Residential Location, Transportation, and Welfare-to-Work in the United States: A Case Study of Milwaukee

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Abstract

This article addresses two questions about spatial barriers to welfare-to-work transition in the United States. First, what residential and transportation adjustments do welfare recipients tend to make as they try to become economically self-sufficient? Second, do these adjustments actually increase the probability that they will become employed?

Analysis of 1997–2000 panel data on housing location and automobile ownership for Milwaukee welfare recipients reveals two tendencies: (1) to relocate to neighborhoods with less poverty and more racial integration and (2) to obtain a car. Results from binary logit models indicate that residential relocation and car ownership both increase the likelihood that welfare recipients will become employed. These findings suggest that policies should aim to facilitate residential mobility for low-income families and improve their neighborhoods, rather than simply move them closer to job opportunities. The findings also suggest a critical role for transportation policy in reducing unemployment.

Keywords: Employment issues; Neighborhood; Transportation

Introduction

The Personal Responsibility and Work Opportunity Reconciliation Act of 1996—also known as welfare reform—marked a drastic departure from traditional welfare programs in the United States. The most fundamental and distinctive characteristic of the new law was the explicit requirement that welfare recipients find employment within a specified length of time. Essentially, welfare reform was aimed at ending low-income families' dependence on public assistance by mandating work.

The ultimate challenge of welfare reform is to enable current recipients of public assistance to succeed in the labor market. For the past eight years, government agencies, community organizations, and other not-for-profit organi-

zations have initiated various programs aimed at facilitating the welfare-to-work transition. Some of these programs increased housing choice for welfare recipients, and others provided them with job training, transportation, and other services. In the meantime, partly because of welfare reform, a substantial amount of research has been undertaken to address questions about unemployment and poverty. Numerous researchers have examined the obstacles low-income people face in their struggle to become productive and economically independent members of society (Bania, Coulton, and Leete 2003; Danziger et al. 2000), and many have provided policy prescriptions for overcoming these obstacles.

A portion of this contemporary research has focused on spatial barriers to employment, especially in large metropolitan areas (Blumenberg and Ong 1998; Cervero, Sandoval, and Landis 2002; Kawabata 2003; Lacombe 1998; Ong 1996; Sanchez 1999b; Shen 1998). However, there are major disagreements among researchers about the nature of these spatial barriers, as well as their effects on employment outcomes for low-income people. One controversial issue is whether central cities represent disadvantaged residential locations for less skilled workers in terms of spatial access to job opportunities. Many argue that there is a geographic imbalance between highly concentrated unemployment in the central cities and rapid employment growth in the suburbs and that the imbalance puts central-city residents at a disadvantage (Community Transportation Association of America 1998; Lacombe 1998).[1] Some point to successful low-income suburban housing programs, most notably the Gautreaux program in Chicago (Rosenbaum 1995), as evidence that suburban residential locations improve spatial access to job opportunities, especially for those moving from distressed urban core neighborhoods.

Others, including Ong (1996) and Shen (1998, 2001), reject the popular characterizations of central cities as locations with relatively few job opportunities compared with outlying suburbs. In empirical studies of the Boston metropolitan area, Shen (1998, 2001) found that current employment in low-skilled occupations, as well as job openings in these occupations, were still relatively concentrated in the central city and inner suburbs.[2] In addition, he found

[1] This argument is based on the popular notion of "spatial mismatch." The perceived locational disadvantage of central cities is an extension of the original spatial mismatch hypothesis. See Kain (1992) for a review of the earlier debate over the spatial mismatch hypothesis.

[2] Shen (2001) used information about job turnover rates and duration of vacancies provided by labor economists, including Anderson and Meyer (1994), as the basis for estimating job openings. He found that in an average U.S. city, over 95 percent of job openings on a typical day come from turnover; employment growth constitutes only a small percentage of them. Therefore, the spatial distribution of current employment is a good approximation of the spatial distribution of job openings.

that for a given transportation mode, central-city locations generally improved accessibility to employment for resident workers and job seekers. He therefore questioned the wisdom of using residential dispersal as a strategy for removing spatial barriers to employment. Similar observations of good job accessibility for central-city residents have been made in studies of Cleveland (Wang 2003), Los Angeles (Blumenberg and Ong 2001; Kawabata 2003), Oakland–Alameda County (CA) (Cervero, Sandoval, and Landis 2002), the San Francisco Bay Area (Shen and Kawabata 2003), and Washington, DC (Turner 1999).

Another focal point of debate is whether spatial access actually affects the probability of employment for low-income people. A study of Atlanta and Portland, OR, by Sanchez (1999a) found that access to bus transit had a positive correlation with employment in both cases. More recently, Ong and Houston (2002) found that single women who were receiving public assistance and did not have a car benefited from transit access. These women were more likely to be employed than women with lower levels of transit access. Kawabata (2003) also found in her study of Los Angeles that improved job accessibility, whether by car, public transit, or residential location, had a positive effect on the probability of employment as well as on working full-time.

Others, however, maintain that transit access and job accessibility have little or no effect on low-income people's labor participation. Such findings were reported in a study of Dade County, FL, by Thompson (1997) and in a recent publication based on a case study of transportation and recipients of Aid to Families with Dependent Children in Alameda County, CA (Cervero, Sandoval, and Landis 2002).[3] Some researchers are skeptical of the effectiveness of public transportation in connecting job seekers with spatially dispersed economic opportunities (Wachs and Taylor 1998).

A third major disagreement is about the relative importance of transportation, especially the car, in determining job accessibility and influencing labor participation. Ong (1996) was the first to examine the relationship between employment status and car ownership among welfare recipients. He found that owning a car increased the employment probability of welfare recipients by 12 percentage points and time worked by 23 hours a month. On the basis of these findings, he proposed policy changes to encourage welfare recipients to own cars. The important employment effects of car mobility were reexamined by Cervero, Sandoval, and Landis (2002), who also found that car ownership had a significant positive effect on the employment status of welfare recipients. In

[3] As described in the next paragraph, Cervero, Sandoval, and Landis (2002) found that once the effect of car mobility is controlled for, local transit access and regional job accessibility did not show a statistically significant positive influence on employment.

fact, they found that welfare recipients who recently acquired a car gained the most in probability of employment. Further, they showed that car mobility was the dominant spatial factor—once the effect of car ownership is controlled for, most other spatial variables either were insignificant or negatively influenced employment outcome.

Shen (1998, 2001) also demonstrated the importance of car mobility by showing that accessibility differentials between locations are minor compared with differentials between modes of transportation. He therefore stressed the importance of improving the transportation mobility of low-income people who depend on public transit to access economic and social opportunities. However, he raised concerns about the social equity implications of car subsidies as well. Previous research also showed that increased car ownership among low-income workers could directly undermine special or employment-related transportation service programs. As low-income workers switch from special services to private cars, transportation providers may find it difficult to maintain a consistent ridership (Rosenbloom 1992).

While the rationale for using housing dispersion as a strategy for increasing spatial accessibility to employment has been seriously challenged, a large volume of research has shown that residential mobility generates positive effects for low-income households that move from poor, predominantly minority neighborhoods to more affluent and racially integrated neighborhoods (DeLuca and Rosenbaum 2003; Ellen and Turner 1997; Turner and Acevedo-Garcia 2005; Varady and Walker 2003). Urban sociologists and social policy researchers have identified several important channels—including the quality of the public schools, mainstream values, peer influences, social networks, and decreased levels of crime and violence—through which neighborhoods can affect the well-being of their residents (Ainsworth 2002; Briggs 2004; Turner and Acevedo-Garcia 2005; Wilson 1996). Briggs (2004) characterizes neighborhood effects as being "traps, stepping stones, or springboards" (1) that greatly affect the likelihood of families' seeking to improve their economic standing. The Gautreaux program, Moving to Opportunity (MTO) demonstration, and Housing Opportunities for People Everywhere (HOPE VI) program have provided some evidence that government housing policy can effectively facilitate the residential mobility of low-income households and help them improve their neighborhood environments and, subsequently, their long-term life chances.[4]

[4] See the recent article by Turner and Acevedo-Garcia (2005) for a concise description of the Gautreaux program, MTO demonstration, and HOPE VI program, as well as a summary of what research to date has found about the benefits of these programs.

Researchers hold different views about the extent to which housing mobility programs have improved movers' locational circumstances. On the one hand, DeLuca and Rosenbaum (2003), for example, found from a longitudinal analysis of a random sample of Gautreaux program participants that residential mobility has an enduring, long-term impact on the residential characteristics of these families. McClure (2004), on the other hand, observed that participants in the tenant-based rental assistance program in Kansas City (MO) typically remained in racially concentrated areas of the central city. These areas, according to McClure (2004), are not among the neighborhoods with job growth or a large number of jobs. A recently published study of the HOPE VI program also reported that some participants are clearly better off, but others are experiencing substantial hardship (Popkin et al. 2004). Researchers found that while most of those who relocated are living in better housing in safer neighborhoods, these new neighborhoods are still extremely poor and racially segregated, and residents continue to report significant problems with crime and drug trafficking. Further, many of those who used vouchers to relocate have struggled to find and keep housing in the private market.

The literature also reveals a variety of perspectives on the major challenges to the success of residential mobility programs and welfare reform. Urban-versus-suburban location (Varady and Walker 2003), job accessibility (Holzer and Stoll 2001), housing affordability (Swartz 2003), social network connections (Kleit 2001), and relocation-related counseling (McClure 2004) are among the key issues examined by researchers. Clearly, all of these have a critical spatial dimension. But it requires a deeper understanding of the complex relationships among housing location, neighborhood, transportation, metropolitan spatial structure, and individuals' employment status and well-being to come up with effective policy approaches. The complexity of the problem is illustrated by the fact that while most researchers believe that opportunities for welfare recipients are more abundant in the suburbs (Holzer and Stoll 2001; McClure 2004), they find that most of the welfare recipients who are working are hired by employers located in the central city and near public transit and that many low-income families choose to remain in the central city instead of relocating to the suburbs.

