second independent variable is car ownership. The survey question, "Does not own a car," presents another categorical dichotomous response. The indicator is a direct gauge of the variable.

Limitations are similar to public transit in that many more respondents own a car than those that do not. Once again, this lack of variation increases difficulties in determining significance and would benefit from a larger sample size. A response of "No," indicating the ownership of a car was coded as a 0 while "Yes," showing car ownership, was coded as a 1.

## Control Variables

It is necessary to control for several other variables in each dataset. Given the SMH and other supporting literature, controlling for race is essential. The GSS lists only three racial / ethnic categories — White, Black and Other. Although limited, the variable still accounts for prominent employment discrimination against Black employees and other minority groups cited in the literature (Kain 1968, McBrier and Wilson 2004, Raphael and Riker 1999, Hanushek 2004). To control for this, I coded non-white races as a 1 and white as a 0.

Education is another factor regularly controlled in studies as a causal mechanism for these variables. It has shown to directly affect income, employment opportunities and where a person lives (Stiglitz 1973). The GSS provides year of education completed, ranging from values of 3 to 20.

Moreover, controlling for age makes logical sense; age and time can affect employment outcomes and car ownership due to work experience and location. It has also shown to have a positive relationship with employment mobility and job opportunities because young workers with less experience try a larger variety of jobs to determine their preference, thus having a larger range of "equally good" jobs (Ong and Blumenberg 1998, Stigler 1962). Topel and Ward use longitudinal employee-employer data to examine this effect, and demonstrate that the majority of job changes occur in the beginning years of an individuals' work. (1992). Age is coded as individual ages ranging from 19 to 75.

It is significantly more difficult to not own a car and work with the additional factor of having children, so it may be more likely that someone has a car for reasons outside of employment when they have children. This has been controlled for in several measures of employment mobility (Baum 2009, Cervero, Sandoval and Landis 2002, Leonardi 2013, Sanchez 1999). Amount of children ranges from 0 to "8 or more," which I code as an 8.

Type of work, whether it be part-time, full-time or temporarily not working, but still employed can have an affect on employment mobility (Copenhagen Business School, Denmark and Borowczyk-Martins 2017). Temporarily not working is considered when someone has a job but is not working because of vacation, illness or strike. I code "Temp not working" as a 0, "Working parttime" as a 1 and "Working fulltime" as a 2. I factored this for later analysis,

which means I treated each category of worker as a dummy variable, representing either a 0 or a 1 if the category applies to the respondent. In regression analysis with factored variables, one must be omitted. Those temporarily not working are not included in the regression models as a baseline measure for the other categories of employment.

The city size can have an effect on both transit commute times and employment opportunities. The GSS lists its largest cities in ascending order as "Suburb, med city," coded as a 0, "Suburb, lrg city," coded as a 1, "City,50-250000," coded as a 2 and "City gt 250000," coded as a 3. The largest two categories here are classified by population in the GSS (50000-250000 for the second largest city size and greater than 250000 for the largest), while the smaller of the two are determined by the GSS surveyors. This variable was also factored and the smallest city size, "Suburb, med city," was omitted once again as a baseline for analysis.

Although the data is limited to lower income individuals, controlling for income levels within this subset is also necessary. If an individual is unemployed, the GSS asks the income from their last place of work.

Finally, gender has a demonstrable effect on employment mobility, larger trends of job growth and the labor market, and thus should be controlled for (Farber 2008, Gottschalk and Moffitt 1999, Keith and Mcwilliams 1997). I coded Male as a 0 and Female as a 1.

## Methodology

In the first dataset measuring work status, I used both a bivariate and multivariate logistic regression model to measure the effects of public transit and car ownership on whether or not an individual was unemployed. I use this model due to the fact that the dependent measure, employment status, is binary.

For the second dataset regarding perceived employment mobility, I utilize a both a bivariate and multivariate Ordinary Least Squares (OLS) model, which takes into account control variables as well as independent and dependent indicators. I used this model to measure the linear relationship between my variables because my dependent measure is categorical and not binary.

