Transit Accessibility to Jobs and Employment Prospects of Welfare Recipients Without Cars

A Study of Broward County, Florida, Using Geographic Information Systems and an Econometric Model

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On August 22, 1996, President William Clinton signed the Personal Responsibility and Work Opportunity Reconciliation Act. This legislation, widely known as the welfare reform act, transformed welfare from a long-term support program into one with a primary objective of moving people off the welfare rolls into gainful employment in the shortest possible time. The passage of this act renewed a long-standing debate over whether improved public transit would lessen the length of time that people remain on welfare. Studies addressing this issue draw different conclusions from their methodological differences in measuring transit accessibility indices and in using aggregate versus disaggregate data. A new study uses distance–decay parameters estimated by a measure of transit accessibility based on origin–destination data and thereby addresses the arbitrary selection of distance–decay parameters in the accessibility equation used by earlier studies. It also uses disaggregate data at the individual level to overcome the shortcomings of earlier studies. Based on welfare recipients in Broward County, Florida, an analysis using a geographic information system and the Florida Standard Urban Transportation Modeling Structure reveals that there is a statistically significant inverse association between transit accessibility to jobs and length of time spent on welfare. This association implies that transit accessibility plays a significant role in the employment prospects of welfare recipients in the study area.

The Personal Responsibility and Work Opportunity Reconciliation Act of 1996, widely known as the welfare reform act, is a set of policies and programs designed to provide transitional assistance to move welfare recipients into unsubsidized employment. This legislation transformed welfare from a long-term support program into one whose primary objective was to move people off the welfare rolls and into gainful employment in the shortest possible time. To achieve this goal, Congress funded a host of welfare-to-work initiatives ranging from job training programs to public transit programs that connect welfare recipients to major employment clusters. The welfare reform act sought to link welfare recipients with jobs providing good career potential for achieving economic self-sufficiency. It replaced the Aid to Families with Dependent Children Act with Temporary Assistance for Needy Families programs, enabling federal block grants to be distributed to states with eligible family assistance programs (*1*). The legislation was designed to end the dependence of welfare recipients on permanent government assistance.

The welfare reform act capped the maximum time a person can stay on welfare: 60 months over a lifetime in most states and 48 months in Florida. This provision compels the poor to be dropped off the welfare rolls after they reach the cap. Scholars and policy makers question whether there will be enough jobs within the job-search distance and time limits of welfare recipients as they are forced to enter the labor market (*1–3*). The national urban policy of the U.S. Department of Housing and Urban Development states that there is a big mismatch between the locations of dropped welfare recipients and suburban jobs: 87% of the newly created entry-level and low-paying jobs are in the suburbs, whereas the candidates for these jobs live in the central city areas. National urban policy agrees that these jobs are virtually inaccessible to welfare recipients by using public transportation, the only transportation mode available to them (*4*).

Effectiveness of using transit to connect welfare recipients to jobs has been studied extensively in the years since welfare reform with widely varying results. Some scholars have found no link between transit accessibility and employment status of welfare recipients (*5, 6*), others find mixed results (*7, 8*), and still others conclude that better transit can make a difference (*9–12*).

Building on the results of these studies and addressing some of their qualifications, this paper examines whether proximity to transit services that are well connected to regional jobs reduces the time that welfare recipients spend on welfare. The paper formulates the null hypothesis that transit accessibility to jobs of a traffic analysis zone (TAZ) does not have significant impact on the employment prospects of welfare recipients. It tests the hypothesis by using a surrogate variable, namely, length of stay on welfare. The length of stay on welfare is measured by number of months a person participates in the program. By using Broward County, Florida, as the study area, this study finds that there is an association between transit accessibility to jobs and reduced time spent on welfare. This association suggests that if transit route structures are changed to provide better access to the dispersed array of destinations typical of most urban areas, welfare recipients will benefit at the margin.

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SPATIAL MISMATCH, TRANSPORTATION, AND EMPLOYMENT

In 1968, John Kain, an economist examining the links among African-American unemployment, job suburbanization, and center city–oriented mass transit systems, proposed what became known as the spatial mismatch theory. The spatial mismatch theory holds that the growing gap between African-American and white unemployment rates results from urban job deconcentration coupled with housing discrimination against African Americans and poor transportation from central-city residential locations to edge city jobs (*13*). In 1970, Kain and Meyer proposed the adoption of a wide-ranging set of transportation policies that embraced taxis, jitneys, and fixed-route public transportation services to help overcome the spatial barrier (*14*).