We believe that a useful way to resolve some of the disagreements and to inform policy debates is to find out how welfare recipients actually changed housing location and modes of transportation in response to welfare reform and whether these changes subsequently affected their employment status. A basic understanding of the residential and transportation choices of welfare recipients will shed new light on the alternative antipoverty strategies scholars

have debated about for decades (Downs 1968; Hughes 1995). Such an understanding will better inform policy makers as they contemplate new low-income housing and transportation programs and other service provisions intended to help economically disadvantaged persons.

In this study, we asked two basic questions. First, what residential and transportation adjustments do welfare recipients tend to make? And, second, do these adjustments actually increase the probability of employment? Our research hypotheses were, respectively, that welfare recipients make residential and transportation adjustments to achieve higher levels of job accessibility and that those who make such adjustments are more likely to become employed.

We used longitudinal data on welfare recipients in Milwaukee County to test our hypotheses. One of our most important findings is that between 1997 and 2000, a substantial number of welfare recipients moved and/or became car owners, and their overall job accessibility improved. However, improved accessibility was attributed solely to the increased level of car ownership, since moving generally resulted in slightly decreased job accessibility but improved neighborhood conditions. Our other major finding is that both residential and transportation adjustments had a positive effect on the employment status of welfare recipients, even though only transportation adjustment helped them overcome spatial barriers in the conventional sense.

The next three sections will explain in detail our data, analytical methods, and empirical findings. We will discuss the policy implications of our findings in the concluding section.

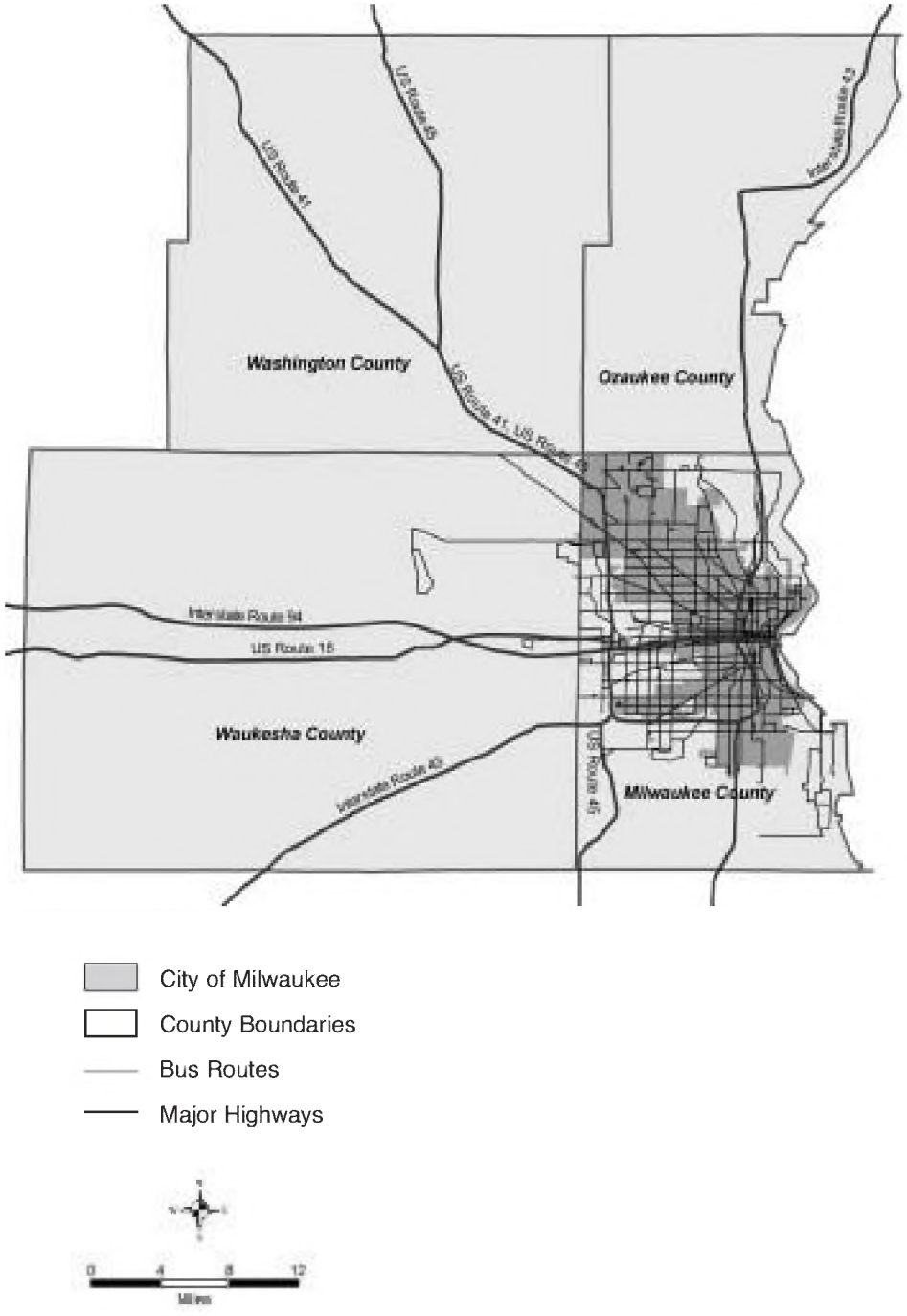
Research methodology

The empirical research used a wide range of data and focused on a case study of Milwaukee. Our methodology consisted of three key elements: (1) a spatial analysis of the metropolitan labor market, (2) a statistical analysis of the residential and transportation adjustments made by welfare recipients, and (3) statistical models of the effects of residential and transportation adjustments on employment outcomes.

The case study and data sources

The study area consists of the four central counties of the Milwaukee metropolitan area (figure 1). Approximately 1.5 million people lived in these counties in 2000. The central city of this metropolitan area, Milwaukee, is located in Milwaukee County and situated by Lake Michigan. There is a high level of concentrated poverty in the city, with a large number of predominantly black low-income persons living in neighborhoods near the central business

Figure 1. Milwaukee Metropolitan Area and Milwaukee City



district (CBD), especially to the northwest of the city. We considered metropolitan Milwaukee a good focus for the research because it shares many of the critical urban issues facing U.S. cities that have been undergoing a major industrial transition (Wood, Orfield, and Rogers 2000). In addition, Wisconsin's implementation of welfare reform, which is known as "W2" (Wisconsin Works), was highly touted for its success in reducing welfare rolls (Swartz 2003; Thompson and Bennett 1997).

Our research used the administrative records of the Wisconsin Department of Workforce Development for individual welfare recipients living in Milwaukee County for the months of June 1997, 1998, 1999, and 2000. These records were generated from the state's Client Assistance and Reemployment and Economic Support (CARES) database. The data included a personal identification number, case (household) identification number, case status, residential street address, city, state and ZIP code, sex, race, date of birth, marital status, highest level of formal education completed, primary person status, beginning and ending eligibility dates, and numbers of adults and children in the household. These records are updated each year for individuals on public assistance. Only those between the ages of 16 and 65 were retained in our data set because the focus was on employment.

Using a geographic information system (GIS), we geocoded each of the records by place of residence. We used street files from Geographic Data Technology Dynamap/2000 for referencing purposes. Over 95 percent of the records were successfully geocoded; unmatched records mostly had incomplete or incorrect addresses and post office boxes. Given that address and post office box errors occur randomly within the sample, it is very unlikely that the unmatched records would bias our results. The geocoded data included records for 45,085 individuals and 26,067 cases (households) for 1997, 23,745 individuals and 14,930 cases for 1998, 14,205 individuals and 9,569 cases for 1999, and 12,429 individuals and 8,734 cases for 2000. The dramatic decrease reflected Wisconsin's success in moving recipients off public assistance. To analyze the effects of residential and transportation adjustments on employment outcomes, we created a panel data set that includes only the welfare recipients originally on the list for June 1997; anyone who started to receive public assistance after that date was excluded from our analysis. The resulting numbers of individuals are 45,085, 17,555, 8,323, and 5,717 for 1997, 1998, 1999, and 2000, respectively, and the corresponding numbers of cases (households) are 26,067, 11,726, 6,168, and 4,522.

For individuals who relocated within the county or metropolitan area at some time between 1997 and 2000, multiple locations—each for a particular time—were identified. Among the 45,085 individuals on the list for June 1997,

19,209 remained on public assistance in June 1998 and/or afterward.[5] About 57 percent of them, a total of 11,008 people, changed residential location at least once between 1997 and 2000. These 11,008 individuals are identified as "movers" who made a residential adjustment after Wisconsin implemented its new welfare reform program. The rest are identified as "nonmovers."

Other extracts from CARES that we used in this research included match records for each welfare recipient's employment status and car ownership and use for the months of June 1997, 1998, 1999, and 2000. These records were updated every year for all current and former welfare recipients. The employment and car ownership data were added to our data set.

Additional information for this study included demographic, worker, and jobs data from the U.S. Bureau of the Census (2002) and transportation data from the Southeastern Wisconsin Regional Planning Commission. The census 2000 demographic data include percentage of households living in poverty, percentage of adults with a high school education, racial composition, and median house value measured at the census block group level. The Census Transportation Planning Package (CTPP), a special tabulation of the Census of Population and Housing, is the source of data on unemployed workers and jobs, which are measured at the traffic analysis zone (TAZ) level.[6] Transportation data from the Southeastern Wisconsin Regional Planning Commission include TAZ-to-TAZ travel times for car and transit commuters, public transit routes, and bus service schedules. Variables derived from these data, including the job accessibility measures described later, were added to the data set by using a GIS.[7]

Spatial analysis of the metropolitan labor market

We used job accessibility measures to characterize the spatial structure of the metropolitan labor market. Each individual's relative spatial position, measured in terms of accessibility to suitable job opportunities, is determined jointly by residential location and transportation mode. To capture the varia-

[5] These 19,209 individuals include 17,555 who remained on public assistance in June 1998 and 1,654 who dropped out of welfare programs in 1998 but rejoined in 1999 or 2000.