My hypotheses will be countered by two null hypotheses; that there is no statistically significant relationship between the independent and dependent variables. The study measures statistical significance with a p-value of 0.05. The p-value indicates how likely it is that we observe a statistic as least as extreme as the one in the sample, assuming that our null hypothesis is true. Controlling for other variables allows for confounding effects on a complex measure (like employment) to be better explained by equalizing each of these factors across cases.

## Results and Discussion

Public transportation and car ownership are two possible means to the same end — increasing employment opportunities for low-income urban workers. Attempting to quantify which

method, if any, aids workers in the most efficient way is essential for policy making regarding urbanization. Scholars have operationalized the measurement of employment mobility in several ways, most commonly in the examination of the employment status (employed or unemployed).

Table 1: Model Comparisons of Logit Regression in Dataset 1

| | *Dependent variable:* | |
|---|---|---|
| | Employment Status of Respondent | |
| | (1) | (2) |
| Needs Access to Public Transit | −0.771 | |
| | (1.244) | |
| Has a Car | | 1.731*** |
| | | (0.637) |
| Income | 0.0001** | 0.0001** |
| | (0.00002) | (0.00002) |
| Age | −0.004 | −0.004 |
| | (0.023) | (0.023) |
| 3rd LargestCity Size | 0.952 | 1.119 |
| | (0.738) | (0.752) |
| 2nd Largest City Size | 1.541* | 1.461* |
| | (0.839) | (0.850) |
| 1st Largest City Size | 1.293 | 1.350 |
| | (0.889) | (0.919) |
| Race | −0.397 | −0.162 |
| | (0.649) | (0.676) |
| Gender | 0.176 | 0.090 |
| | (0.549) | (0.567) |
| Education | 0.008 | −0.045 |
| | (0.111) | (0.119) |
| Children | 0.395 | 0.287 |
| | (0.259) | (0.266) |
| Constant | 0.279 | −0.417 |
| | (1.650) | (1.759) |
| Observations | 340 | 340 |
| Log Likelihood | -56.683 | -53.452 |
| Akaike Inf. Crit. | 135.365 | 128.905 |

*Note: Standard errors in parentheses* *p<0.1; **p<0.05; ***p<0.01

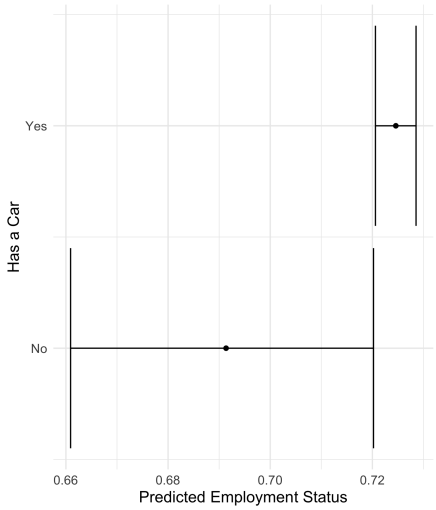


Figure 1: Predicted Probability of Employment Status Given Car Ownership

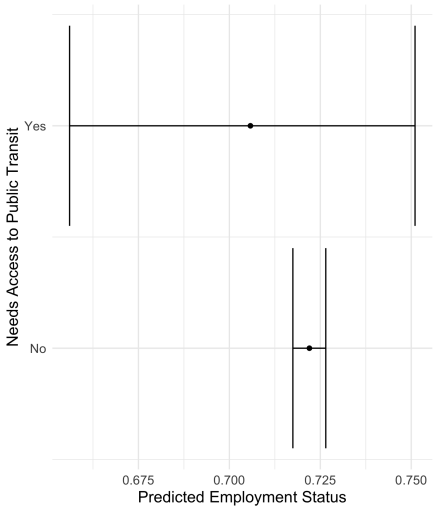


Figure 2: Predicted Probability of Employment Status Given access to Public Transportation

I use a multivariate and bivariate logistic analysis of the first dataset, with the dependent variable of binary employment status and independent variables of car ownership and access to public transit. As seen in Table 1, showing both multivariate models, car ownership has a positive and statistically significant relationship with employment status ($p = .007$), while access to public transportation is not statistically significant. This confirms both of my hypotheses, and demonstrates that not having car has a demonstrable effect on if a worker is unemployed and actively seeking work.

