THE SPATIAL MISMATCH AND SKILLS MISMATCH HYPOTHESES: A STUDY OF THE COLUMBUS METROPOLITAN AREA USING SPATIAL INTERPOLATION METHODS

A Thesis
Presented in Partial Fulfillment of the Requirements for the Degree Masters of Arts in the Graduate School of the Ohio State University

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ABSTRACT

The Spatial Mismatch Hypothesis states that housing market discrimination, resulting residential segregation, in addition to the decentralization of the middle class white population and low-skilled employment, particularly in manufacturing, have all combined to significantly affect African American employment outcomes, as it has created a shortage of employment opportunities relative to the number of African Americans competing for these employment opportunities in and around central city neighborhoods where African Americans are segregated (Kain, 1968, 1992; Ihlanfeldt, 1999).

In addition, the Skills Mismatch Hypothesis states that centers of North American metropolitan regions have transformed from centers of durable goods and manufacturing to centers of administration, technology and information exchange. This created jobs that require higher skill qualifications (Kasarda, 1985, 1989). This has thus led to a mismatch between the skills required for these jobs and the population in the areas surrounding these jobs, as African Americans are generally segregated into central city areas of the metropolitan region and they typically do not have the skill requirements to fill these jobs (Kasarda, 1985, 1989; Bauder and Perle, 1999).

This study tests these hypotheses by constructing surfaces of population and employment opportunities across the study area with the aid of ancillary land
use data in order to realistically represent the true underlying density of population and employment. Data from this study comes from several sources including the Census Bureau, the Mid Ohio Regional Planning Commission, the National Land Use Cover Data Set, the Central Ohio Transit Authority and the Equal Opportunity Commission. Jobs/Persons ratios are constructed from these surfaces at each residential location and later linked to individuals in the census PUMS data set. These jobs/persons ratios reflected the gender, skill level and commuting behavior of the individuals under study.

Several analyses were conducted, including visual analysis of the population and employment opportunity surfaces, differences between actual and expected African American worker locations, accessibility advantage of automobile commute over public transportation and finally a model incorporating logistic regression to test how the employment structure around an individual’s residential location is related to the probability of an individual being employed.

Results from these analyses suggested that residential segregation and employment discrimination appear to be prevalent across the region. In addition, I show how automobile commutes enhances mobility by allowing access to several orders greater numbers of employment opportunities than that same commute by public transit.

Finally, the logistic regression analyses suggested that the life situations that arise within the household may be extremely important determinants on how
the employment structure around an individual’s residential location affects their probability of being employed. Thus, I conclude that one cannot examine the Spatial Mismatch Hypothesis or the Skills Mismatch Hypothesis without taking into consideration the life situations of the individuals being analyzed, especially those situations that arise from within the home. Ignoring these factors may produce misleading or biased conclusions.
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1. Introduction

The Spatial Mismatch Hypothesis states that housing market discrimination and resulting residential segregation, in addition to the decentralization of the middle class white population and low-skilled employment, particularly in manufacturing, have all combined to create substantial barriers for African Americans which significantly affect their positions in the labor market (Kain, 1968, 1992; Ihlanfeldt, 1999).

Thus, these resulting events have led to a shortage of employment opportunities in relation to the number of African Americans competing for these employment opportunities in and around segregated African American central-city neighborhoods (Ihlanfeldt, 1999).

Another hypothesis that is related to the Spatial Mismatch Hypothesis is the Skills Mismatch Hypothesis. Kasarda (1985) states that North American metropolitan region centers have transformed from centers of manufacturing and durable goods into centers of administration, technology and information exchange.

As African Americans are continually segregated into central city neighborhoods, they tend to have insufficient educational qualifications to fulfill these employment opportunities. Thus, in and around African American neighborhoods, there tends to be a mismatch in the skills of the employment
opportunities available and the skills of the labor force near these employment opportunities (Kasarda, 1985, 1989; Bauder and Perle, 1999).

In addition to African Americans, other population subgroups are affected by the economic structure in and around their residential locales. Many researchers have suggested that household and childcare responsibilities are disproportionately borne upon the female partner in a married household. This creates significant time constraints for married women, especially married women with children, to enter the paid labor force (Fox, 1983; Pickup, 1984; Saltzburg and Waite, 1984; Tivers, 1988; Hanson, 1992; Preston, McLafferty and Hamilton, 1993; Cooke, 1996).

This tends to limit a woman's set of employment opportunities to geographically compact areas surrounding their residential locations (Fox, 1983; Pickup, 1984; Tivers, 1988; Hanson and Pratt, 1991; Cooke, 1996). Furthermore, women tend to search for employment from a fixed residential location, as household choices are typically made with the best interests of the male partner in mind (Madden, 1981; Singhell and Lillydahl, 1986; Gilbert, 1988; Preston and McLafferty, 1993; Hanson and Pratt, 1995). Furthermore, when households only have one vehicle, access to the vehicle is almost always given to the male for use in the work commute, forcing women to be more dependent upon the public transportation system if they choose to enter the paid labor force (Pickup, 1984; Hanson and Pratt, 1995). Thus, females should be sensitive to the number of employment opportunities around their residential locations.
In this study, these three explanations will be examined in order to assess whether one can exclude or not exclude them as significant factors affecting the employment outcomes of white females, African American males and African American women.

Many studies have tested these hypotheses in terms of examining commuting time differences between different population subgroups, particularly Whites and African Americans. The use of commuting time is an oversimplified measure that does not take into account the daily life situations of the individuals under study and may be a misleading measure of accessibility (Kwan, 1999).

This study examines the number of employment opportunities available to an individual of a particular skill-level and gender, and this number was examined in relation to the number of persons of that skill-level and gender competing for these employment opportunities. Analysis is conducted within a 10 minute commuting area around an individual’s residential location. The commuting areas are constructed according to the transportation means available to the individuals under study, as a 10 minute commuting area was constructed around an individual’s residential location in accordance to the distance that one can traverse across geographical space through the use of a private automobile or the public transportation system.

Therefore, this analysis takes into account differences in public transportation and automobile speeds across the study area and assumes that the areas that an individual searches for employment are significantly different in accordance to their means of transportation.
The Columbus, Ohio MSA is the area of study in this analysis, which is centered upon Franklin county and includes portions of Delaware, Fairfield, Licking, Madison, Pickaway and Union counties.

Jobs/Persons ratios around an individual’s residential location are calculated. In order to assess these jobs/persons ratios across the study area, surfaces are created that allow redistribution of labor force population and employment opportunities properly across the study area and most importantly, within the zonal boundaries the data are constructed from. Data used to construct these surfaces come from two sources: the labor force population is taken from the 2000 U.S. census SF3 files and the employment opportunity count is obtained from the Mid Ohio Regional Planning Commission (MORPC). The labor force count within each census Block Group and the employment opportunity count within each Traffic Analysis Zone by SIC industry code are the basis for the counts that will be redistributed by these surface creation methods. In order to more accurately reflect the employment opportunities available for certain population subgroups, these counts are broken down by race, gender and skill levels with help from the EEOC-1 and EEOC-4 reports for the employment opportunity data.

Surfaces were then created with the help of ancillary data to redistribute labor force population and employment opportunities across the study area using four different surface creation methods: Dasymetric Mapping, Inverse Distance Weighting (with coefficient \( n=1 \) and \( n=2 \)) and a method structured after David Martin’s (1995) surface creation method, that uses properties of adaptive kernel
estimation and Waldo Tobler’s (1977) pycnophylactic interpolation. These surfaces represent a fairly accurate distribution of the true labor force population and employment opportunity densities available to individuals broken down by race, gender and skill across the study area.

Analyses of these labor force and employment opportunity surfaces will be conducted in several manners for this study. First, I will conduct a visual analysis of the labor force and employment opportunities in and by itself. Next, another visual analysis will be conducted in which I will compare the employment opportunity surfaces, which represent the density of employment counts available by race, gender and skill level, under the assumption of no racial discrimination in the labor market, to the actual number of employees by race and skill obtained from the 2000 Census Transportation Planning Package (CTTP) Part 2 files. I then examined areas where African Americans are underrepresented in the labor force.

These two visual analyses of the population and employment opportunity surfaces reveal that racial segregation is very pertinent within the Columbus MSA, and that there are areas within the region where African Americans are left out of the labor force. A surprising result from these analyses is that African Americans are generally employed in areas that follow the City of Columbus corporation limit. This suggests that racial discrimination in the labor market may be a barrier that some African Americans have to overcome in order to enter the labor market in other municipalities within the region, municipalities that tend to have higher income white residents.
In addition to these analyses, I also examined the number of employment opportunities that an individual can access within a 10 and 15 minute automobile commuting area, and compared this with the number of employment opportunities that can be reached within a 10, 15 and 30 minute public transportation commuting area. This analysis revealed that, on average, residents have access to about 15 to 21 times more low-skilled employment opportunities when computing by automobile, within a 15 minute and 10 minute commuting area, respectively. This advantage is still 2 to 1 when examining the number of employment opportunities within a 15 automobile commuting area relative to a 30 minute public transportation commuting area. Thus, one cannot overstate the significance of the automobile in opening up access to opportunities across geographic space.

Onward, in another analysis of these surfaces, I examined the Jobs/Persons ratios within residential locations where significant numbers of whites and African Americans reside. In white areas, there are, on average, significantly higher Jobs/Persons ratios in terms of low-skilled employment opportunities. However, this average Jobs/Persons ratio is significantly greater than 1.0 near African American neighborhoods for low-skilled employment. In addition, the average Jobs/Persons ratios are significantly less than 1.0 for high skilled employment in these same areas. Thus, I question some of the underlying hypotheses of the Spatial Mismatch and Skills Mismatch Hypotheses.

Finally, the final analysis of these surfaces examined how the Jobs/Persons ratio affects the probability that an individual will be employed.
Using data from the 2000 PUMS 5% files, I extracted a sample of 9,124 white males, 8,477 white females, 1,491 African American males and 1,665 African American females.

Since residential location in the PUMS data are only given by PUMA area, areas that are significantly large and include aggregations of the 262 Census Tracts within Franklin County to create 9 PUMS areas, I needed to find a way to better represent the actual residential location for this sample. In order to do this, I used ancillary data from the Franklin County Auditor to link housing attributes for these individuals to a set of possible residential locations within the PUMA area. I then took 100 stratified random samples of these sets of residential locations to try to mimic the true underlying residential locations for the individuals in the PUMS samples.

The purpose for doing this, is that, this allows us to confidently exclude the Jobs/Persons ratios for an individual as being a significant factor in the probability that an individual is employed, as it is very likely that at least one of these samples is representative of the true underlying population distribution for the PUMS data set.

In order to examine the effect of the Jobs/Persons ratio on the probability of an individual’s employment, I used logistic regression to examine the effect of this ratio on employment probability after individual characteristics are controlled for.

For African American males, there are no samples in which the Jobs/Persons ratio positively affects the probability in a significant manner, that an
individual will be employed. Thus, one must question the Spatial Mismatch/Skills Mismatch Hypotheses in terms of the economic structure near African American males’ residential locations affecting their unemployment rates, if those hypotheses are measured in terms of Jobs/Persons ratios to represent the employment structure.

Finally, for other population subgroups, one cannot rule out the effect of Jobs/Persons on their probability of being employed, especially for women with children. Thus, it appears that the Spatial Mismatch/Skills Mismatch Hypotheses may only apply to African American females, in terms the employment structure affecting their unemployment rate, especially those women with children. This is likely due to the thesis on unequal sharing of household and childcare responsibilities in the household, as these create time constraints that cause these women to become very sensitive to the employment structure in and around their residential locations. Although this has a significant effect on the probability of women being employed, these effects in terms of probability are quite modest, as moving from a residential location where they would have a disadvantage of 1:2 to a residential location where they would have an advantage of 2:1 in terms of the Jobs/Persons ratio, the probability of being employed changes by less than 1% in most all the cases.
2. Literature Review

2.1 The Birth of the Spatial Mismatch Hypothesis

In a 1968 paper entitled *Housing Segregation, Negro Employment and Metropolitan Decentralization*, John Kain gave birth to a controversial issue which has now been tagged, “The Spatial Mismatch Hypothesis”. The Spatial Mismatch Hypothesis contends that racial segregation, as a result of housing market discrimination, in addition to suburbanization of white persons and low-skilled employment, particularly in manufacturing, wholesaling and retailing has created a significant alteration to the geography of African American employment opportunities and accessibility on the urban landscape, which has had a negative impact on the employment rates and wages of African Americans. Thus it is argued that this is part of the reason for the high unemployment rates of inner-city African Americans (Kain, 1968).

This alteration, as caused by housing market discrimination, in addition to the suburbanization of low-skilled employment imposes significant distance and cost barriers on inner-city African Americans in their search for employment and is exacerbated by poor public transportation links between inner-city neighborhoods and centers of suburban economic growth. This alteration has also
significantly deteriorated job and social networks and supports discrimination on the part of suburban employers, in response to inner-city residents (Kain, 1968).

Therefore, a surplus of workers in relation to the number of employment opportunities exists in inner-city neighborhoods, while a surplus of employment opportunities in relation to the number of workers exists in the suburbs. This causes wage rates to increase as one would move across the urban landscape from inner-city neighborhoods to the suburbs, further deteriorating inner-city residents economic conditions, particularly African Americans’ position in the labor market (Ihlanfeldt, 1999).

There is little doubt that housing market discrimination still exists in metropolitan areas, despite the 1968 Civil Rights Act, which was implemented, in part, to end this racial discrimination (Yinger, 1986). Many researchers have demonstrated that racial discrimination is still persistent in the housing markets, most notably, John Yinger, who demonstrated that through fair housing audits conducted in Boston, Massachusetts, in 1981, similar black and white individuals (audits), in terms of socioeconomic characteristics, were treated differently in respect to the number of housing units offered, invited to inspect and actually inspected. The resulting audits revealed that whites were offered, on average, 0.712 more units than similar black individuals (Yinger, 1986). The motivation behind the discrimination in this audit study seems to be the persistence of real estate agents to keep blacks out of white residential suburban neighborhoods, in fear of upsetting or losing potential white customers (Yinger, 1986). Thus, residential segregation continues to be a fixture on the urban landscape, due to
racial discrimination among residences of suburban white neighborhoods or from real estate agents playing out this racial discrimination in their daily work.

This housing market discrimination inhibits inner-city African American residents from moving to suburban neighborhoods and thus allows continuation of high levels of residential segregation in U.S. Metropolitan areas.

Some, however, have claimed that residential segregation is also a result of feelings of black preferences to live with their own race, not white discrimination. However, in recent studies (Krysan, 2002a, 2002b) using data from the Multicity Study of Urban Inequality (MCSUI), it has been shown that the majority of African Americans prefer integrated (mixture of whites and blacks) neighborhoods and view these neighborhoods as ideal. On the other hand, almost 2/5 of whites would prefer to move out of neighborhoods with black residences. As Krysan states, “Blacks are more willing to live with white neighbors than whites are willing to live with black neighbors” (Krysan, 2002b). This seems evidence that the road to racial integration is a long and arduous one.

Also, there is little doubt that employment opportunities have been suburbanizing during the late 20th century. In 1950, 70% of U.S. Metropolitan jobs were located in the central-city. However, by 1990, these central-city jobs have dwindled to only 45% of all U.S. Metropolitan Jobs (Miezkowski and Mills, 1993). The reasoning for employment relocation from the central-city to the suburbs seems to stem from the development of interstate highway systems, lack of central-city space, crime, economic advantages of suburban locations, racial tensions and residential suburbanization (Miezkowski and Mills, 1993).
The central-cities of U.S. Metropolitan areas have also been characterized by job growth in certain sectors of the labor market. These sectors tend to be occupations of high status, such as professional and managerial, that are knowledge-intensive and require higher education. As Kasarda (1985) states, “Thus, American cities have transformed from centers of production and distribution of material goods to centers of administration, information-exchange and higher-order service provision”. This creates a potential mismatch between the skills of inner-city residents and the jobs located nearby, which require more education and higher skills (Kasarda, 1985).

Furthermore, racial discrimination has also played a role in employment relocation to the suburbs, as some employers prefer to hire a predominately white workforce and seek suburban locations to avoid hiring blacks. In a study of 26 auto supply firms in Detroit, Michigan, interviews conducted with employers demonstrate that some employers blatantly admit that the relocation of their firm from the central-city to the suburbs was a result of discrimination against blacks\(^1\) (Kasinitz and Rosenberg, 1996; Turner, 1997).

Since there is direct evidence that housing market discrimination, residential segregation and employment decentralization exists in the urban landscape of U.S. cities, the Spatial Mismatch Hypothesis is an attempt to combine these phenomenon and relate them to the employment outcomes of African Americans (in addition to other minorities). The key of the Spatial

\(^{1}\) Turner (1997): When employers were asked about transportation services designed to improve inner-city African American residents’ job accessibility to their employment firm located in the suburbs, a substantial portion stated that they had no interest in hiring African Americans, and one employer stated “Why do you think we moved out here in the first place?”
Mismatch Hypothesis is to demonstrate how the decentralization of jobs along with residential segregation places African American inner-city residents at a heightened disadvantage in the metropolitan labor market.

The first attempt to do this was John Kain. Kain presented empirical results that the percent of African Americans employed in firms decreased with straight-line distance from the ghetto and that expected African American employment opportunities would be more abundant under the assumption of no housing segregation. Also, Kain points out that African American manufacturing employment decline was more significant between the period of 1950-1960, when the total manufacturing employment decline was greatest (Kain, 1968). Thus, Kain supports his three hypotheses, which are the basis of the Spatial Mismatch Hypothesis, by showing that African American inner-city residents rely heavily on employment around the ghetto neighborhoods and spatial barriers are difficult to overcome for these residents in seeking employment because of residential discrimination in the housing markets and subsequent residential segregation.

In light of Kain’s results and conclusions about his study, many others have attempted to examine the Spatial Mismatch Hypothesis and the resulting evidence from these studies indicate that researchers are far from universal agreement of its existence and magnitude.

In direct response to Kain’s results, Masters (1974) analyzed 65 large SMSA’s in the United States to examine the possible relationship between housing segregation and ratio of median incomes between white and minority

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2 Kain’s (1968) three hypothesis, which make up the Spatial Mismatch Hypothesis are stated as: “Racial segregation in housing markets: 1. affects the distribution of Negro employment. 2. reduces Negro job opportunities and 3. postwar suburbanization of employment has seriously aggravated the problem.
men (Masters, 1974). Masters demonstrates that three segregation indexes\(^3\) he implemented in his study do not significantly explain the variation in the ratio of incomes between whites and minorities. This result suggests that housing market discrimination and resulting residential segregation may not limit black's employment opportunities.\(^4\)

The next three subsections will analyze the different ways in which researchers have tested the Spatial Mismatch Hypothesis. The three most basic ways research has been carried out has been to examine commuting differences between whites and minorities, to examine job accessibility and proximity analysis of residential areas to job opportunities and finally, to examine differences between inner-city and suburban labor markets and the differences in the employers located in these inner-city and suburban locations. Several studies will be examined and the subsequent results of these studies will be discussed.

### 2.2 Commuting Time Analysis of the Spatial Mismatch Hypothesis

Many studies have analyzed the Spatial Mismatch Hypothesis by examination of commuting times (McLafferty and Preston, 1992, 1996; Taylor

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\(^3\) Masters (1974) uses the Tauber's Segregation Index, average ghetto size divided by the number of nonwhites living in nonwhite census tracts and absolute measures of ghetto size. The Tauber index of Segregation measures "the minimum percentage of non-whites who would have to change the block on which they live in order to produce a desegregated distribution" (Masters, 1974). The Tauber Index is similar to the Dissimilarity Index, which measures "the proportion of minority members that would have to change their area of residence to achieve an even distribution" (Massey and Denton, 1988). These measures have been highly criticized, because the measure's purpose breaks down and masks actual segregation patterns, especially if a group dominates a geographical area. No matter how arranged these areas are, the dissimilarity index would equal one, thus overrepresenting actual segregation (Wong, 1993, 1999). Thus, these indexes may not be appropriate in geographical studies (Wong, 1999).

\(^4\) Masters (1974) states "Thus, these results.......suggest that housing segregation does not seriously limit the relative employment opportunities of non-whites, either in total or with regards to better jobs". He further states "First, blacks may be able to obtain suburban jobs without undue difficulty, despite housing segregation, when such jobs are open to blacks. Second, labor markets may be tighter in the central cities than in the suburbs, despite the rapid growth of suburban employment".
and Ong, 1995; Wyly, 1996; Holloway, 1996; Gabriel and Rosenthal, 1996; Johnston-Anumonwo, 1997). These studies tend to indicate evidence that inner-city minority residents have longer commuting times to work than white individuals with similar socioeconomic characteristics, even after controlling for mode of transportation. These researchers tend to voice that these longer commutes suggest a Spatial Mismatch exists between inner-city minorities and employment opportunities that match their skill levels. Hence, inner-city minorities must commute outside their local neighborhood areas to obtain employment, increasing their commuting times, often with no economic incentive for the longer commute.

McLafferty and Preston (1996) analyze the Spatial Mismatch Hypothesis between 1980 and 1990 in the New York Metropolitan Area by examining commuting time differences between minorities and whites. Their measure of Spatial Mismatch is the difference between actual commuting time observed and the expected commuting time in relation to a reference group.⁵

Their results indicate that minority residents have significantly longer commuting times than expected⁶ and that these longer commutes indicated a Spatial Mismatch present for inner-city minorities in the New York Metropolitan Area.

Taylor and Ong (1995) also examine the Spatial Mismatch Hypothesis through commuting time/distance measures, but their results do not conform to

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⁵ Expected commuting time is the commuting time for a minority individual if they were able to make the same commuting decisions as an equivalent white person with the same socioeconomic characteristics.

⁶ African American commuting times in their study were 5 to 6 minutes longer than expected in 1980, and dropped insignificantly by 1990.
most commuting time studies. By using data from the American Household Survey for 10 Metropolitan Areas in the U.S. for the time periods of 1977-78 and 1985, they argue that a Spatial Mismatch would be evident if minorities, especially low-skilled, inner-city minorities’ commuting times/distances increased over time, especially relative to low-skilled white workers.

However, Taylor and Ong’s results suggest a different tale. Their results reveal that among low-skilled workers, minorities had shorter commuting distances, even low-skilled minorities residing in minority (inner-city) neighborhoods. Also, average commuting distances increased more rapidly among residents in predominately white and integrated neighborhoods between 1977-1985. However, the minorities in the study had longer commuting times, suggesting their greater reliance on the slower public transportation.7 Taylor and Ong conclude that the mismatch present was not in accordance to spatial barriers, per say, but rather an “automobile mismatch” was evident.

Elvin Wyly (1996) also examines the Spatial Mismatch Hypothesis in terms of commuting times, but his focus is on the link between commuting times and industry. Wyly uses 1980 and 1990 PUMS data for the Minneapolis-St. Paul Metropolitan Region to analyze this link. Results from his analyses reveals that white males employed in “typical” (white-male dominated industries) occupations

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7 Taylor and Ong (1995): “While the average commute speed for all three population groups increased between 1977-78 and 1985, black commuters averaged nearly 6 miles per hour less than whites in 1977-78 and nearly 7 miles per hour less in 1985”.

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receive wage benefits for making longer commuting trips, but this is not evident among African American males employed in “typical” occupations.  

Wyly states that African American males employed in “typical” occupations actually have shorter commuting times than their white male counterparts employed in their “typical” occupations, thus providing no direct spatial mismatch among individual’s residences and employment opportunities typical of their race/gender. Wyly further states that the mismatch may be caused by the economic shifting of employment sectors within the Minneapolis-St. Paul Metropolitan Region, in that, manufacturing jobs with high benefits have decentralized or disappeared within the inner-city, thus making way for new service sector jobs that replaced them. These service sector jobs lead to significantly decreased wages and benefits and contribute to the wage, benefit and wage disparities within Minneapolis-St. Paul.

Holloway (1996) analyzed the Spatial Mismatch Hypothesis in terms of young white and African American males residing in 50 large metropolitan areas in the U.S. by using 1980 and 1990 Public Use Microdata Samples (PUMS) data and constructing a job-accessibility measure of commuting time for individuals using automobiles. Holloway’s results provoke him to state that between 1980

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8 Wyly’s results also indicate that the increased benefits with increased commuting distances are also not present among African American women and white women.

9 Wyly (1996): The typical employment industry for a racial/gender group was calculated by the “employment quotient”:  

\[ EQ_{ij} = \frac{E_{ij}}{E_j} \]

\( E_{ij} \): the percent of group i employed in job j.

\( E_j \): share of total regional employment in job j.

High employment quotients well over one depict typical jobs held by group i.
and 1990, young black males’ commuting times have decreased as young white males’ commuting times have increased, thus inferring that young black males’ job accessibility has increased.

However, Holloway’s regression analyses demonstrates that the effect of job accessibility on the probability of obtaining employment has decreased, which leads him to further state that this may infer that spatial accessibility may be less of a factor in obtaining employment in 1990 than it was in 1980.

The use of commuting time and distance in examining the Spatial Mismatch Hypothesis, however, introduces several biases into the results. One bias, is that a particular group of persons are left out of the sample; the unemployed. The commuting times are only constructed for employed persons and the effects on the unemployed persons cannot be generalized from them (Preston and McLafferty, 1999). Unemployed persons are a significant part of the Spatial Mismatch Hypothesis, as Kain pointed out, that housing market discrimination and subsequent residential segregation, in addition to decentralization of employment, has affected the job opportunities of inner-city African Americans, which subsequently also refers to unemployed persons. Furthermore, Kwan (1999), in her study of space-time measures of accessibility in the daily commutes of a subsample of men and women in Columbus, Ohio, demonstrates that a person’s commuting time does not have any relationship to a person’s access to urban opportunities. She further points out that using commuting measures as measures of accessibility does not take into consideration
the understandings and experiences of the life situations of the individuals analyzed.

2.3 Job Accessibility/Proximity Analysis of the Spatial Mismatch Hypothesis

Researchers have also examined the Spatial Mismatch Hypothesis in terms of accessibility/proximity of an individual’s residence to employment opportunities (Immergluck, 1998; Ihlanfeldt, 1993; Ihlanfeldt and Sjoquist, 1990a, 1990b; Ellwood, 1986; Muow, 2000; Cohn and Fossett, 1996). These studies also have mixed results, as some researchers tend to show that job proximity matters in explaining the racial differences in employment outcomes, while others claim that proximity does not matter and that the problem is actually racial in nature.

Ihlanfeldt and Sjoquist (1990b) examine the effects of job proximity on white and black youth’s employment outcomes in Philadelphia using 1980 PUMS data in a logistic regression analysis of the probability of obtaining employment. Their measure of job accessibility was the average travel times by automobile for all low-skilled workers residing in a youth’s neighborhood.

Their results indicate that vastly increasing mean commuting times causes a significant decrease in the probability of obtaining employment for both white and black youths. To further state their claim, the authors implemented a partial decomposition analysis, which examines black youth’s probability changes if they had the same accessibility as similar white youths. These results indicate that 29-

\[^{10}\text{Ihlanfeldt and Sjoquist (1990b): Increase in one standard deviation in commuting time reduces white youth’s job probability by 3.8 to 5.1\% and black youth’s job probability by 4.0 to 6.3\%.}\]
54% of the racial gap in employment can be explained by the different job accessibilities of white and black youths, and that job proximity is an important barrier that elevates levels of black youth unemployment.

Immergluck (1998) uses 1990 Census Transportation and Planning Package data for the Chicago Metropolitan Area to examine the effects of job proximity on neighborhood residents by creating a “job catchment” area model around smaller neighborhood zones. Immergluck hypothesizes that a higher jobs-to-resident ratio within a job catchment area would yield a higher proportion of neighborhood residents to work in close proximity to their residence. He also predicts that the skill of these jobs and residents would be a significant determinant of the proportion of neighborhood residents working in close proximity.

The results of his analysis indicates that a large proportion of neighborhood residents work in close proximity to their homes in neighborhoods with high jobs-to-resident ratios, and the reverse is true for neighborhoods with a small ratio. Also, Immergluck finds that an increase in the proportion of young persons (age 25 or younger) residing in a neighborhood increases the proportion of persons working close to home, which strengthens Ihlanfeldt and Sjoquist's (1990b) argument that job proximity is significantly important for youth’s probability of obtaining employment. However, even though Immergluck found that the similarity in the skill of nearby jobs relative to nearby residents increased the proportion of a neighborhood’s residents working in close proximity to their homes, he stated that this increase was not statistically significant.
In an earlier study, Ellwood (1986) also examined the Spatial Mismatch Hypothesis through measures of job accessibility/proximity. He analyzed black and white youths residing in the Chicago Metropolitan Area by constructing three measures of job accessibility.\(^{11}\)

Ellwood’s results indicate that none of the job accessibility measures could significantly explain any of the racial differences in employment between black and white youths. He further analyzed a controlled model and the model results show that the racial differences in employment occur at the same rates within neighborhoods as they do across neighborhoods, implying that race is the significant, if not the sole, determinant of the racial differences in employment outcomes, not geographical space.

Ellwood further puts a dent into the Spatial Mismatch Hypothesis by examining two black ghettos in Chicago, the West-Side and South-Side ghettos, and found no significant differences in employment rates between the two neighborhoods, despite the West-Side ghetto having three times greater job accessibility. These results draw Ellwood to make his infamous statement, “Thus, the problem isn’t space, it’s race”.\(^{12}\)

In yet another study of the Spatial Mismatch Hypothesis using a job accessibility/proximity measure, Cohn and Fossett (1996) use data from the 1980 Urban Transportation Planning Package Files (UTPP) for Boston and Houston.

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\(^{11}\) The three measures of job accessibility that Ellwood created were: 1. the number of jobs within a 30 minute public transit distance from a neighborhood, 2. the ratio of jobs/workers and 3. the average journey-to-work travel time for workers in the neighborhood.

\(^{12}\) Ellwood’s study has come under heavy scrutiny. Data on the job markets for Chicago’s West-Side and South-Side appear to show that the labor markets of these two ghettos were not vastly different. (Kasarda 1989, Kain 1992). Also, the measures of job accessibility may have heavy biases or measurement error. (Kain, 1992)
They constructed a measure of job accessibility called “Job Potential”, which amounts to the number of jobs located in an area around an individual’s residential location that is within their potential job search radius, given their mode of transportation.

The authors’ preliminary analyses on the job search radii conclude that there are not significant differences in the search radii between black and white individuals, and that, these differences are not strikingly different, even by mode of transportation. They further demonstrate, that no matter what mode of transportation black individuals use, even in a worst case scenario, where all blacks are limited to walking, blacks have a greater access to low-skilled employment opportunities; access to 51,000 more low-skilled entry-level jobs. They further demonstrate that white youths are less accessible to employment opportunities, relative to black youths, when they do not have access to automobiles, thus increasing black youths’ advantage to job access. The authors conclude by stating that these results indicate that there is no Spatial Mismatch between jobs and residents for inner-city minorities in Boston or Houston and this leads them to accept Ellwood’s “It’s not space, but race” comment.

13 Cohn and Fossett (1996): The authors’ measure of job potential is: \( JP_{ik} = \sum J_j Z_{ijk} \), where \( JP_{ik} \) is the job potential for tract i within commuting radius k, \( J_j \) is the number of jobs located in tract j and \( Z_{ijk} \) is coded 1 if tract j is within commuting distance k of tract i and 0 otherwise.

14 This study, however, may have some clear overheads and limitations, such as double counting of employment opportunities when two individuals living in two different neighborhoods have overlapping job opportunities in their job search radii, these jobs are counted for both individuals, thus overstating the true number of job opportunities present across the urban landscape. Furthermore, the Jobs/Worker ratio must be taken into account, because the Spatial Mismatch Hypothesis predicts a surplus of workers to jobs in minority inner-city neighborhoods, which may be true, even though there are a higher absolute number of jobs in the area relative to suburban areas.
2.4 Labor Market Analysis of the Spatial Mismatch Hypothesis: Contrasting Suburban and Inner-City Labor Markets as well as Black and White Employers

The Spatial Mismatch Hypothesis can also be analyzed by contrasting inner-city and suburban labor markets, in addition to black and white-owned employer firms (Ihlanfeldt and Young, 1996; Holzer, 1998; Ihlanfeldt, 1999; Holzer and Reaser, 2000; Raphael, Stoll and Holzer, 2000).

Ihlanfeldt (1999) looks at the Spatial Mismatch Hypothesis by analyzing whether the labor market is “tighter” outside central-city minority areas. Market tightness would be present if the rate of job openings were higher, in addition to starting wages being higher in a specified area relative to another area within the Metropolitan Region (Ihlanfeldt, 1999). Ihlanfeldt states that lower starting wages and lower rates of job openings within predominately minority areas would indicate a Spatial Mismatch was present. This would be due to a surplus of workers with respect to employment opportunities, yielding lower rates of job openings, allowing employers to respond by lowering wages.