[6] The TAZ is commonly used by metropolitan transportation planning agencies as the basic geographic unit for modeling transportation demand. It is therefore the smallest geographic area for which origin-to-destination travel time matrices for various modes are available. A TAZ is typically some aggregation of census tracts or block groups. The four-county Milwaukee metropolitan area is divided into 1,431 TAZs.

[7] This data processing procedure used the "spatial relate" function of the ArcGIS software to link geo-coded records of welfare recipients with demographic, employment, and transportation data for census block groups and TAZs.

tions along these two dimensions, we applied the following accessibility measure:

$$A_i^{auto} = \Sigma_j \frac{O_{j(t)} \times f(C_{ij}^{auto})}{\Sigma_k [\alpha_k W_{k(t)} \times f(C_{kj}^{auto}) + (1 - \alpha_k) W_{k(t)} \times f(C_{kj}^{tran})]} \quad (1)$$

$$A_i^{tran} = \Sigma_j \frac{O_{j(t)} \times f(C_{ij}^{tran})}{\Sigma_k [\alpha_k W_{k(t)} \times f(C_{kj}^{auto}) + (1 - \alpha_k) W_{k(t)} \times f(C_{kj}^{tran})]} \quad (2)$$

where

A_i^{auto} and A_i^{tran} are levels of job accessibility for job seekers who are automobile drivers and captive public transit riders, respectively, living in location i; $i = 1, 2, \ldots, N$

$O_{j(t)}$ is the number of estimated job opportunities available in location j at time t; $j = 1, 2, \ldots, N$

$f(C_{ij}^{auto})$ and $f(C_{ij}^{tran})$ are impedance functions for automobile drivers and public transit riders, respectively, traveling between i and j

α_k is the percentage of households in location k that own at least one car

$W_{k(t)}$ is the number of job seekers living in location k at time t; $k = 1, 2, \ldots, N$

$f(C_{kj}^{auto})$ and $f(C_{kj}^{tran})$ are impedance functions for car drivers and public transit riders, respectively, traveling between k and j

Job opportunities considered here were employment in manufacturing, service, and retail. The last two categories are most likely to be suitable for welfare recipients who have relatively little formal education and few job skills. Job seekers include all unemployed workers living in the Milwaukee metropolitan area. The spatial impedance function took a familiar exponential form, $f(C_{ij}) = e^{-\beta C_{ij}}$, where C_{ij} is travel time between i and j, and β is an estimated parameter. This function gives less weight in calculating accessibility to jobs located farther from the job seeker's residential location.[8]

[8] In fact, we also used a travel time threshold function set at 30 minutes, which has been commonly adopted. This threshold function assumes that all jobs located within a 30-minute commute are equally accessible and that all jobs located beyond a 30-minute commute are inaccessible. The results were similar.

As shown in Weibull (1976) and Shen (1998), the measure represented by these equations takes into account the competing demand for available opportunities. In this research context, the competing demand was determined by the spatial distribution of job seekers who were looking for the same jobs. In each equation, the locations of competing demands are generally denoted by k to distinguish them from any particular residential location, denoted by i, for which accessibility is calculated. We also used the Hansen (1959) accessibility measure, which does not consider competing demand, to compare results.

Statistical analysis of residential and transportation adjustments

To test the first hypothesis that welfare recipients make residential and transportation adjustments that result in higher levels of job accessibility, we began by comparing the original residential locations of movers in 1997 with their final locations after 1997. The method used for this analysis is the paired-sample t test, which is a standard statistical procedure for comparing sample means. This method is most appropriate when a group of subjects under certain conditions is compared with the same group under different conditions. Therefore, it is especially suitable for longitudinal comparisons using panel data. The geographic characteristics of residential location we examined were job accessibility for car commuters, job accessibility for transit commuters, walking distance to the closest transit stop, and frequency of transit service.

To gain a more thorough understanding of the nature of the residential adjustment made by movers, we also compared the demographic and socioeconomic characteristics of their original neighborhoods in 1997 with those of their new neighborhoods. We used the percentage of households living in poverty, the percentage of adults who had completed high school, the percentage of white residents, and the median house value as indicators of neighborhood conditions. In this analysis, neighborhood was approximated by the census block group.

We next used the paired-sample t test to examine the transportation adjustment made by welfare recipients. Specifically, their level of car ownership in 1997 was compared with levels in subsequent years, especially 2000.

Finally, this statistical method was used to examine the change in welfare recipients' travel mode–weighted job accessibility. The travel mode–weighted job accessibility for each individual is determined not only by home location, but also by vehicle ownership status. An individual who has a car will be assigned the calculated job accessibility for car, and the resulting level of job accessibility will be much higher than it would be if the accessibility for public transit were assigned. Therefore, change in the level of motor vehicle owner-

ship among welfare recipients will cause a corresponding change in their travel mode–weighted job accessibility.

Statistical modeling of the effects on employment outcomes

Following several previous studies (Cervero, Sandoval, and Landis 2002; Kawabata 2003; Ong 1996), we applied the logit regression model to examine the effects of residential and transportation adjustments on the probability of employment for welfare recipients. The binary logit model was appropriate for this analysis because the dependent variable was employment status measured in dichotomous form. The model can be generally expressed by the following equation:

$$P_{iE} = \frac{e^{(A_i, T_i, H_i, S_i)}}{1 + e^{(A_i, T_i, H_i, S_i)}} \tag{3}$$

where

P_{iE} is the probability for welfare recipient i to be employed

$\mathbf{A}_i$ is a vector of job accessibility variables of welfare recipient i

$\mathbf{T}_i$ is a vector of transportation mobility variables of welfare recipient i

$\mathbf{H}_i$ is a vector of individual and household characteristics of welfare recipient i

$\mathbf{S}_i$ is a vector of socioeconomic characteristics of the residential neighborhood in which welfare recipient i lives

Equation (3) represents the statistical relationship between the probability that welfare recipients will be employed and each of the variables measuring their job accessibility, transportation mobility, individual and household characteristics, and neighborhood socioeconomic characteristics. If residential and transportation adjustments generate significant effects on the employment outcomes of welfare recipients, at least some of the accessibility, mobility, and neighborhood socioeconomic variables in the estimated logit model will have statistically significant relationships with the dependent variable.

We will further specify the logit model later by listing all the explanatory variables and discussing their relevance to the analysis.

Residential and transportation adjustments by welfare recipients

Spatial characteristics of the low-income labor market

To understand the residential location and transportation mobility adjustments made by Milwaukee welfare recipients, it was essential to first gain a basic understanding of the spatial characteristics of the metropolitan labor market. Figure 2 shows the spatial distribution of unemployed workers, and figure 3 displays the spatial distribution of employment opportunities in manufacturing, retail, and service.[9] Generally speaking, the spatial distribution of unemployed workers corresponded well with that of job opportunities.

The next two figures show the spatial variation in job accessibility for, respectively, car commuters and transit commuters.[10] Milwaukee revealed some significant differences from Boston, Cleveland, Los Angeles, and San Francisco, which were examined using the same accessibility measures (Kawabata 2003; Shen 1998, 2001; Shen and Kawabata 2003; Wang 2003). Specifically, the highest job accessibility for *car* commuters, which is displayed in figure 4, was not found in Milwaukee's CBD; instead, it was found in areas along two major highways (Interstate Route 94 and U.S. Route 45) and between Milwaukee and Waukesha County (WI). But there were also basic similarities between Milwaukee's labor market and the other metropolitan labor markets. Most important, as seen in figure 5, the highest job accessibility for *transit* commuters was found in the CBD, reflecting the fact that transit connections and service frequency were both much better in the central city. In other words, from the narrow perspective of spatial access to economic opportunity, the central-city areas near the CBD are the most advantageous residential locations for people who rely on public transit to search for jobs and commute.

[9] Employment opportunities were the estimated number of job openings on a typical day. The estimation was based on the assumption that the average monthly job turnover rate for U.S. metropolitan areas is 3 percent, and the average job vacancy duration is 15 days. See Shen (2001) for a detailed discussion of the method for estimating job openings.

[10] In these maps, a job accessibility score is a scaled measure of a low-skilled worker's relative advantage (or disadvantage) in competing for spatially distributed job opportunities given her or his residential location and transportation mode. The higher the score, the higher the worker's level of job accessibility. Because driving a car is much faster and can reach many more job destinations than taking the bus, accessibility scores for any given residential location are much higher for car than for transit commuters. The weighted average of accessibility scores calculated using equations (1) and (2) is the ratio of total job opportunities to total job seekers on a typical day in the metropolitan area. For Milwaukee, the weighted average is approximately 0.12 when only low-skilled jobs are considered. Because only a small percentage of welfare recipients have a car, their accessibility scores tend to be much lower than the weighted average for all low-skilled workers.