The hypothesis that public transportation may play an important role in individuals' employment outcomes predates Kain's work on spatial mismatch and has been studied since the McCone Commission attempted to sort out causes of the 1965 Watts riots. The McCone Commission report identified inadequate public transportation between the Watts ghetto and employment in other parts of Los Angeles, California, as a significant cause of social discontent (*15*). Several years later, the Kerner Commission, in its analysis of race riots in several of the nation's largest cities, also identified the public transportation isolation of central-city residential locations as a cause for discontent. The Kerner Commission added, however, that discrimination in housing and jobs was more important than transportation to jobs in accounting for the higher rate of unemployment among African Americans (*16*). There also is a critical literature suggesting that transportation plays a small or no role in unemployment of disadvantaged groups; employer discrimination is far more important (*17*).

Racial and ethnic minorities as well as the poorest segment of society contribute to 63% of total transit usage in the nation (*18*). The two major racial groups that use transit are blacks and Hispanics. As transit does not provide services to many parts of a city, the study concluded that blacks, Hispanics, and the poor are attached to much lower mobility than whites and the rich (*18*). When welfare recipients are considered, approximately one of every five welfare recipients does not own an automobile (*5*). These people are left with no better options than depending on public transit. It limits them in choosing the types and locations of their employment (*19, 20*). Although transit generally is a small part of the broader aspects of transportation in most urban areas, it is still important to many welfare recipients.

ESTIMATION OF TRANSIT ACCESSIBILITY TO JOBS

Accessibility is a simple concept. However, it is a daunting task to measure it. Transportation planners have approached this challenge in several ways. The broad major categories of accessibility measures are isochrone measures, gravity-based measures, and utility-based measures. The discussion of all these techniques is constrained by space limitations. The paper focuses instead on the widely used gravity-based measure, which is also applied in this study. Equation 1 presents a simple gravity model:

$$A_i = \sum_{j=1}^{n} O_j * d_{ij}^{-b} \quad (1)$$

where

A_i = accessibility of zone i,
O_j = opportunities, such as number of jobs in zone j,
d_{ij} = frictional factors like distance or travel time or travel costs between zones i and j (there are n zones), and
b = distance–decay parameter to be estimated.

The term d_{ij}^{-b} is the conventional way to represent the effects of distance or travel time or costs on movement frequency. The parameter b represents the severity of frictional effects of distance or travel time or travel costs on trip making. The higher the value of b, the more severe the effects of frictional factors on trip making, ceteris paribus.

This formulation calculates accessibility, on a zonal basis, as being a function of the sum of total opportunities weighted by the distance or time needed to travel from zone of origin to the dispersed opportunities (*21*).

This study examines whether a fuller specification of the transit impedance and destination functions defining transit accessibility might reveal whether transit accessibility to jobs affects the time individuals spend on welfare. It proposes a transit accessibility function that has empirically derived attraction variables and transit impedance variables. The paper uses Equation 2 to estimate transit accessibility index of TAZ i over TAZ j:

$$TA_{ij} = \left(\begin{array}{l} \left[TTT_{ij}^{\alpha} + ATT_{ij}^{\beta} + HWD_{ij}^{\gamma} \right] \times \left[POP_j^{\delta} + POPDEN_j^{\epsilon} \right. \\ \left. + JOB_j^{\eta} + JOBDEN_j^{\rho} + BUFFER_j^{\tau} + CBD_j^{\sigma} + DTN_j^{\psi} \right] \end{array} \right) \quad (2)$$

where

TA_{ij} = transit accessibility to jobs of any origin TAZ i over any destination TAZ j;
TTT_{ij} = door-to-door transit travel time between centroids of TAZ i and TAZ j;
ATT_{ij} = door-to-door free-flow automobile travel time between centroids of TAZ i and TAZ j;
HWD_{ij} = highway distance between centroids of TAZ i and TAZ j;
POP_j = total population in destination TAZ j;
$POPDEN_j$ = population density in destination TAZ j; this reflects the probability that higher densities have more pedestrian-friendly access to transit;
JOB_j = number of jobs available in destination TAZ j;
$JOBDEN_j$ = job density in destination TAZ j, measured per 10th hectare of land;
$BUFFER_j$ = proportion of destination TAZ j within 0.25 mi of a surface street bus route; this is percentage of total area of a TAZ that is covered by 0.25-mi buffer of transit routes and based on a straight-line distance, not a walking distance;
CBD_j = dummy variable depicting core central business district (CBD) TAZs; CBD TAZs are contiguous and have the highest nonindustrial employment density in the region; they have little residential use, and to a large extent reflect high parking fees;
DTN_j = dummy variable depicting downtown (but not core CBD) TAZs; DTN TAZs are those surrounding CBD TAZs. They need to be contiguous and would have lower employment density, but some of it might be industrial.

Some DTN TAZs might have high population density. However, for this study, the DTN variable largely reflects the impact of high parking fees.

Taking the summation of all TA_{ij}, total transit accessibility to jobs of TAZ *i* can be estimated by Equation 3:

$$TA_i = \sum_{j=1}^{n} TA_{ij} \quad (3)$$

where *n* equals 892 since there are 892 TAZs in Broward County, Florida.

