THE GEOGRAPHY OF OPPORTUNITY AND UNEMPLOYMENT: AN INTEGRATED MODEL OF RESIDENTIAL SEGREGATION AND SPATIAL MISMATCH

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ABSTRACT: *This article combines the neighborhood effects and spatial mismatch frameworks into a single model explaining how geographic factors contribute to unemployment. Using National Longitudinal Survey of Youth (1979) data, I estimate a two-step model that separately models the effects of segregation and spatial mismatch. The first model predicts educational attainment as a function of exposure to residential segregation as a youth. The second model predicts unemployment probability as an adult as a function of educational attainment and spatial mismatch. The empirical results show that segregation does have discernable effects on educational attainment for blacks, but not for whites. I also find that spatial mismatch affects unemployment probability for blacks, but such an effect is hardly present for whites. A partial equilibrium analysis using predictions from the models shows that large changes in either segregation levels or the central city/suburban distribution of the black population would yield only moderate decreases in unemployment probability for the black population overall. Yet despite small predicted effects, these results should be viewed with caution because the general equilibrium effects of a large scale movement of blacks and whites across metropolitan space are largely impossible to predict with current data.*

A perennial focus of scholarly attention is explaining the differences in the life successes of whites and blacks. Differences in the quality of neighborhood environments, local educational institutions, and job opportunities have increasingly been used to explain the variation in life outcomes between whites and blacks. Galster and Killen (1995) and others have broadly dubbed this framework, "the geography of opportunity." Though there have been several approaches to measuring the effect of geographic factors, residential segregation between blacks and whites is a theoretical variable that has seen widespread usage by urban scholars in establishing this linkage between geography and individual outcomes.

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How does segregation affect individual outcomes? Two primary empirical approaches have seen use in answering the question. The first approach is concerned with measuring how early exposure to segregation as a child or youth affects life outcomes for those individuals as adults. This first approach has some integral connections with the much broader neighborhood effects literature that has established, with varying degrees of success, a linkage between the quality of the neighborhood environment where people live and a variety of life outcomes, such as educational attainment, out of wedlock childbearing, and labor market outcomes. The neighborhood effects literature has traditionally focused on the formative effects of exposure to poor neighborhood conditions on youth and young adults, as these years are seen as the time when these effects would most likely take their toll.

The second framework is the spatial mismatch hypothesis (SMH). While not strictly the same conceptually as residential segregation, the SMH posits that the growing distance between employment opportunities and the residential location of historically disadvantaged groups, particularly blacks, is a significant factor in explaining the gap in labor market success between blacks and whites. There are several theories about how spatial mismatch actually operates to create these unequal outcomes, but the exact workings of this mechanism are still not firmly established. Nevertheless, a great deal of empirical work has demonstrated that differences in labor market outcomes, particularly between whites and blacks, can be attributed to spatial mismatch.

The key difference between the early exposure and the spatial mismatch approaches is that they examine two very different aspects of how residential location in metropolitan areas affects life success. Formative effects of segregation on life outcomes are the dominant theme in the early exposure approach. To use economic nomenclature, these studies mostly focus on the production function for life outcomes by explicitly modeling exposure to segregation as a salient factor in determining future life outcomes.

The SMH perspective instead focuses on the interactive effects of segregation and job decentralization, which ultimately conspire to make it more difficult for certain groups to supply their labor in metropolitan labor markets as adults. In short, the SMH deals more with the present effects of the geography of opportunity as an impediment to labor market success.

Certainly urban scholars have always understood segregation and spatial mismatch as conceptually distinct. Galster (1992) devised a complex theoretical model of segregation's effects on individuals that uses the notion of cumulative causation. In so doing, he recognized that segregation may have different effects, in different areas of a person's life at different times. It is then indeed surprising there has not yet been any empirical work that has explicitly joined the two dominant approaches of segregation and spatial mismatch together into a unified model using individual persons as the unit of analysis. This article attempts to fill the vacuum by creating an integrated model of the geography of opportunity. In brief, my empirical strategy is to use a two-equation model that measures the effects of exposure to segregation as a youth on later adult educational attainment. The second model estimates the later impact of spatial mismatch effects on unemployment probability. I estimate this two-step model using data from two waves of the National Longitudinal Survey of Youth; the results are used to ascertain the relative magnitude of early exposure to residential segregation and spatial mismatch in determining labor market outcomes for adults.

The basic questions that I seek to answer are, first, what is the combined effect of exposure to residential segregation and spatial mismatch on unemployment probability? And, as a corollary, how might reductions in segregation, spatial mismatch, or both, ultimately affect unemployment probabilities for whites and blacks?

This research fills a significant gap in the literature by integrating the early exposure/segregation and spatial mismatch mechanisms into a unified empirical framework. By modeling the effects of early exposure to segregation and spatial mismatch on individual persons, this article provides the first individual-level estimates of the cumulative effects of segregation on persons. This approach should provide useful results to researchers engaged in the area of urban inequality. If we can better tell what mechanism (residential segregation or spatial mismatch) has a larger effect on life outcomes, we will be able to make better choices as to where to allocate scarce resources in policy directed to remedy urban inequality.

The structure of this essay is as follows. First, I review the residential segregation and spatial mismatch literatures. I next lay out my research design for an integrated model of residential segregation, spatial mismatch, and unemployment probability. The next sections report the results for the residential segregation model and the spatial mismatch model. Finally, the article concludes with policy simulations and a discussion.

SCHOLARLY INQUIRY AND URBAN INEQUALITY

The Residential Segregation Literature

The effect of metropolitan-wide residential segregation on life outcomes, particularly for blacks, has been a topic of repeated study by urban scholars. The logic behind the mechanism for how residential segregation affects life outcomes for blacks is fairly straightforward. Residential segregation, as a metropolitan wide phenomenon, is thought to be the instrument through which neighborhood disparities are created and maintained. Massey and Denton's (1993) work provides a reasoned argument as to how residential segregation will result in concentrated poverty in minority neighborhoods. Using 1980 census tract data, Massey (1990) showed that segregation could be associated with several negative outcomes at the tract level including higher school dropout rates and more neighborhood deterioration. In another series of articles, Galster used MSA-level data to estimate several complex simultaneous equation systems that demonstrate a fairly consistent linkage between increased segregation and worsened economic and social outcomes for blacks (Galster, 1987, 1991).

Cutler and Glaeser (1997) found empirical evidence for negative effects on blacks resulting from residential segregation using individual persons. Using 1990 Public Use Microdata from the Census and the National Longitudinal Survey of Youth, 1979 (NLSY79), they found that exposure to residential segregation increased the probability of unemployment for individuals, reduced wages, and increased the risk of being a single-female headed householder. And so while their research confirmed segregation's deleterious effects on black persons as individuals, it failed to distinguish empirically between segregation's early exposure and later spatial mismatch effects, a key distinction that this article explores.

I noted earlier that scholars surmise that segregation affects life outcomes for blacks by augmenting and exacerbating existing neighborhood disparities. This rationale of how segregation produces negative outcomes for blacks directly weds the metropolitan concept of segregation to the localized concept of neighborhood poverty, and hence, to the much larger body of scholarly inquiry into neighborhood effects. The central theme in the neighborhood effects literature is that there are certain social processes that take place at the neighborhood or school level that affect outcomes for individuals. While the exact means through which neighborhood effects operate is not known, there are several plausible theories that offer an explanation.

Jencks and Mayer (1990) outlined the three major mechanisms that have been thought to explain neighborhood effects. The first mechanism is the *epidemic* mechanism. Operating through peer effects, environments that have a concentration of dysfunction tend to increase the probability that a person living in that environment will tend toward dysfunctional behavior.