Ihlanfeldt uses data from the Multi-City Study of Urban Inequality (MCSUI) for Atlanta, Boston, Detroit and Los Angeles to analyze the Spatial Mismatch Hypothesis in terms of labor market tightness. His results indicate that in 3 of the 4 Metropolitan Areas (except Detroit), the rates of job openings for low-skilled employment opportunities are significantly higher in predominately white areas than in minority areas, suggesting that a Spatial Mismatch may be present.
Furthermore, Ihlanfeldt demonstrates that starting wages are lower in predominately minority areas in Atlanta and Detroit than in predominately white areas. These results indicate that the labor market is tighter outside predominately minority areas in these Metropolitan Areas, especially Atlanta, where both wages and job opening rates are higher in predominately white areas, thus providing evidence for a Spatial Mismatch.

In another study, Ihlanfeldt and Young (1996) constructed interviews with approximately 100 managers of fast food restaurants in the Atlanta Metropolitan Area. Their interviews suggest that employers have substantially more difficulty in filling positions in suburban locations than in central-city locations, prompting the authors to suggest that this may imply a possible Spatial Mismatch, because there is a surplus of workers relative to the number of employment opportunities in the central-city.

Furthermore, the authors show that the starting wages are approximately 25% higher in distant suburban locations than in central-city locations, in addition to a decrease in the proportion of black workers as one travels from a central-city location to a suburban location. Finally, discriminatory hiring practices are suggested in the interviews, as the proportion of black employees increases when a black manager is present and decreases as the proportion of white customers increases.

Raphael, Stoll and Holzer (2000) also contrast the low-skilled labor markets of suburban and central-city locations, as well as black and white
employers, by using data from the Multi-City Study of Urban Inequality (MCSUI) for Atlanta, Boston, Detroit and Los Angeles.\textsuperscript{15}

The authors' results suggest that blacks are hired in lower proportions relative to the number of applications received in the suburbs than in central-cities, however, suburban black employer firms (black owner firms) have a higher ratio of black hiring to applications received than central-city white employer firms, suggesting racial discrimination present in employer hiring practices. However, suburban firms with a black employer are significantly less likely to hire blacks than central-city firms with a black employer, suggesting that space is also important. The authors' results also strengthen Ihlanfeldt and Young's (1996) evidence of a decrease in the likelihood for a black to be employed when the proportion of white customers increases. Thus, the authors suggest that race and space are both important determinants of black employment outcomes in U.S. Metropolitan Areas.

Additional studies that analyze suburban and central-city locations also display evidence that firms who hire a smaller workforce are less likely to hire African Americans than firms who hire a larger workforce (Turner, 1997; Raphael, Stoll and Holzer, 2000). Raphael, Stoll and Holzer (2000) suggests that smaller firms are less likely to adhere to Affirmative Action policies and to be under strict guidelines about hiring discrimination. In addition, they are less likely to be located within central-city locations. Moreover, Holzer points out that smaller firms are generally not concentrated in manufacturing or public sector

\textsuperscript{15} Raphael, Stoll and Holzer (2000) examine labor market differences by analyzing the proportion of a firm's employment force that is black, the probability that the last worker hired was black and the proportion of job applicants who are black by using difference-in-difference statistical techniques.
employment, sectors of the labor market that are generally held by African Americans.

2.5 Policy Implications and Their Effects on the Spatial Mismatch Hypothesis

Many researchers have suggested regional policies that could help alleviate the Spatial Mismatch between African Americans and employment opportunities and subsequently reduce the racial differences in employment outcomes between blacks and whites. One of the most suggested policies in literature is the improvement of public transportation links between the central city and the suburbs. This is due to the fact that many sources of data suggest that blacks rely much more heavily upon public transportation than whites. Another similar policy concerns improving the access to automobiles for minorities, because this would help improve their job accessibility by opening many employment opportunities not accessible by public transportation. These two similarly related policies focus on the improved job accessibility for inner-city minorities by allowing them to become more fluidly mobile in their movement across geographic space.

In one study, the direct effect of improved transportation links between minority residential locations and suburban locations with high employment growth was examined (Holzer, Quigley and Raphael, 2003). The authors analyzed the effects of improved accessibility via a newly constructed public transportation link from a minority residential location to a suburban area of high
employment growth in the San Francisco-Oakland Metropolitan Area. They examine the changes of employers in hiring minorities through conducted interviews with employers, in close proximity to the new transportation stops, and various distances from the stops, before and after the new public transportation link was opened for service.

The authors' study indicates that the new transportation link increased the proportion of Latino hiring rates at employment locations in close proximity to the new transit stops, but this effect was not present for African Americans, who actually increased employment proportions some distance from the transportation stop. The authors suggest that Latinos reside in closer proximity to the transportation stations that directly link their residences to these newly accessible employment opportunities, thus taking advantage of greater job accessibility to these jobs relative to blacks.\(^{16}\)

Also, they suggested that a significant proportion of these employers hired by word-of-mouth and employee referrals, and suggest that there is a possibility that Latinos may have better social networks, which help to better link them to these employment opportunities, relative to blacks.

Raphael and Stoll (2001) shed insight into the second mobility policy: improving minority access to automobiles. The authors demonstrate through data from the Survey of Income and Program Participation (SIPP) and PUMS, that increasing the accessibility of minorities to automobiles could significantly reduce the racial differences in employment outcomes and unemployment rates between

\(^{16}\) Holzer, Quigley and Raphael (2003) The authors denote that the Latino population exceeded the black population by more than 17,000 within a distance of 30 minutes from the station that provided a direct public transportation link to suburban areas of high employment growth.
blacks and whites. Raphael and Stoll show significant evidence that the employment rates show no significant racial differences when examining persons who have access to automobiles. These racial differences in employment outcomes, the authors suggest, are due to the large proportion of minority residents who do not have access to automobiles, which can substantially increase the unemployment rates of minorities. Employment rates show the highest differences between blacks who have access to automobiles and blacks who do not have access to automobiles, suggesting that if blacks had similar access to automobiles as whites, this would reduce 45% of the racial differences in unemployment rates.

In addition to the transportation policies that aim at reducing the Spatial Mismatch between inner-city minorities and employment opportunities, other researchers have suggested residential mobility policies that improve the job accessibility of inner-city minority residents by moving them to suburban neighborhoods to improve their proximity to rich suburban job growth (McLafferty and Preston, 1996). Kain (1992) also suggests that residential mobility policies would improve job accessibility of inner-city minority residents, if and only if these policies reduce residential segregation in the process.\(^{17}\)

Stoll (1999) addresses this particular policy in a study of the Washington D.C. Metropolitan Area.\(^ {18}\) Stoll analyzes the employment outcomes of black and white youths in two suburban counties (one highly segregated and one less

\(^{17}\) Kain (1992) suggests that even in the suburbs, blacks are often segregated from whites and often reside in older sections of the suburbs, still poorly removed from areas of high employment growth.

\(^{18}\) Stoll (1999) states that Washington D.C. has experienced a significant amount of black suburbanization since 1970 and yields the only black majority suburban county in the United States.
segregated) in contrast to inner-city youth outcomes by using 1990 PUMS data. Stoll’s model’s results indicate that all youths do substantially improve their employment outcomes by having a suburban residential location, but white youths benefit more than black youths, which may depict employers generating higher levels of racial discrimination in the suburbs. Also, through decomposition analyses of the model results, Stoll suggests that black employment rates would increase significantly if they were not subject to racial discrimination and had similar job accessibilities as whites, depicting that race and space are significant determinants of the racial differences between black and white youths.¹⁹

Finally, many other researchers have suggested policies for improving inner-city black employment outcomes that range from encouraging employment growth near economically-distressed areas of Metropolitan Regions to stricter enforcement of racial anti-discrimination laws. For an extensive review of policy prescriptions to help alleviate the Spatial Mismatch, in conjunction with significantly improving the employment outcomes of African Americans, see Kain (1992), who outlines a detailed prescription plan, which covers the broad areas of the housing market, the labor market and the education system.

2.6 Competing/Similar Hypotheses: The Skills-Mismatch Hypothesis, Social Network Segregation and Welfare Benefits

In addition to the Spatial Mismatch Hypothesis, there are additional hypotheses that have been introduced in literature, many which are similar to the

¹⁹ Stoll’s model’s results state that suburban whites are 17 and 22% (depending upon suburban county under analysis) more likely to be employed than inner-city whites, while black suburban residents were only 8 and 10% more likely to be employed than inner-city blacks.
Spatial Mismatch Hypothesis in many ways in explaining the racial differences in employment outcomes between whites and African Americans. Two such hypotheses are outlined by Kasarda and Ting (1996): the Skills Mismatch Hypothesis and the Welfare Benefits Hypothesis. The Skills Mismatch Hypothesis is very similar, and in many respects, intertwined with the Spatial Mismatch Hypothesis, in that it deals with the changing economic structure of cities in the United States, especially the decentralization of blue-collar employment opportunities.

The Skills Mismatch Hypothesis contends that central-cities have economically restructured over the past several decades by the decentralization and disappearance of blue-collar employment, and are being replaced by growing white-collar employment opportunities, which require increased skills and education. This, thus, creates a Skills Mismatch between the residences of central-city neighborhoods, whose majority do not have the skills/education required to fill these jobs and the employment opportunities near these central-city neighborhoods (Kasarda, 1985; Kasarda and Ting, 1996; Bauder and Perle, 1999).

On the other hand, the Welfare Benefits Hypothesis states that increased welfare benefits to inner-city poor residents does not encourage employment because the benefits received from these welfare programs significantly outweigh the benefits gained by obtaining employment in low-skilled jobs (Kasarda and Ting, 1996).
Kasarda and Ting (1996) examine these two hypotheses in a study of 67 large U.S. Metropolitan Areas by using 1980 and 1990 PUMS data through a maximum likelihood model technique. Their results suggest that African American women are most severely disadvantaged by the changing economic structure of U.S. cities, and that welfare benefits contribute to unemployment rates more substantially among African Americans. The authors state that the interconnection of Spatial and Skills Mismatch, along with welfare benefits substantially affect unemployment rates in U.S. cities.

Bauder and Perle (1999) also examine the Skills Mismatch Hypothesis, by analyzing white and black youths in the Detroit Metropolitan Area by using 1990 PUMS data. They separate employment opportunities into three sectors: independent primary, subordinate primary and secondary\(^{20}\) and then examine employment probabilities through logistic regression techniques with respect to race and job accessibility.\(^{21}\)

The authors demonstrate that inner-city youths, especially blacks, have high access to high-skilled employment, but do not have the skills required to obtain these positions, implying the existence of a Skills Mismatch present. Bauder and Perle (1999) also show that job accessibility does not affect the probability of obtaining employment in high-skilled employment, but becomes significantly important when examining low-skill employment. They conclude by

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\(^{20}\) Bauder and Perle (1999): Independent Primary Sector is white-collar employment requiring high skills and education and is characterized by high earnings, benefits and job security. Subordinate Primary Sector is white-collar employment and high-wage blue-collar employment with moderate job security and high physical demand. Secondary Sector is low-skilled employment characterized by low wages, job security and benefits.

\(^{21}\) The authors use mean commuting time as a measure of job accessibility.
stating that Skills Mismatch and Spatial Mismatch both play a significant role on the unemployment rates of inner-city youths.

Another hypothesis that tries to explain the racial differences in employment outcomes between blacks and whites is the Social Network Segregation Hypothesis.\(^{22}\) This hypothesis draws upon the fact that many employers use informal job recruitment methods to hire employees. It is thought that these informal employer recruitment methods tend to reproduce high levels of labor segregation, because the social networks among blacks and whites tend to follow racial lines, and that these networks, not geography per say, are responsible for the poor employment outcomes of blacks, because many blacks are segregated from key social networks in which employment information and contacts flow\(^{23}\) (Muow, 2002).

One of the few empirical studies of this hypothesis is Muow (2002), who uses data from the Multi-City Study of Urban Inequality (MCSUI) for Atlanta, Boston and Los Angeles to analyze the effects of social network segregation, employer hiring practices and Spatial Mismatch in employment segregation and employment outcomes of blacks and whites. Muow’s key dependent variable is the probability that the last employee hired by a firm was black.

Muow’s data reveals that nearly 50% of blacks and whites were assisted by friends and relatives in obtaining their current employment. These results of

\(^{22}\) This explanation for the racial differences in employment outcomes between blacks and whites does not have a proper terminology in literature, but will subsequently be referred to here as the Social Network Segregation Hypothesis.

\(^{23}\) Although the key of this hypothesis is social networks, these social networks can be one of the many consequences of residential segregation and spatial isolation of blacks from whites. Thus, these social networks, do, in fact, have a geographical link.
his analyses suggest that the overall black employment rate is not significantly affected by the use of informal hiring practices by employers. However, Muow suggests that blacks are significantly less likely to obtain employment in predominately white firms when informal hiring methods were used, but more likely in black firms. His examination of the Spatial Mismatch Hypothesis uses a measure of residential segregation, along with subsequently taking into account, the location of the firm. This analysis reveals that both the Spatial Mismatch and Social Network Segregation both play a significant role in the employment outcomes of blacks.

In another study, Hanson and Pratt (1992) reveal the importance of social networks and employment hiring methods in the employment outcomes of men, women and minorities, through their interviews with employers and employees in the Worcester, Massachusetts area. The authors show that employers, especially employers who hire a large proportion of low-skilled employees, sometimes choose a location in the area in order to gain access to a particular labor force (racial/gender) in which they find desirable, and this labor force is maintained through their informal hiring methods, especially hiring by word-of-mouth. These employers feel that these informal methods strengthen stability and productivity in the workplace. The authors’ interviews also reveal that many employees are aware of the importance of social networks in obtaining employment.

In a similar study, Kasinitz and Rosenberg (1996) examine the labor market of a Brooklyn neighborhood that has high unemployment rates, despite
having a significant amount of blue-collar employment opportunities located in the local vicinity. The authors conduct interviews with employers in the local area which reveal that social isolation of the neighborhood residents have stigmatized and excluded them from important social networks that lead them to obtaining employment, although racial discrimination towards individuals and neighborhoods was also a substantial part of the employers’ hiring practices.²⁴

Finally, Holzer (1987) shows that employers’ informal methods of hiring are significantly important in accounting for the racial differences in the probability of obtaining employment between black and white youths, as white youths have a greater probability of obtaining employment through informal methods.²⁵ Finally, Holzer points out that the most frequently used methods for searching for employment were informal methods.

Wilson (1987) seems to sum up the social network perspective in a nutshell: “Even in those situations where job vacancies become available in an industry near or within an inner-city neighborhood, workers who live outside the inner-cities may find out about these vacancies sooner than those who live near the industry, because the latter are not tied into the job network (Wilson, 1987; Kasinitz and Rosenberg, 1996).

²⁴ Although the interviewed employers did not openly discuss racism in hiring practices, they disguised the racism in terms of discrimination against local neighborhoods, stating the they felt that local blacks had criminal intents and one employer felt that, “A black would come back and do their real job at night” (Kasinitz and Rosenberg, 1996).
²⁵ Holzer (1987) shows that two informal methods account for 87% of the total racial differences in employment between black and white youths. Although most of this difference is due to direct application, the difference is also significantly due to social contact with family and peers.
2.7 Women and Accessibility/Proximity to Employment Opportunities: The Importance of Space

In addition to African Americans, job accessibility and mobility are important to women, due to similar, plus other constraints. These constraints affect women's employment outcomes within the metropolitan region.

Women, especially married women and those with children are also immobile in their housing choices. This immobility, especially for white married women, is not one due to discrimination in the housing market, but rather due to the fact that most residential choices of households are made with respect to the male partner's employment and economic well-being (Madden, 1981; Singhell and Lillydahl, 1986; Gilbert, 1988; Preston and McLafferty, 1993; Hanson and Pratt, 1995). Also, when households only have access to one automobile, access to the vehicle is almost always given to the male for use in the work commute, forcing women to use public transportation or other means of travel to work (Pickup, 1984; Hanson and Pratt, 1995).

Therefore, married women must search for employment from a fixed residential location and they cannot change residential locations in response to the employment opportunities available across the urban landscape (Madden, 1981; Singhell and Lillydahl, 1986; Hanson and Pratt, 1992; Gilbert, 1997).

In addition to being residentially fixed in dual-career households and transportation-handicapped, marriage and children further inhibit women's mobility to employment opportunities and subsequently, their employment outcomes. Marriage creates household responsibilities that are often primarily the responsibility of women. Many researchers agree that the role of marriage puts
heavier constraints on women (White, 1977; Hanson, 1992; Preston, McLafferty and Hamilton, 1993; McLafferty and Preston, 1993; Blumen, 1994; Cooke, 1997; Gilbert, 1997), while few researchers do not support this idea (England, 1993).

Support for the marriage constraints on mobility come from the unequal sharing of domestic responsibilities that create more obligatory time for the women to fulfill and less time for commuting and paid employment, constraining their employment opportunities and even their labor force participation.

Moreover, children create even more obligatory responsibilities during the course of a woman's daily schedule and further constrains their employment participation and available set of employment opportunities (Fox, 1983; Pickup, 1984; Saltzburg and Waite, 1984; Tivers, 1988; Hanson, 1992; Preston, McLafferty and Hamilton, 1993; Cooke, 1997). Thus, these responsibilities, along with lack of transportation and residential mobility tend to limit women's set of employment opportunities to geographically compact area surrounding their residential location and usually forces them to search for part-time, instead of full-time employment, due to their lack of daily time in their schedules to support full-time work (Fox, 1983; Pickup, 1984; Tivers, 1988; Hanson and Pratt, 1992; Cooke, 1997). These part-time employment opportunities tend to be in female-dominated occupations, which are in the secondary employment sector, characterized by low wages, no career advancement and low benefits (Dyck, 1990; Blumen, 1994).

Women often take these jobs, because they are disproportionately located across the urban landscape, especially in suburban areas, where back offices are
usually located, which support a high amount of clerical jobs, which are available in the areas around their residencies (Nelson, 1986). These women choose these jobs due to their space-time constraints that prohibit a longer commute to areas of the metropolitan area where a more fruitful variety of employment opportunities are available, such as white-collar professional employment (Saegert, 1981; Fox, 1983; Pickup, 1984; Gilbert, 1988; Rutherford and Werkerle, 1988; Hanson and Pratt, 1992; Johnston-Anumonwo, McLafferty and Preston, 1994).

Working in many of these part-time jobs, which are female-dominated continues to produce occupational sex segregation in the economic urban environment, in which women are generally disproportionately represented in few occupation segments (Johnston-Anumonwo, McLafferty and Preston, 1994). In addition, a significant proportion of these married women reside in the suburban environment, where opportunities for social activity are limited (Saegert, 1981). This social isolation in the suburbs constrains their social networks and creates sex segregation in these networks, which are important avenues for job information and employment opportunities, which ultimately continues to align women into female-dominated employment (Gilbert, 1988).

Furthermore, some researchers even suggest that employers locate employment near suburban women’s residences to access their labor, for which
they find desirable\textsuperscript{26} (Nelson, 1986). Other studies suggest that employers do not locate near suburban women for their accessibility\textsuperscript{27} (England, 1993).

Thus, the research supports that married suburban women, especially those with children, face a sort of isolation, being immobile due to a fixed residential location, lack of transportation, household responsibilities, childcare and lack of broad social networks, that tend to force them into employment environments that are severely geographically-limited and characterized by secondary, low-status employment, which is primarily sex-segregated, part-time and can fit into their severe space-time constraints, while inhibiting their access to more prestigious, higher-paid, better overall employment opportunities that are disproportionately located in other portions of the Metropolitan Area.

On the other end of the spectrum, single, childless women are not hampered by the significant constraints of household responsibilities due to marriage and childcare. This allows them to be flexible in their housing choices and if they have the educational attainment, access to a wider variety of employment options, especially opportunities to higher-skilled, white-collar employment, which are typically found in the central areas of the Metropolitan Region (Kasarda, 1985).

Thus, they can freely choose residential locations that allow convenient access to these opportunities and the space-time freedom to be more mobile

\textsuperscript{26} In Nelson's (1986) study of the San Francisco-Oakland Metropolitan Area, she examined six potential locations for a firm that hired a disproportional number of women in a back-office environment. She studied the demographic characteristics around each potential site and concluded that the current location was the location that was best accessible to suburban women's characteristics desired by the employer.

\textsuperscript{27} England (1993) interviewed firms in the Columbus, Ohio, Metropolitan Area, and these interviews revealed that most employers' current location in these pink-collared employment firms were not chosen to access suburban women's characteristics.
across urban space to make these opportunities a feasible option. Therefore, single, childless women are significantly more likely than married women with children to reside in centrally located areas with access to downtown, where these variety of employment opportunities exist (Madden, 1981; Preston, McLafferty and Hamilton, 1993). Single, childless women residing in centrally-located areas can also enhance and broaden their social networks due to the greater social opportunities available in these regions, connecting them to a vast variety of employment opportunities through social contacts (Saegert, 1981).

On the other hand, African American women are additionally constrained due to residential segregation and housing market discrimination (Gilbert, 1988; McLafferty, Preston and Hamilton, 1993). In addition, these women are significantly more likely than white women to be single mothers who are the primary income providers for households (Brewer, 1988; McLafferty and Preston, 1991; England, 1993; Blumen, 1994). African American women also rely more heavily on public transportation than white women (Johnston-Anumonwo, McLafferty and Preston, 1994). Furthermore, these women often do not have the same educational attainment as white women (Johnston-Anumonwo, McLafferty and Preston, 1994).

Thus, due to the fact that these women are residentially segregated and less educated, they do not have access to suitable employment opportunities, which are disproportionately located across the urban landscape (Nelson, 1986), nor to central-city white-collar employment opportunities (Kasarda, 1985). This often results in the need for African American women to have to travel further
distances to access available employment that matches their skills, often for no economic return in wages for additional commuting (McLafferty and Preston, 1991; McLafferty, Preston and Hamilton, 1993; Johnston-Anumonwo, McLafferty and Preston, 1994).

Thus, household and childcare responsibilities, residential segregation, roles of sole income provider and racial discrimination are all obstacles that many African American women must overcome to enter the paid labor force. Thus, the local labor markets surrounding their residential areas would seem to be significantly important to these women, and if employment opportunities are not available, these women may not join the paid labor force at all and seek welfare as an alternative (Kain, 1968; Brewer, 1988).
3 Limitations of Previous Spatial Mismatch Hypothesis Studies

The Spatial Mismatch Hypothesis literature has several limitations that create biases in the results or do not reflect actual accessibilities of job search and opportunities available to individuals in the context of their daily lives.

3.1 The Use of Commuting Times/Distances

The first issue is the use of commuting time/distance as a measure of spatial accessibility to employment opportunities. The use of commuting time is assumed to be related to the employment structure and number of opportunities available in an individual’s local labor market.

However, some question this relationship. Kwan (1999), in her study of suburban men and women in Columbus, Ohio, found that commuting times of men and women do not have a significant linear relationship to the number of urban opportunities available and she suggests that using commuting time alone as a measure of accessibility may be misleading. Also, Guilano and Small (1993) suggest that much commuting is excess or “wasteful” commuting which reflects a poor indication of the urban structure (of residence and employment).

The length of commuting time/distance is a simplified measure for a series of complex inter-working factors relevant to an individual’s daily life. Therefore,
the results of commuting trips between residential and employment locations are not interpreted properly without taking into consideration the understanding of the life situations of the individual’s analyzed (Kwan, 1999).

Moreover, the use of commuting times/distances excludes a very important population subgroup out of the Spatial Mismatch analysis: the unemployed (McLafferty and Preston, 1999; Cooke and Ross, 1999). These commuting times/distances are constructed for employed persons; hence, they measure the average commuting times/distances for employed persons. Cooke and Ross (1999) demonstrate that the use of commuting time leads to a sample selection bias and one cannot infer commuting behavior of the unemployed from the commuting behavior of the employed. Unemployed persons are a significant part of the Spatial Mismatch Hypothesis, as Kain pointed out, that Spatial Mismatch has affected the employment outcomes of inner-city African Americans, which also refers to unemployed persons.

Finally, commuting times do not take an actual look at the employment structure in the areas surrounding residences. The examination of the opportunities and the mix of employment opportunities around an individual’s residence are significantly important to several population subgroups. The use of commuting behavior does not give an areal picture of employment opportunities, as they are scattered across the urban landscape, they are only assumed.
3.2 Women, Where Are They? Generalization of Entire Subgroup and the Endogeneity Issue

The Spatial Mismatch Literature has largely ignored women. Some studies have shown that the context of many women's lives are constraining, both in time and space. Therefore, access to employment opportunities is significantly important to some women, especially married women, women with children and African American women.

Household and childcare responsibilities put many time constraints on women, who often lack adequate transportation. Therefore, these time constraints make long trips to workplaces less feasible, resulting in women searching for employment in local areas around their residencies (Hanson and Johnston, 1985). Therefore, the local employment market, in terms of the numbers of employment opportunities and the mix of industry, seem to be very important to the labor market outcomes of many of these women (Hanson and Johnston, 1985; Gilbert, 1987; Tivers, 1988).

Furthermore, many African American women are female heads of household, meaning that they have double constraints of being the sole income provider, as well as tending to household and childcare responsibilities, in addition to lack of private transportation. Also, these women face housing market and racial discrimination, and are likely to reside in inner-city areas of the metropolitan region. Therefore, the local employment market is crucial for their labor market outcomes (McLafferty and Preston, 1991).
Many Spatial Mismatch studies also generalize by race or gender as a whole, when various subpopulations of race/gender exist, and the spatial context of employment accessibility is significantly different for each subgroup. For example, when examining the group of white women alone, one does not differentiate how married white women's or white women with children's spatial access to employment affects their labor market outcomes, or how their areas of search for employment and the size of their local employment areas differ due to the contexts of their daily lives and time constraints.

Endogeneity is another issue often brought up in Spatial Mismatch Literature, which is said to bias the results. Many authors state that the causal relationship between accessibility of one's residence with respect to employment opportunities may be biased due to the lack of understanding if one chose their residential location prior to gaining their employment or chose their residence based on their employment (Ihlenfeldt and Sjoquist, 1998; Muow, 2000). This is probably true for white men. They do not have any form of discrimination in the housing or labor market and can freely choose where to resides, especially when their income permits them to do so.

However, African Americans, especially inner-city blacks, cannot move their residential locations as freely and suffer from housing market discrimination and are residentially segregated, so they generally choose employment from a fixed residential location, so ignoring endogeneity does not seem to detrimental in creating biased results when examining this group.
Furthermore, married women also do not freely choose their residential location. Several studies have shown that when making residential location decisions, these decisions are usually made with respect to the male’s employment situation (Singhell and Lillydahl, 1986; Hanson and Pratt, 1995). Therefore, ignoring the endogeneity problem with respect to these women does not seem to affect the outcomes of job accessibility results significantly.

In this study, eight groups of populations will be under examination to analyze how job accessibility affects their employment outcomes. These eight population subgroups are:

1. White Men
2. White Women
3. Married White Women
4. White Women with Children
5. African American Men
6. African American Women
7. Married African American Women
8. African American Women with Children

Most of these subgroup populations should be significantly affected by the local labor markets around their residencies. On the other hand, white men, along with single, childless white women should not be significantly affected by the local context of the labor market, as they are free to choose their place of residence and can be freely mobile in the metropolitan area, due to limited time constraints.
3.3 Aggregated Data, MAUP and Employment Data

Many studies use aggregated data on employment locations that may severely bias the results when examining the accessibility of persons to employment opportunities. Many studies examine job accessibility through the use of job catchment areas from residential locations to measure job counts or Jobs/Persons ratios. These catchment zones will only include jobs or persons if the centroid of a zonal aggregated unit is included inside the catchment area, or will calculate that number based on the proportion of that catchment area that intersects the aggregated zone.

Aggregated employment and population data are based on aggregated areal units such as Census Tracts, Traffic Analysis Zones (TAZ) or zip code areas, which do not provide a sufficient representation of the spatial distribution of employment opportunities and residences throughout a metropolitan region, especially when it is often assumed that there is a uniform distribution within these units. These area boundaries are usually constructed in a manner for more efficient data collection (Bracken, 1994; Bracken and Martin, 1995).

In addition, the actual employment opportunity areas for population subgroups, particularly women, cannot be accurately captured using aggregated units, because many women need to obtain employment in very localized areas.
near their residences, due to domestic responsibilities and childcare and lack of access to private automobiles (Hanson and Pratt, 1995; Kwan, 1999). Therefore, many women’s geographic employment opportunity areas are more localized than the areal units provided by the aggregated data, which may overestimate the actual employment opportunities available to them (Hanson and Pratt, 1995).

Therefore, aggregated data does not allow one to differentiate between areas of employment and nonemployment and areas where residences reside and do not reside within these aggregated units. In some areal units, a significant proportion of employment opportunities may be located at the far corner of the zone, not accessible to a particular individual, due to time constraints and mode of transportation, therefore, job catchment areas based upon aggregated areal units may severely overestimate the actual number of employment opportunities actually available to an individual.

To better solve this problem, some population and employment opportunity surface methods are created in this study with the aid of ancillary data, to create a continuous surface, which are free of any spatially aggregated units associated with the current available data. Thus, this provides a more accurate estimation of the underlying population and employment opportunity distributions within each zonal unit and within the metropolitan region. The surface models will realistically capture the residential and non-residential regions of census zones, as well as regions where employment and non-employment land use are located, which is a vast improvement over the assumptions that population and employment is evenly distributed throughout these spatial units.
Four surface generation techniques are used in this study: Dasymetric Mapping, two Inverse Distance Weighting (IDW) methods (with coefficients \( n = 1 \) and \( n = 2 \)) and a method based on Martin (1995), which uses properties from Tobler's (1979) smooth pycnophylactic interpolation and adaptive kernel estimation.

Aggregated data also suffers from the Modifiable Area Unit Problem (MAUP). This problem occurs in aggregated results from scale and boundary issues. Different results occur from using different scales of aggregation, which may lead to several different conclusions about the data. (Openshaw, 1984) Also, at a particular scale, different boundary partitions can lead to many different results (Openshaw, 1984). This MAUP problem is better dealt with (although not completely removed) in this study by creating the surfaces of population and employment opportunities, which breaks free of the zonal partitions and creates a continuous surface, which is as disaggregate as the data will allow, without having the actual raw data.

Finally, many studies do not take into consideration the proportion of employment opportunities actually available to a particular subpopulation group at a certain location. Certain industries/occupations only hire a certain proportion of a racial/gender group. For example, an occupation/industry may hire 80% female workers. Thus, for a women searching for employment opportunities, only 80% of that industry/occupation's employment opportunities would be available to women, not the total 100%, which is typically assumed in most studies.
The employment data used in this study is coded by SIC (Standard Industry Code) code. To correct this problem, through the use of Equal Employment Opportunity data, national averages are used to estimate the proportion of the SIC industry's employment opportunities available to a particular racial/gender group. The use of this Equal Employment Opportunity data also allows us to hold racial discrimination constant across the urban landscape, as all employment opportunities are assumed to hire the proportion of that racial/gender group in question, as this assumption relates all firms to those firms that are held under strict Equal Employment Opportunity Laws.

3.4 Accessibility Measures and Job Catchment Areas

Accessibility measures in the Spatial Mismatch Literature also poorly reflect job accessibility. When studies use job catchment areas to examine the employment opportunities available in the immediate area, they tend to be the same size for each racial/gender group examined. However, as many studies have shown, various daily life contexts and constraints can significantly reduce the job search areas for many different racial/gender groups under study, especially for the mode of transportation used for each group.

For example, women's job search areas can be significantly reduced spatially, due to heavy time constraints, such as marriage, children and reliance on public transportation. Also, many African Americans rely significantly more than whites on public transportation, which may alter their job search areas (Taylor and Ong, 1995). In addition, many job search areas do not take into account areas
of urban space that are not accessible by public transportation, but only accessible by walking from a public transportation stop.

To combat these issues with job accessibility measures, this study will use a job catchment area of various sizes with respect to the population subgroup under analysis, whose size will depend upon the life situations of the individuals in terms of the mode of transportation available to these individuals.
4. STUDY AREA, DATA AND METHODOLOGY

4.1 Construction of Labor Force and Employment Opportunity Surfaces

Four methods for the construction of surfaces that better represent the distributions of the labor force and employment opportunities throughout the study area are utilized in this study: a dasymetric mapping method, two inverse distance weighting (IDW) methods (one with coefficient \( n = 1 \) and one with coefficient \( n = 2 \)) and a continuous surface method based on Waldo Tobler’s (1979) Smooth Pycnophylactic Interpolation, which utilizes adaptive kernel estimation and distance decay, as prescribed in Bracken and Martin (1995).