Both distance–decay and destination–TAZ attribute parameters were estimated by Equation 4 by using origin–destination survey data and are from Thompson (*22*):

$$T_{ij} = \exp\begin{pmatrix} b + \alpha * TTT_{ij} + \beta * ATT_{ij} + \gamma * HWD_{ij} + \delta * POP_j \\ + \epsilon * POPDEN_j + \eta * JOB_j + \rho * JOBDEN_j \\ + \tau * BUFFER_j + \sigma * CBD_j + \psi * DTN_j \end{pmatrix} \quad (4)$$

T_{ij} is a count variable of trips made by transit users from TAZ *i* to TAZ *j*. The minimum value of T_{ij} is zero. Other variables in Equation 4 are as in Equation 2. Scholars have used Poisson regression as the standard method to estimate models of count variables (*11, 22*). The α, β, and γ are distance–decay (frictional) parameters, and δ, ϵ, η, ρ, τ, σ, and ψ are attached to destination–TAZ attributes that attract people from origin TAZ. The use of such estimated parameters addresses the arbitrary selection of distance–decay parameters like –1 or –2 in accessibility equations used by earlier studies (*8, 23*). Equation 4 estimated $\alpha = -0.006067$, $\beta = 0.122780$, $\gamma = -0.250210$, $\delta = 0.000008$, $\epsilon = 0.036496$, $\eta = 0.000058$, $\rho = 0.036647$, $\tau = 0.013648$, $\sigma = 0.372820$, and $\psi = 0.324140$.

TA_i calculation could be simplified by a small example. Say there are only three TAZs in a county: TAZ 1, TAZ 2, and TAZ 3. Their attributes are $TTT_{11} = 0$; $TTT_{12} = 59.845$; $TTT_{13} = 63.665$; $ATT_{11} = 0$; $ATT_{12} = 2$; $ATT_{13} = 2$; $HWD_{11} = 0$; $HWD_{12} = 0.4$; $HWD_{13} = 0.7$; $POP_1 = 1014$; $POP_2 = 1712$; $POP_3 = 0$; $POPDEN_1 = 3.37$; $POPDEN_2 = 3.05$; $POPDEN_3 = 0$; $JOB_1 = 424$; $JOB_2 = 235$; $JOB_3 = 6$; $JOBDEN_1 = 1.41$; $JOBDEN_2 = 0.42$; $JOBDEN_3 = 0.02$; $BUFFER_1 = 61.81$; $BUFFER_2 = 65.92$; $BUFFER_3 = 47.29$; $CBD_1 = 0$; $CBD_2 = 0$; $CBD_3 = 0$; $DTN_1 = 0$; $DTN_2 = 0$; and $DTN_3 = 0$. With these numbers plugged into Equation 2 and with the presented distance–decay parameters, the transit accessibility to jobs of TAZ 1 over TAZ 2 could be calculated as

$$TA_{12} = \begin{pmatrix} \left[\left(59.845^{-0.006067}\right) + \left(2^{0.122780}\right) + \left(0.4^{-0.250210}\right)\right] \\ \times\left[\left(1712^{0.000008}\right) + \left(3.05^{0.036496}\right) + \left(235^{0.000058}\right)\right. \\ \left. + \left(0.42^{0.036647}\right) + \left(65.92^{0.013648}\right) + \left(0^{0.372820}\right) + \left(0^{0.324140}\right)\right] \end{pmatrix}$$

$$TA_{12} = 16.8407$$

Similarly, TA_{11} and TA_{13} are calculated as 0 and 9.22114. By using Equation 3, total transit accessibility to jobs of TAZ 1 over these three TAZs can be calculated as

$$TA_1 = \sum_{j=1}^{3} TA_{ij} = \sum_{j=1}^{3} TA_{1j} = TA_{11} + TA_{12} + TA_{13}$$

$$= 0 + 16.8407 + 9.22114 = 26.06184$$

For this paper, transit accessibility to jobs for any specific origin TAZ *i* was calculated over 892 TAZs. The same methodology was applied 892 times to calculate their transit accessibility to jobs. By using the programming language C++, a computer program was written to accomplish this complicated task.

The data for the transport-related frictional variables came from the Year 2000 transportation network database of the Broward County metropolitan planning organization. The study used Florida standard urban transportation modeling software to get the expected outputs: highway distance between centroids of different TAZs (HWD_{ij}), door-to-door free-flow automobile travel time between centroids of different TAZs (ATT_{ij}), and door-to-door transit travel time between centroids of different TAZs (TTT_{ij}). For transit travel time, the study abstracted each component of time (in-vehicle, walking, waiting, transfer) from the shortest transit path between each pair of TAZs and applied default weights recommended for quick-response-system modeling (*24*). For paths where transfers are involved, a penalty of 23 min was used, recommended for untimed transfers by Horowitz (*24*), because transfers are untimed in Broward County. This process yielded total door-to-door transit travel time between each pair of TAZs. The destination variables were obtained from the census.