A second mechanism is *collective socialization*. Successful adults are thought to be role models and enforcers of values associated with productivity and success. In addition, successful adults, particularly of the same ethnicity as the neighborhood children, help the youngsters to envision the plausibility of their own success. A notable proponent of this idea was William Julius Wilson as evinced in his 1987 work, *The Truly Disadvantaged*. Finally, there is the *institutional* mechanism. This model emphasized the behavior and quality of the adults that are in the institutions that serve the neighborhood. Thus, poor neighborhoods might not have the same quality of teachers, for example.

Another mechanism for neighborhood effects, unexplored by Jencks and Mayer, is the limitation of opportunity to accumulate wealth through home value appreciation. If wealth creation for households is limited in this way, it may hamper parents' opportunities to purchase education for their children and therefore limit their education attainment (Rusk, 2001).

Whatever the exact constellation of responsible factors, exposure to segregation is thought to influence the life outcomes of blacks negatively by creating concentrated areas of poverty that then cut them off from the opportunity structures and positive socialization necessary to get ahead.

The Spatial Mismatch Literature

The effects of exposure to segregation are not limited merely to formative effects on black youth; segregated housing patterns affect black adults by limiting their access to jobs through spatial mismatch. Segregation usually results in a pattern where blacks are largely confined to central city areas, whereas most job growth over the past three decades has been in suburban areas. This mismatch has been shown to reduce employment probability for blacks confined to central city areas.

There are dozens of articles on the Spatial Mismatch Hypothesis (SMH). Beginning with Kain's (1968) seminal article, this area of research has been a central theme in the field of labor economics. It is not my intention to review the entire SMH literature here. Instead, I narrow the focus of SMH research, addressing the effects of employment decentralization, specifically, on labor market outcomes as this research informs the direction that I take in the empirical model that I propose later.

The exact means through which spatial mismatch operates is still open to debate, but three primary theoretical explanations have emerged. First, some have argued that the spatial mismatch is a function of space (Holzer, 1987; Ihlanfeldt & Sjoquist, 1990; Raphael, 1998; Stoll, 1998). The reasoning is that longer commute times discourage central city workers from taking suburban jobs because the net commuting-time adjusted wage is less than the reservation wage. The second mechanism is race. Here the focus is on the interaction between burgeoning suburban employment opportunities and the largely white markets that they serve. The race argument is that disproportionate levels of unemployment among blacks can be explained as a function of suburban employer prejudice (Ihlanfeldt & Young, 1996; Kain, 1968; Leonard, 1987; Raphael, Stoll, & Holzer, 2000; Turner, 1997).

The final explanation argues that job information asymmetry is to blame. The argument is that informal job networks are still the primary means through which jobs are distributed in the labor market. However, blacks generally rely on more formal channels for job information and application and thus do not learn about suburban job opportunities because they are never formally advertised or because they do not use informal application methods (Holzer, 1987).

This is not to suggest that the SMH is beyond dispute. Several articles have questioned the SMH's veracity (Blackley, 1990; Cohn & Fossett, 1996, Ellwood, 1986). However, scholars have noted that the majority of recent studies using more empirically sophisticated techniques seem to almost unanimously support the SMH (Ihlanfeldt & Sjoquist, 1998; Kain, 1992).

I narrow my review of the SMH literature to a specific set of studies used to inform the design that I employ in this article. Several SMH studies have shown a relationship between the degree of employment decentralization and labor market outcomes. This has been done using a MSA-level measure of employment dispersion, by examining the relative effects of suburban versus central city location on employment probabilities, or by using a combination of both methods.

Stoll (1999) used 1990 PUMS data for the Washington, DC area to analyze the relative effects of spatial mismatch and suburban employer discrimination on employment outcomes. His sampling frame was limited to young men with a high school diploma or less. Stoll argued that the DC area offered a good setting for a natural experiment in determining the simultaneous effects of a change in residential location on spatial mismatch and suburban employer discrimination. Using a linear probability model, he estimated the effects of a change in employment probability as a function of usual control factors and residential location. He found that living in a suburban location would increase employment probabilities across the board for blacks and whites. However, using Oaxaca's partial decomposition analysis technique, he was able to further investigate the relative effects of race and space. He found that the portion of whites' employment advantage explained by racial composition of the suburbs was less than that of the differential benefit in employment probability that whites enjoyed from having a suburban residential location in one of the suburban counties, but in the other the effects were roughly equal (Stoll, 1999). This piece, then, provided a two-pronged explanation for why suburbanization of employment adversely affects blacks.

In another article, Stoll (1998) used the NLSY to estimate the effects of employment decentralization on employment outcomes on young men with less than two years of college education. His employment decentralization variable was derived from the 1972 and 1982 Census of Industries. His pooled regressions showed no statistically significant results, but his race-specific regressions showed statistically significant results on his central city-job decentralization interaction term for blacks and Hispanics (Stoll, 1998).

Another key study is Ihlanfeldt and Sjoquist's (1989) piece that used Panel Survey of Income Dynamics data to measure the effects of job decentralization on the income of central city whites and blacks. They found significant earnings effects for both black and white male central city workers resulting from job decentralization. In an auxiliary analysis, they also estimated a set of probit equations to determine if central city workers were likely to move in response to spatial mismatch. Interestingly, they found that central city whites did move in response to job decentralization, but that blacks did not, suggesting constraints on the ability of blacks to move due to housing market discrimination (Ihlanfeldt & Sjoquist, 1989).

There is solid empirical evidence that the decentralization of jobs from the central cities to suburban areas does have an effect on labor market outcomes for central city residents, particularly blacks. However, the SMH research has not attempted to explain how early exposure to differing geographies of opportunity figures into adult outcomes.

Summarizing the major findings from both literatures on urban inequality, the residential segregation and spatial mismatch literatures both show significant effects on life outcomes for blacks arising from geographic factors, but they observe those effects at different points in time. The residential segregation approach largely looks at the formative effects of segregation on youth. The SMH regards the combined effects of segregation and job decentralization as impacting adults. What has been lacking in the literature is an empirical framework that unifies both of these mechanisms of the geography of opportunity.

CONCEPTUAL MODEL, DATA AND EMPIRICAL STRATEGY

My empirical strategy is to measure two discrete influences on life outcomes: (1) the educational attainment effect of exposure to segregation as a youth, (2) an estimate of the subsequent effect of spatial mismatch on adults.Though our approaches are different, the basic recursive design of my model is borrowed from early work by Datcher (1980, 1982) that modeled wages recursively as a function of neighborhood effects and family background operating through education.

The literature on residential segregation has long contended that one of its most pernicious effects is to reduce the life-chances for black youth by limiting opportunity for educational attainment. Equation 1 provides a general functional relationship.

$$Educ_{it} = \mathrm{f}\ (\mathrm{Seg}_{i,\mathrm{t-n},}\mathbf{F}_{i,t-n}, \mathbf{P}_{i,t-n}) \tag{1}$$

Where $Educ_{it}$ is a person's level of educational attainment as an adult, $Seg_{i,t-n}$ is a measure of residential segregation in the MSA of residence for each respondent during the teenage years and $\mathbf{F}_{i,t-n}$ and $\mathbf{P}_{i,t-n}$ represent vectors of relevant family background and personal characteristics.

Spatial mismatch theory proposes that labor market outcomes for adults are partially determined by the combined effects of residential location and job decentralization. Accordingly, I propose Equation 2.

$$\Pr(UE_{it}) = \mathrm{f}\ (\mathrm{SM}_{it}, Educ_{it}, \mathbf{P}_{it}, \mathbf{M}_{it}) \tag{2}$$

Where $Pr(UE)_{it}$ is unemployment probability at for individual i at time t, SM_{it} is a spatial mismatch variable, Edu_{it} is educational attainment, $\mathbf{P}_{it}$ is a vector of relevant exogenous personal characteristics, and $\mathbf{M}_{it}$ is a vector of other metropolitan-level controls. Figure 1 illustrates the logic of this recursive model where educational attainment is partially determined by exposure to residential segregation, and other relevant family background and personal factors. Then educational attainment, spatial mismatch, and relevant metropolitan area-level factors, in turn, act to determine unemployment probability for adults.