Figure 2. Spatial Distribution of Unemployed Workers

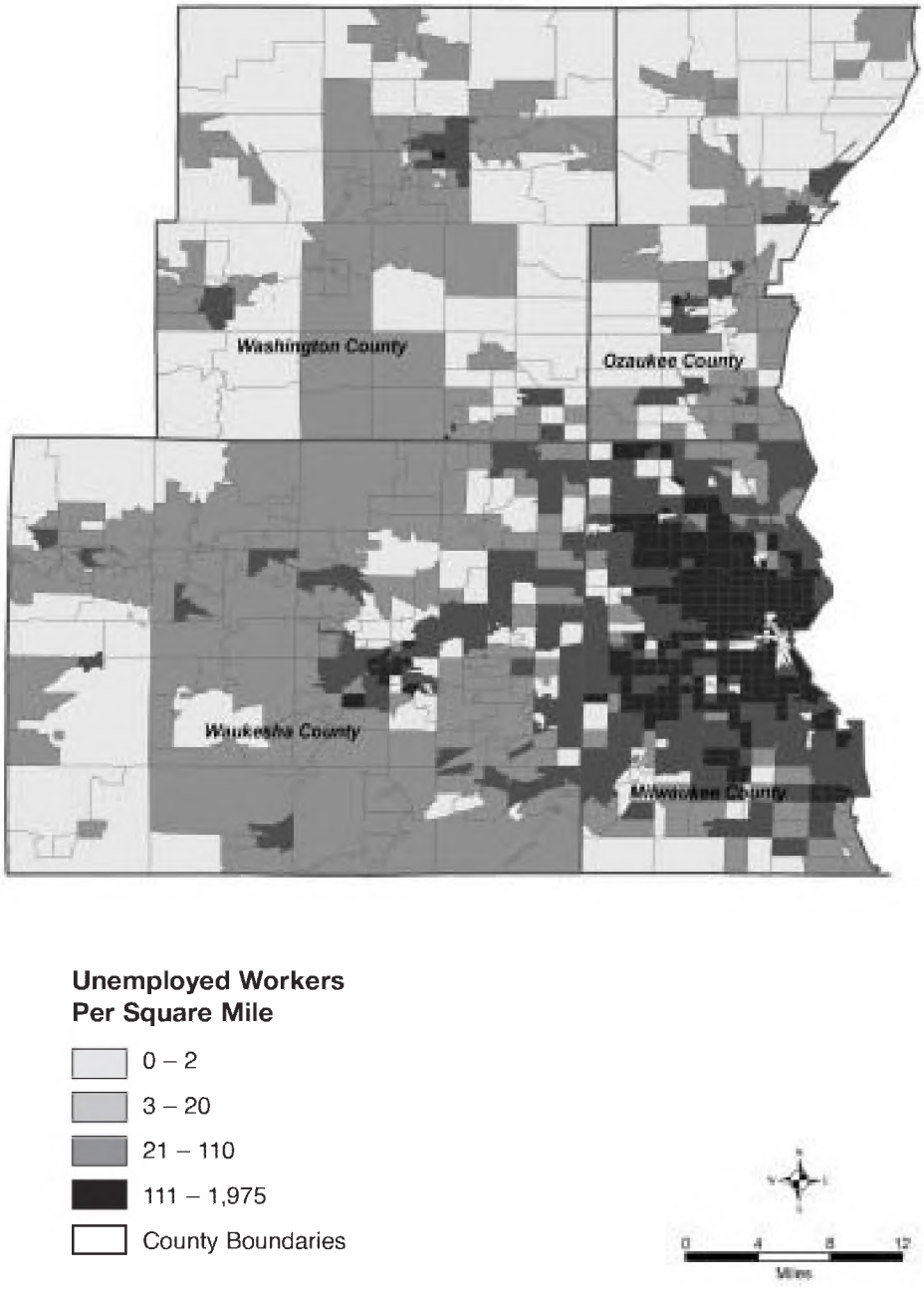


Figure 3. Spatial Distribution of Job Opportunities

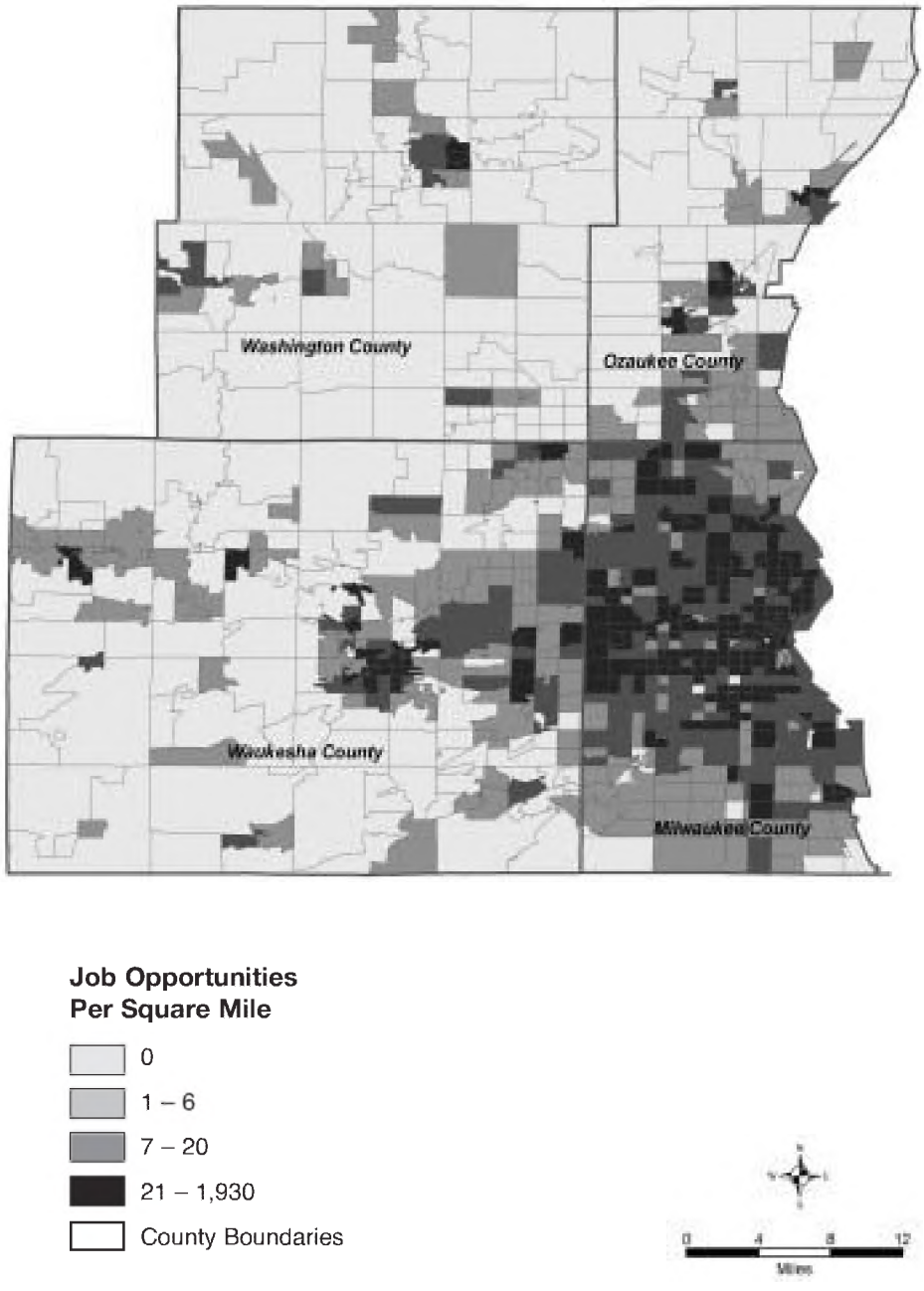


Figure 4. Accessibility for Job Seekers Who Commute by Car

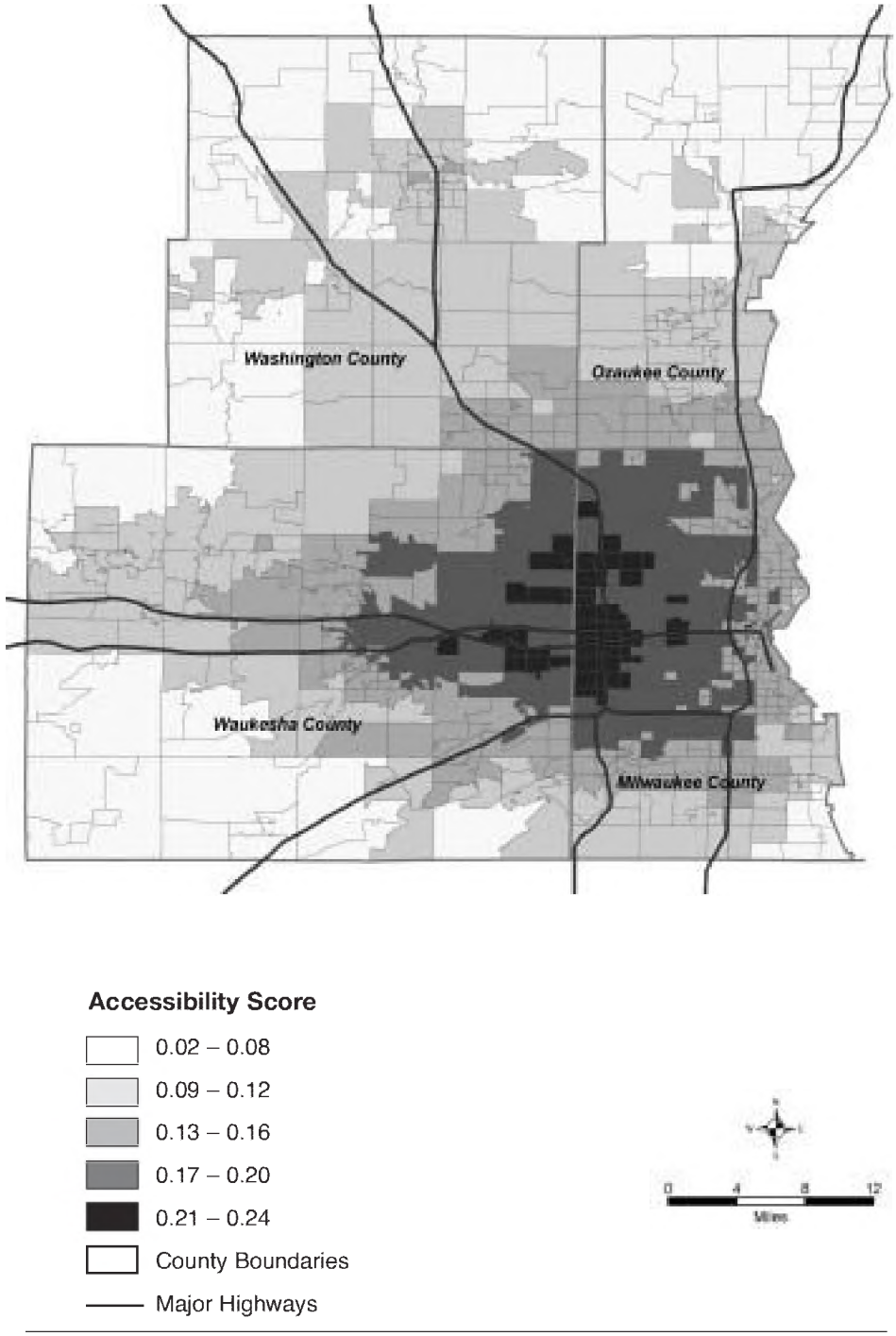
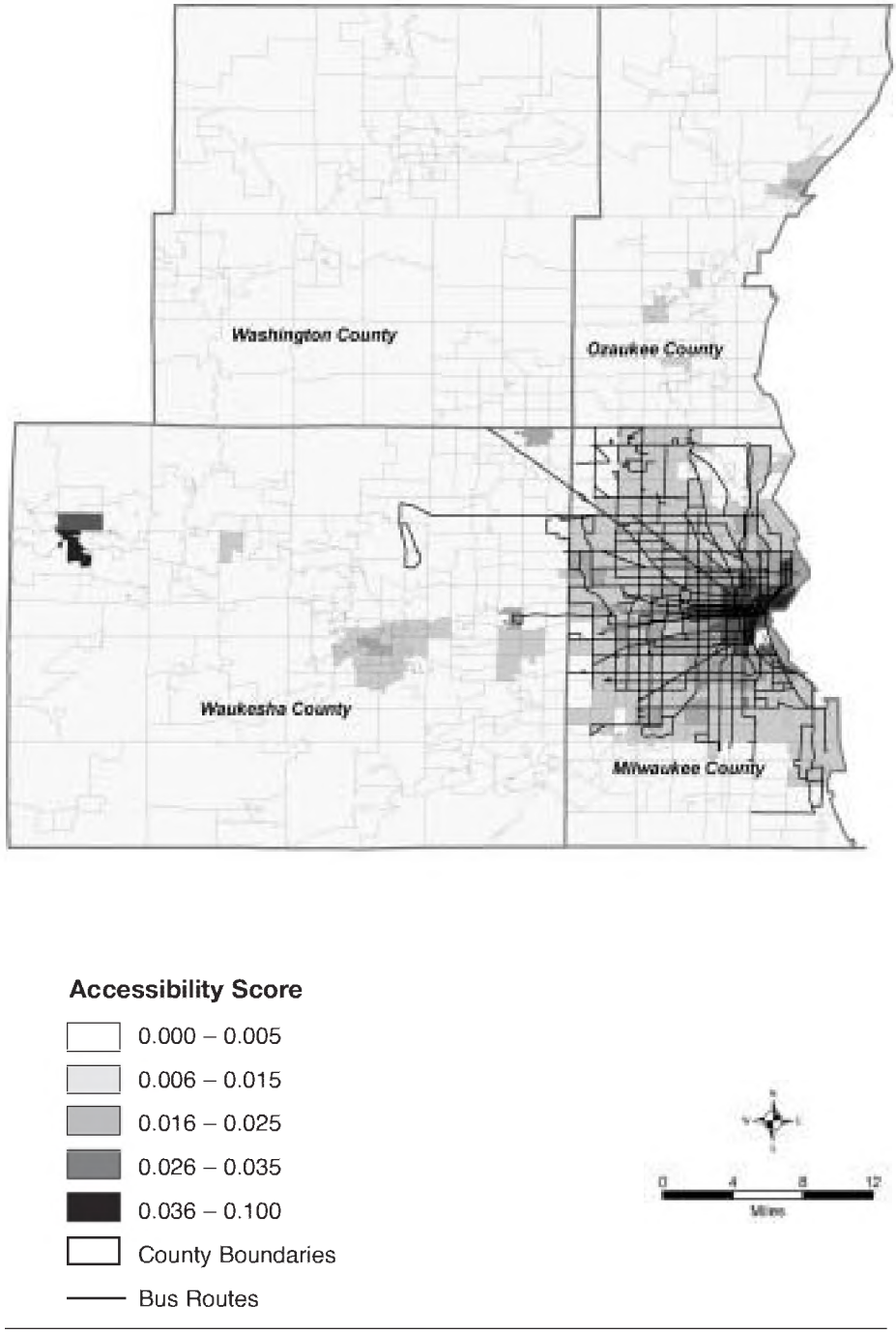


Figure 5. Accessibility for Job Seekers Who Rely on Public Transit



Another important characteristic shared by Milwaukee and the other cases was that people with cars had a much higher level of job accessibility than their transit-dependent counterparts. In fact, the highest class of job accessibility for public transit was nearly the same as the lowest class of job accessibility by car. This indicates the critical importance of transportation mobility in determining spatial accessibility in contemporary metropolitan areas, as stressed by several scholars (for example, Ong 1996 and Shen 1998).

As is the case for other metropolitan areas, low-income neighborhoods in the central city of Milwaukee did not have an overall locational disadvantage with regard to jobs. This was especially true from the perspective of people who relied on public transportation, because neighborhoods located closer to the CBD tended to have greater job accessibility for transit commuters. However, low-income neighborhoods in the central city had an overall transportation mobility disadvantage because a high percentage of their residents did not have a car. Because transportation mobility was more dominant than geographic location as a determinant of spatial accessibility, low-income Milwaukee workers as a group were spatially disadvantaged even though they were not geographically disadvantaged. This point is consistent with the observation made by Shen (1998, 2000) in earlier studies of other metropolitan areas.

Residential location adjustments

As a preliminary examination of residential location adjustments, we mapped the spatial distribution of welfare recipients in 1997 and subsequently. We compared the map that displays the original residential locations in 1997 for all movers with another map that displays their final observed residential locations by 2000.[11] The two maps look almost identical. Clearly, these maps fail to uncover any distinctive pattern of residential change made by movers after 1997. It appears that consistent with the observations made by McClure (2004) and Popkin et al. (2004), welfare recipients tended to remain in poor central-city neighborhoods.

The paired-sample *t* test was an effective tool for uncovering residential adjustments. Changes in the geographic characteristics of residential neighbor-

[11] To save space, these two maps are not included but are available on request from the authors. Also, while we use 2000 to denote the time for the final observations of all residential locations, many of these were actually last observed in 1998 or 1999 because people subsequently dropped off the welfare rolls. In some of the tables presented later, we will continue for simplicity to use 2000 to represent the time of last observation, even though for many it was actually 1998 or 1999.