4.2 Study Area

The study area for this research is the seven-county area of Central Ohio that comprises the Columbus MSA (Delaware, Fairfield, Franklin, Licking, Madison, Pickaway and Union Counties). (Figure 4.1) The focus of this study is on Franklin County.
Figure 4.1: Study Area for this research. Includes Franklin County and portions of the 7-county area that make up the Columbus MSA.

Franklin County is composed of the City of Columbus, as well as several suburban communities and smaller incorporated cities. The total population of Franklin County is 1.07 million, with an African American population of 17.9% (U.S. Census, 2000).

In addition, the central city of Columbus has observed a decline in residents by 8.8% between 1990 and 2000, while the county as a whole has experienced an overall population growth during this same period (City of Columbus, 2002). This evidence of residential suburbanization, along with its significant proportion of African American residents, makes Franklin County an ideal place to study the Spatial Mismatch Hypothesis.
Furthermore, unemployment remains highest in Columbus' central city region, ranging many points higher than Franklin County's overall unemployment rate. With continuing economic development in Northern Franklin County and neighboring Delaware County, away from the central-city, the ongoing residential suburbanization and employment decentralization seems evident into the 21st century, thus, altering the spatial distributions of population and employment opportunities as it relates to the Spatial Mismatch Hypothesis.

4.3 Dasymetric Mapping Method

Dasymetric mapping is an areal interpolation approach that can be used to transform data from aggregated units to a grid-based continuous surface through the guidance of ancillary or external data. Dasymetric mapping makes a better attempt at addressing many of the problems associated with aggregated data, such as the Modifiable Areal Unit Problem (MAUP)\(^{28}\) and the assumption of homogeneity throughout an aggregated unit (Eicher and Brewer, 2001; Mennis, 2003).

Dasymetric mapping addresses the MAUP problem, although not completely ridding the problem, by disaggregating the data based on areal units into units whose size is controlled by the user and whose units better represent the underlying data, most particularly, grid cell units (Eicher and Brewer, 2001). This

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\(^{28}\) The Modifiable Areal Unit Problem refers to the scale and partitioning problems associated with using aggregated data. Two main problems of the MAUP are the scale effect and the partitioning effect. The scale effect refers to the way in which different analytical results can result from different scales of aggregation. The partitioning effect refers to the way in which different analytical results can result from partitioning the zone units in different ways at a particular scale.
technique also relieves the assumption that is held in many social science studies, where the aggregated units are assumed to be homogeneous at each location within the zonal boundary. When mapping and analyzing population distributions using census data, based on Census Tracts or Census Block Groups, or analyzing job opportunities using Traffic Analysis Zones, one cannot know within these units, where the population actually resides or where the jobs are actually located, as there are residential and non-residential areas, along with areas where jobs are located within the units of analysis. With the use of ancillary data, dasymetric mapping techniques allows us to better represent the population distribution and employment opportunity distribution within these census aggregated zones, allowing for a more realistic representation of these distributions throughout the study area. Finally, another advantage of dasymetric mapping is the retaining of the pycnophylactic property, in which, the sum total for all dasymetric mapping units within a particular source zone equals the total in the original aggregated data (Mennis, 2003). No population is lost to other units through the areal interpolation.

In the analysis presented here, I create several continuous labor force and employment opportunity surfaces using the dasymetric mapping technique to better represent the spatial distributions of the labor force for white men, white women, African American men and African American women, as well as the employment opportunities available to them.

The source data and associated source zones for the labor force population surfaces comes from the 2000 U.S. Census SF3 Files, in which the number of
persons in the labor force for each gender/racial class residing in a particular block group is recorded. In addition, educational attainment counts are recorded for each block group. This allows us to differentiate between the labor force competing for low-skilled and high-skilled employment. The source data and associated source zones for the employment surfaces comes from the Mid Ohio Regional Planning Corporation (MORPC). This data contains the number of employees located within a particular Traffic Analysis Zone (TAZ) by Standard Industry Code (SIC) for the year 2000.

In order to make this data useful for the analysis presented here, jobs typical for each population subgroup and skill level had to be extracted. These jobs are the jobs available for the population subgroup under analysis, removing all jobs not available for them, based on occupational segregation and skills. The total number of employment opportunities available for each of these population subgroups is determined by using additional data from the Equal Employment Opportunity Commission’s EEOC-1 and EEOC-4 reports. The EEOC-1 report is constructed annually, by law, under the Civil Rights Act of 1964, in which, the employment makeup of an employment industry is determined (EEOC, 2003). The EEOC-1 covers all employers with 100 or more employees in the private industry sector (excluding Federal and State Governments) (EEOC, 2003). The EEOC-4 report is constructed every two years and determines the employment

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29 The percentage of persons over the age of 25 who do not have a college degree was multiplied by the labor force count to give one the number of persons for a population subgroup competing for low-skilled employment. The proportion of persons who had college degrees was used for estimating the number of high-skilled laborers competing for employment in high-skilled positions.

Data consisting of the percentage of white men, white women, African American men and African American women, along with skill levels\(^\text{30}\) are extracted by SIC 3-digit codes nationally for the year 2000 to examine the industries and employment opportunities available for the population subgroups under analysis. The percentage of white men, white women, African American men and African American women who comprised all employment in each industry, along with the percentage of this industry’s jobs in various skill levels was recorded. This percentage is then used to determine the number of employment opportunities available to each population subgroup for each SIC industry in each TAZ zone. The total number of employment opportunities available for each population subgroup is then aggregated for each TAZ zone, to come up with a total count of employment opportunities available in each TAZ zone.\(^\text{31}\)

By using industry specific data, the actual number of employment opportunities available for a particular population subgroup and skill level can be calculated.

\(^{30}\)Skill levels were determined based upon EEOC-1 reports, as employment in office and managerial, professional and technical positions were recorded as high-skilled, while all other employment (sales workers, office and clerical workers, craft workers, operatives, laborers and service workers) were recorded as low-skilled.

\(^{31}\)For example, suppose one wanted to know the number of employment opportunities available for low-skilled white women in a particular TAZ zone. If the TAZ zone of interest had two industries, one with SIC code 3651 with 1000 employees and another with SIC code 7021 with 2000 employees. From the EEOC-1 reports the percent of total employees that were held by white women and were low-skilled was determined for SIC 3-digit codes 365 and 702.

Suppose that low-skilled white women comprised 44.7% of the total employees nationally in SIC 3-digit industry 365 and 50.1% of total employees in SIC 3-digit industry 702. Then out of these 1000 employees of SIC industry 3651, low-skilled white women, on average, comprise 447 of these employees (0.4470 x 1000) and 1002 of total employees (0.5010 x 2000) for SIC industry 7021. Therefore, in this particular TAZ zone, 1449 (1002 + 447) employment opportunities would be available to white women who possessed low-skilled qualifications.
determined, which has not been taken into account in past research. In the past, all employment opportunities at a particular location was assumed to be available to all population subgroups, which, in reality, is not the case. This employment data allows for specific questions to be answered with respect to the mix of industry, skills and residents within a particular region of the study area, in context of the Spatial Mismatch Hypothesis.

For the public employment sector (State and Local Governments), SIC 3-digit aggregated EEOC-4 Reports were not available, but availability came in the form of 16 different categories of employment industry. For these SIC industries, the 4-digit SIC coded industry is matched up with the category in the EEOC-4 report as accurately as possible (some SIC 4-digit codes actually matched up perfectly with a broad category of the 16 classified).³²

The ancillary data for the construction of the labor force and employment opportunity surfaces and used as a guide to redistribute the counts, comes from the Mid Ohio Regional Planning Corporation (MORPC) land parcel data sets for Franklin, Delaware, Fairfield, Madison and Union Counties. These data sets were constructed by the county auditors depicting all the land parcels throughout each county, along with many attributes, including the land usage of each parcel. The versions of these data sets obtained from MORPC provides 27 land use categories for the land parcels. In the analysis presented here, the 27 categories are broken down into two: residential parcels and non-residential parcels for the labor force

³² For public employment, employment recorded as officials/administration, professionals, technicians and protective service were tagged high-skilled employment, while employment in para-professional, administrative support, skilled craft and service/maintenance were tagged low-skilled employment.
analysis and employment parcels and non-employment parcels for the employment opportunity analysis.

Two counties in the study area, Licking and Pickaway Counties, do not have county land parcel datasets. In order to redistribute appropriate counts in these counties, ancillary data from the 1991 Multi-Resolution Land Characteristics Consortium National Land Cover Data Program is substituted. This data is based on remote-sensed satellite imagery from the Landsat Thematic Mapper Satellite and is available at 30 meter resolution based on 21 land cover categories. These 21 categories were reduced to two for the analysis presented here: urban (residential and employment) and non-urban (non-residential and non-employment). Urban land cover is closely related to residential land use in the land parcel data sets for the other counties, however, the urban land cover would also include industrial and commercial areas of the county for population redistribution and would include residential areas for employment opportunity redistribution.

To be consistent with the spatial resolution of the rest of the study area, this land use data is vectorized and re-rasterized to adhere to the size of the grid cells for the continuous surface implementations.

To construct dasymetric mapping continuous surfaces, the land parcel, as well as the land cover data sets are rasterized into a grid of 50 x 50 meters and reclassified into a classification of residential/non-residential for the labor force

33 Although the National Land Use Cover Data has separate categories for residential and commercial/industrial, it has been noted that this separation is not clear-cut and is not accurately distinguishable from the remote-sensed imagery. Hence, urban/non-urban classification seems plausible for the analysis at hand, given the limitations of the data (USGS, 2004).
surfaces and a classification of employment/non-employment for the employment opportunity surfaces, or a 0-1 classification, with 1 referencing residential and employment cells, respectively.

The spatial resolution of 50 meters is used because, within urban areas, a larger spatial resolution does not capture some residential or employment parcels, as the rasterization process applied would overlook these parcels. Furthermore, a smaller spatial resolution produces a more homogeneous distribution of the labor force and employment opportunities throughout the study area and removes the spatial differences in labor force/employment opportunities that exist throughout the study area, masking areas of high population density for a particular population subgroup, or masking the areas of high employment opportunity density available to these subgroups. Thus, the 50 meter spatial resolution is used, which seems to be a striking balance between capturing the residential and employment parcel cells of the land parcel/land cover data sets and still allowing for the density differences across the study area to be visually and analytically realized.

The block group source data provides the number of white men (high and low-skilled), white women (high and low-skilled), African American men (high and low-skilled) and African American women (high and low-skilled) employed in the labor force for each block group. These totals represent the labor force counts that will be redistributed to the residential grid cells. Subsequently, the TAZ source data provides the number of employment opportunities available for the population subgroups and skill levels under analysis for each TAZ zone.
These employment opportunity counts represent the opportunities that will be redistributed to the employment grid cells.

To find out the labor force or employment opportunities that will be allocated to each individual residential/employment grid cell, the number of residential/employment cells that lie within a particular block group/TAZ zone had to be summed. This sum is then divided into the total labor force/employment opportunity count for a particular block group/TAZ zone to result in a redistribution number for a particular cell in a particular areal unit.

Finally, the block group/TAZ zone data set is then also rasterized at 50 meters, for each population subgroup/skill level and raster multiplication was implemented, giving us continuous labor force and employment opportunity surfaces, one for each population subgroup/skill level under study.

\[
L_{aborForce_{ij}} = \frac{\sum_{i=1}^{n} \text{LaborForce}_{k}}{\text{residential cells}_{k}} \]

LaborForce\(_{ij}\) = the labor force count allocated to residential cell \(ij\).
LaborForce\(_{k}\) = the labor force count of block group \(k\).
\(\sum_{i=1}^{n} \text{residential cells}_{k}\) = the number of residential cells within block group \(k\).

\[
E_{m\,p\,o\,p\,s_{ij}} = \frac{\sum_{i=1}^{n} \text{EmpOpps}_{k}}{\sum_{i=1}^{n} \text{employment cells}_{k}} \]

EmpOpps\(_{ij}\) = the employment opportunity count allocated to employment cell \(ij\).
EmpOpps\_k = the number of employment opportunities available in TAZ zone k.

\[ \sum_{i=1}^{n} \text{employment cells}_k = \text{the number of employment cells within TAZ zone } k \]

These surfaces display areas of a block group/TAZ zone where the population labor force resides or where the employment opportunities are located and these surfaces break free of the assumption of homogeneous distributions at every location within a spatial unit that is associated with aggregated areal units, allowing for a more realistic representation of the underlying labor force/employment opportunity distributions throughout the study area.\(^{34}\) (Figure 4.2)

\(^{34}\) In some TAZ zones, employment opportunities for the subgroup under study were present, but there were no employment land parcels contained within these TAZ zones for which to allocate these opportunities. This may be due to the differing years of the two data sets; the land use data set is for 2003, while the employment opportunity TAZ zone data set is for 2000. It seems plausible that the jobs may have left the TAZ zone between the years 2000-2003, or there may be some error in the land use data set. To combat this problem, all parcels in these TAZ zones were classified as employment parcels, to ensure that no employment opportunities were lost.
**DASYMETRIC MAPPING TECHNIQUE**

**Land Use**

<table>
<thead>
<tr>
<th>Residential (1)</th>
<th>Non-Residential (0)</th>
</tr>
</thead>
</table>

\[
\sum_{\text{residential cell}}^{12} = 12 : 1/12
\]

**BlkGrp Pop. Allocation**

| White Male Population Allocation (120) |

**Dasymetric Surface**

\[
\text{Block Group Population (1200)} = \text{Population Allocation (120)}
\]

**Figure 4.2:** This figure shows how the dasymetric mapping technique for creating a population surface is implemented. In the leftmost figure is the rasterized land use data, in which there are residential cells and nonresidential cells. I assign a one to the residential cells. The sum of residential cells in the block group is 12. The middle figure shows that the population of the block group was 1200. However, each cell would only receive 120 White Males. I then raster multiply the two grids to give us a dasymetric surface for the population distribution, showing only areas where the population resides, each populated cell receives 120 White Males.

**4.4 Adaptive Kernel/Pycnophylactic Method**

The second areal interpolation method utilized in the construction of labor force and employment opportunity surfaces is based on Bracken and Martin’s (1995) and Martin’s (1996) population surface creation techniques, which incorporates adaptive kernel estimation and distance decay based on the distribution of counts represented by zonal count-weighted centroids, while still preserving Waldo Tobler’s (1979) smooth pycnophylactic property in which, the sum of all population or employment cell counts for a particular areal unit zone equals the original count for that zone.
In order to implement this method, one would need to know where the population-weighted and employment weighted centroids are located for each block group or TAZ zone. In literature, this method has been applied to U.K. Census Data, for which a population-weighted centroid for each census zone (Enumeration District) is subjectively determined by manual observation. These population-weighted centroids are readily available to the general public (Martin, 1989; Bracken, 1994). This method of constructing population surfaces has never, to my best of knowledge, been implemented using U.S. Census Data, most likely due to the fact that the U.S. Census Bureau does not construct population-weighted centroids for any census zonal unit.

Therefore, for the analysis here, population-weighted and employment opportunity-weighted centroids must be estimated, which can be done through the use of supplementary data. In order to construct these count-weighted centroids for each block group/TAZ zone, I use the MORPC parcel land use and the National Land Cover Datasets for the seven county study area. These data sets allowed recognition of which parcels (or polygon areas for the Land Cover Datasets) population and employment opportunities reside and which parcels they do not reside.

The technique here requires that every parcel/polygon be located in one and only one block group or TAZ zone. However, in reality, some parcels/polygons are located in more than one zone unit. To alleviate this problem, parcels/polygons that are encompassed by more than one zonal unit
were split into two or more parcels/polygons and the areas of each parcel/polygon in the study area is recalculated.  

Each parcel/polygon is then assigned a Block Group or TAZ Zone ID, corresponding to the zonal unit in which it was located, and the area sum of the residential/employment parcels for each zone is calculated. The population/employment opportunity count for each zonal unit is also calculated. This count for each zonal unit is then redistributed to each residential/employment parcel in the zone based on its area size relative to the sum of the residential/employment parcel areas for a particular zone through the equations:

\[
\bar{y}_{wmc} = \frac{\sum w_i y_i \text{Pop}_{\text{respoint}(i,k)}}{\sum w_i} = \frac{\sum \text{Area}_{(i,k)(\text{residential})}}{\sum \text{Area}_{(i,k)(\text{residential})}} \times \text{Pop}_k
\]

\[
\text{Pop}_{\text{respoint}(i,k)} = \text{population assigned to residential land use parcel } i \text{ in block group } k.
\]

\[
\text{Area}_{(i,k)(\text{residential})} = \text{area of residential land use parcel } i \text{ in block group } k.
\]

\[
\sum_{n} \text{Area}_{(i,k)(\text{residential})} = \text{area of all residential land use parcels } i \text{ in block group } k.
\]

\[
\text{Pop}_k = \text{population of block group } k.
\]

\[
\text{EmpOpps}_{\text{emp point}(i,k)} = \frac{\sum \text{Area}_{(i,k)(\text{employment})}}{\sum \text{Area}_{(i,k)(\text{employment})}} \times \text{EmpOpps}_k
\]

\[
\text{EmpOpps}_{\text{emp point}(i,k)} = \text{employment opportunities assigned to employment land parcel } i \text{ in TAZ zone } k.
\]

35 An Arc View script was implemented, which calculated each parcel's area in the study area. Furthermore, parcels were put into one and only one zonal unit through an intersection function in ArcView, which split parcels that traversed more than one zonal unit by the zonal unit boundary.
Area_{i,k}(employment) = area of employment land use parcel i in TAZ zone k.

\[\sum_n \text{Area}_{i,k}(employment) = \text{area of all employment land use parcels i in TAZ zone k.}\]

EmpOpps_k = employment opportunities in TAZ zone k.

After each residential/employment parcel is assigned a count value, each parcel is converted to a point based on its geographic centroid. From these points, the weighted mean centroid for each block group/TAZ zone is calculated, giving a population-weighted centroid based on labor force counts for all 1068 block groups and an employment opportunity-weighted centroid for all 1520 TAZ zones in the study area. The weighted centroid is calculated as (McGrew and Monroe, 2000):

\[
\bar{x}_{wmc} = \frac{\sum w_i x_i}{\sum w_i}, \quad \bar{y}_{wmc} = \frac{\sum w_i y_i}{\sum w_i}
\]

\[\bar{x}_{wmc}, \bar{y}_{wmc}\] is the weighted mean centroid coordinates.

\[x_i, y_i\] represent the x and y coordinates for each point used in the calculation of the weighted mean centroid.

\[w_i\] represents some weighting factor, which influences the location of the centroid. In this case, the weighting refers to the labor force population or employment opportunity count of each parcel centroid point.

From these population-weighted and employment opportunity-weighted centroids, the labor force and employment opportunities are redistributed to a 50 x
50 meter grid covering the study area. These counts are redistributed from these centroids based on kernel estimation and distance decay, with cells closer to the centroids receiving a greater proportion of the count than cells located further from the centroid. Labor Force/employment opportunities will only be redistributed from a centroid to cells contained within the same block group/TAZ zone the centroid represents (Martin, 1996). This allows Tobler’s (1979) pycnophylactic property to be preserved, in which population/employment opportunities will not be lost to other zonal units and the sum of the cells containing counts equals the original sum of that particular zonal unit.

Furthermore, the redistribution also depends upon the clustering of centroids and the labor force/employment opportunity density. Centroids in a dense-clustered or high density area will not redistribute labor force/employment opportunities in as large of an area as centroids that are located in areas of more sparsely-clustered or low density (Bracken, 1994; Martin, 1996). Finally, these counts are also limited to cells that are residential or employment, which allows for a more realistic redistribution process, only limiting labor force and employment opportunity counts to be redistributed to known regions of block groups/TAZ zones where they reside.

To implement these redistribution methods, kernel estimation is first performed on the weighted-centroids. Kernel estimation is a method of estimating how the density of a point pattern varies across a region (Bailey and Gatrell, 1995; McLafferty, Williamson and McGuire, 2000). Kernel estimation, in this case, will represent how the density of the labor force/employment
opportunities represented by the weighted-centroids varies across the study region. This density estimation is usually in the form of a continuous surface or raster grid, and the density value at each grid cell represents the density of point events in the surrounding neighborhood.

Non-adaptive kernel estimation in the analysis presented here takes the form of the Quartic Kernel Estimation, represented by the function:

\[
\hat{\lambda}_{\tau}(s) = \sum_{d_i \leq \tau} \frac{3}{\pi \tau^2} \left(1 - \frac{d_i^2}{\tau^2}\right)^2
\]

\(\hat{\lambda}_{\tau}(s)\) represents the density estimation at a grid location (s).

\(d_i\) is the distance from the grid location (s) to the point (event) contributing to the estimate at this location.

\(\tau\) is the bandwidth or search radius from a grid point, in which, points (events) within this radius will influence the density estimation at this location.

The bandwidth, \(\tau\), determines the amount of smoothing for the density surface. A smaller bandwidth, \(\tau\), will produce a smaller search radius from each grid point location and localized point events will contribute significantly to the density estimation at this location. Smaller bandwidths enhance localized effects as smoothing is not performed over a large area, hence, the local point events heavily influence the estimation. A larger bandwidth, \(\tau\), on the other hand, will tend to produce a more smooth surface, allowing localized effects to be smoothed.
out or masked, as more points (events) contribute to the density estimation at that grid location (Bailey and Gatrell, 1995).

The non-adaptive kernel density estimation can be thought of as a grid overlain on a study area and each grid point is visited by a search radius, or bandwidth, \( r \), centered on that grid point. Each point or event within this search radius will contribute to the density estimation at that grid location. (Figure 4.3)

**Kernel Estimation**

![Kernel Estimation Diagram](image)

**Figure 4.3:** Kernel Estimation: each grid cell point is visited with a bandwidth or search radius, \( r \), in which, density estimations, \( \hat{\lambda}_{r(s)} \), for each grid location (s) is influenced by the points (red) that fall within this search radius or bandwidth.

From the kernel equation, one can denote that the intensity, \( \hat{\lambda}_{r(s)} \), at a grid location is influenced only by the points (events) that fall within that location’s bandwidth, or whose distance from this grid location is less than, or equal to, the
bandwidth. Also, the distance from the points (events) to this grid location also influences the density estimation. The closer a point event is to the grid location, with respect to the bandwidth, the more influence it has on the density estimation at that location (McLafferty, Williamson and McGuire, 2000). Point events outside of the bandwidth or search radius will not contribute to the density estimation. Thus, at each grid location, non-adaptive kernel estimation estimates a density or intensity value, based on the bandwidth, \( \tau \), or search radius of influence from that grid location, the distances to each point event within that bandwidth, and the number of point events that fall within that bandwidth (Figure 4.4) (Bailey and Gatrell, 1995). Kernel estimation provides an estimation of the density of points throughout the study area at each grid location in the form of a raster grid surface. In this case, the kernel estimation surface represents how the intensity of the labor force population or the employment opportunity (density) varies across the study region by population subgroup and skill type.

**FACTORS THAT INFLUENCE DENSITY ESTIMATION**

![Figure 4.4](image)

**Figure 4.4:** The density estimation, \( \hat{\lambda}_{\tau(s)} \), at grid location (s) (represented by X) will be influenced by point events s1, s2 and s3, because \( d_i \leq \tau \) for each point (the distance from grid location to point is less than the bandwidth). This influence from points s1, s2 and s3 is also determined by the distance of these points to that location with respect to the bandwidth at that point.
To redistribute the labor force population or employment opportunities from the weighted-centroids, however, one would need to implement a varying search radius distance, or bandwidth, from these centroids. The variable distance is influenced by the density of points (centroids) in the local neighborhood. In an area where the intensity is high, which would lead to a smaller bandwidth, \( \tau \), the labor force population/employment opportunities will be redistributed from the centroid in a limited radius from the location. In opposition, centroids located in areas where the intensity is low, and subsequently, the bandwidth is larger, the labor force population/employment opportunities will be redistributed from the centroids at greater distances from this centroid (Bailey and Gatrell, 1995).

In this analysis of kernel estimation, I produce a density surface of 50 x 50 meters for the labor force population, using a bandwidth of \( \tau = 2078.64 \) meters. A density surface was created for employment opportunities using a bandwidth of \( \tau = 1931.81 \) meters.\(^{36}\)

Thus, this creates surfaces of how the density of the labor force population and the employment opportunities vary across the study area. For this kernel estimation to be useful to this redistribution methodology, one would need to find a distance from which the labor force population/employment opportunities are redistributed from each weighted centroid, which takes into account the intensity estimations across the region.

\(^{36}\) The choice of bandwidth was chosen based on a k-nearest neighbor function as suggested in Williamson et. al (1998). This method takes into account the spatial distribution of weighted centroids, which is inherent upon the distances between these points (Williamson et. al, 1998). A k of 10 was used for k-nearest neighbor function. A k of 10 still allowed localized intensity to be recognized without masking the spatial variation of intensity.
This variable distance or bandwidth, \( r \), from which labor force population/employment opportunities will be redistributed represents the weighted centroid’s influence on the local neighborhood. A weighted centroid in a dense area will have a smaller area of influence due to the presence of a dense cluster of other centroids, thus, a higher proportion of labor force population/employment opportunities will be redistributed to cells closer to the centroid. On the other hand, a weighted-centroid in an area of low density will have a larger area of influence, due to the lack of presence of other centroids in the local neighborhood, hence a lower proportion of labor force population/employment opportunities will be redistributed at greater distances, not exceeding the bandwidth, \( r \) (Bailey and Gatrell, 1995).

In order to find the distances that each weighted centroid redistributes counts, I use the non-adaptive kernel estimation surface as a guide. The geometric mean of the kernel estimates across the study area for each grid location is then computed. The geometric mean takes on the form:

\[
\hat{\lambda}_g = \left( \sqrt[n]{\sum_{i=1}^{n} \sum_{j=1}^{j} \hat{\lambda} \left( s_i \right) } \right)
\]

where the geometric mean, \( \hat{\lambda}_g \), is the \( n \)th root of the product of the density estimates for each grid cell location (s).

The density estimate for each location is then compared to the geometric mean, in which, this comparison locally varies the bandwidth or search radius, \( \tau \left( s_i \right) \) through the equation:
\[ \tau \left( s_i \right) = \tau_o \left( \frac{\hat{\lambda}_g}{\hat{\lambda} \left( s_i \right)} \right)^\alpha \]

\( \tau_o \) is the original search radius in the non-adaptive kernel estimation.

\( \hat{\lambda} \left( s_i \right) \) is the intensity estimation at grid cell location \( \left( s_i \right) \).

\( \alpha \) is the sensitivity parameter, which is set to 0.5 in analysis, which produces meaningful results (Bailey and Gatrell, 1995).

After these adaptive search radii are found for each grid location in the study area, the adaptive search radii that corresponds to each of the weighted centroids is found. From the above equation, one can denote the effects of high and low intensity density estimations on the adaptive kernel search radius. In areas where the density of points is high (greater than the geometric mean), \( \frac{\hat{\lambda}_g}{\hat{\lambda} \left( s_i \right)} \) becomes less than one, thus shrinking the original non-adaptive kernel estimation bandwidth and allowing labor force population/employment opportunities to only be redistributed shorter distances from the centroid. On the other hand, in areas where the density of points is low (less than the geometric mean), \( \frac{\hat{\lambda}_g}{\hat{\lambda} \left( s_i \right)} \) becomes greater than one, thus expanding the original kernel estimation bandwidth, and allowing labor force population/employment opportunities to be redistributed at greater distances from the centroid. These adaptive search radii correspond to the extent to which labor force
population/employment opportunities will be redistributed to the cells surrounding the centroid.

A 50 x 50 meter grid is then overlain on the study area and a window of varying size corresponding to the adaptive search radii visits each weighted centroid. Cells located only within the block group/TAZ zone represented by a particular block group/TAZ zone centroid will receive population or employment opportunities from that centroid (Martin, 1996). This preserves Waldo Tobler’s (1979) pycnophylactic property, in which no count is lost to other zones (block groups or TAZ zones) during the interpolation process.

For a particular weighted-centroid, cells located within that block group/TAZ zone are given weights according to a distance decay function, as specified by Cressman (1959):

\[
W_{ij} = \left( \frac{\tau_j^2 - d_{ij}^2}{\tau_j^2 + d_{ij}^2} \right)
\]

\(\tau_j\) is the adaptive search radius for weighted centroid \(j\).

\(d_{ij}\) is the distance from the grid cell location \((i,j)\) to the weighted centroid \(j\).

Cells whose distance, \(d_{ij}\), are greater than \(\tau_j\) are automatically given a weight of zero, because these cells are outside the radius of influence for that particular weighted centroid. Cells that are non-residential or non-employment, as specified through the rasterization of the land use parcel and land cover data sets are also given a weight of zero, which gives us a more realistic representation
of the regions inside the zonal units where the labor force population and the employment opportunities do and do not reside.

The weights assigned to each cell in a particular weighted centroid's search radius are then rescaled to sum one:

\[
weight_{(i,j)} = \frac{W_{ij}}{\sum_{i=1}^{n} W_{ij}}
\]

\(weight_{(i,j)}\) is the rescaled weight for cell (i,j).

\(w_{ij}\) is the original unscaled weight for cell (i,j).

\(\sum_{i=1}^{n} w_{ij}\) is the sum of all unscaled weights for all cells within the search radius for a particular weighted centroid.

These rescaled weights correspond to the proportion of a weighted centroid's labor force population/employment opportunity count that the cell will receive. Cells closer to the centroid will receive a higher proportion of the centroid's count than cells located further from the centroid. Furthermore, cells at the same distances from their respected weighted centroids will also receive different proportions of the centroid's count. In regions where the density of centroids is higher, grid cells at a specific distance will receive a higher proportion of labor force population/employment opportunities than grid cells at the same corresponding distance to weighted centroids located in an area of low density of centroids (Martin, 1989, 1996; Bracken, 1994).
Finally, the actual labor force population/employment opportunities redistributed to the weighted cells are given by the equations:

\[ LabForce_{ij} = \left( weight(i, j) \right) \times (L_k) \]

\( LabForce_{ij} \) = the labor force assigned to grid cell (i,j).

\( weight(i, j) \) = rescaled weight for cell (i,j).

\( L_k \) = the labor force count of block group k represented by block group centroid.

\[ EmpOpps_{ij} = \left( weight(i, j) \right) \times (E_k) \]

\( EmpOpps_{ij} \) = the employment opportunities assigned to grid cell (i,j).

\( weight(i, j) \) = rescaled weight for cell (i,j).

\( E_k \) = the employment opportunity count of TAZ zone k represented by TAZ zone centroid.

In the analysis presented here, labor force population and employment opportunity surfaces using this methodology are applied to represent the distributions of the population subgroups/skill levels under analysis and the opportunities available to these racial/gender/skill level groups throughout the study area. Thus, these create labor force population and employment opportunity surfaces that better represent the underlying distributions than the original zone-aggregated counts. (Figure 4.5)
**POPULATION DISTRIBUTION METHOD**

![Diagram](image)

**Figure 4.5:** This figure represents the population redistribution from a block group centroid. (1) An adaptive search radius of distance \( r(s_j) \) is constructed around the centroid. Each cell has a distance \( d_{ij} \) from the centroid. The block group boundary is represented by the solid line. (2) Only cells that are within the block group represented by the centroid, and within a distance less than the search radius are given weights, \( W_{ij} \). (3) The cells are examined to see if they represent residential or non-residential regions of the block group. (4) All cells that have weights, but correspond to non-residential cells are filtered out, and the weight is then changed to 0. (5) The weights are rescaled to equal one to give the proportion of the centroid’s population that will be assigned to that cell. (6) The population is redistributed based upon the rescaled weights to give a population count at the cells that have weights.

### 4.5 Inverse Distance Weighting Method

The final two areal interpolation methods used in the construction of the labor force population and employment opportunity surfaces are based on a simple Inverse Distance Weighting (IDW) function. An Inverse Distance
Weighting function weights interpolation points according to its distance from the sampled locations, with distances closer to the sampled locations receiving a greater weight, and hence, a greater proportion of the sampled location count (Lam, 1983).

This Inverse Distance Weighting function used here, also preserved Waldo Tobler's (1979) pycnophylactic property, in which no count is lost to zones outside the represented centroid. A 50 x 50 meter grid is placed over the study area and each grid cell is given a weight according to its distance from the weighted centroid located in its zonal unit through the equation:

\[ \text{weight}_{ij} = \frac{1}{d^n} \]

\( weight_{ij} \) = weight of grid cell ij for weighted centroid k.
\( d \) = distance from grid cell ij to respective weighted centroid.
\( n \) = distance decay exponent; controls the degree of distance decay.