All control variables other than income are insignificant in the model, which is surprising given the range of literature documenting the relationship between aspects like race and gender on employment status. Income has a positive relationship with employment status, indicating a higher income person is more likely to be employed. This makes sense, as greater income generally increases human capital and employment opportunities.

I developed two predict plots from the bivariate model, which measure predicted values of employment mobility and status, from the regression for car ownership and public transportation. I use these plots to display the effects of each variable on employment with a 95% confidence interval. The predictors demonstrate what the value of employment mobility or status are for respondents that are the same in all aspects except for their access to public transit or car ownership. The predict models hold all control variables constant. Education, age, income and children are all held at their mean. I held the binary controls and factored variables constant including race, gender and city size at the point which held the most responses in the dataset.

For car ownership, predicted employment is distinct and demonstrates the statistically sig-

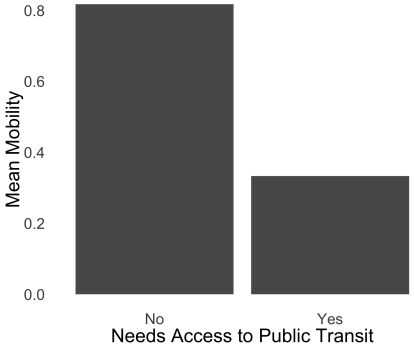


Figure 3: Mean Employment Mobility by Access to Transit.

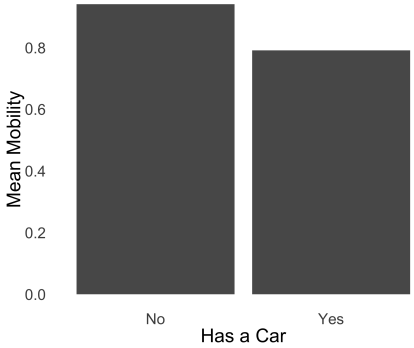


Figure 4: Mean Employment Mobility by Car Ownership.

nificant relationship found in each logit regression (See Figure 1). For those low-income individuals who do not own a car, chances of being employed range from 66% to 72%, while having access to a car increases these chances from 72% to 74%. This difference is not substantively large, but it is distinct, meaning there is a positive relationship between car ownership and employment status for the sample.

Predicted employment status for those who need access to public transit present significant cross-over, with likelihood of being employed ranging from 66% to 75% for those that need access to 71.5% to 72.7% for those that do not need access (See Figure 2). This indicates there is no distinct difference of predicted employment status between two individuals of the same background when access to public transportation is changed.

In addition to these findings, the models from the second dataset also include a new proxy for employment mobility (among employed respondents only). For respondents that need access to public transportation, the average mobility as measured by categorical responses to the job mobility question is much lower than those that do not need access (See Figure 3). For car ownership, the relationship is less clear, and mean mobility is slightly less for those that have a car, compared to those that do not (See Figure 4).

The bivariate model for each independent variable shows statistically insignificant relationships with employment mobility. Access to public transportation ($p = .13$) measures an individual need to use public transit without it being accessible, while car ownership ($p=.40$) is simply whether a respondent owns a car. The results show that the null hypotheses fail to be rejected, and a relationship between each independent variable and employment mobility cannot be inferred. Adjusted R-squared values for either model are very low, indicating car ownership and public transit access explain only about 7 percent of variation in employment mobility. This is lower than desirable, but because employment mobility is a measure that includes many unobserved factors, it is perhaps not surprising.

A multivariate regression model demonstrates similar results. Table 2 displays the two models, each measuring the effect of car ownership or public transit on employment mobility.