hoods in terms of job accessibility and the frequency and convenience of transit service are shown in tables 1 and 2, respectively. The results in table 1 revealed two interesting patterns of residential adjustment. First, there was no significant change in average job accessibility for car between 1997 and 2000 residential locations. Second, for movers without a car as well as movers with a car, there were small—but statistically highly significant—reductions in average job accessibility for transit. The second result was surprising because we had expected transit-dependent movers to gain greater job accessibility through relocation, but the result showed the opposite to be true. The same patterns of change in job accessibility were observed for all Milwaukee welfare recipients.

Table 1. Changes in Job Accessibility Resulting from Residential Relocations

	1997 Mean	2000 Mean	*t* Statistic	Significance
Movers with a car (N = 1,814)				
Accessibility for car	0.1705	0.1699	–1.19	
Accessibility for transit	0.0175	0.0167	–3.54	***
Movers without a car (N = 9,194)				
Accessibility for car	0.1718	0.1720	1.05	
Accessibility for transit	0.0185	0.0179	–6.31	***
All individuals (N = 19,209)				
Accessibility for car	0.1711	0.1712	0.38	
Accessibility for transit	0.0179	0.0176	–7.19	***

*$p < 0.1$. **$p < 0.05$. ***$p < 0.01$.

Table 2. Changes in Transit Service Resulting from Residential Relocations

	1997 Mean	2000 Mean	*t* Statistic	Significance
Movers with a car (N = 1,814)				
Transit service frequency	13.36	12.67	–2.90	***
Distance to the nearest stop	874	854	–1.66	*
Movers without a car (N = 9,194)				
Transit service frequency	13.93	13.53	–3.33	***
Distance to the nearest stop	889	878	–2.14	**
All individuals (N = 19,209)				
Transit service frequency	13.38	13.14	–4.07	***
Distance to the nearest stop	889	883	–2.39	**

Note: Transit service frequency is measured on an hourly basis by the total number of buses passing through the TAZ in which an individual resides. Distance to the nearest stop is measured in feet.

*$p < 0.1$. **$p < 0.05$. ***$p < 0.01$.

In other words, while many welfare recipients made residential adjustments, it does not appear that relocation resulted in a general gain in job accessibility. In fact, as far as transit commuters are concerned, relocations resulted in lower average job accessibility.[12]

Results in table 2 indicate that movers with or without cars tended to relocate to neighborhoods that had less frequent transit service, but were somewhat closer to the nearest transit stop. The small but statistically significant reduction in service frequency contradicted our expectation, whereas the shortening of the distance to the nearest transit stop corresponded with it. Therefore, the overall effect of residential adjustments on welfare recipients' access to public transit was ambiguous.