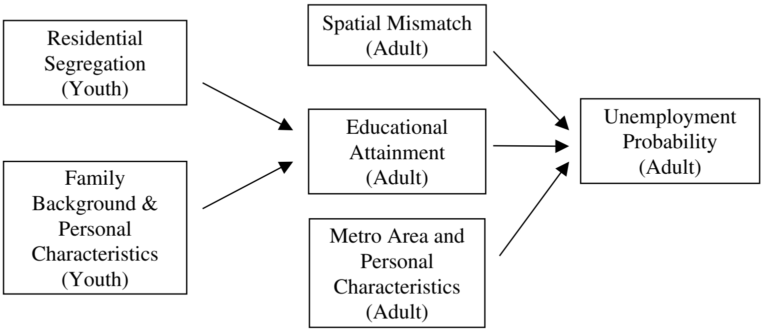

FIGURE 1

Conceptual Model

In order to show the effects of the geography of opportunity at different life stages, a cross sectional analysis is not sufficient. Longitudinal data are necessary in order to observe the effects of segregation during childhood and spatial mismatch during adulthood. The National Longitudinal Survey of Youth (NLSY79) has followed just over 12,000 youth originally aged 14 to 22 since 1979. The dataset offers an assortment of variables including a variety of labor market outcome, family background, family status, and educational attainment and achievement variables. In addition, geocode data is available by special contract with the Bureau of Labor Statistics that identifies the MSA of residence for persons in the sample. The NLSY79 contains three different subsamples: (1) a national probability sample designed to be nationally representative, (2) a special supplemental oversampling of poor and minority youth, (3) and a military sample. This analysis uses the cross-sectional and the supplemental NLSY samples for 1979 and 1990.

THE EFFECTS OF SEGREGATION: EDUCATION MODEL

My first model specifies that an individual's level of educational attainment in 1990 can be expressed as a function of family background, personal characteristics, and exposure to segregation. The dependent variable, educational attainment in 1990, is modeled as a four category ordinal variable where category one represents less than high school, category two is high school, category three is some college, and category four is college degree or greater. Using an ordinal dependent variable suggests ordinal logit as a natural way to model the effects. Moreover, using ordinal logit will allow us to predict a vector of probabilities for different levels of educational attainment, which will facilitate estimation of average segregation effects across white and black populations in simulations below.

The relevant family background variables are those that have been used widely in other applied work using the NLSY79 (see Cutler & Glaeser, 1997, Stoll, 1998). Variables for years of education for both parents are included. Empirical work overwhelmingly supports the notion that parental education is a key factor in determining a child's education. A second family characteristic is household composition, a dummy variable equal to one if the respondent lived with both parents at age 14. The expectation is that, relative to those youth not living with both parents, there will be a positive effect on educational attainment.

Several personal characteristics are also relevant for this analysis. The model contains variables for both gender and age. Also, I use a composite test score derived from the

Armed Forces Vocational Aptitude Battery test (the AFQT score) to proxy for the respondent's ability. The administration of the ASVAB to NLSY respondents was part of a project called "The Profile of American Youth" undertaken by the National Opinion Research Center (NORC) at the University of Chicago to update the normative distributions for the test (Bock & Moore, 1986). Several studies have shown that this test score is an excellent explanatory variable for wage and employment gaps between blacks and whites in the NLSY (Ferguson, 1991; Jacobson, Olsen, Rice, Sweetland, & Ralph, 2001; Maxwell, 1994; O'Neill, 1990).

The AFQT score was tabulated without respect to the respondent's age, which could pose a problem because younger respondents might have scored low simply by virtue of age and not ability. In order to correct for this, I use a solution suggested by Goldsmith and Veum (2002). They used an age-adjusted AFQT score by regressing AFQT on age and using the residuals as their independent variable for the structural equation.

Finally, the salient variable in this analysis is the measure of segregation exposure. The geocode data for the NLSY allows for us to establish the MSA of residence for each respondent in each year of the survey. I used the MSA geocodes for the 1979 (when the respondents in the sample were aged 14 to 22) and matched them to an MSA-level measure of residential segregation, computed from 1980 census data.

Segregation has many dimensions and social scientists have devised literally dozens of ways to measure it. One of the most popular measures is the MSA-level index of dissimilarity, which measures the proportion of persons in the referent group that would have to change neighborhoods in order for each neighborhood to have the same racial composition as the overall MSA. I use the black-white index of dissimilarity in 1980, calculated by the Bureau of the Census' Housing and Household Economics Statistics Division.

Study of residential segregation at the MSA level has been a mainstay in urban research, shown through an abundance of evidence to be a reliable predictor of life outcomes, particularly for blacks. The clear expectation is that higher levels of segregation will be associated with lower levels of educational attainment for blacks. The predicted effect for whites is unknown, but some research has shown that the effect might actually be slightly positive for them (Adelman & Jaret, 1999; Cutler & Glaeser, 1997).

Empirical Results for Educational Attainment Model

Table 1 shows the empirical results from the ordinal logit analysis. Separate equations are shown for whites and blacks. The reported standard errors are robust to within-MSA cluster effects and heteroskedasticity. One point is in order before I discuss the individual coefficients. In ordinal logit, the coefficients do not measure the marginal effects of a unit change in the regressor for a unit change in the dependent variable. This is due in part to the link function and partially to the nature of the dependent variable. Because the link function is nonlinear, the marginal effects on the probability for each category of the dependent variable cannot be obtained simply by looking at the coefficients. Moreover, there are intermediate levels of the dependent variable, making the direct marginal effects on those levels ambiguous. At best, the only valid inference that we can draw simply by looking at the coefficients is the direction of the effect.

For both blacks and whites, the family background variables have the expected effects. Years of education for both parents and living with both parents at age 14 all have positive effects on educational attainment. All of the personal characteristics have the expected effects as well.

TABLE 1

Educational Attainment Model (Ordinal Logit)

Variable	Black Coefficient (Std. Error)	White Coefficient (Std. Error)
Dissimilarity Index	−1.086**	.2073
	(.4702)	(.0231)
Mother's Years of Education	.1257***	.1178***
	(.0203)	(.0231)
Father's Years of Education	.0526**	.1343***
	(.0191)	(.0177)
Lived with both parents at age 14	.5583***	.5018***
	(.1141)	(.0851)
Female	.6091***	.1345**
	(.112)	(.0667)
Age	.0997***	.0932***
	(.0222)	(.0235)
Adjusted AFQT	.0557***	.0506***
	(.0032)	(.0021)
N	1367	3240
Pseudo *R* Square	0.18	0.24

Note. Dependent variable is a 4-level ordinal variable measuring educational attainment in 1990 taking values less than high school, high school, some college and bachelor's degree or higher. Positive coefficients increase the likelihood of higher levels of education. Standard errors robust to intra-MSA clustering and heteroskedasticity reported in parentheses.
2 tailed significance***p $<$ .01 **p $<$ .05 *p $<$ .1

The key variable of interest, the Index of Dissimilarity, has different effects for blacks and whites. For whites, the effect is positive, but not statistically different from zero. For blacks, the effect is unambiguously negative and statistically significant at the .01 level. This finding is not surprising given what other research (Cutler & Glaeser, 1997; Massey, 1990) has shown as to the effects of residential segregation on the educational attainment of black persons.