Table 2: Model Comparisons of Different Variable Formulations in Dataset 2

| | *Dependent variable:* | |
|---|---|---|
| | Employment Mobility of Respondent | |
| | (1) | (2) |
| Needs Access to Public Transit | −0.479 | |
| | (0.314) | |
| Has a Car | | −0.012 |
| | | (0.196) |
| 3rd Largest City Size | −0.116 | −0.131 |
| | (0.176) | (0.177) |
| 2nd Largest City Size | −0.315* | −0.336* |
| | (0.185) | (0.186) |
| 1st Largest City Size | −0.135 | −0.129 |
| | (0.192) | (0.193) |
| Income | 0.00001* | 0.00001* |
| | (0.00000) | (0.00000) |
| Race | 0.255** | 0.236* |
| | (0.125) | (0.127) |
| Gender | −0.019 | 0.006 |
| | (0.108) | (0.108) |
| Education | 0.020 | 0.015 |
| | (0.021) | (0.021) |
| Age | −0.008* | −0.008* |
| | (0.005) | (0.005) |
| Children | −0.067* | −0.064* |
| | (0.036) | (0.037) |
| Part-Time Workers | 0.339 | 0.334 |
| | (0.395) | (0.398) |
| Full-Time Workers | −0.070 | −0.079 |
| | (0.374) | (0.377) |
| Constant | 0.849* | 0.922* |
| | (0.507) | (0.533) |
| Observations | 213 | 213 |
| $R^2$ | 0.135 | 0.125 |
| Adjusted $R^2$ | 0.083 | 0.072 |
| Residual Std. Error (df = 200) | 0.732 | 0.736 |
| F Statistic (df = 12; 200) | 2.600*** | 2.378*** |

*Note: Standard errors in parentheses* *p<0.1; **p<0.05; ***p<0.01

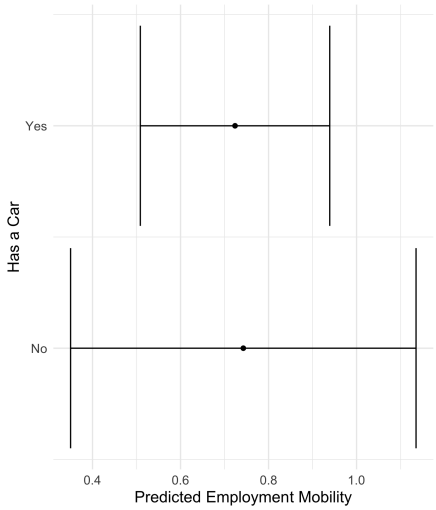


Figure 5: Predict Plots for Car Ownership, Employment Mobility is Measured With 0 Being Least Confident to Find an Equally Good Job and 2 Being Most Confident

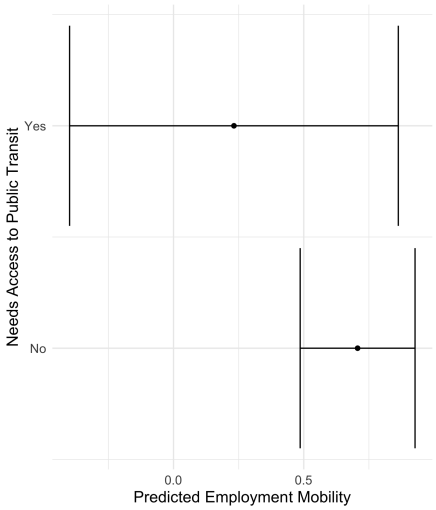


Figure 6: Predict Plots for Public Transportation, Employment Mobility is Measured With 0 Being Least Confident to Find an Equally Good Job and 2 Being Most Confident

Both models do not take into account either independent variable as a control (i.e. Model 1 measures access to public transit but not car ownership) as it did not alter the results of the analysis. The inclusion of control variables increases the R-squared value to .08, which demonstrates the inclusion of control variables explains only 1 percent more of the variation in reported employment mobility.

While car ownership has no meaningful affect on employment mobility, the effect of public transit approaches conventional levels of statistical significance in both bivariate and multivariate models. The model, while insignificant, indicated a robust finding because there was no change in significance through the bivariate and multivariate model. We can infer that a significant relationship between employment mobility and public transportation could hold, even with multiple regressors, with increased variation and sample size.

Although some control variables did not have a relationship with employment mobility, like age, gender or education, several other controls demonstrated significance. As seen in dataset 1, income was significant and positive related to employment mobility. A one dollar change in income corresponds with a .000001 unit change in employment mobility (measured from 0 to 2). It is worth noting that because income is measured in dollars, the relatively small coefficient is expected.