Originally, the paper estimated transit accessibility to service jobs, transit accessibility to commercial jobs, transit accessibility to industrial jobs, and transit accessibility to total jobs. Pairwise correlation suggests the presence of multicollinearity among these four accessibility measures. Therefore, the original plan of using all four accessibility variables was set aside, and transit accessibility to total jobs was used instead as the proxy for other three. The variable "transit accessibility to jobs" means transit accessibility to total jobs in the rest of this paper and is also expressed as "transit accessibility."

STUDY AREA: BROWARD COUNTY

Broward County is located immediately north of Miami–Dade County on Florida's east coast. Broward is a growing, populous county with above-state-average income levels and lower-than-state-average poverty rates. According to the 2000 census, the county had 1.6 million persons, a growth rate of 29% from 1990 (*25*). In 1999, the median household income was $41,691 and the poverty rate was 11.5%.

Broward is a suburban county bounded on the east by the Atlantic Ocean and on the west by the Everglades. As elsewhere in southeast Florida, early development occurred in a string of suburbs along the Atlantic coast. However, in recent decades the built-up area has extended to the boundary with the Everglades. Development patterns outside the older coastal zone are suburban, with major shopping centers serving as the primary activity nodes. Both population and employment are highly decentralized throughout the county. As in other areas characterized by high levels of recent growth, Broward County's employment clusters tend to be oriented to the arterial road network (Figure 1).

Transit Systems in Broward County

Broward County Transit (BCT) is the local public transit operator. Since 1995, BCT ridership has grown by 55% to 37.2 million unlinked passenger trips per year (*26*). This rapid ridership growth reflects both high population growth and transit service changes. Transit service in the county was largely centered on Fort Lauderdale until the system was restructured about a decade ago to provide countywide, multidestination service on a roughly grid pattern (Figure 2). At the time, buses were moved out of neighborhoods and onto major arterials to provide more-direct, more-frequent service to the dispersed set of major destinations. Simultaneously, feeder services were deployed to connect the interiors of neighborhoods to nearby destinations. Broward County is also served by the Tri-Rail commuter

FIGURE 1 Employment density in Broward County, 2000.

rail, which runs between Palm Beach County and Miami–Dade County, but this service now plays a small role in intracounty transit travel. The commuter rail service may play a more important role as a county trunk transit line in the future.

BCT has experienced rapid ridership growth on its arterial bus routes and little patronage on its neighborhood feeder bus routes. The nature of the arterial routes is perhaps best exemplified by Route 18, whose location is shown in bold in Figure 2. Route 18 runs on US-441 through a suburban environment characterized by big-box retail centers and traditional strip commercial development. It is an urban environment with adequate pedestrian amenities and numerous destinations transit riders wish to access. The route carries the largest number of riders in the entire transit system and operates on 15-min headways, a very high level of service for a suburban system.

Welfare Recipients in Broward County

In Florida, the welfare reform program is administered by the state's Department of Children and Families (DCF). Florida limits welfare recipients to a maximum of 24 months of public assistance in a 5-year period, by the end of which they are expected to obtain work, and a maximum of 48 months of assistance over a lifetime (*27*). Disabled persons are excluded from these limitations.

The objective of the welfare reform program is to provide temporary financial assistance until people obtain gainful employment, at which point they would leave the program. However, it is possible for recipients to leave the program for other reasons: they die, they move to other states, they run out of eligibility because they have exhausted their maximum stipulated period of 48 months, or they become ineligible because of marriage or increased household income. Persons in these four categories and disabled persons were removed from the data set, and the final data set included those individuals who had exhausted up to 47 months on welfare to eliminate the ineligible recipients.

The original data set included the information and addresses of 20,343 welfare recipients who were enrolled in the welfare program between 1996 and 2000. After individuals who left the welfare rolls for non-employment-related reasons were removed, the data set had 17,584 welfare recipients. The year 1996 marks the creation of the welfare rolls, and 2000 was chosen as the last year so the recipients over their initial 5-year eligibility period following enrollment could be tracked. Therefore, the data set contains information up to and including 2004. The multivariate regression model includes aggregate data at the TAZ level and disaggregate data at the individual

FIGURE 2 Transit routes and transit buffer in Broward County, 2000.