Another noteworthy observation is appropriate. Even with all of the variables included, this model assumes family characteristics to be exogenous (particularly parental education). Therefore, the model likely underestimates the total historical effect of segregation because the parents of the respondents were likely exposed to even higher levels of segregation during their own childhoods. Also, due to limitations in available variables in the NLSY that describe parental characteristics, the effect of spatial mismatch on parental labor market outcomes cannot be measured. Spatial mismatch would likely influence the parent's labor force attachment and wages and would likely have some bearing on the home environment as well.

As a check for validity, I performed a sensitivity analysis to ensure that these results were robust to other measurements of segregation. The Census now has data on 19 different measures of segregation available through its website. I ran the same ordinal logit using 18 other segregation measures and found that 14 of the 19 measures yielded coefficients that were negative and statistically significant for blacks. In the two cases where the measure yielded a positive coefficient, neither was statistically significant. This auxiliary analysis suggests that segregation's negative effects on blacks are quite robust across a variety of measures.

Instrumental Variables Estimates

Another validity issue concerns possible endogeneity problems with respect to the segregation variable. The first endogeneity problem could arise from segregation resulting from poor educational outcomes (Cutler & Glaeser, 1997). Fortunately, the design of this experiment eliminates this first possibility. Exposure to segregation is measured for respondents in 1979 (when they were between the ages of 14 and 22), but educational attainment is measured 11 years later in 1990 (when they were between the ages of 25 and 33), thus eliminating the problem of simultaneity.

There is possibly a second subtler source of endogeneity coming from unobservable family effects, an item of recent interest in the neighborhood effects literature (Aaronson, 1998; Dietz, 2002; Evans, Oates, & Schwabb, 1992; Plotnick & Hoffman, 1999). The basic problem is one of omitted variables where a model may not have a rich enough set of family characteristics to rule out the possibility that unsuccessful families choose to live in poorer areas. This would introduce an association between these unobservable family attributes (explicitly relegated to the error term), and the neighborhood quality variable. This would very likely bias its estimated coefficient. The problem with estimating an equation such as Equation 3 below is that unobservable family effects may induce correlation between u_i and Seg_i, biasing estimates of a.

$$\mathbf{Educ} = \mathbf{X}\beta + \mathbf{Seg}\alpha + \mathbf{u} \tag{3}$$

Although my design uses MSA-level segregation as the variable of interest, this endogeneity is still a concern. For instance, it is possible that unobservable family attributes are responsible for a portion of the poor educational outcome attributed to segregation, especially if families that fail to emphasize education are more prone to live in segregated areas. In order to test the robustness of segregation's estimated impact in the presence of these unobservable effects, we need to devise instruments for segregation that are uncorrelated with unobservable family attributes that might lead them to self segregate but that are correlated with segregation.

Recanting the well-known criteria for the instrumental variables estimator from econometrics, the two conditions for the instrument, Z, are given below in Equations 4 and 5. Therefore, our task is to find an instrument, Z, that is correlated with segregation (Equation 4) but that is uncorrelated with unobservable family characteristics that may be present in the residual term for Equation 3 (Equation 5).

$$Cov(\mathbf{Z}, \mathbf{Seg}) \neq 0 \tag{4}$$

and

$$Cov(\mathbf{Z}, \mathbf{u}) = 0 \tag{5}$$

Finding such an instrument will allow for us to consistently estimate segregation's effect (α) even in the presence of possible omitted family characteristics. Cutler and Glaeser (1997) sought instruments for segregation that would be uncorrelated with negative life outcomes for individuals such as low educational attainment or low wages. They were trying to account for a possible simultaneity problem between negative life outcomes and segregation. Arguably, this same exigency fits the problem of unobservable family characteristics. If segregation is endogenous, we expect that unobservable family attributes that affect children's outcomes will also be the cause of greater segregation. They would be a cause in the sense that if we aggregated families with unbeneficial characteristics in an MSA, we might expect them to self-segregate, thus making groups of families with these purported unobservables a possible cause of segregation.

Cutler and Glaeser suggest use of the log of the number of governments in 1962 as one possible instrument for MSA segregation. They argued that the log of governments predicts segregation because greater municipal fragmentation could facilitate segregation at the metropolitan level. That is, the number of governments increases the possibility of segregation within metro areas sorted by race; indeed, their own work shows this to be true.

At the same time, they argued that this instrument, because it deals with structural MSA characteristics, is not correlated with negative outcomes for individuals, or as I have argued by extension, families. In other words, even if families self-segregate, that self segregation, particularly in 1979, would not influence the number of governments 17 years prior, though the number of governments does appear to provide a structural facilitation for segregation. Thus, the use of the log of governments as an instrument will yield a consistent (though not perfect) estimate of the effects of segregation even in the presence of possible unobservable family characteristics.

I conducted empirical tests of endogeneity by comparing regressions using OLS and the instrumental variables (IV) estimator (also known as two-stage least squares). Instead of using the ordinal outcome variable used in the ordinal logit analysis, I use the respondent's years of education in 1990. Table 2 shows the OLS and IV coefficients for segregation. For

TABLE 2

OLS and Instrumental Variables Estimates for Effects of Segregation on Years of Education

	OLS Estimates		IV Estimates	
Variable	Black	White	Black	White
Dissimilarity Index	−.8133**	.119	−1.65***	.4014
	(.388)	(.4237)	(.7023)	(.8957)
Mother's years of education	.1141***	.1063***	.1149***	.0997***
	(.0174)	(.0211)	(.0181)	(.0227)
Father's years of education	.0502***	.1258***	.0487***	.1269***
	(.0168)	(.0168)	(.017)	(.0175)
Lived with both parents at age 14	.5063***	.3848***	.4736***	.3605***
	(.0977)	(.0862)	(.0984)	(.0878)
Female	.4951***	.074	.4934***	−.0091
	(.0783)	(.0626)	(.0794)	(.0685)
Age	.0912***	.1062***	.0926***	.1003***
	(.019)	(.0249)	(.0194)	(.0288)
Adjusted AFQT	.0487***	.048***	.0493***	.0484***
	(.0024)	(.0021)	(.0024)	(.0021)
Constant	10.32***	7.73***	10.95***	7.72***
	(.4336)	(.5394)	(.571)	(.9195)
N	1367	3240	1326	2827
Adjusted R Square	0.39	0.48	0.39	0.47

Note. Table reports results of instrumental variable regression of years of education on segregation and other variables. Segregation is instrumented in a first stage regression using the log of the number of local governments in 1962. Standard errors robust to intra-MSA clustering and heteroskedasticity reported in parentheses.
2 tailed significance = ***$p < .01$. **$p < .05$. *$p < .1$.

whites, the IV estimate is larger than the OLS estimate and positive, though neither is statistically significant. For blacks, the IV estimate is more than twice the OLS estimate, indicating that accounting for unobservable family effects may in fact increase estimated effects from segregation. While these estimates cannot definitively determine whether endogeneity exists in the ordinal logit estimates, they certainly increase our confidence that unobservable family effects likely do not result in serious downward coefficient bias.

Simulation of Segregation's Educational Effects

The geography of opportunity, operating through residential segregation, has effects on education but the question of statistical versus substantive significance still needs to be sorted out (McCloskey & Ziliak, 1996). In particular, what is the magnitude of the effects of segregation on educational attainment? As discussed previously, we cannot answer this question by merely looking at the ordinal logit coefficients. In order to get an idea of the effects, I show the predicted probabilities for different levels of educational attainment using the equation and the mean values of the covariates, but instead of using the actual value of the dissimilarity index, I used a specific value (0.3, 0.6, or 0.9). I chose three values for the dissimilarity index for the analysis similar to those used by Massey and Denton (1993) where 0.3 represents a low level of segregation, 0.6 represents an average level of segregation, and 0.9 represents a high level of segregation. By varying the index we get a better idea of the substantive effects of segregation on the educational attainment of black and white persons.