In this study, surfaces of labor force population and employment opportunities are created using a distance decay exponent of \( n=1 \) and \( n=2 \). Also, using the land parcel data, grid cells representing non-residential or non-employment, in the case of employment opportunity surface creation, land use are automatically given a weight of zero. This more realistically allows for distinguishing between areas where the population and employment opportunities do and do not reside.
To maintain the count of the weighted centroid, the weights are rescaled to equal one:

\[
\text{weight}_{ij_k} = \frac{W_{ij_k}}{\sum_{k=1}^{n} W_{ij_k}}
\]

weight_{ij_k} = rescaled weight for grid cell ij in areal unit k.

\[
\sum_{k=1}^{n} W_{ij_k} = \text{sum of all the unscaled weights in areal unit } k.
\]

According to these rescaled weights, labor force population and employment opportunity counts are then assigned to the grid cells according to the zonal unity they are in, represented by the weighed centroid through the functions:

\[
\text{LabForce}_{ij_k} = \left(\text{weight}_{ij_k}\right) \times \left(L_k\right)
\]

LabForce_{ij_k} = labor force allocated to grid cell ij in block group k.

weight_{ij_k} = rescaled weight for cell ij for block group k.

L_k = the labor force count of block group k represented by block group centroid.

\[
\text{EmpOpps}_{ij_k} = \left(\text{weight}_{ij_k}\right) \times \left(E_k\right)
\]
\( EmpOpps_{ij} \) = the employment opportunities assigned to grid cell \( ij \) in TAZ zone \( k \).

\( weight_{ij} \) = rescaled weight for cell \( ij \) in TAZ zone \( k \).

\( E_k \) = the employment opportunity count of TAZ zone \( k \) represented by TAZ zone centroid.

Thus, there are now two surfaces representing the distribution of the labor force population and employment opportunities for the population subgroups and skill levels under analysis, which better represents the continuous nature of these distributions across the geographic landscape and which realistically displays areas in which these counts do and do not reside.

4.6 Job Catchment Areas

Job catchment areas will be created from each grid location to calculate the job accessibility from each location in the study area for each population subgroup under analysis. Two job catchment areas for each population subgroup will be created from each residential location; one reflecting travel behavior of automobile users and the other reflecting the travel behavior of public transportation users.

For automobile users, a job catchment area of 10 and 15 minutes will be constructed using a road network for the study area, reflecting the regions for
which job seekers of a particular population subgroup can look for employment through the use of private transportation.

On the other hand, for public transportation users, a different approach is used to better reflect the areas for which these transit users can seek for employment, based upon the speed of public transit and the areas of the study area served by the transit. Data from the Central Ohio Transit Authority (COTA) is obtained, which allows for the spatial location of each bus stop in the study area to be realized and the time it took each bus to get from one stop to its next. Extracting this data, the average time that it took a bus to get between one bus stop to another is calculated for the entire day. This average time is then converted to an average speed that the bus traveled across each link in the study area’s road network. Every link that supported a public transportation route is thus assigned an average speed, thus allowing a more realistic examination of spatial accessibility across the entire study area.37

In areas where no public transportation was present, each link in these areas is assigned the value of 3 miles per hour, corresponding to the average human walking speed (Pacchierotti, Christensen and Jensfelt, 2005). Therefore, representing persons who use public transportation, a job catchment area of 10, 15 and 30 minutes was created, which allows search areas for employment that more accurately reflect the commuting behavior of persons reliant on public transportation.

---

37 Speeds in miles per hour were calculated from the node on the network line nearest to the starting bus stop to the node on the network link of the end bus stop.
4.7 Job Accessibility Measures

Five measures of job accessibility will be created for each population subgroup/skill level under analysis at each grid location (using the four labor force and employment opportunity surface methods created earlier, plus an average of these four measures). These job accessibility measures will take into account the number of employment opportunities available, with respect to, the number of persons competing for these jobs, in addition to taking into consideration skill and gender.

The measures of job accessibility will take on the form:

\[
JP_{(DA)}_{auto} = \frac{E_j}{L_j} \in \tau_{i(Auto)}
\]

\[
JP_{(DA)}_{pub} = \frac{E_j}{L_j} \in \tau_{i(pub)}
\]

\[
JP_{(PYC)}_{auto} = \frac{E_j}{L_j} \in \tau_{i(Auto)}
\]

\[
JP_{(PYC)}_{pub} = \frac{E_j}{L_j} \in \tau_{i(Pub)}
\]

\[
JP_{(INV1)}_{auto} = \frac{E_j}{L_j} \in \tau_{i(Auto)}
\]

\[
JP_{(INV1)}_{pub} = \frac{E_j}{L_j} \in \tau_{i(Pub)}
\]

\[
JP_{(INV2)}_{auto} = \frac{E_j}{L_j} \in \tau_{i(Auto)}
\]

\[
JP_{(INV2)}_{pub} = \frac{E_j}{L_j} \in \tau_{i(Pub)}
\]

\[
JP_{(Avg)}_{auto} = \frac{E_j}{L_j} \in \tau_{i(Auto)}
\]

\[
JP_{(Avg)}_{pub} = \frac{E_j}{L_j} \in \tau_{i(Pub)}
\]
\[ JP_{i(DM)_{\text{pub}}} = \frac{E_j \in \tau_{i(\text{pub})}}{L_j} + JP_{i(PYC)_{\text{pub}}} = \frac{E_j \in \tau_{i(\text{pub})}}{L_j} + JP_{i(INV1)_{\text{pub}}} = \frac{E_j \in \tau_{i(\text{pub})}}{L_j} + JP_{i(INV2)_{\text{pub}}} = \frac{E_j \in \tau_{i(\text{pub})}}{L_j} \]

\[ JP_{(\text{Avg})_{\text{pub}}} = \frac{1}{4} \]

\[ JP_{i(DM)_{\text{auto}}} = \text{Job accessibility for residential location } i \text{ using the dasymetric mapping surfaces for auto users.} \]

\[ JP_{i(DM)_{\text{pub}}} = \text{Job accessibility for residential location } i \text{ using the dasymetric mapping surfaces for public transit users.} \]

\[ JP_{i(PYC)_{\text{auto}}} = \text{Job accessibility for residential location } i \text{ using the pycnophylactic surfaces for auto users.} \]

\[ JP_{i(PYC)_{\text{pub}}} = \text{Job accessibility for residential location } i \text{ using the pycnophylactic surfaces for public transit users.} \]

\[ JP_{i(INV1)_{\text{auto}}} = \text{Job accessibility for residential location } i \text{ using the IDW (d=1) surfaces for auto users.} \]

\[ JP_{i(INV1)_{\text{pub}}} = \text{Job accessibility for residential location } i \text{ using the IDW (d=1) surfaces for public transit users.} \]

\[ JP_{i(INV2)_{\text{auto}}} = \text{Job accessibility for residential location } i \text{ using the IDW (d=2) surfaces for auto users.} \]

\[ JP_{i(INV2)_{\text{pub}}} = \text{Job accessibility for residential location } i \text{ using the IDW (d=2) surfaces for public transit users.} \]

\[ JP_{(\text{Avg})_{\text{auto}}} = \text{Job accessibility for residential location } i \text{ using the average of the four job accessibility measures created above for auto users.} \]
\( JP_i(Avg)_{pub} = \) Job accessibility for residential location \( i \) using the average of the four job accessibility measures created above for public transit users.

\( E_j = \) the number of employment opportunities available in job catchment area \( j \).

\( L_j = \) the number of persons in the labor force competing for these jobs in job catchment area \( j \).

\( \tau_{i(Auto)} = \) job catchment area for location \( i \) for auto users.

\( \tau_{i(pub)} = \) job catchment area for location \( i \) for public transit users.

These measures better represent the spatial accessibility for various population subgroups of the population as those employment opportunities closer to a person’s residence are more accessible and convenient than those jobs located further away.

Thus, at each residential location one will have 10 job accessibility measures for each population and skills subgroup, one for each surface creation method (4 total) and one for each mode of transportation (2 total) \((4 \times 2 = 8)\), plus an average of all 4 methods for each mode of transportation \((8+2 = 10)\).

In order to find a single job accessibility measure for a person of a particular race, sex and skill level, that person will be seeking out all employment opportunities that are available to that particular gender and skill level, and they will be competing for these opportunities with persons of the same gender and skill level.
For example, a low-skilled African American woman at a particular residential location would have all employment opportunities that are available to women and are low-skilled within her job catchment area, and this woman would be competing for these employment opportunities with other women who are low-skilled that are located within their job catchment area.

This analysis will take into account gendered segregation in the workforce, but will not take into account racial segregation in the workforce, because it is necessary to analyze the spatial effects of accessibility and this is a particular way to remove racial discrimination when calculating the Jobs/Persons ratio accessibility measure.

Therefore, this is a measure of job accessibility that better reflects the population and skill level subgroup under study by representing their commuting behavior based on time constraints and mode of transportation. These spatial accessibility measures will be used to indicate how much spatial accessibility matters in the employment outcomes for the subgroups under analysis.

Finally, these Jobs/Persons ratios will be used in the various analyses that will be conducted in the study, which are outlined in the next section.

4.8 Analysis of the Spatial Mismatch Hypothesis and Statistical Models

The analysis of the Spatial Mismatch Hypothesis with respect to the labor force and employment opportunity surfaces will take on various forms of visual and statistical analyses.
4.8.1 Visual Examination of the Interpolated Surfaces

First, a visual examination of the labor force and employment opportunity surfaces will give us a simple overview of where jobs and the persons competing for these jobs are scattered across the study area. With respect to the Spatial Mismatch Hypothesis, one would expect to see African American population to be clustered near the central city and the white population to be spatially scattered across the study area.

Also, with respect to the employment opportunity surfaces, high-skilled jobs may demonstrate a cluster near the downtown area or Central Business District (CBD), as downtown areas of North American metropolitan areas are changing into information and technology centers (Kasarda, 1985). On the other hand, low-skilled employment opportunities should show a more spatially scattered pattern across space, and locations outside of the central city should bear a good proportion of the low-skilled positions available in the Metropolitan Region. This pattern should be evident, as the decentralization of low-skilled employment, especially manufacturing, is well documented since post World War II (Kain, 1968, 1992).

A Spatial Mismatch may exist if there is evidence of a clustered spatial pattern of African American population near the central city and a dispersed pattern of white population across the study and substantial white populations in suburban areas. African Americans may be confined to these central city areas due to housing segregation, as blacks are discriminated in housing searches and
less likely to obtain housing in suburban areas possibly due to this housing discrimination, in addition to other factors.

A Spatial Mismatch may exist also if the surface patterns of low-skilled employment show very small proportions of total low-skilled employment opportunities near the central city, and a significant proportion of these opportunities in the suburbs. This may be due to the decentralization of well-paid low-skilled employment opportunities after World War II. This spatial pattern may also suggest that a Skills Mismatch exists, as central city African Americans are more likely to be less educated and qualified for the high-skilled employment opportunities in areas near their residencies. Thus, there may be a skills mismatch of low-skilled residents in the central city to abundant high-skilled employment opportunities.

4.8.2 Comparison of Actual Workers to Opportunities for Workers

A second analysis will be conducted in this study that may suggest a Spatial Mismatch exists. Using data from the 2000 Census Transportation Planning Package (CTPP) Part 2 files, one can estimate the number of white and African American employees actually working across the study area. The number of white and African Americans working in low-skilled and high-skilled employment within each particular Census Block Group will be extracted.

Employment surfaces will be created based upon the number of white or African American workers working in each census zone using the same four
methods used for the construction of the employment opportunity surfaces. (Dasymetric Mapping, Pycnophylactic Interpolation and Inverse Distance Weighting (IDW) (n =1 and n = 2) These surfaces will be compared to the number of employment opportunities that should be filled in low-skilled and high-skilled positions across space with respect to the EEOC-1 reports in the employment opportunity surfaces.

The difference between the actual number of workers in a grid cell and the number of employment opportunities that should be filled based upon EEOC-1 reported averages will show areas where blacks are not gaining access to employment or are underrepresented due to lack of spatial access to these employment opportunities, due to lack of viable transportation or housing discrimination. These disparities between the surfaces may also indicate racial discrimination by employers due to personal bias or internal bias based on the surrounding population of the area.

One would expect with respect to African Americans that this difference:

\[
\text{Actual Employment} - \text{Projected Employees}
\]

should be negative outside of central city areas, suggesting that a Spatial Mismatch may exist. This difference should less negative or even positive in the central city areas of the metropolitan area, suggesting better access to these employment opportunities. This difference should linearly become less negative with distance from the central city, suggesting a Spatial Mismatch may exist in terms of housing discrimination, access to viable transportation, decentralization of low-skilled employment or employer discrimination.
4.8.3 Analysis of Number of Jobs by Means of Transportation

The third analysis that will be conducted in this analysis of the Spatial Mismatch Hypothesis will be examining the number of employment opportunities within a 10 and 15 minute job catchment area by private automobile and within a 10, 15 and 30 minute job catchment by the use of public transportation or public transportation + walking. The ratio of the number of employment opportunities reachable by private automobile with respect to this number reachable by public transportation or the combination of public transportation and walking should give us a general overview of the significance of private automobile compared to public transportation in reaching employment opportunities and spatial mobility.

The higher this ratio between auto and public transit, the more significant access to transportation may play a role in the unemployment rates of African Americans and women, population subgroups who are less likely to have access to private means of transportation. This higher ratio may also suggest a Spatial Mismatch, as areas where less employment opportunities of the low-skilled variety are located may be close to areas where there are significant number of persons who rely on public transportation, suggesting that the population subgroups located in these areas are spatially isolated from employment opportunities that may be reachable if they had access to private means of transportation.
4.8.4 Employment Model

The final analysis consists of building a model to examine the effects of job accessibility on an individual being employed. Our model will be constructed using Logistic Regression analysis. Data from the 2000 Public Use Micro Sample (PUMS) 5% files were used for this analysis to extract all African American males and females and White males and females in the labor force and residing in Franklin County.

The PUMS files give very aggregated detail of the geographic location of each individual in the data set. The level of aggregation is the PUMA area in which the individual resides. Each PUMA zone consists of several census tracts, yielding nine PUMA areas out of the 262 census tracts within Franklin County. In order to calculate geographical access, each individual needs to be placed at an appropriate location within the PUMA zone they are located.

The geographical location(s) within the PUMA zone are disaggregated through the use of the Franklin County Auditor’s Parcel Land Use Data. Several household variables within the PUMS data (building type, number of rooms, number of bedrooms and property value) can be matched to several variables in the parcel land use data (land use (building type), number of rooms, number of bedrooms and property value), allowing us to redistribute these individuals to proper areas of the PUMA zone for which they reside.

38 The Franklin County Auditor’s Office did not have a shapefile for the year 2000 readily available and the previous analysis used 2003 auditor land use data to examine residential and employment areas of the county. Luckily, a database of the values for these attributes for the second quarter of the year 2000 was available, which were linked to the 2003 shapefile through the Parcel Unique Identification Number.
Thus, each individual is linked to a set of parcels that they were most likely to reside at, yielding a final sample of 9,124 white males, 8,477 white females, 1,491 black males and 1,665 black females. From this set of possible residential locations where particular individuals were likely to reside, 100 stratified random samples are taken, so that each individual is placed at one specific geographical location out of the set of all possible geographical locations likely for that individual.

This linkage of the PUMS data and the parcel land use data allows a disaggregation of the highly aggregated data and allows for a more realistic and accurate representation of the actual residential locations of the individuals under analysis. Furthermore, through random sampling, one of these samples would be more likely to represent the true underlying residential locations for the population samples. Thus, when examining accessibility and its effect on the probability that an individual will be employed, if none of these samples show a significant relationship, then one can confidently exclude it as a factor in determining whether or not an individual is employed.

Once these random samples are taken, logistic regression models are run on the samples to examine the significance of individual factors, and geographical access on the probability of being employed.

A separate model was run for each different population subgroup (High Skilled white men and white women, Low Skilled white men and white women, High Skilled African American men and women and Low Skilled African American men and women, in addition to African American and white women.
who are married, and African American and White Women with Children) to keep the analysis simplified and examine how individual, neighborhood and accessibility factors affect each population subgroup in terms of the probability of being employed and with respect to the Spatial Mismatch and Skills Mismatch Hypotheses.

The models will take on the form:

$$P_i(E) = f(I_i, JP_{ij})$$

where:

$I_i$ are the vector of individual factors that can affect the probability of one being employed (age, years of education, number of related children, marriage, children under 6, children 6 to 17, enrolled in school, disability and skill level).

$JP_{ij}$ is the accessibility (Jobs/Persons ratio) for the individual $i$ at residential location $j$.

This model is designed to examine how job accessibility is related to the probability of being employed, which has implications in the Spatial Mismatch Hypothesis and Skills Mismatch Hypothesis. Once the individual factors have been accounted for, the effect of the Jobs/Persons Ratio Accessibility measure will be measured to examine the effect it has after the other factors have been controlled for.
5 Analysis and Results

5.1 Comparison of Surface Methods

This analysis begins with the comparison of the surfaces created through the various methods implemented in this study (Dasymetric Method, Pycnophylactic Method, IDW n=1, IDW n=2). I examine how these surface methods create similar and different patterns in this study of the Spatial Mismatch and Skills Mismatch Hypotheses.

Starting off, I examine the differences in the surface generation methods and the strengths and weaknesses of each method. Examining Figure 5.1, one can see how population is distributed across a block group for which there is a count of labor force population. In the top figure, one can examine that the shaded grid cells represent locations where residential land use occurs.

For a method of population distribution to be useful, one would prefer to have the surface method recreate this pattern with counts corresponding to each grid cell that is residential. The Dasymetric Method creates a pattern that follows the residential land use to perfection, as does the Inverse Distance Weighting methods (IDW n = 1 and IDW n = 2). On the other hand, the Pycnophylactic Method does not redistribute labor force population to a significant proportion of the grid cells that are known to be of residential land use. Thus, this method does not create a realistic pattern of where the population does and does not reside.

Figures in this section, figures A.1-A.60 are located in Appendix A.
Figure 5.1 This figure displays the manner in which population is distributed across a zonal boundary by the four surface creation methods used in the study.
For the three methods that do recreate the residential land use patterns, the Inverse Distance Weighting methods create a peak-valley phenomenon, with the count density being highest at the Block Group centroid and decreasing densities as one moves some distance away from the centroid. This peak and valley redistribution across each Block Group in the study area creates several peaks of high labor force population density near the centroid and valleys of low labor force population density away from the centroid and outward towards the Block Group boundary.

When examining the overall patterns of labor force population and employment opportunities as they vary across the study area, these peaks and valleys may distort how the overall pattern varies as one moves across the geographic landscape. The Dasymetric Method redistributes a constant labor force population (and employment opportunity for the employment surfaces) count to every cell that is used for residential land use, and allows notice on how this average value count varies across the study area. This gives us a more realistic view of how the labor force population (employment opportunities) varies across the geographic landscape.

Thus, in the examination of the patterns of the variance of the labor force population and employment opportunities across the study area and how this variance relates to the Spatial Mismatch and Skills Mismatch Hypotheses, I will use the Dasymetric Method of surface creation from this point forward to study visual patterns of labor force population (employment opportunities) and how they relate to the Spatial Mismatch and Skills Mismatch Hypotheses.
The Spatial Mismatch Hypothesis states that African Americans are segregated into central-city areas of the Metropolitan Area due to racial discrimination, especially discrimination in the housing market. This prevents African Americans from moving out of central-city areas and into suburban locations, as to gain access to employment (Kain, 1968).

One can examine the surfaces created for the African American labor force population to examine whether or not in the study area, they are confined to central city locations. One cannot examine, however, if they are segregated, whether this segregation is due to racial discrimination in the form of housing market discrimination. However, an African American population segregated into central-city locations would be necessary for a Spatial Mismatch to exist. On the other hand, African Americans with higher education levels and those who are in the high-skilled employment sector of the labor market are more likely to overcome racial discrimination and reside in a suburban location. Thus, one would expect to see a shift towards the suburbs when examining the differences between where low-skilled African Americans reside and where high-skilled African Americans reside.

Examining the distributions of low-skilled African Americans (figure A.5), one can see an area along the eastern side of Interstate 71, north to south and along East Broad Street, east to west, where a significant proportion of low-
skilled African Americans reside. (See Figure A.4) There are also small high-density patches of low-skilled African Americans along West Broad Street.

These surfaces display evidence that low-skilled African American high-density residential locations generally follow the city limits of Columbus along Interstate 71 and East Broad Street, not showing significant densities of housing locations within smaller municipalities along this North-South and East-West corridor. Low-skilled African American residential locations generally follow a pattern that spans the boundaries of the City of Columbus, outside the borders of Bexley, Whitehall and Gahanna. (See Figure A.3).

The reasoning one observes this residential pattern may be due to a few processes occurring across the metropolitan landscape. Housing market discrimination may play a significant role in this residential pattern, as real estate agents may keep African Americans outside of these communities based upon their personal racially discriminate stereotypes about African Americans or their perception about the residential preferences and/or discriminatory views of their white customers (Yinger, 1986).

Furthermore, another reason low-skilled African American households generally do not reside in high density within these municipalities may be due to the higher property costs and taxes within these municipal boundaries. African American households generally have lower incomes than white households (Ihlanfeldt and Sjoquist, 1998) and they may not have the economic means to afford housing in these communities. If higher costs and taxes are the case, this could be due to racial discrimination among property owners, real estate agents
and the municipal governments within these communities, who may hike up property costs to ensure that African Americans do not reside here. Investigation would be needed to examine this.

On the other hand, outside of the central-city areas of Metropolitan Columbus, there are areas near the perimeter of Franklin County where African Americans do reside, but reside in limited capacity and disproportionately in the Eastern and Northeastern sections of Franklin County. What is also evident is that these lower-density residential locations of low-skilled African Americans also follow the boundary of the City of Columbus, and African American residential locations are generally void within smaller communities, such as Dublin, Worthington, Westerville, Powell and New Albany.

In a more limited capacity, this phenomenon is also evident in the Western part of Franklin County, as low-density residential locations of low-skilled African Americans also follow the boundary of the City of Columbus, with few, if any, low-skilled African Americans residing within communities such as Upper Arlington, Hilliard, Marble Cliff and Grandview Heights.

These patterns further suggest that the residential locations of low-skilled African Americans may be due to one of two factors, or the combined effect of these two factors: housing market discrimination against African Americans or higher property costs and taxes within these smaller, predominately white communities. As suggested earlier, these higher costs may be due to racial discrimination among property owners, real estate agents or the community municipal government.
Finally, the last phenomenon that can be visually realized from these surfaces are that if low-skilled African Americans do enter these communities, albeit, in small proportions, they are generally clustered in small pockets or enclaves within these communities. This can be seen within the municipal boundaries of Dublin and Hilliard, as the low-skilled African Americans who do reside these communities, do so in generally small clustered areas of these municipalities. This supports past literature that suggested that when African Americans do enter suburban communities, they are generally segregated into small areas of these communities, away from white residential populations (Kain, 1992; Holloway, 1996).

This lower density residential pattern for low-skilled African Americans may be due to African American women, who have husbands that have high-skilled employment credentials that would allow them to be more likely to secure a residential location outside the central city. However, upon examination between low-skilled African American males and low-skilled African American females (figures A.8 and A.11), their residential patterns are highly similar and both adhere to the overall low-skilled African American labor force population distribution. Thus, the residential locations of low-skilled African American men and women show similar patterning across the metropolitan region.

Moving on to high-skilled African Americans (figures A.6, A.9 and A.12), the residential surfaces reveal that many high-skilled African Americans are confined to the same areas of the metropolitan region as low-skilled African Americans. However, there are high densities of African Americans along I-71
and East Broad Street that extend a few miles further towards the periphery of Franklin County than where low-skilled African Americans reside. This demonstrates that education could be one avenue that African Americans can pursue to overcome the outcomes the central-city life presents.

On the other hand, it is curious that many high-skilled African Americans reside in the same areas of Franklin County as their low-skilled counterparts and why education was not a stepping stone out of the central city environment for these persons.

This could be where racial discrimination, especially discrimination in the housing market, could play a major role in where African Americans live. Some high-skilled African Americans may pursue a move to more prestigious communities within Franklin County and other sections of the entire study area, but racial discrimination prevents them from doing so and to be continuously residentially segregated into central city locations (Kain, 1968). Although some African Americans do escape central-city environments within Franklin County, it seems as though this movement is limited to areas within the boundary of the City of Columbus, as there are very small proportions of African Americans residing in upscale communities, namely Dublin, Worthington, Upper Arlington and Powell.

According to Kasarda (1985), cities are transforming from “centers of production and distribution of material goods to centers of administration, information-exchange and higher-order service provision” creating a skills mismatch between the skills of inner-city residents and the employment
opportunities located nearby, which require higher educational credentials and higher skill levels. In Franklin County, if high-skilled African Americans are generally residing near these high-skilled employment opportunities, then a central city residential location may not be so detrimental, or even advantageous to these residents in securing employment. Thus, racial discrimination in the housing market should not have a severe effect on the employment outcomes of these persons. Further investigation is needed.

Since whites should not encounter racial discrimination in the housing market, one should expect to see a more dispersed pattern for the white residential locations. Examination of the white labor force population surfaces does reveal this pattern, as whites cover more geographical space in their residential locations as African Americans do.

The residential locations of white low-skilled laborers (figures A.14, A.17 and A.20) reveals that they have high densities of residential locations near the CBD, as well as high-density populations fanning out radially from these central locations to the boundaries of Interstate-270. An interesting phenomena that can be seen is that there is not a well-represented low-skilled white population in high density capacities in the Northwestern sections of Franklin County, near the municipalities of Worthington, Dublin and Powell, in Southern Delaware County.

Examination of high-skilled white laborers (figures A.15, A.18 and A.21) may reveal the reasons why low-skilled whites may be void of this Northwestern pattern. Higher densities of high-skilled whites are abundant in the Northwestern sections of Franklin County. This suggests that high-income professionals
populate these Northwestern communities of Dublin, Worthington and Powell. This could likely be due to the fact that there are more expensive housing property in these communities and residency in these communities may only be accomplished through higher incomes, which are typical of high-skilled occupations.

The residential populations of whites reveal that whites do not encounter racial discrimination in the housing market, so they can freely choose and move to locations in the metropolitan region they find suitable, as long as their incomes permit. What is also striking from observing the residential patterns of whites is that in areas where there are high densities of African Americans, there are very few, if any, whites residing in these areas. This further strengthens the observations of residential segregation suggested earlier, as this reveals that the Columbus MSA is a highly racially segregated region.

The centralized, as well as peripheral pattern of white population, is a phenomena that may be due to certain subgroups of the white population having different residential preferences, as well as the regional economy of the Columbus Metropolitan region.

Economically, unlike many regional economies of Northeastern and Midwestern cities, Columbus does not have as large of a manufacturing economy as other cities (City of Columbus, 2004). Columbus has an economy that is largely based in finance, insurance, university affairs, research, retail, real estate
and state government, which are largely centralized institutions (City of Columbus, 2004).

In many Northeastern and Midwestern cities, manufacturing may be a strong foundation to their regional economy. Many of literature has pointed out that manufacturing has decentralized at a significant rate over the past several decades (Kain, 1992; Miezkowski and Mills, 1993; Ihlanfeldt and Sjoquist, 1998). Therefore, many of these metropolitan regions may have significant low-skilled populations residing in a decentralized manner that follows the decentralized pattern of the manufacturing employment.

Since Columbus is less reliant upon manufacturing in their regional economy, this may be a reason for the pattern of low-skilled white residential locations.

One can, however, see a significant proportion of low-skilled whites living far from the CBD near the perimeter of Interstate-270. Some low-skilled whites may live here for housing amenities, neighborhood preferences or other reasons. Some households may choose non-urban locations for various reasons, stemming from proximity to their employment, (Herbert, 1973; Varady and Raffel, 1995), access to better schools, (South and Crowder, 1997) larger housing and more acreage, (Varady, 1990) or a more rural lifestyle (Michalos, 1997).

Furthermore, high-skilled residents may choose non-urban communities far from the CBD for these same reasons and the residential pattern of high-

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skilled whites suggests that their incomes allow them to enter communities such as Dublin, Worthington and Powell, where housing prices may be much higher and they can trade off housing amenity preferences for longer commutes to professional employment opportunities because their higher incomes allow them to reside in neighborhoods far from the CBD without disproportionately affecting the net wages through commuting costs (McLafferty and Preston, 1992).

Moreover, one can observe high-density residential locations for low-skilled and high-skilled whites near the CBD. This may be due to Columbus having many middle to upper class communities near the CBD, such as Upper Arlington, Clintonville, Marble Cliff and Grandview Heights. Many individuals may choose a more centralized residential location due to proximity to their employment or they may prefer a more urban lifestyle (Varady and Raffel, 1995).

Since Ohio State University is an institution that employs a significant number of high-skilled employees, professors and researchers, a large proportion of high-skilled residents may choose to reside in a more central location to be closer to the university. This may be a reason why some communities, such as Upper Arlington and Clintonville thrive as middle to upper class neighborhoods that offer high quality housing options, as well as close proximity to employment that many high-skilled individuals may prefer.

Finally, central locations of whites could also be due to social factors running counter to the suburbanization of the white population. One such process is gentrification. Gentrification is a process in which higher status individuals move into distressed neighborhoods which offer lower housing costs and
transform the neighborhood into an upscale thriving community with an urban appeal (Ley, 1994). Usually, there is some aspect of a neighborhood, such as historical significance, housing architecture or the like that spurs interests in the transformation process (Ley, 1986).

Gentrification is clearly evident in the Columbus Metropolitan area over the past 30 years, as higher income individuals have taken advantage of lower housing costs, closeness to the downtown CBD employment and urban appeal.

Victorian Village, sandwiched in between the Columbus CBD and Ohio State University is one such place that has undergone gentrification. It’s large Victorian style housing, proximity to downtown and Ohio State University and urban charm has turned this area from a once distressed neighborhood into a bustling neighborhood, significantly changing the socioeconomic makeup of this area (Hansan, 2005).

Another area, adjacent to Victorian Village has also undergone gentrification: the Short North. The Short North’s focus on the arts and urban storefront appeal has drawn many artists and middle to upper class residents to this area, making it a desirable location for many to reside (Hansan, 2005).

Thus, the overall pattern of white residential locations is a very complicated one, one that is void of racial discrimination in the housing market and segregation, one that represents the regional economy of the area and one that is based upon preferences of housing amenities, lifestyle preferences and one that has a family component to it, such as preferences of proximity to quality schools and places individuals deem as good places for their children to grow up.
From the visual inspection of the dasymetric surfaces of the distribution of the labor force population, it appears that residential segregation exists within Franklin County and that higher education levels gained for some African Americans does not significantly affect this residential segregation. Thus, there is now provided some visual evidence for a portion of Kain’s Spatial Mismatch Hypothesis, that African Americans are segregated into central-city areas of the Metropolitan area, whether this is due to racial discrimination, especially in the housing market, cannot be known without further in depth studies.

In the next section, I shall investigate the distribution of employment opportunities available for the labor force under study.

5.3 Analysis of Employment Opportunity Surfaces

The next visual analysis of the Dasymetric surfaces is to analyze the employment opportunities available for the labor force populations under study. These employment opportunity surfaces were constructed based upon the EEOC-1 and EEOC-4 reports discussed earlier and represent the expected distribution of employment by race and gender composition available to the labor force in the absence of racial discrimination in the work environment.

Examination of low-skilled employment opportunities (figures A.43 and A.46), reveals that low-skilled employment opportunities are available to both males and females at relatively significant densities across Franklin County, with
a peak in density near the downtown CBD and mostly confined to within the I-270 outerbelt. On the other hand, high-skilled employment opportunities are also scattered across Franklin County at significant densities, but are more aligned along the major interstates of I-71, I-70 and I-270. This is due to the construction of many office complexes along the northern corridor since the 1980’s corresponding the large suburban growth of populations in this area (Ball, 2001, Columbus Chamber of Commerce, 2001).

Office buildings along the northern corridor in Columbus, like many other North American cities have been growing outside of CBD due to amenities important to businesses, such as access to high-skilled populations, cheaper land, more space and a well-connected transportation network (Canadian Urban Institute, 2005).

In contrast to the high-densities of high-skilled employment along the northern I-270 outerbelt, the peak density of high-skilled employment still corresponds to the CBD, demonstrating that the downtown region is still the heart of Columbus’s financial, insurance and service oriented economy.

These patterns of employment opportunities do correspond with Kasarda’s (1985) thesis that low-skilled employment opportunities are decentralizing and the metropolitan CBD is turning into a center of information exchange, creating jobs that require high-skilled credentials. This can be seen with the high densities of high-skilled employment opportunities located near the CBD. On the other hand, this analysis reveals that low-skilled employment opportunities also peak near the CBD. The transformation of metropolitan Columbus may have also
created numerous low-skilled employment opportunities in the downtown area. Whether these low-skilled employment opportunities are characterized by low pay, minimal benefits and job security would have to be investigated further.

