Determining Travel Time to Work: The Effects of Race and Wage on Commuting in Large Cities

CJ Robinson (cjrobinson34@gmail.com)

March 2020

Abstract

This paper seeks to study the effects of wage on travel time to work for hourly workers in populous cities. While scholars have extensively studied the impact of income on job placement, there is little consensus in the academic community on the Spatial Mismatch Hypothesis, which posits that low-income/Black workers face a disparity between where they live and work. Utilizing responses from the American Time Use Survey and multivariate OLS regression, this study measures the effect of hourly wage on travel time to work. I find that the effect of wage on travel time to work differs for Black and non-Black workers. The study concludes that lower-income Black workers face higher travel times than their counterparts. Furthermore, for every 10 percent increase in wage for Black workers, I find a decrease in travel time by 2 percent. For non-Black workers, I find an insignificant effect on travel time to work when wage increases. This analysis and future studies have important implications for transit policy as it can help inform how to better fund public transit to serve low-income and Black workers with job placement challenges.

Introduction

As the effects of the Great Recession fade and unemployment decreases, the Federal Reserve can focus on one of its lesser-known responsibilities — community development and urbanization.

Patrick Harker of the Philadelphia Fed recently highlighted one of these urban development issues. "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 transportation and employment in a rapidly changing metropolitan environment. Transportation and commuting times 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 income affect the placement of jobs, and if so, are there policy solutions to aid those facing longer commute times?

Over the past two decades, scholars have examined commuting times and methods to help achieve better labor market outcomes 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). One prominent explanation for the variance in transportation access and its relationship with employment is the Spatial Mismatch Hypothesis (SMH). The SMH contends that there is an increasing difference in where low-skilled jobs and low-skilled employees live. John Kain's seminal (1968) paper, "Housing Segregation, Negro Employment, and Metropolitan Decentralization," emphasized structural disadvantages for Black employment due to location. Because of housing discrimination and the 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 in the 1960s, notable studies contributed to this body of literature through the next 50 years (Harrison 1972, Shen 2001, Taylor and Ong 1995). While some studies find little evidence for the SMH, the majority of evidence supports Kain's 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. Suppose poorer residents are located in cities and cannot access jobs increasingly outsourced to suburbs. In that case, reverse commute patterns and public transit policy will affect many 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). For this study, I examine the effects specifically on Black and low-income workers.

I hope to contribute to this body of literature by examining the SMH through the lens of commuting times. Confirming or advancing this body of literature will better motivate policy solutions in the coming years.

Data

Description of Sample

I pull from the 2006-2018 ATUS microdata files. For each year, I choose respondents based on three qualifiers. First, the respondent must live in what the census considers a "Metropolitan, central city." Second, the respondent is in a Metropolitan Statistical Area (MSA) of 5,000,000 or more people. The census describes MSAs as a "geographical region with a relatively high population density at its core and close economic ties throughout the area." Third, to have a continuous variable as my primary independent variable, I use hourly wage. Wage limits the sample to respondents who are not salaried workers. Higher-income individuals comprise most of this group, so the sample I collect is naturally skewed toward those with lower income. The sample size is 2,560.

This sample helps describe and isolate the effects of the Spatial Mismatch Hypothesis. Although the SMH explains both movements from high-income earners from where they live (suburban areas) to where they work (downtown areas) and low-income earners from where they live (downtown areas) to where they work (suburban areas), I focus on attempting to quantify the latter relationship. If there is a negative effect of wage on travel time to work

for this specific sample, it could indicate that lower-income people must travel further outside their cities for jobs near the suburbs, and would confirm the SMH.

There are obvious limitations to this data. First, despite my efforts to subset the data only to include those in large cities, metropolitan areas are not homogeneous and can vary. I attempt to control for this using location fixed-effects. Still, a person living closer to the outside of the city will have a different travel time situation than someone who is directly in a core downtown area. Second, people are forgetful and not precise. They often round their travel time to the nearest 15 or 30-minute mark, which can cause inconsistencies and bunching within the data. Finally, travel time to work is a complex and oftentimes random aspect of a worker's life. Attempting to find a relationship between the variables I hypothesize will have an effect is difficult due to how travel time to work is often assigned by job placement and the market.