The results in Table 3 provide compelling evidence of significant effects from segregation. The upper panel of the table contains the results for black persons. At the lowest level of segregation (0.3), the probability of attaining less than high school is .05, but this increases dramatically to .09 when the index at its highest (0.9). The probability of attaining a high school degree increases from .39 to .51 when segregation reaches its maximum, but the increase comes from others shifting from higher neighboring categories of education. In the Some College category, the probability declines from .43 to .32 as we move from low to high values of segregation. The probability of attaining a college or higher degree declines from .13 to .07 as segregation rises to its maximum. Substantively, segregation has an unambiguous effect on the categorical distribution of black educational attainment. Higher levels of segregation shift more blacks into lower echelons of educational attainment.

For whites, the effects of segregation are never harmful and sometimes beneficial in terms of education. The probability of attaining less than high school decreases slightly

TABLE 3

Predicted Educational Attainment Probabilities by Level of Segregation

	Dissimilarity Index	Less than High School	High School	Some College	College or Higher
Black:	0.3	0.05	0.39	0.43	0.13
	0.6	0.07	0.46	0.38	0.1
	0.9	0.09	0.51	0.32	0.07
White:	0.3	0.05	0.51	0.28	0.16
	0.6	0.04	0.5	0.29	0.17
	0.9	0.04	0.48	0.3	0.18

under higher levels of segregation and the probability of attaining some college or college or higher increases under higher levels of segregation. The probability for High School decreases with more segregation, but this is because more people move into the neighboring categories of higher levels of educational attainment. This suggests that whites may benefit from segregation. However, this finding should be viewed as somewhat speculative in light of the fact that the coefficient on segregation in the equation for whites missed statistical significance at conventional levels.

The foregoing investigation of segregation's effects suggests that the impact of geography on opportunity for blacks is both statistically and substantively significant with varying segregation regimes yielding marked differences in the distribution of the level of educational attainment. However, this first level of analysis solely looked at how exposure to segregation as a child/young adult affects educational attainment. This is certainly not to say that education is not an important outcome in its own right, it is. However, one of the primary values of education is its instrumental worth, specifically, its ability to improve prospects in the labor market. I now turn to an investigation of the effects of geography on persons in adulthood through spatial mismatch.

THE SPATIAL MISMATCH MODEL

The second part of my analysis focuses on how the location where a person lives as an adult affects his/her outcomes in the labor market. As we have already seen, the spatial mismatch hypothesis surmises that there are indeed geographic effects on adult labor market outcomes where persons, particularly black persons, who live far from employment opportunities, have less success in the labor market.

I estimate an empirical model that specifies that a person's unemployment probability can be explained as a function of personal characteristics, including educational attainment, relevant metropolitan-area characteristics, and finally, spatial mismatch. The dependent variable for the labor market outcome model is the probability of being unemployed at the time of the NLSY interview in 1990; I model the effects of the independent variables using binary logistic regression. The sampling frame excludes individuals who were working as homemakers, who were disabled, or who were enrolled in school full time.

The personal characteristics that are used here are similar to those in other applied work including age, gender marital status, and ability (as proxied through used of the age-adjusted AFQT score discussed earlier). The final personal characteristic is educational attainment in 1990, modeled as a three-category vector of dummy variables indicating the following levels of attainment: high school, some college, or college or higher; the base category is less than high school. I use the same categories as those that were used as the dependent variable in the ordinal logit analysis. This will allow us to trace the recursive effects of segregation, acting through educational attainment later on in a simulation analysis.

Prior research has shown certain metropolitan-level characteristics to be relevant control variables. Weinberg (2000) advises inclusion of the natural log of MSA population to control for population size, which I include using 1990 Census data. Also the labor force participation rate for the MSA is a relevant factor that is always controlled in studies of labor market outcomes; the model uses the labor force participation rate for the MSA in 1990. These data come from the 1990 Census. The expectation, of course, is that higher rates of labor force participation will be associated with lower unemployment probabilities for individuals.

Our primary variable of interest for this analysis is spatial mismatch. Theory suggests that individuals, particularly black individuals, who are exposed to higher levels of spatial mismatch will have less success in the labor market. In this analysis I make use of two variables to measure spatial mismatch for individual respondents using a scheme similar to Ihlanfeldt and Sjoquist (1989) and Stoll (1998).

The central component to measuring spatial mismatch is the respondent's residential location. All else equal, central city residents will be at a greater risk of spatial mismatch. Therefore, the expectation is that central city residents will have a higher unemployment probability. Central city residence is modeled by a simple indicator variable.

However, knowledge of the respondent's residential location is not sufficient. Picture a MSA where many jobs are still located near the urban core; in this case, central city residents would actually have an advantage. Spatial mismatch theory predicts that job centralization will be a benefit to central city residents (Weinberg, 2000). I account for this possibility by including a measure of job centralization for the respondent's MSA. I determine the level of job centralization in each MSA in which a respondent resides in 1990. I propose a relatively straightforward measure of job centralization. Namely,

$$\text{Job Centralization} = \frac{(\text{Jobs}_{\text{cc}}/\text{Jobs}_{\text{msa}})}{(\text{Land}_{\text{cc}}/\text{Land}_{\text{msa}})} \tag{6}$$

In words, job centralization is a ratio of ratios where the numerator measures the proportion of jobs that a central city has in a given MSA and the denominator measures the proportion of land that a central city covers in an MSA. Larger values of this variable indicate more job centralization since this indicates that a central city has a relatively larger proportion of the MSA's jobs compared to the proportion of land that it covers. In the model, I combine this measure of job centralization with the dummy variable for central city residence. Job centralization should benefit central city residents, thus theory predicts that the coefficient on the interaction term ought to be positive.

A perennial confounding factor in measuring job centralization is that of relative geographies where the boundaries between central cities and suburbs may vary from MSA to MSA. The vexing problem is that arbitrary differences in central city/suburb boundaries rather than the actual concentration of jobs is the cause of heterogeneity in the job centralization/decentralization measure. The job centralization variable that I propose implicitly controls for this exigency by including land area in the formula. To further bolster the robustness of the results, I excluded the cases where the central city covered 100% of the MSA area.

Empirical Results

Table 4 displays the results for the unemployment probability model. The first panel of the table shows the results for blacks. Most of the personal characteristics have no statistically significant effect on unemployment probability except the AFQT variable and the marriage variable. Neither of the MSA-level controls is statistically significant in the equation for blacks, but the signs of the coefficients are consistent with expectations borne out from previous work.

The spatial mismatch variables show statistically significant effects in the expected direction. Notably, the *Central City* variable is a significant factor that increases unemployment probability for both blacks and whites, though the effect for blacks is almost twice as large.

TABLE 4

Unemployment Probability Results (Logistic Regression)

Variable	Black Coefficient (Std. Error)	White Coefficient (Std. Error)
Age	−0.0488	0.0261
	(−0.0423)	(−0.0439)
Female	0.0255	.7772***
	(−0.1842)	(−0.2611)
Adjusted AFQT	−.018**	−.0211***
	(−0.009)	(−0.0064)
High School	−0.2377	−.6375**
	(−0.2279)	(−0.3148)
Some College	−.6586**	−0.5671
	(−0.2735)	(−0.4727)
Bachelors or higher	−1.343***	−0.5834
	(−0.4907)	(−0.5062)
Never Married	.4184**	.6115**
	(−0.1529)	(−0.2481)
MSA LFP Rate	−0.8594	−1.8174**
	(−1.05)	(−0.802)
Ln(MSA POP)	−0.0233	−0.0434
	(−0.0926)	(−0.0905)
Central City	1.03***	.518+
	(−0.2725)	(−0.3687)
Job Centralization	.0487***	0.0085
	(−0.0186)	(−0.0123)
Central City*Job Centralization	−.0678***	−.0395*
	(−0.0198)	(−0.0235)
Constant	−1.3834	−2.532
	(−1.45)	(−1.69)
N	1353	2414
Pseudo R Square	0.064	0.083

Note. Dependent variable is unemployment, equal to 1 if respondent was unemployed. Positive coefficients increase unemployment probability. Standard errors robust to intra-MSA clustering and heteroskedasticity reported in parentheses.
2 tailed significance = ***p < .01. **p < .05.*p < .1.
1-tailed significance = +p < .1.