Moreover, there are high densities of low-skilled employment opportunities in Southern Franklin county, an area generally void of high-skilled employment. This is due to the Southern Franklin County region being the industrial heart of Franklin County (Columbus Chamber of Commerce, 2001).

Overall, from this analysis, one can only state that low-skilled employment opportunities are located over a significant portion of Franklin County with a peak density near the CBD. High-skilled employment opportunities are also scattered across a significant portion of Franklin County, but follow a more northerly pattern, and are generally aligned along the major interstate arteries within the county, especially along the Northern I-270 corridor, as this area has undergone significant population and employment gains since the early 1980’s (Ball, 2001; Columbus Chamber of Commerce, 2001). High-skilled employment also shows a density peak near the CBD, displaying that the CBD is still the heart of Columbus’s regional economy.

In terms of the Spatial Mismatch Hypothesis, this analysis suggests that a spatial mismatch may be present, especially if those low-skilled employment opportunities that the surfaces display near African American residences are different from the low-skilled employment opportunities located more distant from these African American neighborhoods, especially if the former are characterized by lower wages, fewer benefits and low job security. In addition, a
spatial mismatch may also be present if there are far more African Americans competing for these low-skilled employment opportunities near their residences with a larger share of the labor force, thus creating a shortage of available jobs for the residences, especially if African Americans do not have the means to commute further distances for employment. Further investigation is needed to examine whether this is the case.

Examination of the distribution of employment opportunities by race and gender demonstrate what the gender/race/skill-level of the spatial distribution of employment would be expected in the absence of residential segregation and racial discrimination, whether it be in the housing market or employment market.

African American employees would be expected under this scenario (figure A.31) to be scattered across the study area at relatively moderate to high densities with peaks near the CBD and in the northern suburbs of Franklin County along the I-270 outer belt, with other peaks in eastern and western Franklin County along Interstate 70. Under this scenario, low-skilled blacks (figure A.29) would be expected to be employed across the entire urban landscape with peaks near the CBD and the northern suburban communities along I-270 in northern Franklin County. High-skilled blacks (figure A.30) are also expected to be employed across the study area at a fairly constant rate, also, with a peak near the CBD.

For white employees, (figure A.32, A.35 and A.38) this pattern is similar to expected black employment, except that the density for white employment is higher in all locations compared to blacks, simply due to the larger white
population throughout the study area. For a Spatial Mismatch to potentially exist, the actual workers across the study area must be compared with the expected employment across the study area to demonstrate where in the study area, blacks are disadvantaged, as huge differences between actual and expected would indicate areas where blacks are being left out of the employment market, whether it be due to lack of spatial access to these employment opportunities or racial discrimination in the employment market. This analysis will be examined in the next section.

Finally, as a side note, the surfaces (figures A.23-A.28) indicate the labor force competing for employment opportunities across the study area, as females (or males), whether white or black, will be competing against females (or males), whether white or black, for employment opportunities as they are scattered across the study area.

Also, surfaces (figures A.43 – A.48) indicate the employment opportunities that females (or males), whether white or black will be competing for. By allowing these employment opportunities for a specific gender to be open to both races means that there is controlling of racial discrimination in the work environment across the study area and examining purely the spatial access to employment and how this affects the employment outcomes of the population under study. I also assume that gender discrimination in employment markets is constant across the study area.
5.4 Analysis of Actual vs. Predicted Workers

In the previous section, I examined the expected employment density across the study area based upon data from the EEOC-1 and EEOC-4 reports. This expected density was the density predicted in the absence of racial discrimination, whether it be in the work environment or in the housing market. This density would also be the expected density if blacks had the same spatial access and transportation means as whites. These two disadvantages (racial discrimination and spatial access) were controlled for based upon these counts.

In this section, I will examine the spatial distribution of actual employment density across the study area by race and skill and compare these to areas where specific laborers of gender/race are expected to be employed. I will examine areas within the study area where blacks or whites are underrepresented or over-represented in the labor market. Areas where these under and over-representations are located may give some insight into large and fine scale processes that are occurring across the metropolitan area.

One would expect the employment density in terms of under-representation to show no significant spatial patterns for white laborers, due to the white labor force residential density being relatively uniform and widely dispersed across the landscape. Thus, whites would not suffer from the disadvantages of spatial access, especially when whites have more access to private transportation and do not rely as heavily as blacks upon public transportation (Taylor and Ong, 1995). In addition, whites would not readily be
subjected to racial discrimination in housing markets (Yinger, 1986) or the work environment (Turner, 1997).

African Americans, on the other hand, would be expected to be under-represented in areas distant from their residences. This would be expected in some areas of the study area, especially since it was visually recognized in the previous sections, that blacks were segregated into certain neighborhoods near the central city in the Columbus, Ohio MSA.

Furthermore, blacks rely more heavily upon public transportation than whites (Taylor and Ong, 1995), thus limiting their geographical access and spatially constraining their mobility. In addition, labor market discrimination in the work environment would also likely be a cause of lower African American worker density than would be expected, especially in non-urban neighborhoods that are disproportionately white (Turner, 1997).

Therefore, if racial discrimination in the work environment is present, one would expect the actual number of African American workers to be less than what would be expected then when racial discrimination is controlled, especially in areas where blacks are residentially absent.

Thus, in terms of spatial access, the visual evidence of racial segregation and racial discrimination in the work environment would suggest a spatial pattern where blacks are under-represented in the work environment in non-urban areas, especially in non-urban areas where a significant proportion of residents are white. Also, there should be an under-representation in other areas that are distant from racially segregated African American neighborhoods.
In terms of accessibility and racial discrimination, this pattern would suggest that a Spatial Mismatch may exist. In addition racial discrimination in the housing market and work environment and accessibility issues due to the means of transportation and residential segregation, there are other processes that are likely to be taking place across the study area that should contribute to the overall pattern of worker under and over-representation one will examine across the study area. These process will be discussed during the analysis of these surfaces, as these are no doubt also significant influences to the patterns one will observe.

To construct surfaces that reveal the actual count of workers by race and skill, data from the 2000 Census Transportation Planning Package (CTPP) Part 2 Files was used, which gives the actual count of workers by two-digit NAICS industry and by racial composition in each Census Tract. This count was then used to estimate the percentage of these workers per industry that were high-skilled or low-skilled by examining the EEOC-1 and EEOC-4 reports, broken down by NAICS 2-digit industry. The proportion of jobs in each industry were then summed for each Census Tract to give us a fairly accurate estimation of the workforce for each tract, broken down by race and skill.

These counts are then redistributed to a 50 x 50 meter grid overlain the study area via the Dasymetric Method\textsuperscript{41} of surface creation and the expected count from the employment opportunity surfaces was subtracted at each cell

\textsuperscript{41} The Dasymetric Method was used due to its advantages with respect to the other methods, in that it was better in:
1. lining up counts with expected counts, cell by cell, and:
2. removing possibilities of extreme or outlying values that can be the result of the usage of the IDW or Pycno surface creation methods.
location to give us a count of under-representation or over-representation across the study area.

5.4.1 Analysis of African American Workers

Starting off this analysis, I examine the spatial pattern of actual vs expected African American worker counts, regardless of skill level. Analysis of this surface distribution (Figure A.55) reveals that outside of Franklin County, most areas display an under-representation of black employees, or less employees than would be expected. This is most likely due to the substantially low African American population density in these areas and the distance to and lack of spatial access to these employment opportunities from central city African American neighborhoods, especially when blacks significantly rely upon public transportation more than whites (Taylor and Ong, 1995).

If one would examine the map of COTA bus links (Figure A.2), it can be denoted that areas outside of Franklin County have no bus service and are disconnected to central city African American neighborhoods within Franklin County. Thus, spatial accessibility would seem to be an issue for African Americans to obtain employment outside of Franklin County.

One interesting finding in the surfaces that can be observed is that in extreme Southern Delaware County, there are a few areas that are accessible by COTA bus service. It is in these areas where black worker density exceeds expected African American density. Thus, transportation and accessibility do
appear to a partial cause of the under-representation of African Americans in some areas outside of Franklin County, as these areas of over-representation demonstrate that given transportation access, African Americans can sometimes gain access to employment far from their neighborhoods.

Racial discrimination in these work environments could also be a possible or partial explanation of this pattern. If African Americans can access these employment opportunities through private automobile, this access may be partially offset by racial discrimination in the work environment. As Turner (1997) points out, some employers may choose a suburban or exurban location or use certain hiring methods within these locations to avoid hiring African Americans. This is a possibility as a partial explanation of the patterns visualized in the counties surrounding Franklin County. It is interesting to note, that in Fairfield, Licking, Madison, Pickaway, Union and a significant portion of Delaware County, that there are no areas of significant density where blacks are working more than would be expected under a scenario of no lack of spatial access and discrimination-free work environments.

Other factors and processes may also contribute to this pattern of under-representation of African American workers outside of Franklin County. These processes are social isolation, segregated social networks, establishment size, employer hiring practices and race of employer.

Racial segregation of African Americans also leads to social isolation.

Neighborhoods are important in establishing social contacts and social networks.

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42 There are areas where blacks are working at slightly higher densities than one would expect in these counties. However, these significantly low densities are likely due to the differences in the counts of employment opportunities and workers within the zoning boundaries used from different data sources.
These social networks are typically racially (and gender) segregated and these networks are fairly important to directing persons to employment, housing and other institutions (Wilson, 1987; Hanson and Pratt, 1992; Kasinitz and Rosenberg, 1996). African Americans segregated into certain neighborhoods may mean that they are socially isolated from these networks that lead to employment, thus, they may not be aware of employment opportunities available in other parts of the study area.

Furthermore, characteristics of employment firms may also contribute to the pattern of black under-representation outside of Franklin County. Employer hiring practices may also keep African Americans out of employment in certain areas. Turner (1997), in her study of Detroit auto firms, found that many suburban firms recruited through informal methods such as employee referrals. If these workplaces are already significantly white, then these methods will tend to produce the same proportion of new hires, (Holzer, 1987; Turner, 1997; Raphael, Stoll and Holzer, 2000) as social networks, social isolation and segregation are all tied into informal recruitment hires.

Other factors may be partially responsible for the pattern of under-representation of African Americans outside of Franklin County. Smaller-sized employment centers are more likely to not be held to Equal Employment government regulations. Thus, smaller establishments may tend to hire less African Americans than larger firms, as they can get away with discrimination more easily (Turner, 1987; Raphael, Stoll and Holzer, 2000).
Finally, white-owned employers are disproportionately less likely than black-owned employers to hire African Americans (Raphael, Stoll and Holzer, 2000). Whether, employment centers outside of Franklin County are significantly smaller in size and more white-owned than those within Franklin county would require further investigation outside of this study, but these are always possible factors that contribute to the pattern observed.

Within Franklin County, African Americans are over-represented in the workforce in areas near their residential locations. From the analysis of African American labor force populations, it was denoted that African Americans are segregated into areas near the central city to the east of Interstate 71, running North to South along the interstate. These tend to be the same areas where African Americans are also employed at significant rates.

As with the labor force population, it appears that blacks are employed at higher rates than expected in areas that follow the city of Columbus corporation limit. This pattern reveals that employer discrimination may also play a factor in where African Americans work inside of Franklin County, as employers outside of the City of Columbus corporation boundaries may significantly discriminate against African Americans in the work environment, whether discrimination manifests itself in their discriminatory views of blacks, or their hiring practices, which reproduce the firm’s same type of labor force (Turner, 1997; Raphael, Stoll and Holzer, 2000). This pattern seems to coincide with Turner’s (1997) study, in which, employers outside of the City of Detroit tended to view the labor market as separate from the City of Detroit labor market, where wages were lower within
the City of Detroit, thus allowing employers to hire African Americans, who were willing to work for lower wages, due to shortage of employment opportunities near their neighborhoods. This may also be occurring within the study area here, as the City of Columbus corporation limit may be viewed by employers as a separate labor market, one that is viewed in justification for lowering their wages and hiring African Americans at lower wages due to a less tight labor market within the city of Columbus (Ihlanfeldt, 1999).

The African American worker density pattern within Franklin County also suggests that African Americans are over-represented in the labor market in an area centered near the CBD. This may be due to many state government offices located in downtown Columbus. State governments tend to hire a significant proportion of African American women (EEOC-1, 2000). Thus, these high densities in the eastern portion of downtown may represent the state government locations within the CBD.

On the other hand, examination of areas where African Americans are under-represented in the labor force reveals some interesting patterns in other areas of Franklin County. Many non-urban areas in Northwestern Franklin County have vast areas where African Americans are under-represented in the labor force. These areas correspond to communities where a significant number of upper middle class and upper class whites reside, communities such as Dublin and Worthington. (Figure A.3)

Access to these areas is possible, as these areas are serviced by COTA bus service. This suggests that accessibility cannot be the only reason why African
Americans are not employed here. This suggests that other processes, such as racial discrimination in the workplace may be taking place in these areas, whether it is based upon racially discriminatory views of African Americans, or employer hiring methods, such as employee referrals, which tend to reproduce the same composition of the established workforce (Turner, 1997), especially since social networks are highly segregated (Hanson and Pratt, 1992) and these social networks are important in connecting persons to employment (Wilson, 1987; Kasinitz and Rosenberg, 1996). Thus, African Americans may not be aware of employment opportunities available in these communities.

Similar patterns can also be seen in other non-urban communities across Franklin County, such as Hilliard, Upper Arlington and Reynoldsburg. Thus, racial discrimination in the work environment due to employer’s discriminatory views of African Americans or discrimination in their hiring and recruiting methods may also partially account for the under-representation of African Americans here, especially since these communities also have public transportation links that connected segregated African American neighborhoods to these communities.

Overall, there are significantly more areas in Western Franklin County than in Eastern Franklin County that have under-representation of African Americans in their work force. In addition to racial discrimination in the work environment due to hiring methods and blatant racial discriminatory views of African Americans and increased costs of accessibility to these areas, other factors may also play a role in the distribution of the black work force in these
It is possible that these areas may have significantly more white-owned firms and smaller firms, firms that tend to hire significantly less African Americans, due to the lack of Equal Employment government regulations (Raphael, Stoll and Holzer, 2000) than firms located in the Eastern half of Franklin County, near African American neighborhoods. Thus, these may also be partial reasons for this pattern observed in these areas of Franklin County. Investigation would be needed to examine whether this is the case.

Finally, there are also areas around African American neighborhoods where African Americans are under-represented in the labor force. These firms may hire significantly less African Americans, due to their informal hiring methods, thus, not linking African Americans to these employment areas, due to segregated social networks and social isolation. These firms may be smaller in size or may be owned by whites. Any of these reasons are plausible causes for employment centers near African American neighborhoods to hire less than expected numbers of African Americans. Thus, accessibility is not the only reasoning for lower African American employment rates, as this analysis shows that there are firms located in close proximity to each other that have over-representation and under-representation of African Americans, suggesting that other processes are occurring across the urban landscape that are not linking African Americans to employment.
5.4.2 Analysis of Low-Skilled African American Workers

Examining the under-representation of low-skilled African American workers (Figure A.56) outside of Franklin County conforms to the overall African American pattern, with no significant areas of well representation in these areas, except for a small area of extreme Southern Delaware County where transportation links are present. This pattern may also be due to the reasons outlined for the overall African American pattern of poor accessibility to these employment opportunities, racial discrimination, poor social networking and employer and firm attributes.

Within Franklin County, the low-skilled black worker pattern adheres to the overall black pattern quite consistently also, with a few minor contrasts. First, there are areas to the West of Interstate 71 that show slightly more representation of African American employment than the overall pattern suggests. However, these areas tend to follow the City of Columbus boundaries, and this may be due to the reasons outlined earlier, that employers view the City of Columbus as a separate labor market, and in communities not within the city limits, employers may have more discriminatory views of African Americans, and may use informal hiring methods which leave African Americans outside of these establishments due to their social isolation and segregated social networks. Thus, African American may not be aware of the employment opportunities available in these areas.
In addition, along the Northern corridor of Franklin County, the patterns of under-representation of low-skilled African Americans also conform to the overall pattern, as racial discrimination by employers or employer hiring practices, social isolation and social network segregation are intertwined to create an under-representation of blacks in these areas.

As with the overall African American pattern, there are some non-urban areas along the Northern Corridor where public transportation links are existent and follow the City of Columbus corporation limits. These are areas where African Americans are well-represented in the labor force, displaying that in the absence of racial discrimination in the labor force, transportation access can lead African Americans to employment in areas that are distant from their neighborhoods.

Finally, there are also areas near African American neighborhoods where low-skilled African Americans are significantly under-represented. Access to these employment opportunities cannot be a factor in their representation, as these employment opportunities are on the door step of their neighborhood, so either blacks are not employed in higher numbers in these firms due to social isolation and segregation in social networks that lead to employment, informal hiring methods in employer recruitment, employer discriminatory views of blacks, establishment size or white-owned firms. Investigation beyond this study would be needed to establish the reasoning behind this pattern.
5.4.3 Analysis of Black High-Skilled Workers

The spatial distribution of actual vs expected African American high-skilled workers (figure A.57) also depicts a similar pattern to the overall African American spatial density pattern, however, there are a few differences that will be pointed out.

African Americans are more significantly reliant upon public transportation than whites (Taylor and Ong, 1995). As African Americans gain the educational skills necessary for high-skilled employment, their gains in higher-skilled employment should lead to higher incomes and thus a more likelihood in owning a private automobile (Taylor and Ong, 1995).

From the visual examination of high-skilled African American residential locations, it can be examined that they are still segregated into the same neighborhoods as their low-skilled counterparts. Despite their segregation, they are more likely to be mobile due to the possibility of owning a private automobile. In addition, their higher skill levels and subsequent higher incomes mean that longer commutes should not be as economically damaging to their net wages, as longer commutes would be to lower-skilled workers. Thus, they should be geographically more mobile within the study area. Thus, accessibility should be less of a factor in gaining employment as their low-skilled counterparts.

In examining the surfaces, one can see that outside of Franklin County, high-skilled African Americans are still under-represented in the labor market. Since African Americans with higher skills are not restricted to public
transportation, accessibility to these employment opportunities in these areas should be feasible. Thus, other factors may play a role in their under-representation here, such as employer discrimination or their social isolation and segregated social networks.

High-skilled African Americans still reside in the same segregated neighborhoods as their low-skilled counterparts. Therefore, they may suffer the same social isolation as low-skilled black and their segregated social networks may not lead them to employment opportunities outside of the county, especially if employers here disproportionately use informal means of hiring. Thus, they may not have knowledge of employment opportunities in these areas, despite being in the high-skilled labor market (Kasinitz and Rosenberg, 1996).

Within Franklin County, high-skilled African Americans are well-represented in the downtown CBD, in the same areas as low-skilled African Americans. This may be also due to the locations of state government offices, in which, the public sector tends to hire a large proportion of African American women (EEOC-1, 2000).

In addition, within Franklin County, one can generally rule out accessibility as a key factor in high-skilled African American employment locations. Thus, other social processes/factors may play a more significant role in connecting high-skilled African Americans in employment opportunities across the region. What can be depicted from analysis of the surfaces, is that like low-skilled African Americans, high-skilled blacks are also employed in close proximity to their segregated neighborhoods.
What is interesting to note is that in most areas where low-skilled African Americans are significantly under-represented in the employment market, so too are high-skilled African Americans. Since accessibility can be ruled out as an issue, other factors come into focus. Generally high-skilled African Americans are not employed in non-urban communities, suggesting that employer discrimination, whether in discriminatory views of blacks or in their hiring and recruitment processes, seem to be fairly significant in the Columbus employment market, especially in the Northern Corridor, in communities such as Hilliard, Worthington and Dublin.

Another factor that may be significant could be social isolation and social networks. Since high-skilled African Americans are generally socially isolated, as they generally reside in the same neighborhoods as their low-skilled counterparts, thus, they may have weak social networks that connect them to employment (Wilson, 1987; Kasinitz and Rosenberg, 1996), especially if employers in these communities are using informal recruitment methods to fill their employment.

Other reasons for these areas having lower African American worker counts may be due to these areas disproportionately having smaller firm sizes or are disproportionately white owned, two factors that tend to hire fewer African Americans (Raphael, Stoll and Holzer, 2000).

Thus, from this analysis of high-skilled under and over-representation in the study area it is revealed that low-skilled and high-skilled African Americans are generally employed in the same areas of the study area, since one group (high-
skilled African Americans) are generally more mobile, due to their higher likelihood of owning private automobiles, then other factors are occurring across the urban landscape that are excluding African Americans from gaining employment in certain areas of the labor market. The two most likely factors may be employer discrimination taking place in these areas, whether it be in their personal views or hiring practices, and social isolation and weak social networks, as high-skilled African Americans generally reside in the same areas as low-skilled African Americans.

Thus, despite their higher skill levels, they may be socially isolated in their social networking, which tends to lead persons to employment opportunities. Despite the fact that they are generally more geographically mobile, they may not be aware of distant employment opportunities due to being segregated into these weaker social networks (Wilson, 1987; Kasinitz and Rosenberg, 1996).

Finally, other establishment attributes, such as smaller firm size and white-owned firms may also play a factor in their under-representation into these areas. These factors generally lead to the under-employment of African Americans (Raphael, Stoll and Holzer, 2000).

5.4.4 Analysis of White Workers

White workers, unlike African American workers, are not segregated into confined neighborhoods, unlikely to suffer from racial discrimination in the work
environment, and in addition, have better access to private means of transportation than African Americans. Thus, one would expect the spatial distribution of under-representation or over-representation to show no significant overall spatial pattern across the study area, especially since whites generally reside in a significant proportion of the study area.

Examination of the actual vs. expected white worker surface across the study area (figure A.58) displays this hypothesis pretty significantly. There are pockets of areas where white workers are employed less than expected and these pockets are scattered all across Franklin County and the surrounding counties. However, mixed in these areas are also pockets of over-representation of white workers, where white worker density is higher than what one would expect. Therefore, it is difficult to point out any significant overall pattern from this surface map.

Some smaller scale patterns that can be noted are that in areas where blacks significantly reside, there is a significant absence of white workers, especially along the eastern side of Interstate 71, running North to South. It is unclear why whites do not hold employment in these areas. Some suggestions may be that whites have internalized unfounded fears of African Americans that keep them from going into these areas (Krysan, 2002a).

Another possibility is that the labor market here may have fewer employment opportunities relative to the number of local laborers. Therefore, through supply and demand, wages may be significantly lower in these areas (Ihlenfeldt, 1999). Thus, without geographical constraints due to higher private
automobile ownership, whites may search for employment elsewhere within the county for higher wages. Further studies would be needed to draw a conclusion.

Moreover, in the Northern Corridor of Franklin County in the communities of Hilliard, Worthington and Dublin, there are several areas where whites are employed at higher rates than would be expected. Thus, this strengthens the hypothesis for African Americans, in that, other factors besides spatial accessibility are taking place in these areas, excluding African Americans from employment. There are other areas within Franklin County where this can be seen also, especially in Southern Franklin County, an area where is the industrial center of the Columbus labor market (Columbus Chamber of Commerce, 2001). The pattern of high-skilled employment for whites and African Americans displays that high-skilled whites are significantly over-represented in these areas, as high-skilled African Americans are generally void of employment here, suggesting other patterns besides accessibility going on here.

The spatial distributions of actual vs. expected white low-skilled and high-skilled workers across the study area (Figures A.59 and A.60) reveal similar phenomenon as the overall pattern, as there are very few explanations for the overall spatial patterns revealed, but smaller scale patterns such as those suggested for the overall pattern can be found in some of the same areas of the study area.

One final note is that when examining at each skill level, the pattern across the study area reveals that there are significantly more areas where whites are
over-represented in the work environment than they are under-represented. The reverse is true for African American workers.

5.5 Analysis of Public Transportation vs. Private Automobile

In this section of the analysis, I will examine how much of an advantage a person in the labor force would have by having access to a private automobile vs. being forced to rely on public transportation. It is well documented that African Americans rely more heavily on public transportation than whites (Taylor and Ong, 1995; Ihlanfeldt and Sjoquist, 1998). Public transportation provides less flexibility and mobility and with slower speeds, public transportation can become a mobility restriction that can limit the geographical access of its riders to various opportunities, especially employment opportunities scattered across the geographical landscape, thus, creating a disadvantage to the persons who rely on it as their main means of transportation.

To examine how much of a disadvantage or restriction using public transportation is within the Columbus MSA, I examine how many more employment opportunities can be accessed by having access to a private automobile vs. using public transportation.

This access to employment opportunities ties into the Spatial Mismatch Hypothesis, in that, African Americans, who are generally segregated into central city areas of U.S. Metropolitan areas, are more likely to use public transportation.
than whites (Taylor and Ong, 1995). In the Columbus MSA, it was denoted from earlier analysis that African Americans are indeed racially segregated into areas of the metropolitan area, near the central-city. This, in addition to African Americans being more than four times more heavily reliant on public transportation within Franklin County (8.36% of blacks use public transportation as their means of transportation, compared to only 2.04% of whites) (Census 2000) than whites, can limit their access to employment opportunities and providing them with a disadvantage in the labor market, especially if employment opportunities around these African American neighborhoods are scarce.

To examine the advantage of private automobile vs. public transportation, a job catchment area of x minutes was created around each residential point within Franklin County, one using an area based on traversing a network using private automobile, and another based on traversing the road network using public transportation. After a job catchment area of x minutes (with x set to 10, 15 and 30 for this study) by private automobile (Autox) and by public transportation (COTAx) was created around each of these residential points, the total number of low-skilled (Low) and high-skilled (High) employment opportunities were summed in each of these areas to provide a gross count of the number of opportunities that can be reached within an x minute commute by each means of transportation.

43 If public transportation routes were not provided near a residence, walking as a means of transportation was substituted, as stated earlier, with a speed of 3 miles per hour, the average human walking speed along the road network segments (Average human walking speed is between 1-2 meters per second, which I set to a mean of 3 miles per hour).
The job count by skill level within each job catchment area was provided by each surface creation method used in this study (Dasymetric, IDW d = 1, IDW d = 2, and Pycno Method), and an average of the four methods was computed, which will be used for the discussion provided here. (Table 5.1)

### Number of Jobs within 10, 15 and 30 Auto and Public Transit Commute

<table>
<thead>
<tr>
<th>Skill Level</th>
<th>D = 1</th>
<th>D = 2</th>
<th>Average</th>
<th>10</th>
<th>15</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Dasymetric</td>
<td>1632</td>
<td>1623</td>
<td>1618</td>
<td>35585</td>
<td>35880</td>
<td>35867</td>
</tr>
<tr>
<td>Low Dasymetric</td>
<td>2645</td>
<td>2642</td>
<td>2623</td>
<td>56358</td>
<td>56912</td>
<td>56913</td>
</tr>
<tr>
<td>High IDW d = 1</td>
<td>1631</td>
<td>1623</td>
<td>1626</td>
<td>21.8</td>
<td>22.0</td>
<td>22.0</td>
</tr>
<tr>
<td>Low IDW d = 1</td>
<td>2642</td>
<td>2623</td>
<td>2632</td>
<td>35880</td>
<td>35911</td>
<td>35811</td>
</tr>
<tr>
<td>High IDW d = 2</td>
<td>1623</td>
<td>1632</td>
<td>1619</td>
<td>21.3</td>
<td>21.5</td>
<td>21.7</td>
</tr>
<tr>
<td>Low IDW d = 2</td>
<td>2623</td>
<td>2632</td>
<td>2619</td>
<td>56358</td>
<td>56913</td>
<td>56948</td>
</tr>
<tr>
<td>High Pycno</td>
<td>1618</td>
<td>1626</td>
<td>2619</td>
<td>22.2</td>
<td>22.0</td>
<td>21.7</td>
</tr>
<tr>
<td>Low Pycno</td>
<td>2619</td>
<td>2632</td>
<td>2619</td>
<td>56948</td>
<td>56783</td>
<td>56783</td>
</tr>
<tr>
<td>High Average</td>
<td>1626</td>
<td>1626</td>
<td>1626</td>
<td>14.8</td>
<td>14.9</td>
<td>14.9</td>
</tr>
<tr>
<td>Low Average</td>
<td>2632</td>
<td>2632</td>
<td>2632</td>
<td>39657</td>
<td>39933</td>
<td>39934</td>
</tr>
</tbody>
</table>

Table 5.1: The average employment opportunity count by skill level around each residential point within Franklin County using a job catchment area of 10, 15 and 30 minutes for private automobile and public transportation, including the advantage/disadvantage between the two. Each of the four surface creation methods were used, as well as the average of the four methods.

Examining a 10 minute commuting area within Franklin County, an automobile user has access to an average of about 22 times as many high-skilled employment opportunities and about 21.5 times as many low-skilled employment opportunities, on average, from a residential location within Franklin County, as a person relying on public transportation. Within a 15 minute commuting area, the
advantage is still almost 15 times larger for auto users having access to low and high-skilled employment opportunities.

An interesting finding is that even when comparing a 30 minute public transportation commute to a 15 minute private automobile commute, the 15 minute private automobile commute still provides an individual at a residential location within Franklin County, on average, with an advantage of almost 2.2 times as many low and high-skilled employment opportunities as one would have access to if they had a commuting area of 30 minutes via public transportation.

These results may seem overwhelming and suggest that having access to a private automobile has an astronomical advantage to the gross total number of employment opportunities as compared to being a captive rider using public transportation. However, in terms of the Spatial Mismatch Hypothesis, one is concerned about the disadvantage of African Americans in spatial access to employment.

From the previous analysis, it was denoted that there are many areas within Franklin County where the public transportation system does not operate. These areas include a significant amount of areas where African Americans do not reside. This may account for a huge proportion of the disadvantage in the gross number of employment opportunities for public transportation users, when examining all residential locations within the county.

Furthermore, it was previously analyzed that the majority of African Americans within the Columbus MSA were segregated within areas of Franklin County near the central-city, areas where public transportation system operates
heavily. (Figure A.2) Since African Americans are more heavily reliant upon public transportation than whites, (in this case, more than four times more reliant within Franklin County (Census 2000)), it is within these areas where one would like to examine how much of a disadvantage using public transportation is, compared to having access to a private automobile. This shall give us a general idea of how much public transportation limits the ability for African Americans within Franklin County to gain access to employment. Thus, I will examine the average employment opportunity count in commuting areas of the four surface creation methods by skill level, limiting ourselves to residential locations where African Americans significantly reside.44 (Table 5.2)

<table>
<thead>
<tr>
<th></th>
<th>10 Minute</th>
<th>15 Minute</th>
<th>30 Minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Average</td>
<td>3364</td>
<td>57824</td>
<td>11392</td>
</tr>
<tr>
<td>Low Average</td>
<td>5509</td>
<td>89151</td>
<td>18322</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17.2</td>
<td>16.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>121918</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>18322</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>188986</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>72848</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>111306</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.7</td>
</tr>
</tbody>
</table>

Table 5.2 Comparison of the gross count by skill level of the average number of employment opportunities a person would have access to by means of transportation within a commuting area of x minutes within areas of Franklin County where African Americans reside significantly.

Examining areas where African Americans significantly reside, the advantage of a private automobile is still significantly evident. For a 10 minute commuting area, a private automobile user has access to about 17.2 times as many

44 By significantly reside, I will examine areas where the African American labor force resides at a rate of one standard deviation or greater in comparison to the overall African American count within the study area.
high-skilled and about 16.2 times as many low-skilled employment opportunities as a public transportation user. When examining a 15 minute commute, the advantage for auto users shrinks somewhat, but is still astronomically significant as compared to public transit users, as automobile users have access to 10.7 times as many high-skilled and about 10.3 times as many low-skilled employment opportunities as public transit users making a similar time based commute.

Furthermore, for a comparison between a 30 minute public transit commute and a 15 minute automobile commute, on average, the 15 minute automobile commute still has access to 1.7 times as many high-skilled and access to 1.7 times as many low-skilled employment opportunities as a 30 minute commute using public transportation.

Thus, by examining areas of Franklin County where African Americans significantly reside, one can see that having access to an automobile is a huge advantage in the spatial mobility of African Americans. Public transportation limits a person’s mobility as analyzed through the gross number of employment opportunities a person has access to in a commuting zone of x minutes.

Thus, for African Americans being spatially segregated into central-city areas of the Metropolitan Area, the number of local employment opportunities would seem to be a significant determinant of the employment outcomes of African Americans, not only in the gross number of employment opportunities, but also in comparison to the gross number of persons competing for these employment opportunities.
Therefore, from the analysis here, blacks who are spatially segregated are spatially disadvantaged in their mobility, as they rely more heavily upon public means of transportation than whites and have tremendously less access to employment opportunities than automobile users in a commuting area of x minutes. This serious disadvantage seems to indicate that local employment opportunities may play a heavy role in the employment outcomes of African Americans.