Hypothesis

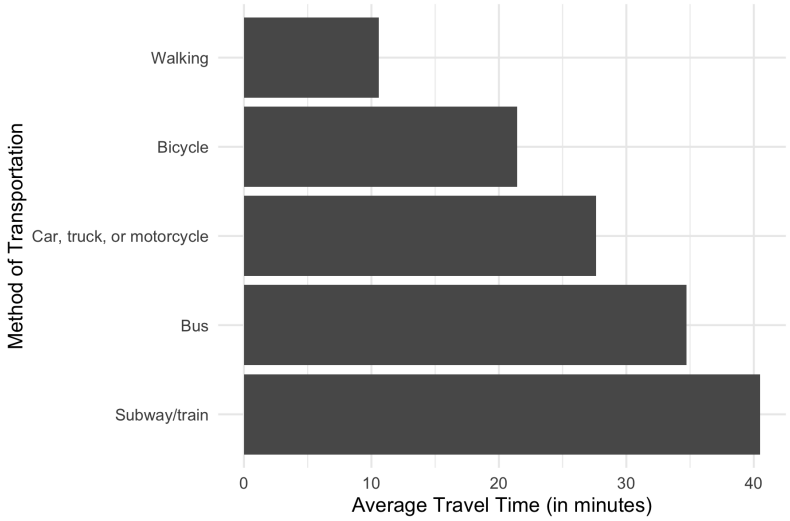

Figure 1: Mean Travel Time by Method of Transportation

Based on the literature surrounding this issue, I hypothesize that wage will have a negative effect on travel time to work. I also think that being Black will have a positive effect on travel time. In other words, any wage increase will decrease travel time to work for those in my sample area, and Black respondents will have a longer travel time overall.

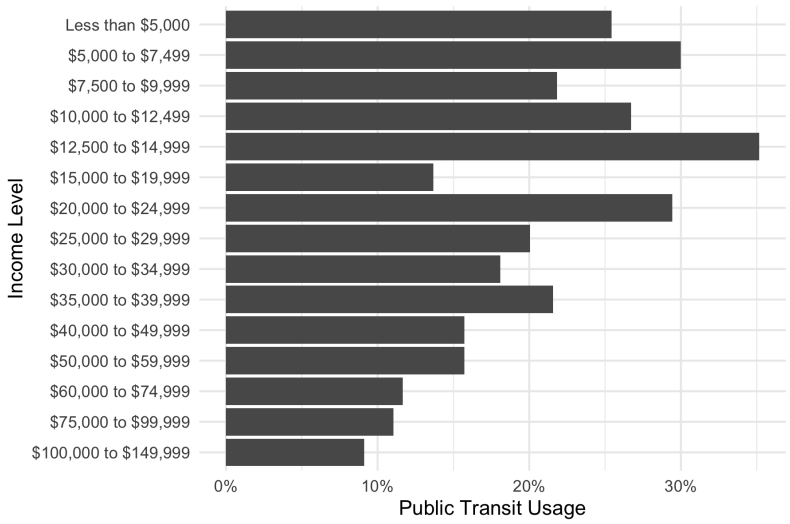

Figure 2: Proportion of Travel Entries with Subway or Bus Ridership by Total Household Income

Additionally, an initial view of the data supports this. As seen in Figure 1, mean travel time is highest at public transportation options like buses, rail lines, or trains. This relationship makes sense as these travel forms are less individualized and usually less convenient for commuters than a car.