Race, measured as either white or non-white, shows a significant, positive relationship with employment mobility in the model. The result is substantiated by a statistically significant bivariate relationship, although with a smaller coefficient (See Appendix IV). This is in direct

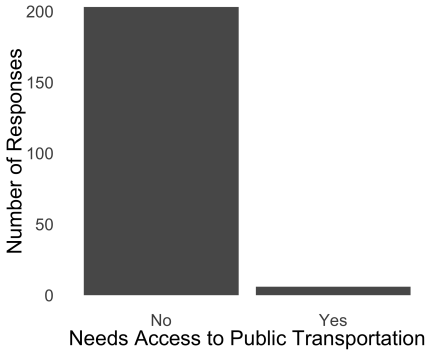


Figure 7: Variation in Public Transit Access

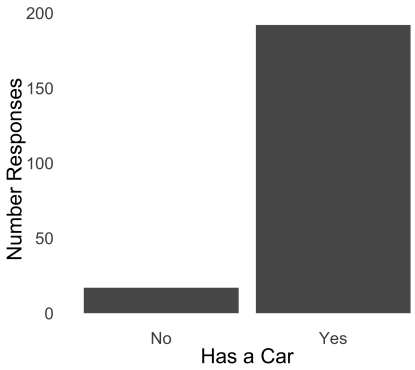


Figure 8: Variation in Car Ownership

conflict with the majority of the literature, pioneered by with John Kain, describing effects of employment discrimination that black residents have historically faced. Even still, actual employment opportunities may differ from the measure of perceived employment mobility for each individual. Additionally, there may be racial differences in perceptions of employment opportunities not accounted for in employment literature.

Predicted employment mobility for those that do not have a car ranges from 0.35 to 1.14. The results indicate that the confidence in finding an equally good job ranges from "Not easy" (coded as a 0) to "Somewhat easy" (coded as a 1). For those that do have a car, predicted mobility outcome ranges from 0.51 to 0.93. The large range of predicted outcomes with regard to car ownership is a direct result of the lack of variation in that independent variable, so accurately and confidently predicting mobility for those without a car is difficult without more responses. Thus, there is significant cross over between intervals, suggesting that the results are not statistically different. This corroborates the lack of statistical significance found in Model 2.

Mobility for employment in terms of whether or not respondents have access to public transportation also has significant cross-over, but presents more interesting results. For those that do not need access to public transit, employment mobility is high, ranging from predicted values of 0.55 to 0.97. For those that do need access, the range is much larger, from -0.33 to 0.89. Although this cross-over is not indicative of distinct results for mobility depending on public transit access, the small range of the mobility of those that do not need access is encouraging because the results are very predictable for this group. The wider predicted range for those that do not need access could be a result of the decreased sample size in the GSS for low-income, urban individuals. More responses may help decrease the 95% confidence interval and illustrate whether there is a concrete difference in predicted employment mobility given public transit access (See Figure 7 and Figure 8).

Although Hypothesis 2 was confirmed through the results of the second dataset, suggestive findings demonstrate the opposite intuition drawn from both hypotheses. Although both inde-

pendent variables are insignificant, the results suggest that car ownership has no relationship with mobility, while access to public transportation might. Future research is necessary to make more conclusive inferences.

There are several differences in the logistic model with the first dataset regarding employment status and the OLS model with the second dataset measuring perceived employment mobility. First is the obvious statistical significance between lack of car ownership and unemployment that is not present with the analysis of perceived employment mobility. This may have occurred for several reasons. First, the small sample size and lack variation in the second dataset makes it much more difficult to achieve statistical significance. Second, each dataset measures different populations. The first focuses on both employed and unemployed low-income, urban workers. This encapsulates those that may be much more insecure in employment opportunities, and may make finding significant relationships between transportation and employment easier due to this increase in instability. The second datset surveys only employed individuals as they are the only respondents able to answer questions about "equally good" jobs. While this population may face similar challenges to the other, unemployment is a specific situation not accounted for in the second model.

## Conclusion

Urban, low-income workers deserve attention. Increasing urbanization and growth can often develop with adverse effects, and the study of employment opportunities and transit access for marginalized populations is ever important. The first dataset in this study demonstrates a positive relationship between employment and car ownership, but suggests that there is no relationship between access to public transportation and employment. I also find that there is not a statistically meaningful relationship between either car ownership or access to public transit on perceptions of employment mobility among low-income residents. However, the low sample size and lack of variation in responses ultimately renders these results inconclusive. Further research can better address these questions that focus on an individualized and psychological perspective. Using this more granular approach in surveying, future research also may bring better insight into the debate between public and private transportation. Policymakers and the public should not use this results to discredit the effects of public transit, but rather to understand how public transportation can better serve low-income individuals needing to commute to the suburbs for low-skilled jobs.