Why did movers, especially those who depended on public transportation, relocate to neighborhoods with lower levels of job accessibility and reduced transit service frequency? One powerful explanation is shown in table 3, which compares neighborhood socioeconomic characteristics before and after reloca-

Table 3. Changes in Neighborhood Socioeconomic Characteristics Due to Relocations

	1997 Mean	2000 Mean	*t* Statistic	Significance
Movers with a car (N = 1,814)				
Households in poverty	28.18%	26.40%	–4.25	***
Adults with a high school education	63.62%	65.55%	4.77	***
Residents who are white	26.76%	28.92%	3.49	***
Median house value	$58,500	$61,300	2.14	**
Movers without a car (N = 9,194)				
Households in poverty	32.29%	31.18%	–5.91	***
Adults with a high school education	61.31%	62.39%	6.08	***
Residents who are white	17.37%	19.02%	6.67	***
Median house value	$50,500	$53,700	5.89	***
All individuals (N = 19,209)				
Households in poverty	31.09%	30.39%	–7.12	***
Adults with a high school education	62.06%	62.76%	7.49	***
Residents who are white	19.64%	20.63%	7.52	***
Median house value	$53,200	$54,900	7.63	***

Note: Neighborhood is approximated by the census block group.
*$p < 0.1$. **$p < 0.05$. ***$p < 0.01$.

[12] It is important to note, however, that movers without a car had slightly higher transit accessibility in both 1997 and 2000 than movers with a car, suggesting that the importance of accessibility cannot be dismissed for people who rely on public transportation.

tions. On average, relocation improved movers' residential environment as indicated by a lower percentage of households living in poverty, a higher percentage of adults who were high school graduates, more racial integration as measured by a higher percentage of residents who were white in predominantly minority neighborhoods, and a higher median house value in the census block group. These improvements were statistically highly significant for movers with and without cars, and for all welfare recipients combined. It is useful to note that like the finding reported in Popkin et al. (2004), most of those who relocated were living in neighborhoods with somewhat higher income and more racial integration, but these new neighborhoods were still very poor and their residents still consisted predominantly of ethnic minorities.

Transportation mobility adjustments

The data clearly showed that there was a substantial increase in the level of car ownership among welfare recipients in Milwaukee after 1997. As indicated in table 4, this substantial increase was observed among movers as well as nonmovers. Car ownership increased from 10 percent to 16 percent for movers, from 12 percent to 18 percent for nonmovers, and from 11 percent to 17 percent for all welfare recipients.[13] These significant increases suggest that many responded to welfare reform by enabling themselves—through increasing transportation mobility—to better access spatially distributed opportunities.

Table 4. Changes in the Level of Car Ownership

	1997 Mean	2000 Mean	*t* Statistic	Significance
Movers (N = 11,008)				
Car ownership	10%	16%	28.57	***
Nonmovers (N = 8,201)				
Car ownership	12%	18%	21.12	***
All individuals (N = 19,209)				
Car ownership	11%	17%	35.51	***

*$p < 0.1$. **$p < 0.05$. ***$p < 0.01$.

[13] These margins of growth in car ownership were actually the differences between the values observed in 1997 and the values last observed in 1998, 1999, or 2000. Because many of the last observations were made in 1998 when the level of ownership was still relatively low, they do not fully reflect the magnitude of increases between 1997 and 2000.

How much of an impact on job accessibility did the increase in car ownership generate? The results in table 5 show the comparisons of average travel mode–weighted job accessibility in 1997 and 2000 for movers, nonmovers, and all welfare recipients. Here, welfare recipients who were car owners were assigned the job accessibility for car commuters, and their counterparts who were transit dependent were assigned the job accessibility for transit commuters. Because the level of car ownership was much higher in 2000, overall job accessibility was much improved. Compared with the results in table 1, transportation adjustments resulted in job accessibility change that was of much greater magnitude and higher statistical significance. The margin of increase was over 30 percent for movers and over 20 percent for nonmovers.

Table 5. Changes in Travel Mode–Weighted Job Accessibility

	1997 Mean	2000 Mean	*t* Statistic	Significance
Movers (N = 11,008)				
Mode-weighted accessibility	0.033	0.043	25.67	***
Nonmovers (N = 8,201)				
Mode-weighted accessibility	0.036	0.044	20.93	***
All individuals (N = 19,209)				
Mode-weighted accessibility	0.034	0.043	33.03	***

*$p < 0.1$. **$p < 0.05$. ***$p < 0.01$.

To assess the robustness of the findings reported in tables 1 through 5, we performed the paired-sample *t* tests for 1998, 1999, and 2000 separately. The results for each year were essentially the same as the results for the pooled data measuring the last observed values.

Modeling welfare recipients' employment outcomes

Independent variables

To appropriately measure the effects of residential and transportation adjustments on employment outcomes, it was essential to avoid biases in model specification. We therefore included in our binary logit model a range of independent variables to control for the influence of factors other than residential location and car ownership. The variables and their measurements and expected effects on employment are displayed in table 6. These variables can be grouped into three categories: (1) individual and household characteristics that can potentially influence employment status; (2) residential neighborhood

Table 6. Independent Variables Included in the Logit Model

Variable	Measurement	Expected Effect on Employment
Female	1 if female, 0 if male	+/–
Age	Years of age in 2000	+
Age squared	Years of age in 2000 squared	–
Black	1 if black, 0 otherwise	+/–
Hispanic	1 if Hispanic, 0 otherwise	+/–
White	1 if white, 0 otherwise	+/–
High school graduate	1 if a high school graduate with a diploma, 0 otherwise	+
Primary person in the household	1 if the primary person in the household, 0 otherwise	+
Married	1 if married, 0 otherwise	+/–
Number of adults in the household	Number of persons aged 16 or older	+/–
Number of children in the household	Number of persons aged 15 or younger	–
Percentage of block group households in poverty, 1997	Percentage of block group households with incomes below the poverty line, census 2000 data for the1997 residential location	–
Percentage of block group adults with a high school education, 1997	Percentage of block group adults with at least a high school education, census 2000 data for the 1997 residential location	+
Percentage of block group residents who are white, 1997	Percentage of block group residents belonging to this racial category, census 2000 data for the 1997 residential location	+
Median house value for the block group, 1997	Block group median house value, census 2000 data for the 1997 residential location	+/–
Transit service frequency, 1997	The total number of buses passing through the TAZ per hour in the morning for the 1997 residential location	+
Distance to the nearest transit stop, 1997	The walking distance (feet) to the nearest bus stop for the 1997 residential location	–
Job accessibility for car commuters, 1997	The ratio of the number of job opportunities within reach by a car commuter to the number of competing workers, based on the car commuter's 1997 residential location	+
Job accessibility for transit commuters, 1997	The ratio of the number of job opportunities within reach by a transit commuter to the number of competing workers, based on the transit commuter's 1997 residential location	+
Owned one or more cars, 1997	1 if owned at least one car in 1997, 0 otherwise	+
Change in the percentage of households in poverty	Difference between 1997 and 2000 residential locations	–
Change in the percentage of adults with a high school education	Difference between 1997 and 2000 residential locations	+
Change in the percentage of residents who are white	Difference between 1997 and 2000 residential locations	+
Change in median house value	Difference between 1997 and 2000 residential locations	+/–
Change in transit service frequency	Difference between 1997 and 2000 residential locations	+
Change in distance to the nearest transit stop	Difference between 1997 and 2000 residential locations	–
Change in job accessibility for car	Difference between 1997 and 2000 residential locations	+
Change in job accessibility for transit	Difference between 1997 and 2000 residential locations	+
Change in car ownership	Difference between 1997 and 2000	+
Moved residence	1 if moved at least once from 1997 to 2000, 0 otherwise	+/–

characteristics, transit service, job accessibility, and car ownership in 1997, the base year; and (3) changes in residential neighborhood characteristics, transit service, job accessibility, and car ownership after 1997. Each independent variable is briefly discussed next:

Female. Given the critical role women play in shouldering household responsibilities, being female may either increase a recipient's probability of employment (if she plays the key role in supporting the household financially) or reduce it (if she is overburdened with child care and other household tasks).

Age and age squared. The combination of these two age variables creates a nonlinear relationship between age and probability of employment. The older a person gets before reaching a certain age, the more likely that he or she is employed. After a person passes that threshold, the probability of employment decreases with age. Therefore, the regression coefficient for age is expected to be positive, but the coefficient for age squared is expected to be negative.

Black, Hispanic, and white. Race can significantly affect employment outcome because of racial discrimination in the job market. The basic comparison group consists of welfare recipients in all other ethnic minority groups (Asians, American Indians, and so on). The expected sign for each racial variable is uncertain.

High school graduate. More education usually translates into more marketable job skills, which are critical in determining employment status. The coefficient is expected to be positive.

Primary person in the household. The primary person in the household usually plays the key role in supporting it financially. The regression coefficient is expected to be positive.

Married. Being married may relieve an individual of part of the household responsibilities and hence increase the probability of employment. However, being married also implies that the work responsibility may fall on an individual's spouse. The expected sign of the regression coefficient cannot be predetermined.

Number of adults and children in the household. The expected effect of the number of adults in a household on each individual's employment outcome is uncertain for the same reason given for marital status. The number of children is expected to have a negative correlation with an individual's employment status.

Percentage of block group households in poverty, 1997. A neighborhood with a high percentage of households living in poverty implies the lack of positive role models and social networks for job searching. The expected effect on employment is negative.

Percentage of block group adults with a high school education, 1997. A neighborhood with a high percentage of adults who have completed high school is expected to have a positive effect on employment outcomes.

Percentage of block group residents who are white, 1997. For low-income minority neighborhoods, a higher percentage of white residents usually indicates more racial mixture, a greater influence of mainstream values, and less concentration of poverty. Therefore, the expected effect on employment is positive.

Median house value for block group, 1997. Higher median house value may indicate a better residential environment, which is expected to have a positive effect on employment. However, it may also indicate higher housing cost and consequently fewer financial resources for child care and transportation, which would reduce the probability of employment.

Transit service frequency, 1997. Higher transit service frequency reduces the time cost for welfare recipients who rely on public transportation to search for jobs and commute. The regression coefficient is expected to be positive.