In addition to this relationship, it is apparent through Figure 2 that income is related to public transportation usage. This figure represents family income rather than the hourly wage used in this study and demonstrates the drastic drop in public transportation commuters for those earning $50,000 and above yearly. Not only is usage smaller, but Spatial Mismatch states that public transportation will not be as adequate for lower-income workers. Because they often commute in the opposite direction of their high-income counterparts, low-income workers face increased times and fewer options to travel where job opportunities exist.

Results and Discussion

The regression results are reported below in Table 1.[1]

As reported in Table 1, there was an effect of wage on travel time to work, but only for

[1]Note that the commuting time fixed effects variables are included in the model and regression but not reported in the table itself.

Table 1: Model Results and Robustness Checks

	Dependent variable:		
	Log Travel Time		
	(1)	(2)	(3)
Log of Hourly Wage	0.061*	0.009	0.007
	(0.035)	(0.034)	(0.038)
Black (=1)	−0.015	0.028	0.468**
	(0.040)	(0.036)	(0.209)
Female (=1)		−0.191***	−0.170***
		(0.032)	(0.033)
Years of education		−0.008	−0.008
		(0.006)	(0.006)
Age		0.003***	0.002*
		(0.001)	(0.001)
Holds multiple jobs (=1)		−0.154***	−0.100*
		(0.055)	(0.057)
Hours worked in a week		−0.001	−0.001
		(0.002)	(0.002)
Part time (=1)		−0.092*	−0.068
		(0.054)	(0.055)
Number of Children		0.031**	0.014
		(0.014)	(0.014)
Not Married (=1)		−0.048	−0.103***
		(0.037)	(0.038)
Driving (Reference Group)			
Walking		−0.988***	−1.048***
		(0.042)	(0.049)
Bus		0.188***	0.125**
		(0.056)	(0.058)
Subway/Train		0.474***	0.383***
		(0.054)	(0.062)
Bicycle		−0.307**	−0.332**
		(0.153)	(0.155)
Wage * Black (=1)			−0.175**
			(0.079)
Constant	2.779***	3.177***	2.879***
	(0.095)	(0.142)	(0.224)
Observations	2,560	2,560	2,560
R^2	0.001	0.267	0.340
Adjusted R^2	0.001	0.263	0.320

Note: Model 3 includes fixed effects. *p<0.1; **p<0.05; ***p<0.01

Black workers. The coefficient of the log of hourly wage is statistically significant for the first model with just race and wage but is found to be insignificant once more variables are added. This represents the effect of hourly wage on travel time for non-Black workers as the interaction term below accounts for the difference between non-Black and Black workers.

When wage is controlled at 0, and all other variables are held constant, Black workers travel on average 46 percent longer than their non-Black counterparts. This relationship is represented by the statistically significant coefficient on Black (=1) in the regression table.

The interaction term at the bottom of the regression table represents the difference in simple slopes for the reference group (non-Black workers) and those included in the interaction (Black workers). Because the result for non-Black workers is insignificant, it can be interpreted that for every 10 percent increase in wage, Black workers' travel time decreases by 1.7 percent. In contrast, any increase in wage for non-Black workers does not affect their travel time to work.

These findings have interesting implications regarding policy and the SMH. More recent literature on the subject has extended Kain's original argument of Black mismatch to low-income individuals in general. These findings contradict the previously cited studies but specifically support Kain's conclusions.

The contrast may be explained partially by Figure 3. This figure is the same chart as Figure 2 but broken out by race. The blue bars represent Black usage of public transportation options to travel to work by income, while the red bars represent non-Black usage. Black workers use public transit more than their counterparts at every income level. However, the discrepancy between Black and non-Black usage is much smaller at higher income levels, indicating that Black workers are more responsive to wage effects on transportation options, as shown in the regression.

There may be other reasons that the relationship does not hold for non-Black workers. First, Kain's explanation describes the history of discrimination and redlining. Because of this, white power structures required that Black individuals live in disadvantageous communities away from adequate job opportunities. The US has perpetuated this marginalization and is most likely the reason for these results. Additionally, due to the skewed nature of the sample toward lower-income, hourly workers, there may be a wage effect at higher incomes for non-Black workers that is not captured by the model.