The coefficient on *Job Centralization* shows the effect of job centralization on suburban residents. The results show a small increase in the probability of unemployment for suburban blacks. This is to be expected because that would indicate a spatial mismatch for suburbanites. The *Central City *Job Centralization* variable shows the opposite effect. That is, job centralization decreases the risk of unemployment for central city blacks, a finding consistent with spatial mismatch theory. The spatial mismatch effects for whites are less in terms of both magnitude and certainty. For suburban whites, *Job Centralization* slightly increases the unemployment probability, but the coefficient is not statistically different from zero. For central city whites *Central City * Job Centralization* decreases unemployment probability but by about half that shown in the equation for blacks.

The education dummy variables all show statistically significant negative effects on the risk of unemployment for blacks. Furthermore, the coefficient for each level of education is progressively larger than the last, indicating lower risks of unemployment for blacks at each level of education. The equation for whites shows some contrasts in terms of educational effects. The effect of increasing levels of educational attainment on unemployment probability is much less robust, particularly at the highest levels of education. This suggests that education may be much more of a factor in determining employment for blacks as compared to whites.

In summary, this second model shows another way in which geography affects opportunity, namely spatial mismatch. Central city residents benefit from job centralization, but high levels of job centralization do not exist in many metropolitan areas. Since the 1950s there has been a sustained trend toward less job centralization. Thus central city residents, particularly blacks, suffer in terms of greater unemployment risk.

Instrumental Variable Estimates for the Spatial Mismatch Model

Not surprisingly, empirical spatial mismatch models can also suffer from potential endogeneity problems. The problem is the possibility of a feedback between a person's labor market status and where he/she lives; this is known in the spatial mismatch literature as the problem of residential endogeneity (Ihlanfeldt & Sjoquist, 1998). In the context of the empirical strategy used above, the problem could be that people that live in the central city do so because of their employment status (because rents might be less, for example), leading to potential bias in the estimated effect of central city residence. Equations 7 and 8 demonstrate the possible empirical problem. If central city residence and unemployment are jointly determined and we estimate (Equation 7) without taking the simultaneity in (Equation 8) into account then we will not get consistent estimates of α.

$$\Pr(UE) = \mathbf{X}\beta + \mathbf{CC}\alpha + \mathbf{u} \tag{7}$$

$$\Pr(CC) = \mathbf{X}\delta + \mathbf{UE}\gamma + \mathbf{v} \tag{8}$$

Given the potential for residential endogeneity bias, the challenge is to develop a set of instruments (Z) that are both uncorrelated with unemployment status and correlated with the probability that a person will live in the central city.

$$Cov(\mathbf{Z}, \mathbf{CC}) \neq 0 \tag{9}$$

and

$$Cov(\mathbf{Z}, \mathbf{u}) = 0 \tag{10}$$

There are two instruments that arguably meet this criterion. The first is the ratio of central city to MSA land area. We would not expect for a central city resident's labor market experience to affect this quantity, but certainly a larger relative central city land area would increase the probability that a person would reside there, regardless of their labor market status. The second is the area of the central city in square miles. The expectation, as with the ratio variable, is that more central city square mileage is associated with a higher probability of residence in the central city.

A small discussion on estimation procedures is also warranted. When there is only one binary endogenous variable, the problem is tractable in the context of nonlinear models. In the empirical model (binary logit) used in this article, the analysis contains an endogenous binary variable and its interaction with a continuous covariate (i.e., *Central City*

* *Job Centralization*), for which there is no ready solution in the context of a nonlinear model. The use of a linear probability instrumental variable estimator in this case seems justified as a test for endogeneity.

To test for residential endogeneity I used OLS to estimate a linear probability model for unemployment using the same set of variables as were used in the logit analysis and then compare those to the IV estimates. Table 5 contains the results. In the case of whites, the OLS and IV estimates show little difference; in both cases *Central City* and *Job Centralization* are not statistically different from zero. The OLS estimate shows some statistically significant effect for *Central City*Job Centralization* but the IV estimate does not. This echoes the findings in the logistic regression results presented previously, namely, spatial mismatch does not appear to have much of an effect on whites.

The OLS estimates for blacks show statistically significant effects in the expected directions for the variables. OLS and IV yield identical directional effects for *Central City* and the IV estimate is greater in magnitude, though less certain in terms of statistical

TABLE 5

OLS and Instrumental Variables Estimates for Unemployment Probability

	OLS Estimates		IV Estimates	
Variable	Black	White	Black	White
Central City	.0883***	0.0139	.2726+	0.0094
	(−0.0223)	(−0.0118)	(−0.1941)	(−0.0388)
Job Centralization	.00045**	0.0004	0.0021	−0.001
	(−0.002)	(−0.0006)	(−0.0106)	(−0.0028)
Central City*Job Centralization	−.0062***	−.001+	−0.0034	0.0034
	(−0.002)	(−0.0007)	(−0.0128)	(−0.0077)
Age	−0.0028	0.0015	−0.0034	0.0018
	(−0.0041)	(−0.0014)	(−0.0042)	(−0.0016)
Female	0.0008	.0221***	0.0063	.0211***
	(−0.018)	(−0.0078)	(−0.0218)	(−0.008)
Adjusted AFQT	−.0011**	−.0006***	−.0011**	−.0006***
	(−0.0006)	(−0.0002)	(−0.0005)	(−0.0002)
High School	−.0429+	−.0413**	−0.0363	−.0419**
	(−0.032)	(−0.0185)	(−0.0637)	(−0.0191)
Some College	−.0889***	−.0397*	−.0842**	.0409*
	(−0.033)	(−0.0215)	(−0.0384)	(−0.0223)
Bachelors or higher	−.1138***	−.0379*	−.0898*	−.0479+
	(−0.0407)	(−0.0207)	(−0.0521)	(−0.03)
Never Married	.0411***	.0195**	0.0251	.0162*
	(−0.0148)	(−0.0087)	(−0.0231)	(−0.0097)
MSA LFP Rate	−0.0945	−.0597*	0.0622	−.069*
	(−0.1066)	(−0.0307)	(−0.1704)	(−0.0536)
Ln(MSA POP)	−0.002	−0.0008	−0.0126	−0.00003
	(−0.0097)	(−0.0029)	(−0.0139)	(−0.0046)
Constant	0.199	0.0695	0.1524	0.0594
	(−0.1548)	(−0.0603)	(−0.2439)	(−0.0963)
N	1353	2414	1353	2414

Note. Table compares OLS and IV linear probability models of unemployment. The first stage instruments for central city residence and the interaction term are the ratio of central city to MSA land area and natural log of central city land area in square miles. Standard errors robust to intra-MSA clustering and heteroskedasticity reported in parentheses.
2 tailed significance = ***$p < .01$.**$p < .05$.*$p < .1$.
1-tailed significance = +$p < .1$.

significance. *Job Centralization* and *Central City * Job Centralization* are no longer different from zero in the IV regressions, providing some mixed evidence about the effects of spatial mismatch on blacks once we account for residential endogeneity. Nevertheless, the fact that the key spatial mismatch variable, *Central City*, remains statistically significant in the IV results implies that residential endogeneity does not seriously bias single equation estimates downward for blacks.