As a side note, these results do not conform at all with Cohn and Fossetts’ (1996) study, where they found that African Americans in Boston and Houston had greater spatial access to a greater number of employment opportunities than whites, no matter how restricted in their means of transportation blacks were. These results suggest heavily in the other direction, in that limiting a person’s means of transportation can significantly reduce their access to the gross number of employment opportunities in the study area. These results may have to do with the superior means of redistributing population and employment opportunity counts and the problems inherited from using zonal boundaries provided by the data.

Finally, not only is the access to the gross number of employment opportunities important, but also the comparison of this count to the gross number of the labor force within the same commuting zone of spatial access competing for these opportunities. If automobile use significantly increased the Jobs/Persons ratio compared to the Jobs/Persons ratio within a public transit commuting catchment area of x minutes, then one can say that it is very likely that access to
automobile has a very significant effect on the employment outcomes of the labor force, especially on African Americans, who are racially segregated into the central-city regions of Metropolitan Areas, and rely more heavily on public transportation than whites. Examination of the Jobs/Persons ratios near white and African American residential locations will be analyzed in the next section.

5.6 Comparison of Jobs/Persons ratios near African American and White neighborhoods

The Spatial Mismatch Hypothesis states that housing market discrimination and subsequent residential segregation, in addition to the decentralization of low-skilled employment, particularly in manufacturing have created a surplus of African American laborers in relation to the number of employment opportunities available in and around African American neighborhoods (Kain, 1968, 1992; Ihlanfeldt, 1999).

On the other hand, the Skills Mismatch Hypothesis posits that centers of North American metropolitan areas have transformed from centers of durable goods and manufacturing into centers of technology and information exchange. This has created employment opportunities with higher skill qualifications near the downtown CBD. As African Americans are continuously segregated into central-city neighborhoods in the metropolitan region, and as African Americans are still behind whites in terms of educational attainment, this has created a mismatch in terms of the skill level of residents of central-city segregated
neighborhoods and the employment opportunities in and near those neighborhoods (Kasarda, 1985, 1989; Bauder and Perle, 1999).

In this section, I will analyze these two hypotheses, as I will compare the average number of jobs/persons in terms of skill and gender within an automobile commute of 10 minutes\(^{45}\) and within a public transit commute of 10 minutes around residential locations where whites and African Americans significantly reside.\(^{46}\) I will then compare the means of these two areas to examine whether there are significant differences in the mean jobs/persons ratios between these two areas\(^{47}\). I will examine the Jobs/Persons ratio in terms of the average of all the Jobs/Persons ratios from all four of the population and employment opportunity surface creation methods.

**10 Minute Automobile Commuting Area**

<table>
<thead>
<tr>
<th>Male High Skilled</th>
<th>Black</th>
<th>0.723</th>
<th>0.000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>White</td>
<td>0.634</td>
<td></td>
</tr>
<tr>
<td>Male Low Skilled</td>
<td>Black</td>
<td>1.483</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>1.926</td>
<td></td>
</tr>
<tr>
<td>Female High Skilled</td>
<td>Black</td>
<td>0.779</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>0.675</td>
<td></td>
</tr>
<tr>
<td>Female Low Skilled</td>
<td>Black</td>
<td>1.630</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>1.944</td>
<td></td>
</tr>
</tbody>
</table>

**Table 5.3** The comparison of the average Jobs/Persons ratio between areas where African Americans and whites significantly reside according to gender and skill level, in addition to the significance of the differences between the means within a 10 minute automobile commuting area.

---

\(^{45}\) Here, I will examine only a 10 minute commuting area, as this will be the commuting area I will analyze for my regression analysis in the next section.

\(^{46}\) By significantly reside, I will examine areas where the African American labor force resides at a rate of one standard deviation or greater in comparison to the overall African American count within the study area. In addition, I will examine areas where the white labor force resides at a rate of one standard deviation or greater in comparison to the overall white population count within the study area.

\(^{47}\) Significant differences of means will be tested via a difference of means test.
Table 5.4 The comparison of the average Jobs/Persons ratio between areas where African Americans and whites significantly reside according to gender and skill level, in addition to the significance of the differences between the means within a 10 minute public transportation commuting area.

Comparison of the mean values of low skilled Jobs/Persons ratios between the white and black residential areas, one can see that in white residential areas, the average number of employment opportunities in relation to the number of persons competing for these opportunities in these areas is significantly higher than that number in black residential areas in both a 10 minute automobile and a 10 minute public transit commuting area.

This is in accordance with the Spatial Mismatch Hypothesis which states that there should be a lower Jobs/Persons ratio near African American residential locations (Kain, 1968, 1992; Ihlanfeldt, 1999).

What this analysis does reveal that does not fit with the Spatial Mismatch Hypothesis, is that there is not a shortage of employment opportunities in relation to the number of labor force competing for these opportunities near African American neighborhoods, as the Jobs/Persons ratios for low-skilled individuals is well above 1.0 in all cases, across gender and commuting lines. This reveals that
low-skilled employment opportunities are plentiful in and around both African American and white neighborhoods.

In terms of the Skills Mismatch Hypothesis, there tends to be higher Jobs/Persons ratios in terms of high-skilled employment around African American neighborhoods compared to white neighborhoods. However, there are greater numbers of high-skilled African Americans in comparison to the number of high-skilled employment opportunities around African American neighborhoods. This is revealed by the Jobs/Persons ratios well below 1.0. Therefore, there does not appear to be a Skills Mismatch in terms of the number of high-skilled employment opportunities in relation to the number of high-skilled residents.

Thus, there does not appear to be a Spatial Mismatch or Skills Mismatch in terms of the number of employment opportunities and skill level around African American neighborhoods at an average residential location. However, this does not rule out the Spatial Mismatch Hypothesis or the Skills Mismatch Hypothesis as a significant possibility in affecting African American employment outcomes, as the variation across these two areas is not taken into consideration, as there may be locations within these areas that have significantly different Jobs/Persons ratios that differ from the mean value.

Finally, what is important here, in terms of the Spatial Mismatch Hypothesis and Skills Mismatch Hypothesis, is not whether there are significantly lower Jobs/Persons ratios near African American neighborhoods in terms of low-skilled employment opportunities (or significantly higher ratios for high-skilled
employment opportunities), but rather, how these jobs/persons ratios affect the employment outcomes of African Americans. This will be examined in the next few sections.

5.7 Logistic Regression Analysis

Logistic regression analysis will complete this study. Individual and accessibility factors that affect a person’s employment outcome will be examined for each gender/race subgroup.

The logistic regression equations will examine the individual and accessibility factors that affect an individual’s probability of being employed. Each population subgroup will be examined by a separate equation and will be constructed to examine the overall effects that race, gender and skill have on the probability of being employed.

The equations will take the form:

$$P_i(E) = f(I_i, JP_{ij})$$

where:  $P_i(E)$ is the probability that individual i is employed.

$I_i$ are the individual factors that affect the probability that an individual is employed.

$JP_{ij}$ accessibility; Jobs/Persons ratio for individual i at location j.

Individual factors shown in past literature that may affect the probability of being employed include: Number of related children in the household, Age in
years, Female Head of Household, Children Under 6 years old, Children 6 to 17 years old, Enrollment in School, Education in years and Disability.

Finally, the accessibility variables will be added to the equations to examine how much accessibility to employment opportunities affects the employment outcomes of individuals after individual characteristics are controlled for. The accessibility measures include the Jobs/Persons ratios measured from the Dasymetric, Inverse Distance Weighted and Pycnophylactic surfaces created earlier in this analysis. Finally, an average measure of these four Jobs/Persons ratios will also be calculated. These ratios are calculated within a 10 minute job search areas around an individual’s residential location.48

5.7.1. Predicted Factors affecting White Women

The first population subgroup that will be analyzed is white women. A number of factors should affect a white woman’s probability of being employed. First off, marriage should reduce a white woman’s probability of being employed. Married white women generally search for employment from a fixed residential location. When searching for housing, residential location is usually chosen with the interests of the male partner in mind (White, 1977; Madden, 1981; Singhell and Lillydahl, 1986; Gilbert, 1988; McLafferty and Preston, 1992).

48 A 10 minute commute area is examined here, due to the fact that for Public transit links in Franklin County, the average speed on these network links is approximately 19.7 miles per hour, which equates to about, on average, approximately a 2.5-3 mile job catchment area. This is consistent with past studies, especially Immergluck (1998), who states that an area approximately that size is consistent with government economic development plans.
White married women also bear most of the responsibility of the household chores (Saegert, 1981; Brewer, 1988; Gilbert, 1988; Wyly, 1996; Cooke, 1997; Kwan, 1998). This unequal sharing of household responsibilities gives married white women more time constraints that may affect their ability to enter the paid workforce. If married white women do enter the workforce, they may be limited in the area in which they search for employment opportunities, especially if they do not have access to a private automobile. If a household only has one private automobile, access to that automobile usually is given to the male partner (Fox, 1983; Pickup, 1984; Gilbert, 1988; Blumen, 1994).

Furthermore, especially if white married women are restricted to the use of public transportation, they may look for employment in the local area of their residential location, due to the restrictive geographical access via public transit, especially from suburban locations, where public transit links are essentially nonexistent (Cooke, 1997; Raphael, Stoll and Holzer, 2000; Raphael and Stoll, 2001; Holzer, Quigley and Raphael, 2003). Therefore, married white women may take a job in the local area, one that may not be full-time and of lower skill level than what could be obtained if they have higher educational attainment. These married white women may take a part-time job in a secondary area of the employment sector, characterized by low pay and little opportunity for career advancement, as these jobs are usually located closer to their residential locations (Gilbert, 1988; Dyck, 1990; Hanson, 1992; McLafferty and Preston, 1992; McLafferty, Preston and Hamilton, 1993; England, 1993; Blumen, 1994).
Even if these women have the educational skills to take a prestigious high skilled career position, they may not be able to obtain these types of opportunities, as these jobs are disproportionately located in the downtown CBD of metropolitan areas (Tivers, 1988; Cooke, 1997; Preston and McLafferty, 1999). Thus, marriage for white women can affect the probability of being employed, as household responsibilities, time constraints, lack of access to private automobiles and residential fixity may prevent them from obtaining higher professional employment in the downtown CBD and force these women to accept employment in lower secondary-status jobs, characterized by lower pay, part-time hours and little career advancement opportunities. These jobs have little incentive to make longer commute distances, but these women may be forced into these jobs if they are located in the vicinity of their residential location, as they may view these employment opportunities as convenient and view their income as supplemental to their husband’s income (Dyck, 1990; England, 1993).

If these types of jobs are not located near the women’s residential location, they may not enter the labor force at all, as their restrictive mobility and their view as secondary wage earners may prohibit them from making long commutes to jobs that have no net wage benefits for that long commute (Madden, 1981; McLafferty and Preston, 1992; Wyly, 1996). Thus, for married white women, especially those women who don’t have access to a private automobile, the Jobs/Persons ratio should be a significant factor in their probability of being employed.
Another factor that should have an affect on white women's employment probability is children. Women still bear primary responsibility of childcare, whether they are single or married mothers (Madden, 1981; Saegert, 1981; Brewer, 1988; Wyly, 1996; Cooke, 1997; Kwan, 1999).

The younger the children, the more of an effect on women's employment probability the children should have. Married women with children have very demanding time constraints that consist of childcare and household responsibilities and paid employment may only be feasible in areas close to their residential location, thus limiting access into likely lower-skilled, lower-paying secondary sector of the labor market (Dyck, 1990; McLafferty and Preston, 1992).

As children grow older, some of the demands of childcare may be lifted, especially as children enter schooling and participate in after school activities. This may free up some time for these women to enter the paid workforce (Saltzenberg and Waite, 1984; Tivers, 1988; Preston, McLafferty and Hamilton, 1993).

Married women often feel that their children are their primary responsibility in their lives and may see employment as a secondary responsibility and may only take employment if it is located within the immediate vicinity of their residential location and seen as convenient (Pickup, 1984; Dyck, 1990; McLafferty and Preston, 1992). Thus, the Jobs/Persons ratio should be very important to women with children, especially married women with children. Thus, if there are less jobs within their local area, these women may stay out of the workforce and should be more likely to be unemployed.
Age is another factor that should have an effect on white women’s employment probability. Older women are less likely to have childcare responsibilities and are more likely to have been in the paid labor force for a longer period of time. Thus, older women should be more likely to be employed than younger women.

On the other hand, white female heads of households may be the primary breadwinners of their households. Thus, they should be more likely to be employed than married woman due to the fact that they are less fixed in their residential locations and can reduce their distance from home to work and juggle the responsibilities of children and paid work in a more aggressive fashion. These women do not have the luxury of taking a “convenient” job for supplemental income to their partner’s income. Thus, for these reasons, one should expect white female heads of households to be more likely to be employed.

Finally, single women without children are also not fixed in their residential locations and don’t have the responsibilities of children to take up their time constraints. These women, if their educational backgrounds allow them to, can take high-skilled professional employment opportunities (England, 1993). Therefore, the local supply of jobs/persons should not be of significant importance to these women, as less responsibilities in the home atmosphere should allow them to have more free time to make longer journeys to work, or they have the free will to obtain housing that fits their amenity preferences (Madden, 1981; England, 1993).
Thus, overall, marriage, children, use of public transit, and age should all have significant effects on white women’s probability of being employed. Accessibility in the form of the Jobs/Persons ratio should also have a significant effect on the probability of being employed, but only for married women, especially married women with children, non-married women with children and married women who have a lack of access to a private automobile.

5.7.2. Predicted Factors affecting White Men

The next population subgroup I will analyze is white men. White men do not confront any discrimination in the housing or labor markets and usually have the highest wages among all working groups in the United States (Wyly, 1996).

Unlike white women, marriage should not affect a white man’s employment outcome. Unequal sharing of household responsibilities within the home sphere are disproportionately shouldered by the female partner (Madden, 1981; Saegert, 1981; Brewer, 1988; Kwan, 1999). This unequal sharing does not create any time constraints for white males to participate or commute long distances to paid employment. Generally, the residential location of married households are made with respect to the benefit of the male householder, as location decisions are made with residential amenities that are beneficial to the male partner in mind, may it be in terms of housing or location to their
employment (Singhell and Lillydahl, 1986; Gilbert, 1988; McLafferty and Preston, 1992).

White men, unlike African American men, do not face discrimination in the housing market, so they are free to live anywhere in the metropolitan region, thus not having to search for employment from fixed residential locations, unlike a good proportion of African Americans and some married women. Therefore, the Jobs/Persons ratio should not have a significant effect on white male’s employment outcomes, generally because white men can generally adapt their residential locations to benefit their employment gains.

Furthermore, access to automobiles should not have as much as a significant effect upon white male’s employment outcomes as it does for the other population subgroups. White males generally have greater access to private automobiles than other population subgroup, as their higher wages allows them to purchase automobiles, thus giving them greater geographical mobility throughout the metropolitan region (Johnston-Anumonwo, 1996). Also, when there is only one vehicle in a married household, the access to the private automobile generally goes to the male partner (Fox, 1981; Pickup, 1984; Gilbert, 1988; Blumen, 1994). Finally, when males do use public transit, it is usually because the public transit usage is generally a convenient means of transportation to the work environment (Cooke, 1997). If white males are forced to use public transit, not because of convenience, they are free from residential housing discrimination and are generally free to adjust their location in space to take advantageous gains in the paid labor market.
Children should not have a significant effect on white male’s employment outcomes either. When married households have children, childcare responsibility disproportionately falls on the shoulders of the female partner (Brewer, 1988; Wyly, 1996; Cooke, 1997). Thus, children do not put time constraints on male’s daily schedules and do not affect their employment outcomes. However, single white males with children may suffer the same dual responsibility as single mothers, in that they are responsible for childcare and the sole earner of income in the household. The effect of children on white males should not be as significant as other population subgroups, as white males’ higher wages in the paid labor market may enable them to better juggle the household, child and paid employment responsibilities. These higher wages may enable them a better opportunity to own a private automobile, thus giving them better geographical mobility throughout the metropolitan region, and the higher wages may also enable them to have more money to pay for childcare services, which frees up time for them to tackle their paid employment responsibilities.

Overall, age may be the only factor that has a significant effect on white male’s employment. Older men are more likely to have more employment experience, which may give them an advantage in the paid labor market. Also, older men should be more likely connected to social networks that flow job information that lead to paid employment (Ihlanfeldt, 1993; Cooke, 1997). Thus, their working experience and better access to social networks should lead them to being more likely being employed than those with less experience and less ties to these essential social networks.
5.7.3. Predicted Factors affecting African American Men

The next population subgroup under analysis is African American men. African American men are generally segregated into central city neighborhoods in the metropolitan area due to housing market discrimination (Kain, 1968). African American men cannot adjust their residential locations as white men do in response to employment, as blacks often encounter discrimination in the housing market and whites are more reluctant to live with blacks as blacks are to live with whites (Krysan, 2002b). If African Americans do take a suburban residential location, they are often segregated into older suburban areas, away from white residential areas (Kain, 1992; Holloway, 1996).

African American men also encounter employer discrimination in the labor market, especially from white owned suburban firms (Raphael, Stoll and Holzer, 2000). Furthermore, blacks often rely upon public transportation at significantly higher rates than whites (Taylor and Ong, 1995; Johnston-Anumonwo, 1996; Raphael and Stoll, 2001). This higher reliance on public transportation limits their access and mobility within the Metropolitan region. In addition, well-paying blue-collar employment opportunities have been decentralizing in central city areas of metropolitan areas. Blacks often have lower educational attainment than whites, and are generally reliant upon these low-
skilled employment opportunities for their economic well-being (Kasarda, 1985; Kasarda and Ting, 1996; Bauder and Perle, 1999).

Thus, the combination of residential segregation, employment decentralization, lower educational skills, employer discrimination and reliance upon mass transit leaves African American men at a disadvantage in the labor force. Therefore, the Jobs/Persons ratio around African American residential locations should play a significant role in their employment likelihood.

Generally, literature has suggested that central cities have had a surplus of workers relative to the number of employment opportunities in this area (Ihlanfeldt, 1999; Stoll, 1999). Poor public transportation links to employment growth areas along with employer discrimination may force blacks to become discouraged and take themselves out of the paid labor force (Kain, 1968; Holloway, 1996; Kasarda and Ting, 1996; Stoll, 1999). Thus, blacks should be very sensitive to the employment opportunities and labor force located in and around their residential locations.

Individual characteristics should also play some role in their probability of being employed. Like white men, marriage and children should not have significant effects on the employment outcomes of African American men, as household responsibilities are disproportionately the responsibility of women (Madden, 1981; Saegert, 1981; Brewer, 1988; Wyly, 1996; Cooke, 1997; Kwan, 1999). However, single African American men with children may have the same dual responsibility of childcare and employment as women, which may affect their employment outcomes. Unlike single white men with children, single
African American men with children cannot adjust their residential location with respect to employment and mitigating time constraints. Furthermore, their reliance upon public transportation limits their geographical access and puts a more stringent constraint in balancing childcare and paid employment. Therefore, children should have a larger effect on single African American men than single white men.

As pointed out before, access to automobiles should be a significant factor in the employment probability of African American men. Access to automobiles should allow African American men to be more geographically mobile and should open up their geographical space to search for employment opportunities, thus increasing the likelihood of being employed. However, some of this access advantage may be offset if the areas an automobile can access that public transit cannot, hold firms that have discriminatory hiring practices or their employers disproportionately discriminate against blacks (Turner, 1997; Stoll, 1999; Muow, 2000; Raphael, Stoll and Holzer, 2000).

Finally, age should be another factor that affects African American men’s employment probabilities. Older men are more likely to be hired and employed due to their greater work experience in the paid labor market. Furthermore, older African American men should be more likely to be tied to social networks that lead to employment opportunities than younger African American men (Ihlanfeldt, 1993; Cooke, 1997).
5.7.4. Predicted Factors affecting African American Women

The final population subgroup I will examine in this study is African American women. Like African American men, African American women suffer the same residential segregation, employment decentralization, lower educational attainment and reliance on public transportation issues that leave African American males at a severe disadvantage in the Metropolitan economy.

Thus, African American women are generally looking for employment from a fixed residential location. For this reason alone, the number of employment opportunities available to African American women in relation to the number of persons competing for these jobs in and around their residential locations should have a significant effect on the employment outcomes of African American women.

African American women, however, are generally gender segregated into certain employment sectors of the paid workforce that differ from African American men (Blumen, 1994; Preston and McLafferty, 1999). Thus, the employment opportunities in and around their residential locations should play a differing role on their employment outcomes than for African American men, however, both should have the same directional (positive) effect on their employment outcomes.

Individual factors should also play an important role in the employment outcomes of African American women. Like many women, the residential location of married couples is generally made with the best interests of the male
partner in mind (Madden, 1981; Singhell and Lillydahl, 1986; Gilbert, 1988; McLafferty and Preston, 1992). Most African American men do not have much fluidity in their residential location choices due to housing market discrimination and the real and perceived discriminatory stereotypes of suburban whites (Krysan, 2002a).

However, if a married African American couple is fortunate enough to gain a suburban residential location, this residential location would be made in the best interests of the male partner (Madden, 1981; Singhell and Lillydahl, 1986; Gilbert, 1988; McLafferty and Preston, 1992). Therefore, if African American women can escape the fixity of searching for employment in residentially segregated neighborhoods, they are faced with searching for employment from a fixed residential location in the suburbs.

Furthermore, in addition to marriage, children can have a significant constraint on African American women’s ability to enter the paid labor force due to the unequal sharing of domestic responsibilities within the household (Brewer, 1988; Wyly, 1996; Cooke, 1997). In addition, if African Americans married couples do have a private automobile, then the male typically has access to the automobile (Pickup, 1984; Gilbert, 1988; Blumen, 1994).

Therefore, marriage, children and access to private automobiles should have a significant effect on the employment outcomes of African American women, as married women, especially married African American women with children should be less likely to be employed in the labor force than single, childless African American women with access to private automobiles.
Children within the household should have a larger effect on African American women’s employment than marriage alone, as these women may feel that they have a greater responsibility to their children, than to be secondary wage earners (Pickup, 1984; Tivers, 1988; Dyck, 1990; Preston, McLafferty and Hamilton, 1993). African American women with children have to juggle the responsibilities of household and childcare and thus these time consuming activities really puts a significant constraint on their ability to enter the paid labor force. In response to this, these women may not enter the paid workforce, especially if there are not local employment opportunities nearby and they are relying on inflexible public transportation to juggle these responsibilities (Saegert, 1981; Pickup, 1984; Gilbert, 1988; Tivers, 1988; Peake, 1995).

Thus, these women should be quite sensitive to the Jobs/Persons ratios around their residential locations and these ratios should have a significant effect on their likelihood of being employed. However, if these women are residing in suburban locations, the jobs/persons access may be partially offset if employers in that area disproportionately discriminate against African Americans, whether it be in their hiring practices or in their negative racial attitudes or perceived negative racial attitudes of their white customers (Turner, 1997; Immergluck, 1998; Stoll, 1999; Muow, 2000; Raphael, Stoll and Holzer, 2000; Muow, 2002).

It is also well documented that African American households are disproportionately headed by females (McLafferty and Preston, 1992; Preston, McLafferty and Hamilton, 1993; Johnston-Anumonwo, McLafferty and Preston, 1994; Preston and McLafferty, 1999). These women are seriously constrained in
their responsibilities of household, childcare and primary wage earning in the household. Thus, the number of Jobs/Persons ratios around the residential locations of African American female head of households should play a significant role in whether these women are employed, especially if they are geographically restricted in their access due to reliance upon public transportation.

The responsibility of juggling these household, childcare and wage earning responsibilities may only be plausible if there are jobs actually located near and around their residential locations. If jobs are not located around their residential locations, then they may not enter the work force at all and become reliant upon welfare communalities (Kain, 1968; Holloway, 1996; Kasarda and Ting, 1996).

Finally, age should also play a role in the employment outcomes of African American women. Older women are more likely to be hired or employed due to their greater work experience than younger women (Cooke, 1997). Also, older African American women are more likely to be void of children within the household, thus freeing up some time to enter the paid workforce away from the time consuming responsibilities that children bring into the household. In addition, older women are more likely to be linked to social networks that lead to employment opportunities than are younger women.
5.8 Logistic Regression Results

5.8.1 Individual Characteristics Affecting Employment Probabilities

5.8.1.1 White Males

The first population subgroup under analysis is white males. Examination of the logistic regression equation for white males:

\[ P(\text{Employed}) = 1.228 + 0.018\text{Age} + 0.879\text{MarrSpP} + 0.112\text{Education} - 0.359\text{Disability} - 0.548\text{LowSkill} \]

<table>
<thead>
<tr>
<th>Variable (sex)</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: age</td>
<td>.018</td>
<td>.005</td>
<td>11.698</td>
<td></td>
<td>.001</td>
<td>1.018</td>
</tr>
<tr>
<td>MarrSpP</td>
<td>.879</td>
<td>.141</td>
<td>35.330</td>
<td></td>
<td>.000</td>
<td>2.409</td>
</tr>
<tr>
<td>Education</td>
<td>.112</td>
<td>.029</td>
<td>15.452</td>
<td></td>
<td>.000</td>
<td>1.119</td>
</tr>
<tr>
<td>Disability</td>
<td>-0.359</td>
<td>.160</td>
<td>5.020</td>
<td></td>
<td>.025</td>
<td>0.698</td>
</tr>
<tr>
<td>Lowskill</td>
<td>-0.548</td>
<td>.159</td>
<td>11.834</td>
<td></td>
<td>.001</td>
<td>0.578</td>
</tr>
<tr>
<td>Constant</td>
<td>1.228</td>
<td>.441</td>
<td>7.753</td>
<td></td>
<td>.005</td>
<td>3.416</td>
</tr>
</tbody>
</table>

* Variable(s) entered on step 1: age, MarrSpP, Education, Disability, Lowskill.

Table 5.5 Logistic Regression results for the overall white male population. shows that several individual characteristics affect the probability of a white male being employed.

reveals that one individual characteristic that stands out in this equation is the effect of marriage on employment. Marriage has a strong positive effect on a white male’s probability of being employed. Many researchers have suggested that there is strong unequal sharing of household and domestic responsibilities within a married household, which creates time constraints for the female partner. (Madden, 1981; Saegert, 1981; Brewer, 1988; Kwan, 1999). Therefore, marriage should not have a negative effect on the employment outcomes on the male partner, as they are free to participate in the labor force without constraint, thus
even allowing them to commute long distances to employment (Madden, 1981; Johnston-Anumonwo, 1996).

The above appears to be the case here, as the white male married population has a significantly higher probability of being employed than their non-married counterparts. What is surprising is how strong of a positive effect that marriage has on their probabilities. In terms of probabilities, controlling for all other variables\(^{49}\), marriage increases the probability of a white male being employed by approximately 2.1%. Thus, the thesis on unequal sharing of household and domestic responsibilities seems to hold up fairly strong here.

However, there may be alternative explanations on why white males that are married have higher probabilities of being employed. One alternate explanation may be that married white males may feel a strong sense of responsibility of being an economic supporting member of a household, especially if that household has children. They may feel more of a sense of obtaining employment than a non-married white male. Furthermore, married white males are generally less likely to be enrolled in school, and are generally older than a significant portion of the white male population. Therefore, these reasons confounded with marriage may be an explanation to why marriage typically leads to a higher probability of being employed for white males.

With regards to other individual characteristics that have strong significant effects on white males' employment probabilities are disability and skill level.

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\(^{49}\) By controlling all other variables, this refers to setting the other variables to the mean value of that variable. The probability between married and non-married white males can then be examined through the equation \( p_i = \frac{1}{1 + e^{-L_i}} \) where \( L_i \) is the logit for married =1 and married = 0, giving us \( p_i(1) - p_i(0) \), displaying the difference, or effect, of being employed between the two individual characteristics.
The reasons why disabled white males are less likely to be employed seem to be transparent enough to be left out of this discussion.

On the other hand, skill level also has a strong effect on the probability of white males being employed, a negative effect, meaning that having low skill qualifications leads to a less likelihood of being employed. Lower skilled employment is generally characterized by lower wages, job security and fewer benefits, and this is generally true for all population subgroups except for white males (Wyly, 1996; Bauder and Perle, 1999). In this sample of white males, in terms of probabilities, low-skilled white males have employment probabilities that are approximately 0.80% lower than for high-skilled males. This is a fairly small effect (especially in relation to African American males, in which I’ll examine later). This small effect may be characterized by the fact that wages are generally higher for white males obtaining low-skilled employment. Thus, there may not be a sense of not entering the paid labor force, as there may be for other subgroups, especially if obtaining employment with low wages, low job security and fewer benefits actually is not economically more advantageous than not participating (Kain, 1992; Bauder and Perle, 1999). Therefore, white males should be less likely to be discouraged from entering the paid labor force.

Finally, age is another significant factor influencing the probability that a white male is employed, although its effect is quite modest. Examining age, older individuals have a stronger likelihood of being employed, as these individuals may have more employment experience. Employers may choose a more experienced employee than a less experienced one when making hiring choices,
which may be a reason why age is a significant effect on the probability of an individual being employed. In addition, older individuals are more likely to be tied into the social networks that lead to employment opportunities (Hanson and Pratt, 1992; Kasinitz and Rosenberg, 1996), thus, increasing their probability of being employed. Therefore, these two factors may be explanations why age has a significant effect on the probability of a white male being employed, although its effect is quite modest.

5.8.1.2 White Females

The next population subgroup I will analyze is white females. There are also many individual characteristics that affect the probability that a white female in the sample will be employed. This can be seen from the logistic regression equation:

\[
P(\text{Employed}) = 1.517 - 0.117Nrc + 0.026Age + 0.654MarrSpP + 0.081Education - 0.388LowSkill
\]

<table>
<thead>
<tr>
<th>White Female Overall</th>
<th>( B )</th>
<th>( \text{S.E.} )</th>
<th>( \text{Wald} )</th>
<th>( df )</th>
<th>( \text{Sig} )</th>
<th>( \text{Exp}(B) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 * Nrc</td>
<td>-0.117</td>
<td>0.064</td>
<td>3.312</td>
<td>1</td>
<td>0.069</td>
<td>0.889</td>
</tr>
<tr>
<td>age</td>
<td>0.026</td>
<td>0.066</td>
<td>0.056</td>
<td>1</td>
<td>0.813</td>
<td>1.026</td>
</tr>
<tr>
<td>MarrSpP</td>
<td>0.554</td>
<td>0.164</td>
<td>15.963</td>
<td>1</td>
<td>0.000</td>
<td>1.923</td>
</tr>
<tr>
<td>Education</td>
<td>0.087</td>
<td>0.039</td>
<td>5.126</td>
<td>1</td>
<td>0.024</td>
<td>1.091</td>
</tr>
<tr>
<td>LowSkill</td>
<td>-0.336</td>
<td>0.190</td>
<td>3.177</td>
<td>1</td>
<td>0.075</td>
<td>0.712</td>
</tr>
<tr>
<td>Constant</td>
<td>1.517</td>
<td>0.575</td>
<td>6.956</td>
<td>1</td>
<td>0.008</td>
<td>4.559</td>
</tr>
</tbody>
</table>

* Variable(s) entered on step 1: Nrc, Age, MarrSpP, Education, LowSkill.

Table 5.6 Logistic Regression results for the overall white female population. shows that several individual characteristics affect the probability of a white female being employed.

What is surprising from this equation is that marriage has the largest effect on the probability that a white female is employed, and this effect is a positive effect. In terms of probability, holding all other variables constant, marriage
increases the probability that a white female will be employed by approximately 1.1%. Some researchers argue that marriage borne women with domestic and household responsibilities that create time constraints that inhibit them from entering the paid labor force (Saegert, 1981). However, many suggest that not marriage, but rather children, especially younger children, create time constraints that may prevent women from entering the paid labor force (Saltzburg and Waite, 1984).

However, in this analysis, the number of related children in the household only has a small effect upon the probability that a white female will be employed. In terms of probability, controlling for all other variables, a woman with one child has only a 0.23% less probability of being employed than a woman with no related children in the household. Furthermore, the variable presence of children under 6 in the household is not a significant predictor of white women’s employment, as it is not included in this final regression equation shown above. Thus, in the sample here, it appears that white women are quite adaptive to fulfilling all household and childcare responsibilities while still entering the paid labor force.

The best way to describe the effects of marriage and children on white women in light of these regression results can best be described by England (1993), in which she states that, “we need to accept women as knowledgeable agents with transformative capacities”. Thus, it appears that white women in

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50 Final Logistic Regression equations were chosen through a procedure called “All Possible Regression”, in which all possible combinations of independent variables were analyzed and the equation which yielded the best fit, in addition to all variables yielding significant coefficients at the 0.10 significance level was chosen as the final logistic regression equation.
these samples are quite adaptive to coping with the time constraints created by household and childcare responsibilities in order to enter the paid labor force.