level. Data for which the unit of analysis is individual entity are called disaggregate data, whereas higher-level data composed of a multitude or combination of other more-individual data are called aggregate data. The examples of disaggregate data could be an individual's employment status, education, age, or income, and that for aggregate data could be total population of a TAZ, transit accessibility to jobs of a TAZ, and so forth. The study assumed that the TAZ characteristics are attributable to all welfare recipients living in that specific TAZ. However, the Florida DCF database does not reveal the TAZ number in which a specific welfare recipient lives. Therefore, the residential locations of all 17,584 welfare recipients were geocoded by using an ArcMap geographic information system. The geocoding process matched more than 87% of 17,584 addresses, keeping 15,298 welfare recipients in the final data set. The Geographic Data Technology (GDT) streets map of Florida was used to find the specific locations of welfare-recipient residences. The GDT streets map is for all of Florida, whereas the available TAZ map was for Broward County. After geocoding the residential addresses, the study superimposed the GDT streets map on the TAZ map of the county by spatially joining the two maps. Doing so attributed the transit accessibility characteristic of any specific TAZ to all welfare recipients living in that TAZ. This explanation holds true for other aggregate variables. Therefore, although the study has used some aggregate variables, the regression analysis is at the disaggregate level.

Transit Accessibility to Jobs in Broward County

Figure 3 shows the overlay of the distribution of welfare recipients on the spatial distribution of transit accessibility, as classified on the basis of natural breaks in the data. The accessibility indices presented in Figure 3 are relative measures and are grouped in five categories. The darker TAZs with higher scores possess higher transit accessibility to jobs, and vice versa. This implies that a welfare recipient living in an accessibility-rich TAZ has easier access to other TAZs of the county and, therefore, will be employed earlier than a person living in an accessibility-poor TAZ, and thus will leave the welfare program earlier than her or his counterpart. The figure shows that the areas with the highest transit accessibility are located in an east–west bulge located in the center of the county and in north–south

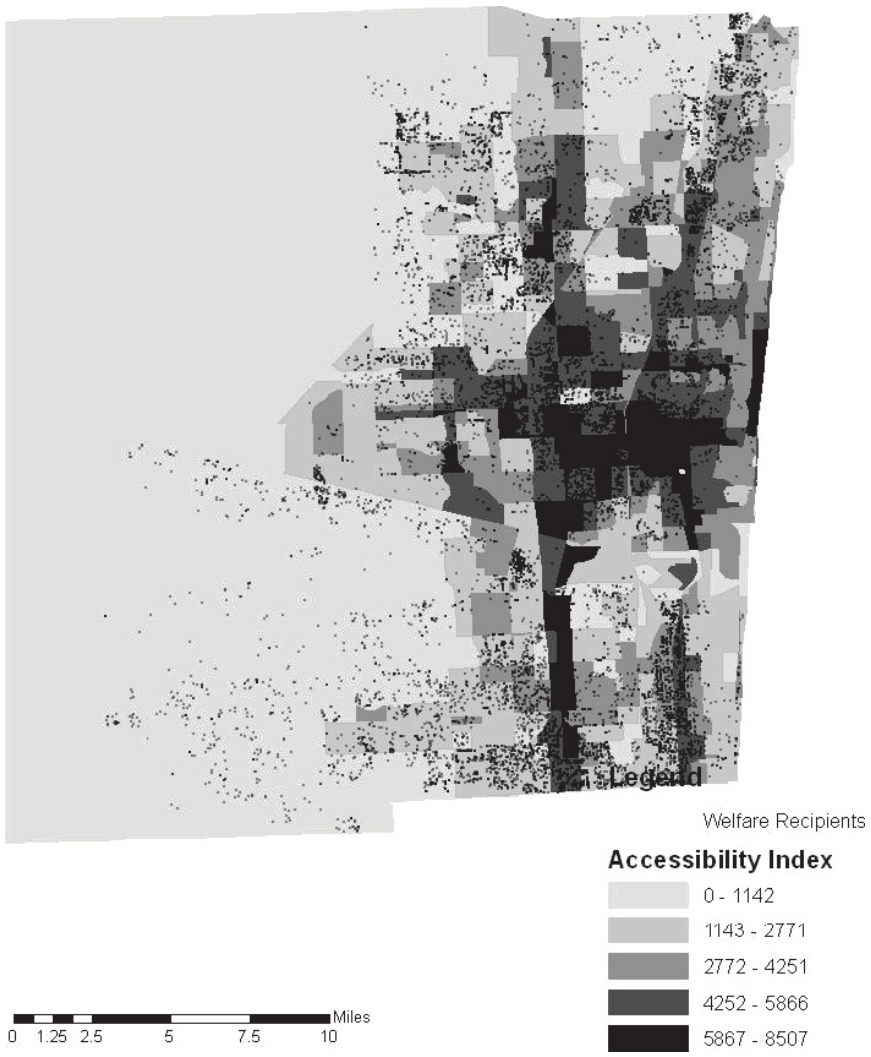

FIGURE 3 Transit accessibility and location of welfare recipients in Broward County, 2000.

bands located several miles inland from the coast that nearly run the length of the county. The band with the highest levels of transit accessibility follows the approximate path of BCT Route 18 discussed earlier.

