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A Note on Commutes and the Spatial Mismatch Hypothesis

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ABSTRACT

A number of empirical studies have tested the spatial mismatch hypothesis by examining the commuting times of blacks and whites. This note points out that the link between spatial mismatch and commuting times may be weak when employment probabilities decline as the distance from job site to residence increases. A simple spatial model of urban employment is developed in which a fixed number of agents live in the central city. Two examples are presented in which increased spatial mismatch may either increase or decrease the average commuting time of central city minorities, depending on the rate at which employment probabilities decline with distance.

INTRODUCTION

The spatial mismatch hypothesis (SMH) claims that a spatial mismatch between central city residential location and suburban job growth may result in poor labor market outcomes for central city residents, and in particular for central city minorities. The most common argument for this view is the observation that unemployed workers find jobs through a costly search process (Kain 1968). Continuing this line of argument, it is assumed that search costs increase with distance as transportation costs increase and as informal job networks (such as word of mouth) convey less information about the availability of openings. Therefore, as spatial mismatch increases, job market outcomes for central city minorities will get worse, holding constant other relevant characteristics.

A common method of testing the SMH is to examine whether minorities have, on average, longer commutes to work than whites after controlling for all other relevant characteristics. Ihlanfeldt and Sjoquist (1998) recently reviewed a number of studies testing the spatial mismatch hypothesis, including five that use a commuting-based test of the SMH. As can be seen in Table 1, the results of these studies are mixed. Two studies (Wyly (1996) and Taylor and Ong (1995)) did not find evidence of racial commuting differences, but three studies (Sabriel and Rosenthal (1996, McLafferty and Preston (1992) and McLafferty and Preston (1996)) did find differences.

Ihlanfeldt and Sjoquist (1998) make two objections to commuting-based tests of the SMH. The first is that in the standard monocentric economic model of an urban area, higher levels of economic resources are associated with longer commuting times. Interpreting inter-racial differences in commuting distances may be difficult if the researcher is not able to control for all forms of income and wealth that lead some people to choose relatively long commutes. Second, they note that spatial mismatch may not produce longer commuting times for central city minorities if there is not adequate public transportation from central cities to suburban areas.

The purpose of this note is to point out that the problems with commuting-based tests of the SMH may be deeper than the above criticisms suggest; increased spatial mismatch may either increase or decrease the average commuting time of central city minorities, depending on the rate at which employment probabilities decline with distance. If employment probabilities decay with distance at a sufficiently slow rate, increases in spatial mismatch may increase the average commuting distance of central city residents. However, if employment probabilities decay with distance at a sufficiently fast rate, decreases in spatial mismatch may increase the average commuting distance of central city residents. The threshold rate is defined as the intermediate case–the rate of decay in employment probabilities for which an increase in spatial mismatch neither increases nor decreases the average commuting distance of employed central city residents. By presenting examples of a model in which spatial mismatch decreases average black commuting times, I establish that spatial mismatch does not necessarily imply an increase in black commuting times, even when all economic resources relevant to location decisions are observable and poor residents have adequate access to public transportation.

This result suggests that there are two alternative interpretations for the findings in Table 1. The "standard" interpretation might be that the evidence for spatial mismatch is weak. This interpretation assumes that all of the MSAs studied have conditions in which spatial mismatch increases the commuting times of minorities and decreases the commuting times of whites. The "alternative" interpretation, suggested by the findings presented here, might be that spatial mismatch is present in all of the cities studied; however, the conditions which map spatial mismatch into commuting times vary from city to city or over time. The key condition being considered here is the rate at which employment probabilities decline with distance. Under this interpretation, the results from the studies in Table 1 test whether employment probabilities decline at a rate above or below the threshold rate. A finding that blacks have shorter commuting times than whites would indicate that employment probabilities decline faster than the threshold value. A finding that blacks have longer commuting times than whites would indicate that employment probabilities decline slower than the threshold value.

Why might an increase in spatial mismatch decrease the average commuting time of employed central city minorities? There are two countervailing effects when jobs move farther from the central city. First, moving jobs from the central city to the suburbs means, for central city residents, a larger proportion of available jobs now have longer commutes. Second, because employment probabilities decline with distance, moving jobs farther from the central city means that central city residents will find fewer jobs overall. Thus, jobs near the central city will now have a larger share of central city residents' employment. While the first effect tends to *lengthen* the average commuting times of employed central city residents, the second effect tends to *shorten* the average commuting times. Whether the first effect dominates the second is an empirical question.

A HEURISTIC EXAMPLE

To clarify matters, consider a simple heuristic example (outlined in Tables 2a and 2b) of an urban area on a line. The central city, where only blacks live, is located at the point farthest to the left (A), and the suburb, where only whites live, is located at the point farthest to the right (C). All points are one mile apart. The probability of a central city resident finding a job at points A, B, and C are 1, 0.5, and 0 respectively. In the baseline case (Table 2A), there is one vacant job at point A and one at point B. Thus, the expected commuting time for central city residents is given by the distance of each point from the central city weighted by the expected employment share for each point. In the baseline case, the expected commute is [(1)1(0) + (1)0.5(1) + 0(0)(2)]/ [1(1) + (1)0.5 + 0(0)] = 0.33 miles. Table 2B computes expected commuting times for blacks after a redistribution of all the jobs at point B to point C. The new expected commuting time for central city residents is now [(1)1(0) + (0)0.5(1) + 1(0)(2)]/ [1(1) + (0)0.5 + 1(0)] = 0 miles. Thus, an increase in spatial mismatch results in decreased commuting time for central city minorities.