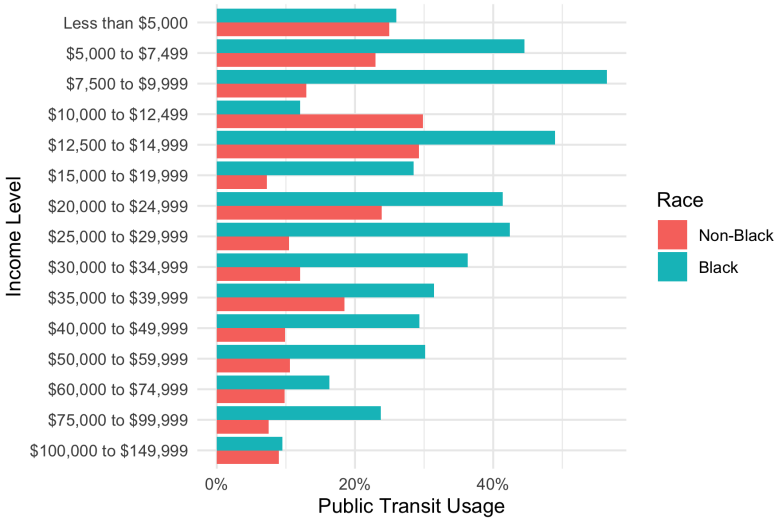

Figure 3: Public Transit Usage and Income, Separated by Race

There were several other significant results in the final model. First, the female dummy variable indicates that being female decreases travel time by 17 percent on average, which may represent a larger share of mothers with parental responsibilities who cannot commute as far. Additionally, job placement may function differently for women, even controlling for other factors like age or education. Additional research may field more insightful results.

Age had a relatively small but positive effect on travel time. For every ten-year increase in age, travel time to work increased by .02 percent, which is insignificant in magnitude.

On average, those who hold multiple jobs have a 10 percent smaller travel time than those with only one job. This is a puzzling finding. It may be that those who work in larger cities and do not travel as far have job opportunities that are lesser in quality. People with multiple jobs are usually low-wage and what economists would describe as low-skilled. These jobs may be part-time in the city, unlike full-time, better-quality jobs in the suburbs for this population.

Being married increases travel time by about 10 percent, but the number of children a person has does not have any statistically significant effect. This relationship is also difficult to explain. It may be that married individuals have to balance the jobs of both individuals, so even if they have mobility in their living situation, it may be a compromise in location preference between the two, increasing the travel time of each. Once again, more research may

shed light on this topic.

The method of travel also has definite effects on travel time to work. Compared to commuting as a driver or passenger in a car, those walking have 104 percent less travel time to work. On average, those taking the bus take 12.5 percent more time to get to work than those who drive. Commuters on the train/subway take around 38 percent more time to get to work than those in cars. Those traveling by bike have a 38 percent smaller travel time than drivers. These results make intuitive sense and are substantiated by Figure 1.

Conclusion

Travel time to work is an often overlooked aspect of labor markets and worker behavior. However, its implications and relationships with job market outcomes provide insight into new policies lawmakers can enact to boost employment mobility and reduce inefficiencies in how commuters function. This study finds that Black, and more specifically low-income Black workers, face higher commuting times than their similarly situated counterparts. The findings further the argument that SMH holds, but only for Black individuals. Additionally, the results suggest that the SMH is a problem that Black individuals can overcome with an increase in hourly wage. However, the study finds that Spatial Mismatch does not apply to non-Black workers.

There are several solutions to the SMH problem for low-income Black workers. First lies in transit engineers who decide where bus/rail lines are constructed and how often they run. Considering the voices of low-income communities that are predominately Black is essential to understanding how their travel and commuting behaviors differ. Additionally, the study shows that access to a car, controlling for all other factors, decreases travel time compared to public transportation. While this may seem like an apparent relationship, policymakers could address this in two ways. First, increase funding for public transit overall. An interconnected and efficient public transportation system will alleviate the burdens associated with commuting significantly. Second, several states have experimented with policies to help low-income people buy cars. Subsidies for low-income car ownership may help alleviate the job search that is already burdensome.