The areas shown to be highly transit accessible in Figure 3 differ considerably from the 0.25-mi service buffers shown in Figure 2, which represents a more traditional approach to measuring transit accessibility. For example, many areas in the southeastern part of the county that lie within the service buffer and would be considered accessible turn out to have very low levels of accessibility by using the measure of this study. The pattern of accessibility in Figure 3 reflects the multidestination nature of a transit network, as shown in Figure 2. In a multidestination network, accessibility is dispersed, whereas in a radial network accessibility is concentrated at the center, where the routes converge.

Figure 3 also indicates that although welfare recipients are located throughout the county, the largest clusters of welfare recipients correspond to areas with higher levels of transit accessibility. Thus, most welfare recipients appear to reside in areas with moderate to high levels of transit accessibility.

STATISTICAL MODEL

By using a multivariate regression model, this paper examines the association between transit accessibility and number of months individuals received welfare. The ideal dependent variable would be the employment status of the welfare recipients. Unfortunately, Florida DCF does not maintain this variable. Therefore, this study uses a surrogate variable, namely, number of months an individual stayed on the welfare rolls. The variable comes from the Florida DCF data set.

Table 1 shows the full set of variables and their expected effects on welfare duration, that is, length of stay on the welfare rolls and employment prospects. The explanatory measures include variables of individual characteristics, household characteristics, and neighborhood characteristics. The third category is at TAZ level and includes aggregate variables. Following are the explanatory variables:

- Age 26 to 55. The prospect for young people to be on the welfare rolls is high before they reach a certain age, when they are employed and leave the welfare program. Similarly, older people generally tend to be on welfare. Therefore, this study expects that

TABLE 1 Expected Effects of Explanatory Variables and Parameter Estimates of Multivariate Regression Model

	Measurement	Expected Effect on Welfare Duration	Expected Effect on Employment Prospects	Coefficient	*t*-Value	*P*-Value
(Constant)				11.051	19.207	0.000
Individual-Level Variables						
Age 26–55	Whether the welfare recipient is between 26 and 55 years of age. 1 if yes, 0 otherwise	–	+	–1.417	–5.066	0.000
High school graduate	1 if high school graduate, 0 otherwise	–	+	–2.350	–9.320	0.000
Black	1 if black, 0 otherwise	+/–	–/+	2.706	17.531	0.000
Hispanic	1 if Hispanic, 0 otherwise	+/–	–/+	0.898	4.509	0.003
Asian	1 if Asian, 0 otherwise	+/–	–/+	–0.020	–0.004	0.937
White	1 if white, 0 otherwise	+/–	–/+	1.141	0.227	0.820
Female	1 if female, 0 otherwise	+	–	1.380	5.367	0.000
Married	1 if married, 0 otherwise	+/–	–/+	0.736	1.614	0.503
Household-Level Variables						
Children	Number of children aged younger than 18 at household	+	–	2.946	6.314	0.000
Adults	Number of persons aged 18 or older at household	–	+	–0.718	–3.664	0.037
Access to automobile	1 if the welfare recipient can get access to automobile from others, 0 otherwise	–	+	–1.417	–5.066	0.000
TAZ-Level Variables						
Percent black in the TAZ	Percentage of black residents in a TAZ	+	–	0.358	2.033	0.043
Percent Hispanic in the TAZ	Percentage of Hispanic residents in a TAZ	+	–	1.437	1.805	0.071
Poverty rate	Percentage of people in a TAZ who live below poverty line	+	–	2.362	1.675	0.194
Transit accessibility	Transit accessibility to jobs	–	+	–0.129	–3.056	0.002
R^2				0.327		
Adjusted R^2				0.328		

NOTE: Dependent variable: welfare duration (number of months a welfare recipient stays on welfare).

the regression coefficient for age 26 to 55 would be negative for welfare duration and positive for employment prospects.