This does not exclude marriage and children affecting white women’s employment outcomes. For example, white married women, especially married women with children, may have educational qualifications that allow them to obtain high-skilled employment. However, marriage and especially children may create time constraints that disallow them from seeking full-time higher-skilled employment, especially when high-skilled employment is disproportionately located near the downtown CBD (Tivers, 1988; Cooke, 1997; Preston and McLafferty, 1999).

Therefore, married white women, especially those with children, may take a job in the local area, one that may not be full-time and of lower-skill level than what could be obtained through their skills qualifications. Thus, this leads to women taking a part-time job in a secondary sector of the labor market, employment disproportionately characterized by lower pay and little opportunity for career advancement, as these jobs are typically located closer to the residential locations typically held by married women (Gilbert, 1988; Dyck, 1990; Hanson, 1992; McLafferty and Preston, 1992; McLafferty, Preston and Hamilton, 1993; England, 1993; Blumen, 1994).

Thus, this regression analysis does not exclude that marriage and children have large significant effects on women’s employment. What one can say is that it does not appear to have large significant effects on the probability of whether they will be employed or not.
Furthermore, low skilled women are less likely to be employed than women who have higher skill qualifications. Lower skilled employment is typically characterized by lower wages, less job security and fewer benefits, and this is especially true for all population groups except for white males (Wyly, 1996; Bauder and Perle, 1999).

It is possible that in this sample, some of the effect of low skill is confounded with marriage, as marriage and especially children create time constraints that would discourage women from entering the paid labor force if their set of employment opportunities are limited to only low-skilled employment, as they may not enter the paid labor force, especially if they view their economic gains from entering paid employment as secondary to their husband’s. They may view employment as secondary and their prime responsibility is to their children. Thus, they may find no benefits from entering the paid labor force (Dyck, 1990).

Finally, older women are more likely to be employed than younger women. Again, as with white men, older women may be better tied to social networks that lead to employment and they may have more work experience that gives them an advantage in the labor market.

5.8.1.3 African American Males

The next population subgroup I will analyze is African American males. Several individual characteristics affect African American males’ employment probabilities and can be seen in the equation:
\[ P_i(\text{Employed}) = 2.403 + 0.038 \text{Age} + 0.884 \text{MarrSpP} - 1.514 \text{LowSkill} \]

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: age</td>
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<td>.011</td>
<td>11.254</td>
<td>1</td>
<td>.001</td>
<td>1.038</td>
</tr>
<tr>
<td>MarrSpP</td>
<td>.884</td>
<td>.340</td>
<td>6.757</td>
<td>1</td>
<td>.009</td>
<td>2.421</td>
</tr>
<tr>
<td>Lowskill</td>
<td>-1.514</td>
<td>.314</td>
<td>23.250</td>
<td>1</td>
<td>.000</td>
<td>.220</td>
</tr>
<tr>
<td>Constant</td>
<td>2.403</td>
<td>.456</td>
<td>27.814</td>
<td>1</td>
<td>.000</td>
<td>11.055</td>
</tr>
</tbody>
</table>

a. Variable(s) entered on step 1: age, MarrSpP, Lowskill.

Table 5.7 Logistic Regression results for the overall African American male population shows that several individual characteristics affect the probability of an African American male being employed.

The largest effect on the probability of African American male's employment is skill level. The Spatial Mismatch Hypothesis is built upon the economic disadvantage of African Americans, as there are high unemployment rates among low-skilled African Americans (Kain, 1968, 1992). The reasons for the effect of low-skilled employment qualifications leading to higher unemployment rates for African Americans in the study here may have many reasons for such a phenomenon.

In terms of the Spatial Mismatch Hypothesis, housing market discrimination and subsequent residential segregation, in addition to the decentralization of low-skilled employment, especially in manufacturing, have left a surplus of African American laborers in relation to the number of employment opportunities available near the central city African American
neighborhoods (Kain, 1968, 1992; Ihlanfeldt, 1999). Thus, in terms of the Spatial Mismatch Hypothesis, I will examine, not if there are lower Jobs/Persons ratios in and around African American neighborhoods, but if this Jobs/Persons ratio affects the probability that African American males are employed. Thus, the Jobs/Persons ratios for low-skilled employment may be a reason for the lower employment probability for low-skilled African American males in relation to their high-skilled counterparts. Thus, in the next section I will thoroughly examine this.

Alternatively, low skilled qualifications can also have an effect on African American males' employment, not if, there are fewer jobs/person within their residential locations, but whether or not their lower skills match the skills of the employment opportunities around their neighborhoods. Thus, there may be a skills mismatch between the skills of the African American males in this study and the skill requirements of the employment opportunities around their residential locations (Kasarda, 1985; Immergluck, 1998; Bauder and Perle, 1999). Thus, in the next section, I will examine for a skills mismatch as being the cause for the lower employment probabilities for low-skilled African Americans.

Furthermore, lower skilled African Americans tend to have lower education levels than individuals with higher skilled qualifications. Thus, from this analysis, it appears that education can be an avenue in which African American males can improve their employment outcomes, in general, and in relation to their white counterparts.
African American males may not be affected by the jobs/persons around their residential locales if they are not tied into the informal social networks that are racially and gender segregated. These social networks are very important avenues that lead to employment (Hanson and Pratt, 1992; Kasinitz and Rosenberg, 1996).

Thus, I will examine in the next section whether this low-skill qualification’s negative effect on African American males’ employment probabilities is due to Spatial Mismatch, Skills Mismatch, a combination of both, or whether it is likely due to alternative explanations, as I will examine the Jobs/Persons ratio’s relationship to the employment outcomes of African American males.

Another important individual characteristic on the probability of African American males’ employment is marriage. As with white males, marriage has a large positive effect on the probability of being employed. The explanation for this phenomenon may be explained again by the unequal sharing of household and childcare responsibilities within a married household. Many researchers have suggested that women are mostly responsible for the household and childcare responsibilities within the household (Madden, 1981; Saegert, 1981; Brewer, 1988; Kwan, 1999). It appears that this unequal sharing is not just a white phenomenon, as it appears that this unequal sharing of responsibilities does not create time constraints for African American males that would inhibit them from entering the paid labor force, as it does not with white males also.
Again, what is surprising, is the strength of the positive effect of marriage on the probability of being employed. In terms of probabilities, controlling for all other variables, marriage increases the probability of being employed by approximately 2.5% for African American males. Thus, like white males, it appears that marriage enables African American males to enter the paid labor force without constraint.

Finally, age is another factor that increases the probability that an African American male will be employed, although this effect is fairly modest. As with the other population subgroups, the explanations of work experience and social networks fit the result shown here.

5.8.1.4 African American Females

The last population subgroup I will analyze in this study is African American females. The logistic regression equation for African American women is shown here:

\[
P_i(\text{Employed}) = 1.329 + 0.065\text{Age} + 0.689\text{MarrSpP} - 1.190\text{LowSkill}
\]
### African American Female Overall

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1&lt;sup&gt;a&lt;/sup&gt; age</td>
<td>.065</td>
<td>.012</td>
<td>31.671</td>
<td>1</td>
<td>.000</td>
<td>1.068</td>
</tr>
<tr>
<td></td>
<td>MarrSpP</td>
<td>.689</td>
<td>.357</td>
<td>3.712</td>
<td>1</td>
<td>.054</td>
</tr>
<tr>
<td></td>
<td>Lowskill</td>
<td>-1.190</td>
<td>.259</td>
<td>21.117</td>
<td>1</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>1.329</td>
<td>.409</td>
<td>10.541</td>
<td>1</td>
<td>.001</td>
</tr>
</tbody>
</table>

<sup>a</sup> Variable(s) entered on step 1: age, MarrSpP, Lowskill.

#### Table 5.8 Logistic Regression results for the overall African American female population shows that several individual characteristics affect the probability of an African American female being employed.

One can see two individual characteristics have large effects on the probability that an African American female is employed. Again, what is surprising, is the large positive effect of marriage on this group of women’s probability of being employed. Like white women, it is suggested that African American women are searching for employment from a fixed residential location, as housing choices are likely to be made with the best interest of the male partner in mind (Madden, 1981; Singhell and Lillydahl, 1986; Gilbert, 1988; Preston and McLafferty, 1993; Hanson and Pratt, 1995).

In addition, African American women are likely to encounter racial discrimination in the housing market, just like their male counterparts (Kain, 1968; Yinger, 1986). Thus, in addition to their fixed residential location due to their marital status, their partner’s housing locations are also restricted due to racial discrimination in the housing market and racial segregation.

Moreover, African Americans generally have less access to automobiles than whites and are generally more likely to rely upon public transportation. Thus, in households where there are fewer vehicles than laborers, then the access
to the private automobile generally goes to the male partner (Pickup, 1984; Hanson and Pratt, 1995). Therefore, these women are generally dependent upon public transit to enter the paid labor force.

Thus, all of these factors combined would seem to suggest that marriage would have a negative effect on the probability that an African American female would be employed. Instead, in terms of probability, holding all other variables constant, marriage increases the probability that an African American female is employed by nearly 1.8%. Marriage increases the likelihood that African American women are employed.

Some explanations could fit this phenomenon. First, marriage creates time constraints due to unequal sharing of household responsibilities (White, 1977). Married women, especially those with children have to juggle household and childcare responsibilities in order to enter the paid labor force. Some of these women may not enter the paid labor force if they have significant time constraints due to these responsibilities and they may view their primary responsibility to their childcare and household responsibilities. This is especially true if their incomes are secondary in the household and their unemployment does not affect the economic welfare of the household (Dyck, 1990).

African American males generally have lower incomes than white males and are more likely to be unemployed than white males (Wyly, 1996; Ihlanfeldt and Sjoquist, 1998). Thus, African American women may not have the luxury to choose whether or not to enter the paid labor force, as their incomes may be vital to the economics of the household. Thus, African American females may not
have the luxury of dedicating all of their time to household and/or childcare responsibilities.

Furthermore, a significant proportion of African American households are headed by a female without a male spouse present (McLafferty and Preston, 1992). Thus, African American female head of households suffer from racial discrimination in the housing market and must juggle the responsibilities of household and/or childcare responsibilities by themselves, in addition to being the sole wage earner in the household (McLafferty and Preston, 1992). The time constraints encountered by these situations may become infeasible for some of these women that they may not enter the paid labor force if welfare benefits are actually more beneficial to the household than their employment (Kasarda and Ting, 1996). Thus, this may be a reason that marriage increases an African American women’s probability of being employed, as the male partner may help to assist the women in some sharing of their duties.

Finally, African American married women may be able to adapt strategies to cope with the burden of household responsibilities, as married women, especially those without children, may be able to shift responsibilities to evenings or weekends, thus, allowing them to enter the paid labor force. England’s (1993) quote may also apply to African American women, as she states that “we need to accept women as knowledgeable agents with transformative capacities”.

In contrast to marriage, low-skill qualifications reduces African American women’s probability of being employed. Controlling for all other variables, African American women with low-skilled qualifications have a probability of
entering the paid labor force that is approximately 3.8% lower than women with high-skilled qualifications.

It has been well stated in literature that low-skilled employment is characterized by lower wages, fewer benefits and low job security for all population subgroups except for white males (Wyly, 1996; Bauder and Perle, 1999). Thus, lower wages affects a person's ability to purchase a private automobile (Taylor and Ong, 1995).

Thus, lower skills should lead to heavier reliance upon public transportation for African American women. In addition to already being more likely to be residentially segregated and searching for employment from a fixed residential location and disproportionately responsible for household and childcare responsibilities, they may be geographically restrictive in their mobility to obtain employment. If the economic gains from entering the paid labor force in a low-skilled job are less beneficial, not only economically, but also with respect to the well-being of children in the household, then African American women may find welfare benefits as a good alternative for the household (Kasarda and Ting, 1996).

Thus, for these reasons, some African American women may not enter the paid labor force. Also, there is a possibility that there are fewer employment opportunities in terms of low-skilled employment in relation to the number of persons competing for these opportunities. Although it can be seen from the analysis in Section 5.6 that this does not seem to be the case. However, the concern is not about Jobs/Persons ratios as a number, but how this ratio affects the
probability that an African American woman is employed. I shall analyze this in the next section. Thus, the Spatial Mismatch Hypothesis and the Skills Mismatch Hypothesis are kept open as reasons for the lower employment rates among low-skilled African American women.

5.8.2: Does the Jobs/Patsons Ratio Affect Employment Probabilities?

The Spatial Mismatch Hypothesis states that housing market discrimination and its subsequent resulting residential segregation, in addition to the decentralization of low-skilled employment, especially in manufacturing have combined to create an economic structure detrimental to the economic well-being of African Americans, as it has created a surplus of workers relative to the number of employment opportunities in and around African American residential locations (Kain, 1968, 1992; Ihlanfeldt, 1999).

In addition to being geographically isolated and distant from areas of employment, African Americans are also more likely to rely upon public transportation than whites (Taylor and Ong, 1995). Thus, African Americans are restricted in their geographical mobility and should be quite sensitive to the number of nearby employment opportunities, especially in relation to the number of persons competing for these opportunities. Thus, for this study here, one would expect to see that the Jobs/Patsons ratio within a 10 minute commuting
area be vitally important to the economic outcomes of African Americans, in this case, the probability of being employed.

On the other hand, the Skills Mismatch Hypothesis states that North American metropolitan regions have transformed from centers of manufacturing and durable goods to centers of technology and information exchange. This transformation has created employment opportunities that require higher skill qualifications (Kasarda, 1985, 1989; Bauder and Perle, 1999). Thus, African Americans segregated into central city neighborhoods of the Metropolitan region tend to have lower educational attainment and generally do not have the skill qualifications to fill these employment opportunities (Kasarda, 1985, 1989; Bauder and Perle, 1999). This creates a mismatch of skills between the residents of central city residents and the employment opportunities in and around these central city residential locales.

Therefore, in terms of the Skills Mismatch Hypothesis, the number of employment opportunities in relation to the number of persons competing for these opportunities, in addition to the skill levels of the opportunities and competitors should be vitally important to residents, especially African Americans, who generally have lower educational attainment and are generally segregated into central city neighborhoods (Kain, 1992; Ihlanfeldt and Sjoquist, 1998). Thus, for African Americans, in terms of the Skills Mismatch, the Jobs/Persons ratio in this study should be positively related to the employment

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51 A 10 minute commute area is examined here, due to the fact that for public transit links in Franklin County, the average speed on these network links is approximately 19.7 miles per hour, which equates to about, on average, approximately a 2.5-3 mile job catchment area. This is consistent with past studies, especially Immergluck (1998), who states that an area approximately that size is consistent with government economic development plans.
outcomes of these individuals, since this Jobs/Persons ratio takes into account the skill of the residents, as well as, the skill level of the employment opportunity density across geographic space.

In addition to the Spatial Mismatch Hypothesis and the Skills Mismatch Hypothesis, other theories should be related to the Jobs/Persons ratios' affect on employment probability for certain population subgroups in this study. Many researchers have posited that within households, there is an unequal sharing of household and childcare responsibilities, as these are generally the responsibility of the female partner (Madden, 1981; Saegert, 1981; Brewer, 1988; Blumen, 1994). Therefore, this unequal sharing of responsibilities lead to increased time constraints for women, as they have to juggle these responsibilities. This may cause them to be less likely to enter the paid labor force or to take employment near their residence, especially if they are restricted to public transportation, as women generally have lower access to private automobiles, as the access to the vehicle generally goes to the male partner (White 1981; Blumen, 1994).

Thus, for both married white women and married African American women and/or women with children, the number of employment opportunities near their residential locations in relation to the number of persons competing for these employment opportunities should have a significant effect on the employment probabilities of white and African American married women and/or women with children. These women have to balance household and domestic responsibilities, therefore creating times constraints that may affect their ability to enter the paid labor force.
If married white women view their incomes as secondary to their partner’s income, they may feel an obligatory responsibility to their household and domestic responsibilities, thus, if there are not sufficient employment opportunities available near their residence, especially with the time constraint burden and greater likelihood of reliance upon public transportation, they may not enter the paid labor force, especially if by not entering the paid labor force is not detrimental to the economic well being of the household (Fox, 1981; Saltzburg and Waite, 1984; Gilbert, 1988; Tivers, 1988; Dyck, 1990; McLafferty and Preston, 1992).

African American women, in addition to the Spatial Mismatch Hypothesis and the Skills Mismatch Hypothesis, are likely to also suffer from the same constraints of household and domestic responsibility time constraints that white women suffer. In addition, African American women are more likely than any other racial group of women to be female head of households (McLafferty and Preston, 1992). Thus, in addition to the Spatial Mismatch Hypothesis and the Skills Mismatch Hypothesis, African American female head of households must also juggle the demands of household and childcare responsibilities, in addition to being the sole economic provider for their household. Therefore, the number and skill levels of employment opportunities in relation to the number and skill levels of persons competing for these opportunities should be vital to their economic outcome, in this study here, their probability of being employed. Thus, one would expect a positive effect of the Jobs/Persons ratio on their probability of being employed.
5.8.2.1 White Males

In relation to the Spatial Mismatch Hypothesis, research has suggested that white males should not be sensitive to the number of employment opportunities in relation to the number of persons competing for these jobs for many reasons.

First, unlike African Americans, white males are free to move anywhere in the metropolitan area as they do not face racial discrimination in the housing market. Thus, white males can adjust their residential location in relation to their employment, if needed, thus, giving them an advantage in the employment market (Ihlanfeldt, 1999).

In addition, when married couples choose housing, housing choices are generally made with the best interests of the male partner in mind, whether that is due to employment location or housing amenities (White, 1981; Blumen, 1994). Therefore, unlike white women, white males are not searching for employment from a fixed residential location.

Furthermore, white males are more likely to use a private automobile than African Americans and white women (McLafferty and Preston, 1992; Ihlanfeldt, 1999). Therefore they can overcome geographical barriers if they would present themselves and find employment.

Thus, for all the above reasons, one should expect that the Jobs/Persons ratio should have no effect on the employment outcomes of white males.
Examining the results in table 5.c, one can see that for white males overall and for low-skilled white males, that within a 10 minute commuting job catchment area, the Jobs/Persons ratio does not affect the employment outcomes of white males, as there are only two samples out of 100 where the Jobs/Persons ratio is significant. However, the signs on the coefficients are not what are expected, as in these cases, as the Jobs/Persons ratio increases, it would actually reduce the probability of a white male being employed.

### White Male Overall

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>tenJPIDW2</td>
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</tr>
<tr>
<td>tenJPPycno</td>
<td>-0.0690</td>
</tr>
</tbody>
</table>

**Table 5.9a** Significant Jobs/Persons ratios out of 100 samples for the overall white male population. Maximum value indicates the coefficient on the variable in the logistic regression equation.

### White Male with Children

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>tenJPDas</td>
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</tr>
<tr>
<td>tenJPIDW1</td>
<td>-0.3060</td>
</tr>
<tr>
<td>tenJPIDW2</td>
<td>-0.3090</td>
</tr>
<tr>
<td>tenJPPycno</td>
<td>-0.3070</td>
</tr>
<tr>
<td>tenPAvg</td>
<td>-0.3080</td>
</tr>
</tbody>
</table>

**Table 5.9b** Significant Jobs/Persons ratios out of 100 samples for white males with children. Maximum value indicates the coefficient on the variable in the logistic regression equation.
Table 5.9c Significant Jobs/Persons ratios out of 100 samples for the overall high-skilled white male population. Maximum value indicates the coefficient on the variable in the logistic regression equation.

Table 5.9d Significant Jobs/Persons ratios out of 100 samples for the overall low-skilled white male population. Maximum value indicates the coefficient on the variable in the logistic regression equation.

Table 5.9e Significant Jobs/Persons ratios out of 100 samples for the overall high-skilled white male population. Maximum value indicates the coefficient on the variable in the logistic regression equation.

Therefore, overall, within a 10 minute commuting job catchment area, it can be stated, that even in the best case scenario, none of the Jobs/Persons ratios are significantly positively related to the employment probability that a low-skilled white male or a white male in the overall population will be employed.
Thus, for the reasons stated above, white men can adjust their residential locations to overcome any geographical disability they may encounter from the economic structure around their residential location. Also, white men are not searching for employment from a fixed residential location as their residential locations are not subjected to housing market discrimination and for married men, their residential location is generally made with the best interest of their needs in mind (White, 1977). In addition, white males generally have greater access to private means of transportation. Thus, any economic structure near a white male’s residential location can easily be overcome by opening up access to more geographical access that a private automobile can. As seen in Section 5.5, automobile users can access approximately 17 times more employment opportunities within a 10 minute commuting area around an average residential location than they could if they used public transportation.

If one examined white male subpopulations, such as white males with children and married white males, it can be seen that in all these cases, the Jobs/Persons ratios are again not positively significant predictors for the employment probabilities of white males. Therefore, it seems that children and marriage do not cause white men to be sensitive to the employment structure around their residential locations. Thus, in terms of the thesis of unequal sharing of household and childcare responsibilities, this would seem to show that marriage and children do not create time constraints that affects their employment outcomes. Thus, in terms of this thesis, it seems that unequal sharing in the
household of domestic responsibilities enables white males to enter the labor market unconstrained.

In conclusion, for white males, it can be confidently stated that the Jobs/Persons ratio within a 10 minute commuting area around their residential location does not significantly affect the probability that they are employed. Thus, one can conclude that there is fair certainty that white males in the Columbus MSA do not suffer from a Spatial Mismatch or a Skills Mismatch, if Spatial Mismatch or Skills mismatch is measured by the number and skill level of the employment opportunities around their residential locations in relation to the number and skill level of persons competing for these employment opportunities within a 10 minute commuting area. Thus, this is consistent with past literature, as past literature states that African Americans are the ones suffering from these mismatches. Finally, in terms of the Spatial Entrapment Thesis, these results are also consistent with the past research that suggests that marriage and children do not cause white males to be sensitive to the local economic structure around their residential locations, as household and childcare responsibilities are unequally shared within the household, thus not creating time constraints that would affect their labor market situations.

5.8.2.2 White Females

For white women, the concern is with how the Jobs/Persons ratios affect their employment probabilities, especially for married women and women with
children. From the statements in the opening of this section, household and childcare responsibilities may cause white women to be quite sensitive to the employment structure around their residential locations. Generally, married women are searching for employment from a fixed residential locations, as the residential locations are generally made with respect to the best interests of the male partner (White, 1977).

The responsibilities of household and childcare may create time constraints that may affect the ability for white females to enter the paid labor force. Generally, in order to balance these time constraints and enter the paid labor force, white women generally tend to work close to home, as this allows them to balance all of these responsibilities in a capable manner (McLafferty, Preston and Hamilton, 1993; Johnston-Anumonwo, 1996).

Furthermore, if women cannot balance their time constraints by taking employment near their residential locations due to there being a shortage of employment opportunities available, white women may not enter the paid labor force, especially if their lack of income is not detrimental to the welfare of the household and if they view their primary responsibility as taking care of household and childcare responsibilities (Dyck, 1990).

Thus, one would expect to see the Jobs/Persons ratios to be significantly and positively related to the probability that married white women and women with children are employed.

Examination of the effects of Jobs/Persons ratios on the employment outcomes of white women (Tables 5.10a-e), one sees that for white women
overall, there are many samples (60-80%) where the Jobs/Persons ratios near the women’s residential location has significant effects on their probability of being employed.

**White Female Overall**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample Size</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>tenJPDas</td>
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<tr>
<td>tenJPIDW1</td>
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<tr>
<td>tenJPycno</td>
<td>66</td>
<td>0.6170</td>
</tr>
<tr>
<td>tenJPAvg</td>
<td>79</td>
<td>0.6410</td>
</tr>
</tbody>
</table>

*Table 5.10a* Significant Jobs/Persons ratios out of 100 samples for the overall white female population. Maximum value indicates the coefficient on the variable in the logistic regression equation.

**White Female with Children**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample Size</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>tenJPIDW1</td>
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<td>tenJPIDW2</td>
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<td>0.4750</td>
</tr>
<tr>
<td>tenJPycno</td>
<td>6</td>
<td>0.5180</td>
</tr>
<tr>
<td>tenJPAvg</td>
<td>5</td>
<td>0.4820</td>
</tr>
</tbody>
</table>

*Table 5.10b* Significant Jobs/Persons ratios out of 100 samples for white females with children. Maximum value indicates the coefficient on the variable in the logistic regression equation.
White women, especially those that are married are generally searching for employment from a fixed residential location (White, 1977; Madden, 1981). Thus, unlike white men, white women who are married are generally searching for employment from a fixed residential location and cannot adjust their
residential locations in order to improve their accessibility in the labor market. In addition, in married households with fewer vehicles in relation to the number of laborers, the vehicle access is disproportionately given to the male partner for the use in job commuting (Pickup, 1984; Hanson and Pratt, 1995). Thus, this causes these women to be disproportionately reliant upon public transportation.

Furthermore, household and childcare responsibilities are generally the burden of the women, as there is unequal sharing of household responsibilities within the household (White, 1977; Fox, 1983; Pickup, 1984). Therefore, this creates women with time constraints that cause them to juggle household and childcare responsibilities and still try to enter the paid labor force.

All these factors combined cause women to be less flexible in their geographical mobility and may cause them to be more likely to be sensitive to the jobs/person ratios around their residential locations and less likely to be able to enter the paid labor force. For white women, these constraints may force them to become discouraged from entering the paid labor force, especially if they view income gained from entering the paid labor as secondary to their husband’s and view their primary responsibilities are with their children and household (Dyck, 1990).

In terms of probability, for white women overall, moving from a residential location where a white woman would have a 1:2 disadvantage in Jobs/Persons ratio to a residential location where they would have a 2:1 advantage increases their probability of being employed by a maximum of 1.68% in the sample with the largest positive effect. Thus, for all these reasons combined, one
cannot rule out that white women are sensitive to the employment structure around their residential locations.

Examination of subpopulations of white women, one can assess that it is likely that certain white women are affected by the employment structure around their residential locations in different ways.

Examination of the effects of Jobs/Persons ratio on married white women's probability of being employed, one can see that there are no samples in which there is a significant positive effect on their probability of being employed. Thus, it is very unlikely that the number of employment opportunities in relation to the number of persons competing for these opportunities according to the skill level of the individual has a significant effect on the ability for white married women to enter the paid labor force. This is consistent with some researchers, who have suggested that not marriage alone, but rather children have greater significant effects on the probability that women are employed, especially younger children (Fox, 1983; Pickup, 1984; Saltzburg and Waite, 1984; Cooke, 1997).

Thus, although there may be significant unequal sharing of household responsibilities within the household, married women, especially those without children, may be able to create adaptive strategies in order to be able to balance these responsibilities and still enter the paid labor force. For instance, some married women may shift household responsibilities around paid work, as they may be able to shift these responsibilities to evening hours or even the weekend.
These strategies may not be feasible for women with children, especially younger children, as these responsibilities require around the clock management.

Thus, in the population of white women, it appears that marriage alone does not cause women to become sensitive to the employment structure around their residential locations, in their ability to enter the paid labor force. Whether or not it affects the types and quality of employment they gain, would still be open to debate and would have to be investigated further.

On the other hand, if white women with children were examined, it appears that there are samples, however, few (around 10%), that show significant effects of the Jobs/Persons ratios on their employment probabilities. In terms of probability, at maximum, for women with children, moving from a residential location where they would have a 1:2 disadvantage in terms of the Jobs/Persons ratio to a residential location to where they would have a 2:1 advantage, this would increase their probability of being employed by approximately 1.5%.

These results are consistent with past literature, in that children are more important determinants on women's employment (Fox, 1983; Pickup, 1984; Saltzburg and Waite, 1984). Thus, in this sample, it appears that marriage alone does not make women sensitive to the employment structure around their residential locations. Only when women have children, do they become sensitive to the structure, in that women with children are significantly more likely to be unemployed if they reside in areas where there are fewer jobs that match their skills in relation to the number of persons competing for these opportunities within a 10 minute commuting area.
These results, however, do not exclude the possibility that marriage alone causes women to be sensitive to the economic structure around their residential location, in terms, of probability of being employed. Some researchers have suggested that due to time constraints that marriage creates, in addition to the greater likelihood of relying on public transportation, some married women may enter low-skilled, low benefit secondary sector employment, even if they have the skill qualifications to enter high-skilled employment, as this allows them an opportunity to balance their time constraints, as high-skilled employment is disproportionately full-time and located near the downtown CBD (Fox, 1983; Pickup, 1984; Tivers, 1988).

In order to take this into account as a possibility, I will examine how the number of low-skilled employment opportunities in relation to the number of low-skilled persons competing for these opportunities affects married women and women with children, regardless of their skill qualifications.

When examining these results (Tables 5.10f-g), one can now see that married women are sensitive to the employment structure around their residential locations. Thus these results show that there are now about 15% of the samples that show significant positive effects of the Jobs/Persons ratios on the probability of being employed. In terms of probability, at maximum, moving from a residential location where there is a 1:2 disadvantage in the jobs/person ratio to a residential location where there is a 2:1 advantage, increases the probability of a white female being employed by approximately 0.9% for married women, 2.9% for women with children and 1.3% for white women overall.
White Female Overall (Low Skill Assumption)

<p>| | | |</p>
<table>
<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
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<td>tenJPIDW1</td>
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</tr>
<tr>
<td>tenJPAvg</td>
<td>48</td>
<td>0.2040</td>
</tr>
</tbody>
</table>

Table 5.10f Significant Jobs/Persons ratios out of 100 samples for the overall white female population substituting low skilled Jobs/Persons ratios. Maximum value indicates the coefficient on the variable in the logistic regression equation.

White Female with Children (Low Skill Assumption)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>tenJPDas</td>
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<tr>
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<td>11</td>
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<td>tenJPPycno</td>
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<td>0.4510</td>
</tr>
<tr>
<td>tenJPAvg</td>
<td>10</td>
<td>0.4120</td>
</tr>
</tbody>
</table>

Table 5.10g Significant Jobs/Persons ratios out of 100 samples for white females with children substituting low skilled Jobs/Persons ratio. Maximum value indicates the coefficient on the variable in the logistic regression equation.

Married White Females (Low Skill Assumption)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>tenJPDas</td>
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<td>tenJPAvg</td>
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<td>0.2900</td>
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</tbody>
</table>

Table 5.10h Significant Jobs/Persons ratios out of 100 samples for the married white female population substituting low skilled Jobs/Persons ratios. Maximum value indicates the coefficient on the variable in the logistic regression equation.
Thus, in conclusion, what can be stated from results as a whole, is that married white women cannot be excluded as being sensitive to the employment structure around their residential locations. Furthermore, it appears that children create significant time constraints that may affect the probability of women’s entrance into the paid labor force, thus causing them to be sensitive to the employment structure around their residential locations.

Thus, women with children who reside in areas where there are fewer employment opportunities available in comparison to persons competing for these opportunities are less likely to be employed than women who reside in areas of greater Jobs/Persons ratios. This is most likely due to these time constraints, along with their residential fixity and limited geographic mobility due to heavier reliance upon public transportation. Married women, especially those without children, seem to be able to better balance their household responsibilities in a manner that allows them to enter the paid labor force.

5.8.2.3 African American Males

For African American males, the Jobs/Persons ratio should have a significant effect on the probability that they are employed. For the reasons stated earlier, the Spatial Mismatch Hypothesis and Skills Mismatch suggests that African Americans are segregated into central city neighborhoods in areas where there are significantly more persons competing for employment than there are opportunities, especially in low-skilled employment, employment that African
Americans disproportionately are qualified for, due to their lower educational levels (Kain, 1968, 1992; Ihlanfeldt, 1999).

In this study, concern is not about whether the Jobs/Persons ratio around African Americans’ residential locations as a whole is lower, but rather, how this ratio affects the employment outcomes of African Americans.

Results (Table 5.11a-e) shows that in none of the samples, even for low skilled African Americans, do the Jobs/Persons ratio show a positive significant effect on the probability that African Americans are employed.

### African American Male Overall

<table>
<thead>
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<tr>
<td>tenJPavg</td>
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</table>

**Table 5.11a** Significant Jobs/Persons ratios out of 100 samples for the overall African American male population. Maximum value indicates the coefficient on the variable in the logistic regression equation.

### African American Male with Children

<table>
<thead>
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<th>Variable</th>
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<tr>
<td>tenJPavg</td>
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</tr>
</tbody>
</table>

**Table 5.11b** Significant Jobs/Persons ratios out of 100 samples for African American males with children. Maximum value indicates the coefficient on the variable in the logistic regression equation.
High Skilled African American Males

Table 5.11c Significant Jobs/Persons ratios out of 100 samples for the overall high-skilled African American male population. Maximum value indicates the coefficient on the variable in the logistic regression equation.