This paper additionally shows a need for policymakers to reconsider the implications of certain public transportation planning that may not serve the populations that most need it. The analysis presented in this study demonstrates support for the Spatial Mismatch Hypothesis. Because private transportation is effective at increasing the odds of a low-income individual becoming employed, the public transportation system may be working in reverse order for this subset of individuals. Buses and trains may be prioritizing high-income earners going from the suburbs to downtown jobs, rather than the opposite where low-income earners need it most. Solutions to this mismatch may come in several forms. Experimental car subsidy programs

or carpool programs for low-income workers may boost opportunities and stability as a stand-in while more effective public transportation is built. These measures that focus on private transportation may not make sense in relation to other goals of urbanization though, like the increasing push for green energy.

A more effective method is for transit planners to take more account of low-skilled community members' needs. Public transportation is often thought of as a way for low-income and low-skilled individuals to overcome to barriers in life, but in reality falls short for those looking to bridge employment gaps. Those in power must take these populations into account when scheduling buses, trams and trains. They must also ensure construction of new systems are not built with a priority for high-income riders. No matter the policy or implementation, those most vulnerable to employment insecurity should be aided in attempts to solve increasing problems of equity and poverty in large cities. Transportation is valuable to all, but is a unique and advantageous method for governments to provide a public good to disadvantaged populations.

# Appendix I: Control Variable Tables for Dataset 1

Table 3: Correlation Matrix for Controls in Dataset 1

| | Work | City Size | Income | Race | Gender | Children | Age | Education |
|---|---|---|---|---|---|---|---|---|
| Work | 1 | 0.067 | 0.152 | −0.029 | 0.005 | 0.086 | 0.053 | 0.043 |
| City Size | 0.067 | 1 | −0.039 | 0.207 | 0.074 | −0.050 | 0.003 | 0.069 |
| Income | 0.152 | −0.039 | 1 | −0.046 | −0.175 | 0.014 | 0.110 | 0.181 |
| Race | −0.029 | 0.207 | −0.046 | 1 | 0.033 | 0.119 | −0.155 | −0.097 |
| Gender | 0.005 | 0.074 | −0.175 | 0.033 | 1 | 0.095 | 0.109 | 0.127 |
| Children | 0.086 | −0.050 | 0.014 | 0.119 | 0.095 | 1 | 0.339 | −0.128 |
| Age | 0.053 | 0.003 | 0.110 | −0.155 | 0.109 | 0.339 | 1 | 0.032 |
| Education | 0.043 | 0.069 | 0.181 | −0.097 | 0.127 | −0.128 | 0.032 | 1 |

Table 4: Summary Statistics for Controls in Dataset 1

| Statistic | N | Mean | St. Dev. | Min | Pctl(25) | Pctl(75) | Max |
|---|---|---|---|---|---|---|---|
| Work | 340 | 0.953 | 0.212 | 0 | 1 | 1 | 1 |
| City Size | 340 | 1.603 | 0.961 | 0 | 1 | 2 | 3 |
| Income | 340 | 29,049.260 | 14,532.400 | 3,500 | 18,750 | 37,500 | 55,000 |
| Race | 340 | 0.256 | 0.437 | 0 | 0 | 1 | 1 |
| Gender | 340 | 0.512 | 0.501 | 0 | 0 | 1 | 1 |
| Children | 340 | 1.462 | 1.523 | 0 | 0 | 2 | 8 |
| Age | 340 | 40.976 | 12.582 | 19 | 31 | 51 | 78 |
| Education | 340 | 13.800 | 2.541 | 3 | 12 | 16 | 20 |