- High school graduate. Generally, people with more years of schooling are attached to more marketable employment skills that lead to earlier employment. Therefore, the paper expects a negative coefficient for welfare duration and positive coefficient for employment prospects.
- Black, Hispanic, Asian, and white. Race plays an important role on welfare duration of the welfare recipients and their employment prospects. Although it is generally perceived that whites are employed sooner than other races, it may not be true for the poor, like welfare recipients. Thus, the signs of the coefficients are uncertain.
- Female. It is widely believed that women stay on the welfare rolls for longer than do men because they are less skilled and they may have children to care for, which reduces their employment prospects compared to men. The expected coefficient is positive for welfare duration and negative for employment prospects.
- Married. Being married can either relieve some household responsibility or create extra burdens. The expected effect of being married on welfare duration and employment prospects is uncertain.
- Number of children at household. The paper expects that the more children a welfare recipient has, the longer she or he will stay on welfare. The expected coefficient is positive for welfare duration and negative for employment prospects.
- Number of adults at household. More adults at household generally means more earning members, which implies that the welfare recipient will run out of eligibility to be on the welfare rolls because her or his household income will rise. Negative coefficient for welfare duration and positive coefficient for employment prospects are expected for this variable.
- Access to automobile. This is a dichotomous variable that measures whether an individual welfare recipient has the opportunity to borrow an automobile from a neighbor or friend who lives nearby. The study expects that access to automobile will have negative impacts on welfare duration and positive impacts on employment prospects.
- Percentage black in the TAZ, percentage Hispanic in the TAZ, and poverty rate. A TAZ with a high proportion of blacks or Hispanics generally implies that the TAZ is poor (*28*). This paper considers a welfare recipient who lives in a TAZ with relatively high percentage of blacks or Hispanics, or both, or in a TAZ where a large

proportion of residents live under the poverty line will stay on welfare for longer period and her or his employment prospects will be lower. Therefore, positive and negative coefficients are expected for all three variables for welfare duration and employment prospects, respectively.

- Transit accessibility. The final variable used in the regression model is transit accessibility to jobs. This variable is of prime interest to this study, which hypothesized that people living in TAZs with higher levels of transit accessibility would stay in the welfare program for a shorter period, whereas those living in TAZs with low levels of transit accessibility would stay in the program for a longer period. Thus, the study theorized that better transit accessibility to jobs would help welfare recipients use transit to search, reach, and retain jobs. Therefore, negative and positive coefficients are expected for welfare duration and employment prospects, respectively.

RESULTS AND DISCUSSIONS

The multivariate model (Table 1) explains one-third of variation in the dependent variable with an R^2 value of 0.327. This is typical of models dealing with impacts of accessibility on employment and closely follows the explanatory power of models used in similar studies (*6, 11, 12*). Therefore, the regression model is robust and acceptable. There is no indication of multicollinearity among the variables. Among the individual characteristic variables, age, educational achievement, gender, role of the person in household, and, in part, race play a significant role in the duration of a person on welfare. The negative sign for age 26 to 55 implies that the welfare recipients of this age group come off the welfare rolls earlier, indicating that they are employed earlier than their younger and older counterparts. It is a realistic argument because this cohort is the major working group in society. In contrast, the younger and older members are usually dependent on the earning members of their families. Having a high school diploma means achievement of necessary skills and a chance of being employed soon. Hence, welfare recipients with a high school diploma stay on welfare for shorter periods. However, blacks, Hispanics, and women tend to be on welfare for longer. In reality, transit accessibility to jobs alone does not contribute to getting and retaining jobs by women. Other factors like child care, job training, and number of children are also determining factors for women in this regard. However, men are more likely to get and retain jobs if they have better transit accessibility, as they are less likely to be responsible for factors like child care. Therefore, the finding of this study that women stay on the welfare rolls for longer periods is acceptable. The most influential variable is race (black and Hispanic), which is associated with positive signs. This implies that blacks and Hispanics are more likely to stay in the welfare program for a longer time compared to people of other races. One would expect this finding because most welfare recipients in the United States are blacks and Hispanics. Interestingly, being Asian, white, or married does not play a significant role on welfare duration in Broward County. This argument is acceptable since a small proportion of welfare recipients are Asian and whites (*6, 12*).

All three household-level variables turn out to be significantly important for employment prospects. The number of children younger than 18 in a household, number of persons age 18 or older, and whether welfare recipients can access an automobile behave as expected. Having more children implies an extra burden on the household head, which leads her or him to staying longer on welfare. The two other household-level variables have negative impacts on the length of stay on welfare and positive impacts on the employment prospects. Having more adults at home generally implies more household income, which results in running out of eligibility to participate in the welfare program. Similarly, accessing an automobile means a wider chance of searching, getting, and retaining jobs, which implies that the recipient no longer qualifies for welfare. Thus the results are what one would expect.

Of four, two neighborhood quality variables, percent black in the TAZ and transit accessibility, play a statistically significant role on the employment prospects of welfare recipients, whereas two others (percent Hispanic in the TAZ and poverty rate) do not. Welfare recipients living in TAZs where a high percentage of the population is black are influenced by Wilson's culture of poverty (*28*), and therefore have a tendency to depend on welfare resources for an extended period. Poverty rate is not statistically significant because the poverty characteristic is covered by the similar variables "percentage of black residents" and "percentage of Hispanic residents at the TAZ level." The high percentage of Hispanics in a TAZ does not play a similar role in welfare duration as that of percentage of blacks in a TAZ. This indicates that the Hispanics are not affected by Wilson's culture of poverty (*28*).