Given the specified employment probabilities at points A, B, and C in this example, any redistribution of jobs from point A to point C will weakly increase expected commuting distance, while any redistribution of jobs from point B to point C will weakly decrease expected commuting distance. To understand the intuition behind this result, consider the distribution of distances from the central city to particular job centers in a hypothetical urban area that has many job centers. Further, consider a redistribution of jobs from the job center that has the minimum commuting distance to any other job center. Such a move will increase average commutes unless the new point has an employment probability of zero, in which case the commuting distance may stay the same or increase depending on the prior distribution of jobs.

Now consider a redistribution from a job center that is relatively close to the central city (call it point O) but is not the job center closest to the central city, to a point relatively far away. This type of redistribution could either increase or decrease average commuting distance depending on the distribution of employment probabilities. In fact, it is easy to see that any set of employment probabilities in which there is a positive probability at O and zero probability at job sites farther from the central city than O, will always decrease expected commutes.

This example relies on a highly stylized and specific distribution of employment probabilities. The next section explores a model in which employment probabilities are perhaps more realistic. In that model, employment probabilities decline with distance at a constant rate and do not ever reach zero. Nevertheless, the result of the current section remains intact: increases in spatial mismatch may increase or decrease the commutes of central city residents depending on how employment probabilities change with distance.

A SIMPLE MODEL

As before, consider three points on a line -A, B, and C- all 1 mile apart, with all blacks in the labor force living at A. There are 300 jobs, 100 at each point. Let P be the employment probability of central city residents in the central city and let α be the rate at which employment probabilities decline with distance between job centers, with $P \in [0,1]$ and $\alpha \in [0,1]$. Thus, the employment probabilities for black job seekers are P, $P\alpha$, and $P\alpha^2$ for points A, B, and C, respectively. Expected black employment at points A, B, and C is $100P$, $100P\alpha$, and $100P\alpha^2$, respectively. Thus, the average commute for an employed black worker is given by

$$\frac{(0)100P + (1)100P\alpha + (2)100P\alpha^2}{100P + 100P\alpha + 100P\alpha^2} = \frac{\alpha + 2\alpha^2}{1 + \alpha + \alpha^2} \tag{1}$$

Now consider the effect of shifting one job from B to C so that the number of jobs at points A, B, and C is 100, 99, and 101 respectively. Expected black employment at points A, B, and C is $100P$, $99P\alpha$, and $101P\alpha^2$, respectively. The new mean commuting time for blacks is given by

$$\frac{(0)100P + (1)99P\alpha + (2)101P\alpha^2}{100P + 99P\alpha + 101P\alpha^2} = \frac{99\alpha + 202\alpha^2}{100 + 99\alpha + 101\alpha^2} \tag{2}$$

This example of spatial mismatch will result in longer commuting times when equation (2) is greater than equation (1). This occurs when employment probabilities decay slowly as the distance from a job center to a central city residence increases, specifically when α is larger than its threshold value, (in this case, approximately 0.37). However, the new mean commuting time for blacks will decrease with spatial mismatch when α is less than 0.37.

CONCLUSION

This note develops a simple spatial model of urban employment in which the employment probabilities of central city residents depend negatively on the distance from a job site to a person's home. The main result is that the relationship between spatial mismatch and commuting distance is indeterminate. Spatial mismatch may either increase or decrease the average commuting distance of central city minorities, depending on the rate at which employment probabilities decline with distance. When no restrictions are placed on employment probabilities, spatial mismatch is consistent with minority commutes that are longer, shorter or the same as those of whites. Absent knowledge of how employment probabilities change with distance, it may be difficult to test the SMH using comparisons of minority and white commuting times or distance.

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Table 1. Recent Commuting-Based Studies of the Spatial Mismatch Hypothesis

Study	Data	Finding
Wyly (1996)	1980 and 1990 PUMS for Minneapolis/St. Paul	Increase in mismatch over time did not increase black commuting times
McLafferty and Preston (1992)	1980 PUMS for Northern New Jersey	Black and Hispanic women have longer commutes (time) than white women
McLafferty and Preston (1996)	1980 and 1990 PUMS for New York	Large difference in commuting times for central city blacks and whites, small difference for suburban blacks and whites
Gabriel and Rosenthal (1996)	1985 and 1989 American Housing Survey	Blacks have commutes 14% longer than those of Asian or white counterparts
Taylor and Ong (1995)	1977/78 and 1985 AHS for 10 MSAs	No evidence of difference in commuting times

Source: Ihlanfeldt and Sjoquist (1998).

Table 2A. Baseline Case, Heuristic Example

	Central City		*Suburb*
Job Centers	A	B	C
Distance from central city (miles)	0	1	2
Probability that a central city resident finds a vacant job	1	0.5	0
Number of vacant jobs	1	1	0

Average commute for employed central city residents = 0.33

Table 2B. Increase Spatial Mismatch, Heuristic Example

	Central City		*Suburb*
Job Centers	A	B	C
Distance from central city (miles)	0	1	2
Probability that an central city resident finds a vacant job	1	0.5	0
Number of vacant jobs	1	0	1

Average commute for employed central city resident = 0

Table 3A. Baseline Case, Simple Model

	Central City A	B	*Suburb* C
Number of vacant jobs	100	100	100
Distance from central city	0	1	2
Probability that a central city resident finds a vacant job	P	αP	$\alpha^2 P$
Expected employment of central city residents	$P100$	$\alpha P100$	$\alpha^2 P100$

Table 3B. An Increase in Spatial Mismatch, Simple Model

	Central City A	B	*Suburb* C
Number of vacant jobs	100	99	101
Distance from central city	0	1	2
Probability that a central city resident finds a vacant job	P	αP	$\alpha^2 P$
Expected employment of central city residents	$P100$	$\alpha P99$	$\alpha^2 P101$