In a similar vein to the segregation analysis, we can now turn to the question of the substantive significance of spatial mismatch and recursive educational effects. To that end, I computed various unemployment probabilities based on the labor market equations for whites and blacks, using the means of the covariates, to show how outcomes differ for central city and suburban residents at the different levels of educational attainment. Equation 11 presents the formula for each cell. Formally, each cell is the expected probability of unemployment from the prediction equation. The model uses the mean covariate values for all variables, except for educational attainment (*Educ*), which can take one of ($k = 4$) levels, and residential location (*Loc*) which can take one of ($m = 2$) levels, central city or suburb.

$$\Pr(UE \mid \bar{\mathbf{x}}, \mathbf{Educ} = \mathbf{k}, \mathbf{Loc} = \mathbf{m}) \tag{11}$$

The outcome of this exercise is found in Table 6. Glancing at the differences in predicted unemployment probabilities for central city versus suburban blacks, the contrast is stark. For central city blacks, the effects of residential location have the largest absolute effect for those with less than high school. Central city blacks with less than high school have a predicted unemployment probability of .19, whereas suburban blacks with the same level of education have an expected probability of .12. This amounts to a substantial difference in expected probabilities of unemployment due to residential location.

The differences in unemployment probability attributable to education are even greater for blacks. For central city blacks, unemployment probability is over 300% higher for those with less than high school as compared to those with a college degree or more [(.19/.06) * 100]; for suburban blacks, it is 400% higher [(.12/.03) * 100]. Clearly, educational attainment makes a substantial difference in how blacks fare in the labor market.

The unemployment probability difference between central city and suburban whites at all levels of education is only .01, showing a negligible effect for spatial mismatch for whites. As we move to higher levels of education, the effects of residential location are less

TABLE 6

Predicted Unemployment Probabilities by Educational Attainment and Residential Locaiton

Place of Residence/ Race	Less than High School	High School	Some College	College or Higher	High School Minus College or Higher Probability
CC black	0.19	0.15	0.11	0.06	+0.13
Suburban black	0.12	0.1	0.07	0.03	+0.09
Probability difference	+0.07	0.05	0.04	0.03	
CC white	0.05	+0.03	+0.03	+0.03	+0.02
Suburban white	0.04	0.02	0.02	0.02	+0.02
Probability difference	+0.01	+0.01	+0.01	+0.01	

Note: Table reports predicted unemployment probabilities for various levels of educational attainment and residential location holding all other variables at their means.

for blacks, but still present, where the effects are still virtually nonexistent for whites. Interestingly, the impact of educational attainment seems to matter less for determining the employment status of whites as compared to blacks. The unemployment probability difference for whites with educational attainment less than high school and whites with college or more is only +.02 for central city and suburban locations.

Perhaps this means that education, in its own right, is more important for blacks than whites as a means of getting a job. One plausible interpretation is that educational attainment may be a labor market proxy that employers use to infer whether a black worker has desirable employment characteristics, a proxy that may not be deemed necessary for whites. In this way, lower levels of educational attainment may have differential effects for blacks and whites due to employer discrimination in the criteria that they use to evaluate potential applicants. This factor would help to explain the large unemployment gaps that have seemed to persist in unemployment between blacks and whites without high school education.

In summary, the implications of this analysis are threefold. First, the differential effects of residential location and spatial mismatch are much larger for less educated persons in terms of absolute unemployment probability. (Technically, the empirical model does not estimate separate marginal effects for spatial mismatch for differing levels of education, but the nonlinearity of the logistic function itself yields nonlinearity in outcomes. And so, the differential effects of residential location result from the nonlinear effects of education although the effects of residential location on the logit are the same for each level of educational attainment.)

Second, blacks clearly stand to lose much more from spatial mismatch than whites. This latter finding lends credence to prior research that postulates that one of the primary ways in which spatial mismatch operates is through suburban employer discrimination. Also, research shows the black households are less likely to own automobiles (Taylor & Ong, 1995). Either or both of these race-specific mechanisms would explain the larger effects on blacks. Finally, the educational attainment has a dramatic impact on black unemployment probability, but, in absolute terms, has much less of an impact for whites.

COMBINING THE EFFECTS OF RESIDENTIAL SEGREGATION AND SPATIAL MISMATCH

This article investigated two ways through which geography affects opportunity. In early life, geography affects people by sorting individuals across an unequal landscape of opportunity through means of residential segregation, concentrating disadvantages geographically, which contributes to different outcomes in educational attainment for blacks and whites. The first empirical analysis related segregation to educational attainment and showed negative effects for blacks and slightly positive effects for whites. The instrumental variables estimates confirmed that these results were robust even in the face of possible unobservable family attributes.

Going forward 11 years, the persons in the survey are now beginning their adult lives and experiencing mixed fortunes in the labor market. The second empirical model demonstrated that disparate labor market outcomes between blacks and whites could be partially explained as a function of both education and spatial mismatch. Moreover, IV estimates showed that residential endogeneity was not a serious problem. Now we have laid all of the empirical groundwork to answer the original research question–what is the combined effect of residential segregation and spatial mismatch?

One way to conceptualize the combined effect is to examine how the unemployment rate would vary for blacks and whites as groups, given exposure to different levels of

TABLE 7

Population Averaged Unemployment Probability Predictions for Different Levels of Segregation (as a youth) by Residential Location (as an adult)

Index of Dissimilarity	Central City Black	Suburban Black	Central City Suburb Difference	Central City White	Suburban White	Central City Suburb Difference
0.9	0.135	0.084	0.051	0.03	0.022	0.008
0.6	0.13	0.08	0.05	0.03	0.022	0.008
0.3	0.123	0.077	0.046	0.03	0.022	0.008
High Low Difference	0.012	0.007		0	0	

Note. Table reports weighted unemployment probabilities given the predicted distribution of various levels of educational attainment as a result of residential segregation.

segregation as youth and different residential locations as adults. In Table 7, I take the product of the expected probabilities of the four levels of educational attainment under increasing levels of segregation from Table 3 [Pr ($Educ = k|Seg = q$)] and the expected unemployment probabilities under those same levels of educational attainment and residential location from Table 6 [Pr ($UE|Educ = k$, $Location = m$)]. This product yields the weighted unemployment effects for the population. Summing across all educational categories yields the average effect for each group; that is, the population-averaged (PA) effect. Mathematically, this population averaged unemployment probability is

$$\text{PA Pr}(UE|Seg = q, Location = m) = \sum_{k=1}^{k} [\Pr(Educ = k|Seg = q))^{*} \Pr(UE|Educ = k, Loc = m)] \tag{12}$$

The values in Table 7 show that for central city blacks, the recursive unemployment probability effects of childhood exposure to segregation are negligible as we go from low to high levels of segregation. The difference in unemployment probabilities for high and low levels of segregation is +.012, translating into an unemployment probability difference of about +9.8% [(.012/.123) * 100] as we go from low to high segregation. In other words, the population-averaged recursive effect of increasing the index of dissimilarity from 0.3 to 0.9 yields a 9.8% increase in unemployment probability for central city blacks. For suburban blacks, the recursive effect is smaller in absolute terms; the high-low difference is .007. In proportional terms as compared to central city blacks, the effect is roughly the same: the recursive effect of increasing segregation from 0.3. to 0.9 yields a 9.1% increase in unemployment probability [(.007/.077) * 100]. The lack of any effect for whites is striking; the recursive effects are zero. There is no difference in adult unemployment probability attributable to early exposure to segregation for whites.