Distance to the nearest transit stop, 1997. A longer walk to the nearest transit stop increases the time cost for welfare recipients who rely on public transportation to search for jobs and commute. The regression coefficient is expected to be negative.

Job accessibility for car commuters and for transit commuters, 1997. Higher job accessibility implies a spatial advantage in competing for job opportunities. Both variables are expected to have a positive effect on employment outcomes.

Owned one or more cars. Automobiles are the most effective means for connecting job seekers with job opportunities in a dispersed metropolitan labor market. The regression coefficient is expected to be positive.

Change variables. These are change in the percentage of households in poverty, change in the percentage of adults who are high school graduates, change in the percentage of residents who are white, change in median house value,

change in transit service frequency, change in distance to the nearest transit stop, change in job accessibility for car, change in job accessibility for transit, and change in car ownership. These variables, which measure changes in neighborhood characteristics, transit service, and job accessibility that occurred after 1997, are expected to generate incremental effects on employment outcomes that are consistent with the effects of the corresponding variables for the base year (1997).

Moved residence. If mobility indicates primarily conscious efforts by welfare recipients to improve their residential conditions, the expected effect on employment outcome will be positive. However, if mobility results primarily from insecure housing tenure and unstable households, the expected effect on employment outcome will be negative.

Descriptive statistics

Before we estimated our logit model to examine factors influencing employment outcomes for welfare recipients, we obtained descriptive statistics of the data. Table 7 displays the summary statistics of the relevant variables. First, for each period of observation, a considerable percentage of welfare recipients—41 percent in 1997 and 59 percent in 2000—were actually working. It is important to note, however, that employment status was defined rather loosely here. A person was counted as employed in a given year if he or she was working on June 30 of that year. Many of them were working only part time and earning a small amount of income.

Second, some important demographic and household characteristics are worth noting. A large proportion of the adults, approximately 83 percent, were women, and 62 percent were identified as black. As of 1997, only 3 percent of all welfare recipients graduated from high school with a diploma, and only 7 percent of adult welfare recipients were married, even though their households had on average 2.4 dependent children.

Third, welfare recipients tended to live in neighborhoods where a high percentage of households were poor and where most residents were racial or ethnic minorities. Very few of them initially owned cars—only 11 percent in 1997. That number had increased to 17 percent when the last observations were made. This population exhibited a high level of residential mobility, since 57 percent of them relocated at least once during this period. The reasons for relocating could not be determined from the original data, however.

Finally, distinctive trends that reflected residential and transportation adjustments were observed. As discussed earlier, movers tended to relocate to

Table 7. Summary Statistics

	1997					2000 (Last Observed)				
Variable	N	Minimum	Maximum	Mean	Standard Deviation	N	Minimum	Maximum	Mean	Standard Deviation
Employed	19,209	0	1	0.41	0.49	19,209	0	1	0.59	0.49
Female	19,209	0	1	0.83	0.37	19,209	0	1	0.83	0.37
Age	19,209	16	65	28.53	9.70	19,209	16	65	28.53	9.70
Black	19,209	0	1	0.62	0.48	19,209	0	1	0.62	0.48
Hispanic	19,209	0	1	0.07	0.26	19,209	0	1	0.07	0.26
White	19,209	0	1	0.08	0.27	19,209	0	1	0.08	0.27
High school graduate	19,209	0	1	0.03	0.16	19,209	0	1	0.05	0.23
Primary person in the household	19,209	0	1	0.68	0.47	19,209	0	1	0.68	0.47
Married	19,209	0	1	0.07	0.25	19,209	0	1	0.07	0.26
Number of adults in the household	19,209	0	3	0.99	0.31	19,209	0	3	1.03	0.23
Number of children in the household	19,209	0	14	2.42	1.56	19,209	0	14	2.60	1.59
Percentage of block group households in poverty	19,193	0.00	81.74	31.09	15.11	19,191	0.00	81.74	30.39	15.08
Percentage of block group adults with a high school education	19,193	20.75	100.00	62.06	14.67	19,191	20.75	100.00	62.76	14.65
Percentage of block group residents who are white	19,193	0.00	100.00	19.64	23.31	19,191	0.00	100.00	20.63	23.98
Median house value for the block group ($)	18,983	17,100	1,000,001	53,249	39,245	18,992	17,100	1,000,001	54,935	42,530
Transit service frequency	17,630	0.00	138.29	13.37	7.48	17,647	0.00	138.29	13.13	7.17
Distance to the nearest transit stop (feet)	17,630	0.86	1,319.99	888.64	328.78	17,647	0.05	1,320.00	882.55	331.76
Job accessibility for car commuters	19,209	0.06	0.24	0.17	0.02	19,209	0.05	0.23	0.17	0.02
Job accessibility for transit commuters	19,209	0.00	0.09	0.02	0.01	19,209	0.00	0.09	0.02	0.01
Owned one or more cars	19,209	0	1	0.11	0.31	19,209	0	1	0.17	0.38

Table 7. Summary Statistics *Continued*

	1997					2000 (Last Observed)				
Variable	N	Minimum	Maximum	Mean	Standard Deviation	N	Minimum	Maximum	Mean	Standard Deviation
Change in the percentage of households in poverty						19,185	–79.59	79.59	–0.70	13.61
Change in the percentage of adults with a high school education						19,185	–67.79	65.35	0.70	12.96
Change in the percentage of residents who are white						19,185	–96.00	95.20	0.99	18.29
Change in median house value						18,862	–965,801	966,201	1,742	38,405
Change in transit service frequency						16,887	–135.33	117.19	–0.25	7.82
Change in distance to the nearest transit stop						16,887	–1,303.81	1,260.90	–6.37	346.37
Change in job accessibility for car						19,209	–0.13	0.12	0.00	0.02
Change in job accessibility for transit						19,209	–0.07	0.07	–0.00	0.01
Change in car ownership						19,209	–1	1	0.06	0.24
Moved residence						19,209	0	1	0.57	0.50
Valid N (listwise)	17,452					16,613				

residential neighborhoods with less poverty, more racial mixture, and higher median house values but lower job accessibility. In the meantime, many welfare recipients obtained cars.

Regression results

Table 8 summarizes the results obtained from running the logit model. Among the individual and household variables, being female, black or white, a high school graduate, or a primary person in the household and having more adults in the household were associated with a higher probability of employment. However, having more children in the household was associated with a lower likelihood of employment. The relationship between age and probability of employment was polynomial, indicating that the probability increases until age 35 and then decreases with age.[14] However, marital status did not show a statistically significant relationship with employment outcome.

Neighborhood characteristics appeared to have significant effects on welfare recipients' labor market outcomes. More distressed neighborhood environments, measured by a higher percentage of households in poverty, had a significant negative effect on employment status. This result provided some evidence of the influence of neighborhood social and cultural environments on individual behavior, a point stressed by some urban sociologists and social policy researchers (Briggs 2004; Kleit 2001; Turner and Acevedo-Garcia 2005; Wilson 1996). However, probably due to multicollinearity, the other neighborhood variables were either insignificant or, in the case of "percentage of block group adults with a high school education, 1997," were significant but had a coefficient with an unexpected negative sign.[15]

As expected, living in a neighborhood with frequent public transit service had a positive effect on probability of employment. The walking distance to the nearest transit stop, however, did not show a statistically significant relationship with the likelihood of being employed.

[14] The age (35 years old) associated with the highest probability of employment is derived from the regression coefficients for the variables "age" and "age squared."

[15] The correlations between "percentage of block group households in poverty, 1997" and "percentage of block group adults with a high school education, 1997" and "percentage of block group residents who are white, 1997" were, respectively, –0.66 and –0.60. Therefore, we estimated a more parsimonious model by excluding "percentage of block group adults with a high school education, 1997" and "percentage of block group residents who are white, 1997" from the regression. We found that the regression outcome remained essentially unchanged and that "percentage of block group households in poverty, 1997" still had a significant negative effect on employment status with only a slightly smaller coefficient of –0.004.

Table 8. Regression Results for All Recipients Who Remained on Welfare after 1997

Variable	Coefficient	Standard Error	Significance
Female	0.569	0.068	***
Age	0.313	0.015	***
Age squared	–0.004	0.000	***
Black	0.210	0.054	***
Hispanic	–0.006	0.087	
White	0.166	0.093	*
High school graduate	0.525	0.098	***
Primary person in the household	1.529	0.060	***
Married	0.053	0.084	
Number of adults in the household	0.485	0.090	***
Number of children in the household	–0.071	0.013	***
Percentage of block group households in poverty, 1997	–0.005	0.002	**
Percentage of block group adults with a high school education, 1997	–0.006	0.002	***
Percentage of block group residents who are white, 1997	0.002	0.001	
Median house value for the block group, 1997	0.000	0.000	
Transit service frequency, 1997	0.009	0.004	**
Distance to the nearest transit stop, 1997	0.000	0.000	
Job accessibility for car commuters, 1997	–3.585	1.378	***
Job accessibility for transit commuters, 1997	3.005	3.816	
Owned one or more cars	0.605	0.072	***
Change in the percentage of households in poverty	–0.003	0.002	
Change in the percentage of adults with a high school education	–0.005	0.002	**
Change in the percentage of residents who are white	0.004	0.002	**
Change in median house value	0.000	0.000	
Change in transit service frequency	0.003	0.003	
Change in distance to the nearest transit stop	0.000	0.000	
Change in job accessibility for car	–0.910	1.465	
Change in job accessibility for transit	–1.876	3.842	
Change in car ownership	1.151	0.103	***
Moved residence	0.235	0.041	***
Constant	–5.724	0.397	***

Note: Valid cases: 16,613; Nagelkerke R^2: 0.425; correct predictions: 79.2%.
*$p < 0.1$. **$p < 0.05$. ***$p < 0.01$.