# Appendix II: Control Variable Tables for Dataset 2

Table 5: Correlation Matrix for Controls in Dataset 2

| | Work | City Size | Income | Race | Gender | Children | Age | Education |
|---|---|---|---|---|---|---|---|---|
| Work | 1 | 0.142 | 0.275 | −0.015 | −0.159 | −0.063 | −0.104 | −0.019 |
| City Size | 0.142 | 1 | −0.048 | 0.178 | 0.130 | −0.040 | −0.027 | 0.063 |
| Income | 0.275 | −0.048 | 1 | −0.028 | −0.122 | −0.028 | 0.066 | 0.159 |
| Race | −0.015 | 0.178 | −0.028 | 1 | 0.044 | 0.142 | −0.152 | −0.125 |
| Gender | −0.159 | 0.130 | −0.122 | 0.044 | 1 | 0.086 | 0.155 | 0.148 |
| Children | −0.063 | −0.040 | −0.028 | 0.142 | 0.086 | 1 | 0.341 | −0.095 |
| Age | −0.104 | −0.027 | 0.066 | −0.152 | 0.155 | 0.341 | 1 | 0.065 |
| Education | −0.019 | 0.063 | 0.159 | −0.125 | 0.148 | −0.095 | 0.065 | 1 |

Table 6: Summary Statistics for Controls in Dataset 2

| Statistic | N | Mean | St. Dev. | Min | Pctl(25) | Pctl(75) | Max |
|---|---|---|---|---|---|---|---|
| X | 213 | 357.854 | 196.592 | 8 | 202 | 515 | 714 |
| work | 213 | 1.779 | 0.459 | 0 | 2 | 2 | 2 |
| citysize | 213 | 1.643 | 0.959 | 0 | 1 | 2 | 3 |
| income | 213 | 29,300.470 | 14,819.160 | 3,500 | 18,750 | 45,000 | 55,000 |
| race | 213 | 0.263 | 0.441 | 0 | 0 | 1 | 1 |
| gender | 213 | 0.516 | 0.501 | 0 | 0 | 1 | 1 |
| children | 213 | 1.545 | 1.540 | 0 | 0 | 2 | 8 |
| age | 213 | 40.502 | 12.355 | 19 | 30 | 50 | 75 |
| educ | 213 | 13.901 | 2.528 | 3 | 12 | 16 | 20 |

# Appendix III: Bivariate Analysis with Both Datasets

Table 7: Bivariate Models in Dataset 1

| | *Dependent variable:* | |
|---|---|---|
| | Employment Status of Respondent | |
| | (1) | (2) |
| Needs Access to Public Transit | −1.105 | |
| | (1.101) | |
| Has a car | | 1.971*** |
| | | (0.557) |
| Constant | 3.051*** | 1.427*** |
| | (0.264) | (0.455) |
| Observations | 340 | 340 |
| Log Likelihood | -64.126 | -59.375 |
| Akaike Inf. Crit. | 132.253 | 122.750 |
| *Note:* | *p<0.1; **p<0.05; ***p<0.01 | |

Table 8: Bivariate Models in Dataset 2

| | *Dependent variable:* | |
|---|---|---|
| | Employment Mobility of Respondent | |
| | (1) | (2) |
| Needs Access to Public Transit | −0.483 | |
| | (0.315) | |
| Has a car | | −0.150 |
| | | (0.193) |
| Constant | 0.816*** | 0.941*** |
| | (0.053) | (0.185) |
| Observations | 213 | 213 |
| $R^2$ | 0.011 | 0.003 |
| Adjusted $R^2$ | 0.006 | -0.002 |
| Residual Std. Error (df = 211) | 0.762 | 0.765 |
| F Statistic (df = 1; 211) | 2.347 | 0.605 |
| *Note:* | *p<0.1; **p<0.05; ***p<0.01 | |

# Appendix IV: Bivariate Analysis with Race in Dataset 2

Table 9: Bivariate Model of Race

| | *Dependent variable:* |
|---|---|
| | Employment Mobility of Respondent |
| Race | 0.081** |
| | (0.040) |
| Constant | 0.198*** |
| | (0.044) |
| Observations | 209 |
| $R^2$ | 0.020 |
| Adjusted $R^2$ | 0.015 |
| Residual Std. Error | 0.438 (df = 207) |
| F Statistic | 4.128** (df = 1; 207) |
| *Note:* | *p<0.1; **p<0.05; ***p<0.01 |

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