<table>
<thead>
<tr>
<th>Variable</th>
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</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

Low Skilled African American Males

Table 5.11d Significant Jobs/Persons ratios out of 100 samples for the overall low-skilled African American male population. Maximum value indicates the coefficient on the variable in the logistic regression equation.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>tenJPDas</td>
<td>-0.1680</td>
</tr>
<tr>
<td>tenJPIDW1</td>
<td>-0.1340</td>
</tr>
<tr>
<td>tenJPIDW2</td>
<td>-0.1710</td>
</tr>
<tr>
<td>tenJPPycno</td>
<td>-0.1500</td>
</tr>
<tr>
<td>tenJPAvg</td>
<td>-0.1340</td>
</tr>
</tbody>
</table>

Married African American Males

Table 5.11e Significant Jobs/Persons ratios out of 100 samples for the married African American male population. Maximum value indicates the coefficient on the variable in the logistic regression equation.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>tenJPIDW2</td>
<td>-0.3930</td>
</tr>
</tbody>
</table>

Thus, it is very likely that one of these samples is representative of the true population distribution of African Americans. These results show that one can be confident that within a 10 minute commuting area there is no significant positive effect of the Jobs/Persons ratio on the employment outcomes of African American males.

What can be said from these results, is that I do not argue that in and around African American neighborhoods, there may be fewer employment
opportunities in relation to the number of persons competing for these jobs. What can be confidently stated is that within a 10 minute commuting area, this measure does not significantly affect the probability that African American males are employed. Therefore, one can confidently state that in the Columbus MSA, in terms of the Spatial Mismatch Hypothesis and Skills Mismatch Hypothesis, the skill and numbers of employment opportunities in relation to the skills and numbers of persons competing for these jobs does not have a significant positive effect on an African American male individual’s probability of being employed.

Whether or not, it significantly affects their employment outcomes in other ways, is still open for debate. The employment structure can have effects on African American males’ employment outcomes in terms of lower wages and terms of employment quality. Additional research would have to be pursued to answer such questions. Thus, the Spatial Mismatch Hypothesis and Skills Mismatch Hypothesis cannot be ruled out, but what can be ruled out is that the employment structure in terms of gross numbers of employment opportunities around African American’s neighborhoods is not a significant factor in the unemployment of African Americans. Thus, one must question research that posits that the Spatial Mismatch Hypothesis and/or Skills Mismatch are a significant explanation for the high unemployment rates among African Americans, as a whole and in relation to whites.
5.8.2.4 African American Females

In terms of Jobs/Persons ratios, one would expect to see an effect on African American women’s employment probabilities for several reasons. First off, according to the Spatial Mismatch Hypothesis and Skills Mismatch Hypothesis, African American women, due to housing discrimination and subsequent residential segregation, tend to be segregated into central city areas of the metropolitan region. Thus, as the Spatial Mismatch Hypothesis and Skills Mismatch state, this, in addition to, the decentralization of the white population and low-skilled employment, particularly in manufacturing, has created a surplus of persons competing for employment opportunities in relation to the number of these opportunities available in and near segregated African American neighborhoods (Kain, 1968; Ihlanfeldt, 1999).

In addition, North American metropolitan centers have transformed from centers of durable goods and manufacturing into centers of administration, technology and information exchange, creating employment that requires higher skills (Kasarda, 1985). This, then creates a mismatch between the skill levels of the employment opportunities available near African American neighborhoods and the residents located here, which are disproportionately located near the central city. In addition, African Americans tend to lack the skills required to fill these opportunities (Kasarda, 1985, 1989).

In Section 5.6, it was determined that from an average residential location in an African American neighborhood, it did not appear that a Spatial Mismatch
or Skills Mismatch existed, as there were fewer low-skilled laborers in relation to the number of low-skilled employment opportunities. As well, there were fewer high-skilled employment opportunities in relation to the number of high-skilled residents in these areas. However, both the Spatial Mismatch Hypothesis and the Skills Mismatch Hypothesis are left open as a possibility of affecting African American female’s probability of being employed, because the concern here is not with the average Jobs/Persons ratio from an average residential location within an African American neighborhood, but rather, how individuals scattered across these neighborhoods are affected by these ratios.

In terms of subpopulations of African American women, it would seem likely that African American women who are married and especially those women with children would be sensitive to the Jobs/Persons ratios within a 10 minute commuting area surrounding their residential locations.

Marriage, as has been suggested several times in this study is said to generally be characterized by unequal sharing of responsibilities within the home, in terms of both household and childcare responsibilities. These create time constraints for African American women, in which they must balance in order to enter the paid labor force. Therefore, it may be necessary for these women to work near their residential locations in order to make this balance feasible (McLafferty, Preston and Hamilton, 1993; Johnston-Anumonwo, 1996).

Furthermore, in order to gain employment, married women may have to search for employment from a fixed residential location, as housing choices are generally made with the best interests of the male partner in mind (White, 1977).
In addition to this fixity created by marriage, African Americans as a whole encounter racial discrimination in the housing market and are generally segregated into certain neighborhoods, generally in the central-city (Kain, 1968; Yinger, 1986). Therefore, married African American women are generally doubly constrained in their ability to improve residential locations for economic benefit.

In addition, when there are fewer private automobiles in the household in relation to the number of laborers, access to this automobile is generally given to the male partner for use in labor commuting (Pickup, 1984).

African Americans as a whole are generally more reliant upon public transportation than whites (McLafferty and Preston, 1992). It is quite possible that fewer African American women than white women have access to private automobiles. Thus, this may cause them to become geographically immobile in terms of balancing household responsibilities and entering the paid labor force. Therefore, in addition to all these reasons, African American women should be quite sensitive to the employment structure near their residences, thus, one should see a positive significant effect of the Jobs/Persons ratio on the probability of African American entering the paid labor force.

Some researchers have suggested that not marriage alone, but rather the number and ages of children present create the greatest time constraints for women that may inhibit their ability to enter the paid labor force (Fox, 1983; Pickup, 1984; Saltzburg and Waite, 1984; Cooke, 1997).
Therefore, one should also see a positive significant effect on the probability of African American women with children entering the paid labor force, as they too should be quite sensitive to the employment structure near their residential locations and more so than married women alone. Thus, if there are not significant numbers of employment opportunities available for these women to enter the paid labor force, they may opt to other alternatives such as welfare, especially if this is more beneficial than entering the paid labor force, not in economic terms alone, but also in terms of the welfare of the household, especially the children in the household (Kasarda and Ting, 1996).

This would be especially true for African American female head of households. Disproportionate numbers of African American females are head of households and this creates responsibility for household and childcare responsibilities, in addition to being the primary wage earner in the household (McLafferty and Preston, 1992). Thus, these women should also be quite sensitive to the economic structure around their residential locations, as they would need to seek employment near their residence to handle all of these constraining responsibilities. If there are no employment opportunities available, then they may seek alternative means of economic support, such as welfare, as it may actually have greater benefits for the household, economically or psychologically, than making long commutes to a dead end job (Kasarda and Ting, 1996).

Examination of (Tables 5.12a-e) show that only
African American Female Overall

<table>
<thead>
<tr>
<th>Variable</th>
<th>Count</th>
<th>Value</th>
</tr>
</thead>
<tbody>
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<tr>
<td>tenJPIDWi</td>
<td>16</td>
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</tr>
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<td>tenJPIDW2</td>
<td>19</td>
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</tr>
<tr>
<td>tenJPPycno</td>
<td>15</td>
<td>0.3340</td>
</tr>
<tr>
<td>tenJPAvg</td>
<td>17</td>
<td>0.3710</td>
</tr>
</tbody>
</table>

Table 5.12a Significant Jobs/Persons ratios out of 100 samples for the overall African American female population. Maximum value indicates the coefficient on the variable in the logistic regression equation.

African American Female with Children

<table>
<thead>
<tr>
<th>Variable</th>
<th>Count</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>tenJPAvg</td>
<td>12</td>
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</tbody>
</table>

Table 5.12b Significant Jobs/Persons ratios out of 100 samples for African American females with children. Maximum value indicates the coefficient on the variable in the logistic regression equation.

High Skilled African American Females

<table>
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<tr>
<th>Variable</th>
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</tr>
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<tr>
<td>tenJPPycno</td>
<td>35</td>
<td>-0.3380</td>
</tr>
<tr>
<td>tenJPAvg</td>
<td>39</td>
<td>-0.3390</td>
</tr>
</tbody>
</table>

Table 5.12c Significant Jobs/Persons ratios out of 100 samples for the overall high-skilled African American female population. Maximum value indicates the coefficient on the variable in the logistic regression equation.
Low Skilled African American Females

<table>
<thead>
<tr>
<th>Variate</th>
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</tr>
</thead>
<tbody>
<tr>
<td>tenJPDas</td>
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<tr>
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</tr>
<tr>
<td>tenJPAvg</td>
<td>10</td>
<td>0.4520</td>
</tr>
</tbody>
</table>

Table 5.12d Significant Jobs/Persons ratios out of 100 samples for the overall low-skilled African American female population. Maximum value indicates the coefficient on the variable in the logistic regression equation.

Married African American Females

<table>
<thead>
<tr>
<th>Variate</th>
<th>#</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
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<td>tenJPIDW2</td>
<td>6</td>
<td>-0.5320</td>
</tr>
<tr>
<td>tenJPPycno</td>
<td>5</td>
<td>-0.5490</td>
</tr>
<tr>
<td>tenJPAvg</td>
<td>6</td>
<td>-0.5260</td>
</tr>
</tbody>
</table>

Table 5.12e Significant Jobs/Persons ratios out of 100 samples for the married African American female population. Maximum value indicates the coefficient on the variable in the logistic regression equation.

about 1/5 of the samples show significant positive effects on African American females as a whole. In terms of probability, at a maximum, the Jobs/Persons ratio would increase an African American women’s probability of being employed by approximately 1.7% if they moved from a residential location where they had a disadvantage of 1:2 in Jobs/Persons ratio to a residential location where they had an advantage of 2:1 in the Jobs/Persons ratio.
When one examines high-skilled African American females (Table 5.12c) and low-skilled African American females (Table 5.12d) it can be seen that there are no significant positive relationship between the Jobs/Persons ratio and the probability of a high skilled African American female being employed in any of these samples.

However, in the low-skilled African American female population, one can see at least 10% of the samples showing a positive significant effect on the probability of a low-skilled African American female being employed. The effect here is very large. In terms of moving from a residential location in which they would have a 1:2 disadvantage in terms of Jobs/Persons ratio to a residential location where they had a 2:1 advantage, the probability that a low-skilled African American women will be employed increases by nearly 4.4%, a very significant increase in probability.

What can be said from these results in terms of the Spatial Mismatch Hypothesis and Skills Mismatch Hypothesis is that it is not just the economic structure in terms of Jobs/Persons ratios that affect African Americans' ability to enter the paid labor force, but rather this employment structure, in addition to the life situations of African Americans, especially those life situations that are created out of the household, that affect their probability of entering the paid labor force. Thus, this is probably the reason why the Jobs/Persons ratios have large significant positive effects on African American females probability of employment in these samples and no African American male low-skill samples show this positive effect. Thus, one must take into account the life situations of
individuals when examining the Spatial Mismatch Hypothesis and Skills Mismatch Hypothesis, especially those life situations that are generated within the household or the results may be misleading.

Furthermore, in examination of African American married women, it cannot be seen in any of these samples in this analysis that show positive significant effects of the Jobs/Persons ratios on their ability to enter the paid labor force. However, when examining African American women with children, one can see approximately 10% of the samples showing significant positive effects for the Jobs/Persons ratios on the probability that they will be employed.

For African American women with children, moving from a residential location in which they have a 1:2 disadvantage in the Jobs/Persons ratio to a residential location where they have a 2:1 advantage increases their probability of being employed by approximately 1.5%. Thus, this is consistent with the literature that suggests that children, not marriage alone, creates time constraints that make women quite sensitive to the employment structure around their residential location (Fox, 1983; Saltzburg and Waite, 1984; Cooke, 1997).

Married women may not be affected by the employment structure around their residential locations due to their ability to shift time constraining activities to non-working hours and weekends. As England (1993) states, married African American women may be “knowledgeable agents with transformative capacities”.

African American women with children may not be able to adapt to their time constraints, as childcare requires significant constant timing. Thus, African American women with children may need to work close to home in order to fulfill
these constraints and enter the paid labor force (Fox, 1983; Pickup, 1984; Saltzburg and Waite, 1984; Tivers, 1988; Hanson, 1992; Preston, McLafferty and Hamilton, 1993; Cooke, 1997)

Therefore, if employment opportunities are not available, it may not be feasible to make longer commutes to employment and fulfill their obligations as mothers. Thus, these women may adapt to these demands by accepting public welfare as an alternative, especially if this welfare is more beneficial, not just economically, but in terms of the well-being of the children within the household, as they require the mothers responsibility to fulfill their needs (Dyck, 1990; Kasarda and Ting, 1996).
6. CONCLUSION

The Spatial Mismatch Hypothesis states that housing market discrimination, resulting residential segregation, in addition to the decentralization of the middle class white population and low-skilled employment, particularly in manufacturing have all combined to significantly affect African American employment outcomes, as it has created a shortage of employment opportunities relative to the number of African Americans competing for these employment opportunities in and around central city neighborhoods where African Americans are segregated (Kain, 1968, 1992; Ihlanfeldt, 1999).

In addition, the Skills Mismatch Hypothesis states that centers of North American metropolitan regions have transformed from centers of durable goods and manufacturing to centers of administration, technology and information exchange. This created jobs that require higher skill qualifications (Kasarda, 1985, 1989). This has led to a mismatch between the skills required for these jobs and the population in the areas surrounding these jobs, as African Americans are generally segregated into central city areas of the metropolitan region and they typically do not have the skill requirements to fill these jobs. Thus, this creates a mismatch between the skills of African Americans in segregated neighborhoods and the employment opportunities surrounding these neighborhoods (Kasarda, 1985, 1989, Bauder and Perle, 1999).
This study tests these hypotheses through the use of four creation surface methods: a Dasymetric Mapping method, two Inverse Distance Weighting (IDW) methods, one with a coefficient of $n = 1$ and one with a coefficient of $n = 2$, and a method based upon the work of David Martin (1996), who incorporates a population surface method that incorporates the principles of adaptive kernel estimation and pycnophylactic interpolation. The study area for this study is the Columbus, Ohio MSA, which is centered on Franklin County and includes portions of the surrounding counties of Delaware, Fairfield, Licking, Madison, Pickaway and Union.

The data used in this study distinguished between employment opportunities that are available and not available to certain sector of the population through the aid of the EEOC-1 and EEOC-4 reports, which allowed us to take into account gender segregation within the labor market along with the skill levels of the jobs and the persons competing for these jobs. Previous studies of the Spatial Mismatch Hypothesis and the Skills Mismatch Hypothesis have ignored this.

The population and employment opportunity surfaces were created with the aid of ancillary land use data, leading to a more realistic representation of population and employment opportunity densities across the study area, and most importantly within the zonal boundaries in which these data were taken from. These created surfaces attempt to address the issues of the Modified Areal Unit Problem (MAUP) and homogeneous density assumptions at every location within zonal boundaries associated with the original aggregated data.
Jobs/Persons ratios were then constructed at each residential location across the study area, which reflected the commuting behavior of automobile and public transit use. A public transit network was constructed based upon the true travel behavior of the public transit system of the Columbus Metropolitan region.

Finally, PUMS data was used to link housing attributes of individuals to appropriate residential locations within their correct PUMA zone. As some persons within the PUMS sample had more than one possible residential location, 100 stratified random samples were taken from the total set of likely residential locations. This was done as an attempt to construct the underlying residential locations of the persons contained within the PUMS data. Each person in every sample was then assigned a Jobs/Persons ratio that reflected their gender, skill level and commuting behavior.

Visual analysis of these population surfaces was then undertaken. These surfaces revealed that African Americans are heavily segregated into certain neighborhoods within the Columbus MSA and that higher educated African Americans are still segregated into these same neighborhoods.

Furthermore, through the use of CTPP census data, I examined the actual vs. predicted African American employment densities across the study area. This analysis revealed that African Americans were generally employed in areas that followed the City of Columbus corporation limit, suggesting the possibility of racial discrimination by employers in smaller municipalities within the metropolitan area, as these are areas significantly populated by upper middle class and upper class whites.
Next, I analyzed the number of employment opportunities accessible through a 10 and 15 minute automobile commute and through a 10, 15 and 30 minute commute by public transportation, from an average residential location within the study area. This analysis revealed that automobiles give access to 15 (in a 15 minute commuting area) to 22 (in a 10 minute commuting area) more employment opportunities than that same length of commute by public transportation. This advantage is still 2:1 when a 15 minute automobile commute is compared to a 30 minutes public transit commute and this advantage held up when I examined only residential locations where significant numbers of African Americans reside.

Furthermore, I then examined the Jobs/Persons ratios from an average residential location in areas where whites and African Americans significantly reside. Although Jobs/Persons ratios were significantly higher in white areas, there was no evidence of a surplus of workers to jobs in low-skill terms near African American neighborhoods, as Jobs/Persons ratios were significantly, on average, greater than one. This advantage, however, did not take into account variations across neighborhoods, so one could not exclude the Spatial Mismatch Hypothesis and the Skills Mismatch Hypothesis as significantly affecting African American employment.

The final analysis conducted a logistic regression analysis of the PUMS data for the effect of the Jobs/Persons ratios within a 10 minute commuting area on the probability of certain sectors of this sample population being employed.
For white males and African American males, there were no significant positive Jobs/Persons ratio coefficients in any of the samples. This questions the Spatial Mismatch Hypothesis as an explanation for the higher unemployment rates among African American males. Thus, African American males are not sensitive to the employment structure in and around their neighborhoods in terms of gaining employment. Thus, the Spatial Mismatch Hypothesis is questioned for African Americans in terms of unemployment rates. This does not disregard the Spatial Mismatch completely, as African Americans may be affected by a Spatial Mismatch effect that affects other facets of their employment outcomes, such as wages or the types of employment they gain.

For white women and African American women, women with children may be affected by the employment structure around their residential locations, as some samples reveal significant positive Jobs/Persons ratios on their probability of being employed. This is most likely due to the time constraints that children bring upon women that may limit them to sets of employment opportunities near their residential locations (Fox, 1983; Pickup, 1984; Saltzburg and Waite, 1984; Cooke, 1997).

Married women, on the other hand are not sensitive to the employment structure around their residential locations in this study, as there are no significant jobs/persons coefficients in any of the samples (except when I substitute low-skill Jobs/Persons ratios for white women) that positively affect their probability of being employed. Thus, married women may be able to shift responsibilities to
non-work hours and as England (1993) states that women “need to be accepted as knowledgeable agents with transformative capacities”.

Furthermore, for African American low-skilled women, there are strong effects of the Jobs/Persons ratios on their probabilities of being employed, as in terms on probability, a low-skilled African American women moving from a residential location where they have a 1:2 disadvantage in the Jobs/Persons ratio to a residential location where they have a 2:1 advantage would have at a maximum, a 4.4% increase in their probability of being employed. In comparison to African American men, who show no samples with significant positive Jobs/Persons ratio coefficients, one can state that not the employment structure, but rather the employment structure, in addition to the life situations of African Americans, especially those life situations that are generated within the household affect the probability that African Americans are employed.

Thus, one must take into account the life situations of individuals when examining the Spatial Mismatch Hypothesis or the Skills Mismatch Hypothesis, especially those life situations that are generated within the household, or the results may be misleading or biased.

This study does have some limitations. The PUMS data does a very poor job of allowing recognition of residential locations for individuals within the metropolitan region. I linked the PUMS housing attributes to land parcel data containing the same attributes. Unfortunately, this did not lead to a single residential location for each individual, but a set of residential locations from one to n residential locations. So, one cannot state what the true effect of
Jobs/Persons ratio on the subpopulations in this study in terms of strength of effect is, but rather one can only generalize whether it is or is not significant and the maximum effect of the employment structure on the probability of being employed. Only when the Census Bureau becomes more lenient on the confidentiality issues of its data can this true strength be truly investigated and estimated.

Furthermore, there are probably several individual variables that could not be included in the analysis that may significantly affect an individual’s probability of being employed. For example, means of transportation is only available for employed persons, thus, automobile access may have significantly strong effects on the probability that certain subgroups of the population are employed. For the construction of Jobs/Persons ratios in this study, I assumed that men had access to the private automobile in the household when there was vehicle access in question (Madden, 1981). Thus, males were given access when the Vehicles/Persons ratio within the household exceeded 0 and women were given access when it exceeded 0.5.

Other limitations in this study is the exclusion of neighborhood variables in the logistic regression analysis. Neighborhood variables may be important to a person’s employment outcomes for several reasons. First, neighborhoods serve as places where social interaction take place and social networks are modeled. These social networks typically lead to employment opportunities in many situations (Wilson, 1987; Kasinitz and Rosenberg, 1996).
Furthermore, employers may practice address discrimination in their hiring practices, as they may not hire applicants based upon where they reside, as the address may be predicated in their residential stereotypes about individuals that reside in certain neighborhood (Kirschenman and Neckerman, 1991; Hanson and Pratt, 1992; Kasinitz and Rosenberg, 1996; Turner, 1997).

Due to the complexity of this study, neighborhood variables were left out of the analysis. Preliminary examination of neighborhood variables, however, did reveal that they were highly correlated with individual characteristics, thus, this led to the decision to leave them out of the analysis.

Finally, there is no doubt that other factors that are spatial in nature and shaped by the spatial environment are important determinants of the employment outcomes of individuals. For example, many researchers state that social networks are one of the most important factors that lead to employment opportunities (Kasinitz and Rosenberg, 1996; Turner, 1997; Muow, 2002). Thus, residential segregation may lead to social isolation of African Americans. As many social networks tend to follow gender/racial lines, there is no doubt that these are important factors connecting persons to employment (Kasinitz and Rosenberg, 1996; Muow, 2002).

How much more important social networks are in affecting the employment outcomes of individuals than the employment structure around an individual’s residential location is beyond this study’s purpose. However, I do not disagree that social networks are significant in connecting persons to employment.
In addition, there is little doubt also that there is racial discrimination in the labor market. How much more important this is than the employment structure around an individual’s residential location is again beyond this study’s purpose. However, I do acknowledge the significance of employer discrimination on the employment outcomes of African Americans’ employment.

In conclusion, this study has revealed that the Jobs/Persons ratios around an individual’s residential location may be significant predictors in the employment outcomes of certain sectors of the population. However, one cannot examine this effect without taking into consideration the life situations of the individuals under study. It appears that the home is an important sphere in geographical space that creates life situations that cause individuals to become sensitive to the employment structure around their residential location, in this case, sensitive refers to the affect on their probability of being employed.

Thus, there is a call to future research in which the interactions and compromises of the sharing of household and childcare responsibilities within the household, in addition to the decisions made in access to private automobiles need to be examined to determine how these affect the geography of an individual’s employment and how some overcome burdening of such responsibilities to enter the paid labor market. This would no doubt shed light into how a person’s life situation affects their ability to obtain employment.
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APPENDIX A: CHAPTER 5 FIGURES
Figure A.1 This figure shows the census zonal boundaries for Franklin County: PUMA Areas, Census Tracts and Census Block Groups
Figure A.2 This figure shows the roads within Franklin and Southern Delaware County served by COTA bus service.
Figure A.3  This figure displays the municipalities within Franklin County.
Figure A.4 The figure depicts the major roads within Franklin County. Major roads refer to roads that have posted speed limits greater than or equal to 45 mph.
Figure A.5 This figure depicts the spatial distribution of the low-skilled African American labor force population across the study area.
Black High Skilled Labor Force Dasymetric

Figure A.6 This figure depicts the spatial distribution of the high-skilled African American labor force population across the study area.
Figure A.7 This figure depicts the spatial distribution of the African American labor force population across the study area.
Figure A.8 This figure depicts the spatial distribution of the low-skilled African American male labor force population across the study area.
Figure A.9 This figure depicts the spatial distribution of the high-skilled African American male labor force population across the study area.
Figure A.10 The figure depicts the spatial distribution of the African American male labor force population across the study area.
Figure A.11 The figure depicts the spatial distribution of the low-skilled African American female labor force population across the study area.
Figure A.12 The figure depicts the spatial distribution of the high-skilled African American female labor force population across the study area.
Figure A.13 The figure depicts the spatial distribution of the African American female labor force population across the study area.
White Low Skilled Labor Force Dasymetric

Figure A.14 The figure depicts the spatial distribution of the low-skilled white labor force population across the study area.
White High Skilled Labor Force Dasymetric

Figure A.15 The figure depicts the spatial distribution of the high-skilled white labor force population across the study area.
White Labor Force Dasymetric

Figure A.16 The figure depicts the spatial distribution of the white labor force population across the study area.

Projection: Lambert Conformal Conic
State Plane Ohio South NAD 83

Study Area
Labor Force
0
0 - 1.37
1.37 - 8.36
8.36 - 15.35
15.35 - 22.33
22.33 - 1741.01
No Data
White Male Low Skilled Labor Force Dasymetric

Figure A.17 The figure depicts the spatial distribution of the low-skilled white male labor force population across the study area.
Figure A.18 The figure depicts the spatial distribution of the high-skilled white male labor force population across the study area.
White Male Labor Force Dasymetric

Figure A.19 The figure depicts the spatial distribution of the white male labor force population across the study area.
White Female Low Skilled Labor Force Dasymetric

The figure depicts the spatial distribution of the low-skilled white female labor force population across the study area.
Figure A.21 The figure depicts the spatial distribution of the high-skilled white female labor force population across the study area.
Figure A.22 The figure depicts the spatial distribution of the white female labor force population across the study area.
Figure A.23 The figure depicts the spatial distribution of the male low-skilled labor force population using the Dasymetric surface creation method. These are the labor force populations that males will be competing against for employment opportunities.
Male High Skilled Labor Force Dasymetric

Projection: Lambert Conformal Conic
State Plane Ohio South NAD 83

Figure A.24 The figure depicts the spatial distribution of the male high-skilled labor force population using the Dasymetric surface creation method. These are the labor force populations that males will be competing against for employment opportunities.
Male Labor Force Dasymetric

Figure A.25 The figure depicts the spatial distribution of the male labor force population using the Dasymetric surface creation method.
Figure A.26 The figure depicts the spatial distribution of the female low-skilled labor force population using the Dasymetric surface creation method. These are the labor force populations that females will be competing against for employment opportunities.
Female High Skilled Labor Force Dasymetric

Figure A.27 The figure depicts the spatial distribution of the female high-skilled labor force population using the Dasymetric surface creation method. These are the labor force populations that females will be competing against for employment opportunities.
Figure A.28 The figure depicts the spatial distribution of the female labor force population using the Dasymetric surface creation method.
Black Low Skilled Employment Opportunities Dasymetric

Figure A.29 The figure depicts the spatial distribution of African American low-skilled males under the assumption of no employer discrimination in the labor market and African Americans having the same spatial access as whites.
Figure A.30 The figure depicts the spatial distribution of African American high-skilled males under the assumption of no employer discrimination in the labor market and African Americans having the same spatial access as whites.
Figure A.31 The figure depicts the spatial distribution of African Americans under the assumption of no employer discrimination in the labor market and African Americans having the same spatial access as whites.
White Low Skilled Employment Opportunities Dasymetric

Figure A.32 The figure depicts the spatial distribution of the expected distribution of the white low-skilled employment.
White Male Low Skilled Employment Opportunities Dasymetric

Figure A.33 The figure depicts the spatial distribution of the expected distribution of the white male low-skilled employment.
Figure A.34 The figure depicts the spatial distribution of the expected distribution of the white female low-skilled employment.
White High Skilled Labor Force Dasymetric

Figure A.35 The figure depicts the spatial distribution of the expected distribution of the white high-skilled employment.
White Male High Skilled Employment Opportunities Dasymetric

Figure A.36 The figure depicts the spatial distribution of the expected distribution of the white male high-skilled employment.
White Female High Skilled Employment Opportunities Dasymetric

Figure A.37 The figure depicts the spatial distribution of the expected distribution of the white female high-skilled employment.
White Employment Opportunities Dasymetric

Figure A.38 The figure depicts the spatial distribution of the expected distribution of the white employment.
Figure A.39 The figure depicts the spatial distribution of the expected distribution of the African American male low-skilled employment under the assumption of absence of employer discrimination and assumption that blacks have the same access as whites.
Black Male High Skilled Employment Opportunities Dasymetric

Figure A.40 The figure depicts the spatial distribution of the expected distribution of the African American male high-skilled employment under the assumption of absence of employer discrimination and assumption that blacks have the same access as whites.
Figure A.41 The figure depicts the spatial distribution of the expected distribution of the African American female low-skilled employment under the assumption of absence of employer discrimination and assumption that blacks have the same access as whites.
Figure A.42 The figure depicts the spatial distribution of the expected distribution of the African American female high-skilled employment under the assumption of absence of employer discrimination and assumption that blacks have the same access as whites.
Figure A.43 This figure depicts the spatial distribution of the employment opportunities available for low-skilled males using the Dasymetric surface creation method. These are the employment opportunities that low-skilled males will be competing for.
Male High Skilled Employment Opportunities Dasymetric

Figure A.44 This figure depicts the spatial distribution of the employment opportunities available for high-skilled males using the Dasymetric surface creation method. These are the employment opportunities that high-skilled males will be competing for.
Male Employment Opportunities Dasymetric

Figure A.45 This figure depicts the spatial distribution of the employment opportunities available for males using the Dasymetric surface creation method. These are the employment opportunities that males will be competing for.
Figure A.46 This figure depicts the spatial distribution of the employment opportunities available for low-skilled females using the Dasymetric surface creation method. These are the employment opportunities that low-skilled females will be competing for.
Female High Skilled Employment Opportunities Dasymetric

Figure A.47 This figure depicts the spatial distribution of the employment opportunities available for high-skilled females using the Dasymetric surface creation method. These are the employment opportunities that high-skilled females will be competing for.
Female Employment Opportunities Dasymetric

Figure A.48 This figure depicts the spatial distribution of the employment opportunities available for females using the Dasymetric surface creation method. These are the employment opportunities that females will be competing for.
Figure A.49 This figure depicts the spatial distribution of the actual white low skilled employment locations created from the Census CTTP Part 2 files using the Dasymetric surface creation method.
White High Skilled Workers

Figure A.50 This figure depicts the spatial distribution of the actual white high skilled employment locations created from the Census CTTP Part 2 files using the Dasymetric surface creation method.
Figure A.51 This figure depicts the spatial distribution of the actual white employment locations created from the Census CTTP Part 2 files using the Dasymetric surface creation method.
Figure A.52 This figure depicts the spatial distribution of the actual African American low-skilled employment locations created from the Census CTTP Part 2 files using the Dasymetric surface creation method.
Black High Skilled Workers

Figure A.53 This figure depicts the spatial distribution of the actual African American high-skilled employment locations created from the Census CTTP Part 2 files using the Dasymetric surface creation method.
Figure A.54 This figure depicts the spatial distribution of the actual African American employment locations created from the Census CTTP Part 2 files using the Dasymetric surface creation method.
Figure A.55 This figure depicts the areas of the study area where African Americans are under-represented and over-represented in the employment market. This figure was created using the Dasymetric method of surface creation.
Figure A.56 This figure depicts the areas of the study area where low-skilled African Americans are under-represented and over-represented in the employment market. This figure was created using the Dasymetric method of surface creation.
Figure A.57 This figure depicts the areas of the study area where high-skilled African Americans are under-represented and over-represented in the employment market. This figure was created using the Dasymetric method of surface creation.
Figure A.58 This figure depicts the areas of the study area where whites are under-represented and over-represented in the employment market. This figure was created using the Dasymetric method of surface creation.
White Actual - Expected Low Skilled Workers

Figure A.59 This figure depicts the areas of the study area where low-skilled whites are under-represented and over-represented in the employment market. This figure was created using the Dasymetric method of surface creation.
Figure A.60 This figure depicts the areas of the study area where low-skilled whites are under-represented and over-represented in the employment market. This figure was created using the Dasymetric method of surface creation.
CBD: Central Business District

COTA: Central Ohio Transit Authority

CTPP: Census Transportation Planning Package

EEOC: Equal Employment Opportunity Commission

IDW: Inverse Distance Weighting

MAUP: Modifiable Area Unit Problem

MCSUI: Multi City Study of Urban Inequality

MORPC: Mid Ohio Regional Planning Commission

MSA: Metropolitan Statistical Area

NAICS: North American Industrial Classification System

PUMA: Public Use Microdata Area

PUMS: Public Use Microdata Samples

SF3: Summary File 3

SIC: Standard Industry Code

TAZ: Traffic Analysis Zone