The most important variable of this study, transit accessibility to jobs, behaves as expected and has an inverse relationship with welfare duration. It is expected that a welfare recipient is susceptible to a lengthy stay on welfare rolls if her or his TAZ is attached to low transit accessibility to jobs. The model results establish this for the study area. The results suggest that transit accessibility to jobs of a TAZ has negative significant impacts on the length of time a welfare recipient stays on welfare. The length of stay on welfare decreases with the increase in transit accessibility to jobs of a TAZ, and vice versa. However, number of months is a surrogate variable of employment prospects of welfare recipients, and it is believed that welfare recipients leave the program when they get a job. This is particularly applicable for this study, because all welfare recipients who left the program for other reasons than those who would have left the program after they were employed were excluded from the database. Thus the regression results imply that the increase in transit accessibility to jobs increases the employment prospects of the welfare recipients in Broward County, Florida.

CONCLUDING REMARKS ON PUBLIC POLICY IMPLICATIONS

This study is among the few that address the impacts of transit accessibility on the employment prospects of the welfare recipients. The policy implications of the empirical findings of this study are important in that they support existing studies (*8–12*) and imply that providing better transit services to welfare recipients will improve their employment prospects. It is evident that transit has an important role to play, and that a multidestination transit system with its resulting dispersed patterns of transit accessibility is more desirable in today's dispersed urban environments. Many of the welfare recipients cannot find and retain suitable jobs that are located in the suburban areas outside of the job search areas served by the traditional transit services. These transit systems do not make trips to the suburban areas, where most of the suitable jobs for the poor are located.

When employment prospect is influenced by transit accessibility to jobs like the findings of this study, one may argue that government intervention is needed, as the poor cannot increase their accessibility by purchasing automobiles. Government can improve the situation by introducing different programs. Although programs like welfare-to-work exist in some places, there are other viable options.

The creation of new jobs and improvement of transit services from inner-city residential areas to suburban job locations are at the center of most important policy implications. Creation of new jobs would certainly increase the opportunity for more job accessibility; however, this alone will not be sufficient if the transit connection between central-city homes and suburban job locations are not improved. If both initiatives are successfully implemented by the government, the resulting increase in transit accessibility to jobs will lead welfare recipients to searching for, getting, and retaining suitable jobs. The connection between inner-city homes and suburban job locations could also be improved by taking several other measures. These may include fixed-route reverse-commute bus service, carpooling, demand-responsive taxi service, and demand-responsive van service. It might also introduce nonmotorized transit services like jitneys. By using traditional transit services, welfare recipients may reach their jobs if these are located within the service area of the transit systems and not beyond. With existing transit service systems, welfare recipients would not be able to commute and reverse commute if they work at night. Therefore, effective and sustainable transit policy should include services beyond traditional morning and evening peak periods and traditional service areas.

There are important policy implications of other predictor variables as well. However, these policies should be in accordance with those related to transit service improvements. For example, the study finds that the people younger than 26 and older than 55 stay longer on the welfare rolls. The same is true for blacks, Hispanics, women, and people living in TAZs with a high percentage of blacks. This implies that the government should implement focused programs for these groups so they can commute and reverse commute easily to and from their job locations. The programs discussed in the previous paragraph will help these groups increase their transit accessibility to jobs and thereby their employment prospects. This paper also finds that welfare recipients with high school diplomas stay a shorter time on the welfare rolls, that is, they are employed sooner than their counterparts. The best policy implication of this finding is to initiate effective educational and job training programs appropriate for low-income blacks, Hispanics, the elderly, women, and the young, with specific reference to neighborhoods that are predominantly black. Effective and affordable child care programs for women will also be of great importance to job search and retention. Further, the article reveals that employment prospects of welfare recipients increase if they have automobile access, whether by borrowing from friends or relatives living in the same neighborhood or by simply purchasing one. This finding is supportive of much existing literature (*5, 6*). A variety of programs like low-interest car loans and no pay without job could be initiated by the government to help the poor to access automobiles. However, such programs will encourage more vehicles on urban streets and contribute to air pollution. Therefore, government agencies and transit planners must decide wisely whether to invest in transit or automobile.

Although the results of this research prove the significance of transit accessibility to jobs for employment prospects of the welfare recipients, the policy to provide transit accessibility to welfare recipients for job retention is not tested. The relationships between transit accessibility to jobs and residential location choice also is not tested in this study. The hypothesis is not tested in other cities, although pioneering studies on one city are not uncommon (*6, 11, 17, 23*). Additional research would be necessary to explore the relationships between transit accessibility to jobs and job retention, and between transit accessibility to jobs and residential location choice in Broward County and elsewhere.

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