Finally, this study shows the need for further research into why and how travel behaviors are affected by socioeconomic characteristics. Job markets and placements are essential to the economy and deserve more attention in the literature.

References

Baum, Charles L. 2009. "The effects of vehicle ownership on employment." *Journal of Urban Economics* 66(3):151–163. http://www.sciencedirect.com/science/article/pii/S0094119009000412.

Blackley, Paul R. 1990. "Spatial Mismatch in Urban Labor Markets: Evidence from Large U.S. Metropolitan Areas." *Social Science Quarterly* 71(1):39–52. http://www.jstor.org/stable/42863585.

Cervero, Robert, Onésimo Sandoval and John Landis. 2002. "Transportation as a Stimulus of Welfare-to-Work: Private versus Public Mobility." *Journal of Planning Education and Research* 22(1):50–63. http://journals.sagepub.com/doi/10.1177/0739456X0202200105.

Costa, Pedro Nicolaci da. 2018. "There's a major hurdle to employment that many Americans don't even think about — and it's holding the economy back.". https://www.businessinsider.com/lack-of-transport-is-a-major-obstacle-to-employment-for-americas-poor-2018-1.

Easley, Janeria. 2018. "Spatial mismatch beyond black and white: Levels and determinants of job access among Asian and Hispanic subpopulations." *Urban Studies* 55(8):1800–1820. http://journals.sagepub.com/doi/10.1177/0042098017696254.

Gobillon, Laurent, Harris Selod and Yves Zenou. 2007. "The Mechanisms of Spatial Mismatch." *Urban Studies* 44(12):2401–2427. http://journals.sagepub.com/doi/10.1080/00420980701540937.

Harrison, Bennett. 1972. "The Intrametropolitan Distribution of Minority Economic Welfare." *Journal of Regional Science* 12(1):23.

Holzer, Harry J. 1991. "The Spatial Mismatch Hypothesis: What Has the Evidence Shown?" *Urban Studies* 28(1):105–122. http://www.jstor.org/stable/43192425.

Ihlanfeldt, Keith R. and David L. Sjoquist. 1998. "The spatial mismatch hypothesis: A review of recent studies and their implications for welfare reform." *Housing Policy Debate* 9(4):849–892. http://www.tandfonline.com/doi/abs/10.1080/10511482.1998.9521321.

Ong, Paul M. 2002. "Car ownership and welfare-to-work." *Journal of Policy Analysis and Management* 21(2):239–252. https://onlinelibrary.wiley.com/doi/abs/10.1002/pam.10025.

Sanchez, Thomas W. 1999. "The Connection Between Public Transit and Employment: The Cases of Portland and Atlanta." *Journal of the American Planning Association* 65(3):284–296. http://www.tandfonline.com/doi/abs/10.1080/01944369908976058.

Sanchez, Thomas W., Qing Shen and Zhong-Ren Peng. 2004. "Transit Mobility, Jobs Access and Low-income Labour Participation in US Metropolitan Areas." *Urban Studies* 41(7):1313–1331. http://journals.sagepub.com/doi/10.1080/0042098042000214815.

Shen, Qing. 2001. "A Spatial Analysis of Job Openings and Access in a U.S. Metropolitan Area." *Journal of the American Planning Association* 67(1):53–68. http://www.tandfonline.com/doi/abs/10.1080/01944360108976355.

Taylor, Brian D. and Paul M. Ong. 1995. "Spatial Mismatch or Automobile Mismatch? An Examination of Race, Residence and Commuting in US Metropolitan Areas." *Urban Studies* 32(9):1453–1473. http://journals.sagepub.com/doi/10.1080/00420989550012348.