Having one or more cars in the household was associated with a greater probability of employment, consistent with the findings reported in several previous studies (Cervero, Sandoval, and Landis 2002; Ong 1996). Further, the regression results showed that after controlling for the effect of car ownership, job accessibility for car commuters was negatively related to employment. This result was also consistent with the finding reported in Cervero, Sandoval, and Landis (2002). However, it was surprising that job accessibility for transit commuters did not show a statistically significant positive effect on employment outcomes.

Overall, changes resulting from residential and transport adjustments appeared to have notable effects on employment. Increased racial integration in the neighborhood, measured by higher percentages of white block group residents, was positively associated with a higher probability of employment. Again, probably because of multicollinearity, the coefficient for "change in the percentage of adults with a high school education" had an unexpected negative sign.[16] Most important, change in car ownership was positively and significantly associated with increased probability of employment. It is worth noting that our model, like that of Cervero, Sandoval, and Landis (2002), indicated a relatively greater positive effect of car mobility acquired for new owners. However, changes in the percentage of households in poverty, median house value, transit service frequency, distance to the nearest transit stop, and job accessibility did not show a statistically significant relationship with welfare recipients' status in the labor market.

Another intriguing finding worth discussing was the positive and statistically significant relationship between the variable "moved residence" and employment outcomes. This result suggests that in addition to the general and measurable benefits associated with residential relocation—improved neighborhoods with less poverty and more racial mixture—there might be less tangible but important benefits associated with housing mobility that are specific for individual movers.

We tested the robustness of these findings by running separate regressions for 1998, 1999, and 2000 instead of pooling the data. The results from the logit models for different years were highly consistent with those described earlier. In particular, the main findings on the effects of residential and trans-

[16] "Change in the percentage of households in poverty" and "change in the percentage of adults with a high school education" are strongly correlated, with a Pearson correlation coefficient of –0.64. We once again estimated a more parsimonious model by excluding "change in the percentage of adults with a high school education" and found that the regression outcome remained essentially the same.

portation adjustments on welfare recipients' employment outcomes were nearly identical for all models.

A further examination of the effect of car ownership on employment

While a strong, positive statistical relationship existed between car availability and employment status, the question remained as to whether this association implied a causal-effective relationship. It is conceivable that causation worked only in the reverse direction: Car ownership in the base year was determined by employment status in that year, and change in car ownership after the base year was also the result of change in employment status. To address this causation issue, we performed additional analyses.

We gained important insights about the role of a car by examining closely the individuals who were unemployed in the base year. Our reasoning was that for welfare recipients who were unemployed, employment was not the direct cause of their car ownership status in that year. If we can establish a positive statistical relationship between car availability in 1997 and employment status after 1997 for this subgroup, we could make the case that causation also worked in the other direction—from car availability to employment.

Records for individuals who were unemployed in 1997 were selected to re-estimate our logit model (see table 9). It was clear that car ownership in the base year was associated with increased probability for this subgroup of welfare recipients to be eventually employed. This result presents strong evidence that car availability may be an important causal factor for employment.

It is important to note that while change in car ownership showed a positive and statistically significant relationship with employment outcomes, causation could not be established because "change in car ownership" was measured concurrently with the dependent variable. Similarly, causation could not be ascertained for the variables "change in the percentage of residents who are white" and "moved residence" because they were also measured concurrently with the dependent variable. However, given their strong positive statistical associations with employment outcomes, there was little doubt that neighborhoods with more racial diversity, as well as residential mobility itself, were positively connected with individuals who became employed.

An important difference between the model in table 9 and the previous one is that the variable "job accessibility for transit commuters" now has a positive and statistically significant relationship with the dependent variable. This result, together with the significant, positive regression coefficient for the transit service frequency variable, suggests that public transportation service and

Table 9. Regression Results for Recipients Who Were Unemployed in 1997

Variable	Coefficient	Standard Error	Significance
Female	0.507	0.091	***
Age	0.169	0.023	***
Age squared	–0.003	0.000	***
Black	0.071	0.069	
Hispanic	–0.100	0.112	
White	0.070	0.121	
High school graduate	0.413	0.123	***
Primary person in the household	1.797	0.089	***
Married	0.118	0.115	
Number of adults in the household	0.238	0.122	**
Number of children in the household	–0.038	0.016	**
Percentage of block group households in poverty, 1997	0.000	0.003	
Percentage of block group adults with a high school education, 1997	–0.005	0.003	
Percentage of block group residents who are white, 1997	0.003	0.002	*
Median house value for the block group, 1997	0.000	0.000	
Transit service frequency, 1997	0.009	0.005	*
Distance to the nearest transit stop, 1997	0.000	0.000	
Job accessibility for car commuters, 1997	–4.644	1.798	***
Job accessibility for transit commuters, 1997	9.847	4.887	**
Owned one or more cars	0.344	0.096	***
Change in the percentage of households in poverty	–0.003	0.003	
Change in the percentage of adults with a high school education	–0.004	0.003	
Change in the percentage of residents who are white	0.005	0.002	**
Change in median house value	0.000	0.000	
Change in transit service frequency	0.002	0.004	
Change in distance to the nearest transit stop	0.000	0.000	
Change in job accessibility for car	–1.350	1.856	
Change in job accessibility for transit	2.878	4.786	
Change in car ownership	1.051	0.128	***
Moved residence	0.292	0.053	***
Constant	–4.069	0.530	***

Note: Valid cases: 9,815; Nagelkerke R^2: 0.334; correct predictions: 74.5%.
*$p < 0.1$. **$p < 0.05$. ***$p < 0.01$.

job accessibility were important for some welfare recipients in their struggle to attain employment.

Conclusion

This research provided some basic understanding of how welfare recipients adjust their housing and transportation choices as they try to make the transition from welfare to work. It also provided new insights into the effects of residential and transportation adjustments on the probability of employment for people on public assistance. Statistical analyses of panel data on welfare recipients in Milwaukee, using the paired-sample *t* test and the binary logit model, allowed us to test the two hypotheses we stated at the outset.

The empirical results indicated that a considerable percentage of welfare recipients made residential and transportation adjustments over time. However, while transportation adjustments in the form of increased car ownership substantially improved job accessibility, residential adjustment did not lead to similar results. Instead, relocation tended to provide welfare recipients with neighborhoods that had more desirable socioeconomic conditions. As a group, Milwaukee movers who were transit dependent actually experienced a slight decrease in job accessibility but had a significant gain in the quality of their residential environment. Therefore, the first research hypothesis was only partially validated.

The logit models showed that an increased level of car ownership and an improved residential environment measured by a lower percentage of residents in poverty and a higher level of racial integration both have positive and statistically significant relationships with the probability of employment for welfare recipients. These positive associations were quite robust in the case of Milwaukee. Of particular importance is that our analysis provided strong evidence suggesting that car ownership increases the probability of employment for welfare recipients, so our second hypothesis was validated.

Also important is the finding that, after controlling for measurable changes in neighborhood characteristics for movers, relocation had a positive and statistically significant effect on their employment outcomes. This finding suggests that housing mobility has some highly significant intangible benefits for individual movers.

These findings indicate that improving neighborhood socioeconomic conditions should be a major consideration for low-income housing programs. For many welfare recipients, living in a better neighborhood may have a stronger positive influence on employment outcome than living closer to job opportunities. While we found no evidence that the suburbs were superior in

terms of job accessibility for less educated people, we found a positive link between neighborhood socioeconomic status and the probability of employment for welfare recipients. In addition, our empirical result suggests that residential mobility also creates less tangible but highly significant positive effects on labor participation. These findings suggest that housing policies should aim to facilitate the residential mobility of low-income families and improve their neighborhood conditions, rather than simply move them closer to job opportunities.

To the extent that desirable neighborhood socioeconomic characteristics are more likely found in the suburbs, the residential dispersion strategy advocated by many researchers (Hughes 1995; Varady and Walker 2003) may generate positive employment outcomes through reducing the social and cultural barriers—rather than the spatial barriers in the conventional sense—that the economically disadvantaged population must face. This may explain why housing programs that provide low-income households with residential choice, such as the Gautreaux program in Chicago and the welfare-to-work housing voucher program implemented by the U.S. Department of Housing and Urban Development, generated encouraging results (Bania, Coulton, and Leete 2003).[17] However, questions remain:

1. To what extent are welfare recipients, especially those who do not have cars, willing to trade convenience of access to public transit for improvements in neighborhood conditions?

2. How much capacity do middle-income suburban neighborhoods have to absorb movers from distressed neighborhoods?

3. Do welfare recipients indeed find themselves generally better off after moving to the suburbs?

Further, these findings provide additional evidence of the critical importance of car mobility in determining accessibility in contemporary metropolitan areas and in influencing the employment outcome of low-income people (Cervero, Sandoval, and Landis 2002; Ong 1996; Shen 1998). Appropriately designed programs to enhance car mobility will likely facilitate the labor participation of low-income people. However, major issues in terms of program design and implementation, financial cost, and social equity must be addressed:

[17] It is conceivable that the success of some housing dispersal programs such as the Gautreaux program can be attributed solely to the positive influence of improved neighborhood social and cultural environments. Success might not have anything to do with geographic proximity to job opportunities, as some researchers have suggested.

1. Is private car ownership the only approach to obtaining the desired level of transportation mobility?
2. Is it financially feasible for an average welfare recipient to own a reliable car?
3. What percentage of low-income households is transit dependent because of constraints other than financial difficulty?
4. How would a new transportation mobility strategy affect the demand for and supply of traditional public transit service?

While our research sheds new light on how residential relocation and transportation improvement generate significant positive effects on the social and economic well-being of families otherwise facing difficult circumstances, it also shows the multifaceted nature of unemployment and poverty. It is essential that in making policies to enable welfare recipients to become economically productive and self-sufficient, residential location, neighborhood conditions and social networks, transportation, employment accessibility, and local social services be considered as integral parts of coherent strategies. Future research should focus on the interaction among these components.

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