For blacks, the population-averaged effect on adult unemployment probability due to spatial mismatch is much larger than the recursive education effect. The difference for unemployment probability between central city and suburban blacks ranges from a low of .046 to a high of .051, depending on the level of residential segregation, which creates nonlinearities in the marginal effects. This demonstrates a much larger absolute unemployment effect due to spatial mismatch. For instance, the unemployment effect of central city location for a black person that had a 0.3 level of segregation as a youth is 37% [(.046/

.123) * 100] higher than for a suburban black resident who had the same level of segregation as a youth. In sharp contrast, spatial mismatch effects for whites are virtually nonexistent. The effect in every case is only .008, though in relative terms, central city whites have a 26% greater chance of being unemployed than suburban whites [(.008/.03) * 100]. Moreover, recalling that the spatial mismatch variables were insignificant for whites, these predictions hold less weight.

Some Simple Policy Simulations

The forgoing analysis gives us a tool for conducting a few partial equilibrium policy experiments. The first experiment addresses the question, what would be the recursive unemployment effect of reducing the index of dissimilarity from 0.9 to 0.3 for blacks? Table 7 provides an answer. If we reduced segregation in an MSA from a high of 0.9 to a low of 0.3, unemployment probability would decline by .012, or about 9% [(.012/.123 * 100], for central city blacks and .007, or a little more than 8% [(.007/.084) * 100] for suburban blacks. Of course, the effect for whites would be zero.

The second policy experiment examines partial equilibrium effects of correcting spatial mismatch. What would the effects be if public policy changes were able to make the distribution of blacks over central cities and suburbs 50–50? In the sample, about 72% of blacks lived in a central city area and 28% in suburban areas. Therefore, we can use these proportions to weight the probabilities. Table 8 shows what the weighted unemployment probability effects would be if we changed the central-city/suburb distribution of blacks from 72–28 to 50–50 for each of three levels of segregation exposure as a youth. The difference in weighted unemployment probabilities is the predicted effect of a change in the residential distribution for total black unemployment rates. As the table shows, the difference would be small. For example, changing the residential distribution from 72–28 to 50–50 for persons exposed to an index of dissimilarity of 0.6 would yield a 9.48% reduction in unemployment probability [(.011/.116) * 100].

Of course, one large caveat to these partial equilibrium analyses is the dubious assumption that we could change the level of residential segregation without that changing the distribution of black residences between the central cities and suburbs. Indeed, segregation

TABLE 8

Weighted Unemployment Probability Effects of Changes in Proportion of Blacks Living in Central City and Suburban Areas

Index of Dissimilarity	Weighted CC UE Probability	Weighted Suburban UE Probability	Total Weighted UE Probability
0.3	.72* .123 = .088	.28* .077 = .024	0.112
	.50* .123 = .062	.50* .077 = .039	0.101
Difference in UE Probability with Different Residential Distributions			0.011
0.6	.72* .13 = .094	.28* .08 = .022	0.116
	.50* .13 = .065	.50* .08 = .04	0.105
Difference in UE Probability with Different Residential Distributions			0.011
0.9	.72* .135 = .097	.28* .084 = .024	0.121
	.50* .135 = .066	.50* .084 = .042	0.108
Difference in UE Probability with Different Residential Distributions			0.013

in large measure is between central cities and suburbs (Farley, 1987). Then the question becomes one of combined partial effects.

The average level of segregation for the sample was about 0.6. In this partial equilibrium analysis, I make the assumption that if the level of segregation were halved from 0.6 to 0.3, this reduction would in turn result in a 50–50 residential distribution of blacks between central cities and suburbs. What would the combined effects be in this situation? Again, referring to Table 8, comparing the weighted unemployment probability for the top row of panel 2 (corresponding to segregation equal to 0.6) and the bottom row of panel 1 (corresponding to segregation equal to 0.3 with a 50–50 residential distribution) yields .116 − .101 = .015. The estimated effect would be a 12.9% [(.015/.116) * 100] reduction in unemployment probability for blacks as a whole.

In sum, these policy simulations show that there would be discernable effects from changes in segregation and residential location, but that those changes would likely result in fairly small improvements in employment probability for blacks as a whole, at least for such large population relocation. Yet, as earlier analysis revealed, the effects for blacks at lower levels of the education spectrum would be significant.

The limits of the empirical model for predication of general equilibrium effects are most acutely seen once we delve into policy experiments. The difficulty with these results is that the full general equilibrium effects are simply too complicated to estimate from existing data. For example, a major shift of blacks from the central city to the suburbs would likely change the political landscape of metropolitan America. There might be effects in terms of new patterns of school investment, taxation, and policies aimed at the urban core. Indeed, we might also see a major shift in the distribution and composition of employment as well. At best, we can only speculate what the long-term effects of such a redistribution of populations across urban space might be. Accordingly, the simulation results ought to be viewed, at best, cautiously, in light of this limitation.

Finally, regardless of the small population averaged effects, the empirical analyses demonstrated very acute differences in unemployment probability across different levels of educational attainment and between different residential locations, particularly for blacks. Accordingly, changes for individual persons could be extremely significant, something that is masked by population-averaged effects.

CONCLUSION

The fundamental contribution made by this article is the demonstration of a tractable empirical strategy for modeling how metropolitan geography affects opportunity both in childhood and adulthood. Based on Galster's cumulative causation model, this analysis demonstrates substantive and distinct effects from segregation and spatial mismatch. These results strongly support future research taking a longitudinal approach to modeling the effects of metropolitan geography on opportunity for blacks.

This basic framework could be extended in a myriad of ways. There are clearly some obvious avenues for future research. This article's use of MSA-level variables for neighborhood effects and spatial mismatch, while certainly a valid approach, is also an admittedly crude means of measuring some of these phenomena. Use of census-tract level measures of neighborhood quality and spatial mismatch would perhaps provide for better measurement of both neighborhood effects and spatial mismatch.

Moreover, the demonstrated presence of discernable MSA-level effects in this article leaves many questions unanswered as to how exactly neighborhood effects and spatial mismatch actually operate. Indeed, other researchers have called for investigators to renew their efforts to distinguish between and discern specific mechanisms through which neighborhood effects and spatial mismatch operate (Ihlanfeldt & Sjoquist, 1998; Sampson, Morenoff, & Gannon-Rowley, 2002). Clearly a better understanding as to how these influences work will add needed guidance to steer future empirical inquiry.

In addition, the focus of this article was limited to unemployment but what about other labor market outcomes? What we can say from these results is that while the recursive effects of segregation and spatial mismatch have discernable impacts on unemployment, these effects are fairly small, but this does not necessarily hold for all labor market outcomes. In particular, little work has been done in the area of spatial mismatch and wages except for Ihlanfeldt and Sjoquist's 1989 article. Future research could look at integrated models of the effects of geography of metropolitan opportunity on wages, acting recursively through education and contemporaneously through spatial mismatch and possibly labor market discrimination. The recursive effects of segregation acting through education could have a much more noticeable impact on wages given the large wage differentials that result from differing levels of education. Other outcomes that would be good candidates for future research are unemployment duration (extending the work of Stoll) or possibly occupational choice.

A fuller understanding of how and to what extent geography affects opportunity can only aid policymakers. Particularly now as the research on urban sprawl is moving toward an examination of sprawl's social effects, the framework that I propose builds the foundation for future research that will provide a much needed quantification of the effects of those geographic disparities. Finally, replication of this integrated model of neighborhood effects/segregation and spatial mismatch is strongly warranted. If indeed policymakers are making decisions based upon purported large-scale impacts resulting from neighborhood effects and spatial mismatch, precision and validity are necessary in order to channel policymakers in fruitful directions to reduce urban inequality.

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