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Job Access and Work Among Autoless Adults on Welfare in Los Angeles

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JOB ACCESS AND WORK AMONG AUTOLESS ADULTS ON WELFARE IN LOS ANGELES

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Note: This study presents research drawn from author's Ph.D. dissertation at MIT.

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ABSTRACT
Lack of auto ownership is frequently cited as a major barrier to welfare recipients' transition to work. The importance of accessible job opportunities in employment outcomes has not, however, been empirically analyzed for welfare recipients who do not own automobiles. This study analyzes the effect of job accessibility on employment outcomes for autoless adults on welfare in Los Angeles. Two important components of this analysis are the computation of job-access measures that take into account travel modes and the incorporation of the job-access measures into multinomial logit models. The job-access measures show a considerable disparity in the number of spatially accessible job opportunities for auto users and transit users. The multinomial logit analysis indicates that for autoless welfare recipients, improving transit-based job accessibility significantly enhances the employment probability, although it does not make a significant difference in the probability of earning $4,500 or more per year. The analysis further reveals that the job-access effect is greater for autoless welfare recipients than for auto-owning recipients. Certain policy implications suggested by the empirical findings are discussed.

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1. INTRODUCTION

A public concern arising from North America's extensive suburbanization in recent decades is spatial mismatch—the geographic separation between residence and workplace. Since many suburban jobs are essentially inaccessible by public transportation, this dispersal of metropolitan economies may hinder workers without automobiles from finding and securing jobs.

Among the most disadvantaged are welfare recipients, who are currently under strong pressure to make the transition from welfare to work. The Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA), enacted in 1996, replaced Aid to Families with Dependent Children (AFDC) with Temporary Aid to Needy Families (TANF), requiring most welfare recipients to work, as a condition of receiving public assistance. The welfare-to-work transition is a severe challenge for welfare mothers who, besides working, have to perform diverse tasks including childcare, housework, and shopping.

The lack of reliable transportation is frequently cited as a major barrier to welfare recipients' employment success (Blumenberg and Ong, 2001; Lacombe, 1997; Sawicki and Moody, 2000; Wachs and Taylor, 1998). Compared to the general population, welfare recipients display a considerably lower rate of auto ownership, and recipients' autos are often old and unreliable, according to recent research (Ong et al., 2001). Not having access to autos poses a particular disadvantage in access to jobs. A basic indicator of spatial mismatch is the number of spatially accessible job opportunities, which is termed *job accessibility* in this study. It is known that job accessibility for transit users is much lower than that for auto users (Kawabata, 2002; Shen, 1998, 2001). In other words, spatial mismatch is much greater for transit users than for auto users, suggesting that higher job accessibility for transit users may help autoless welfare recipients make the welfare-to-work transition.

The importance of job accessibility for employment outcomes, however, has not been empirically analyzed for autoless welfare recipients. Ong (1996) and Raphael and Rice (2002), while they find that auto ownership significantly increases employment outcomes, do not incorporate job accessibility (location information about spatial mismatch) into their analyses (Ong, 1996; Raphael and Rice, 2002). In essence, their studies investigate transportation mismatch, rather than spatial mismatch.

Using recent survey data on welfare recipients in Los Angeles, then, this study examines the importance of transit-based job accessibility in employment outcomes for autoless adults on welfare. It investigates a combination of spatial mismatch and transportation mismatch, thus contributing new perspectives to the spatial mismatch problem and the literature surrounding it. Specifically, I attempt to answer the following two research questions: 1) Does improving transit users' job accessibility significantly enhance employment outcomes for welfare recipients without autos? and 2) Is the job-access effect on employment outcomes greater for autoless welfare recipients than for auto-owning recipients?

An important issue to be clarified is that this study is not an examination of John Kain's well-known spatial mismatch hypothesis. Kain (1968) hypothesizes that a combination of housing segregation and job suburbanization both decreases employment opportunities for African-Americans in inner cities and lowers their employment outcomes (Kain, 1968). The focus of this study, however, is on the spatial mismatch problem for all autoless welfare recipients in a metropolitan area as a whole, not on inner-city minority workers. In fact, the people who suffer most from spatial mismatch are likely to be transit-dependent persons who live in suburban areas where jobs are dispersed and public transportation poorly developed.

2. METHODOLOGY

2.1 Job-Access Measures by Travel Mode

An important methodological component of this study is to construct job-access measures that take into account travel modes. The differentiation of travel modes in a measurement of job accessibility, which has rarely been done in previous spatial mismatch studies, is critical for this study because of the large disparity in job-access levels for auto commuters and transit commuters. The computation of the job-access measures uses the following formulas:

$$A_i^{auto} = \sum_j (O_{j(t)} \times f(C_{ij}^{auto})),$$

$$A_i^{pub} = \sum_j (O_{j(t)} \times f(C_{ij}^{pub})).$$

A_i^{auto} and A_i^{pub} represent job-access measures for welfare recipients living in zone i who are auto commuters and transit commuters, respectively. The number of job opportunities for welfare recipients in zone j at time t is given by $O_{j(t)}$. $f(C_{ij}^{auto})$ and $f(C_{ij}^{pub})$ represent impedance functions for auto users and transit users, respectively, who are traveling between zone i and zone j.

In the foregoing calculations, the geographic unit (zone) is the transportation analysis zone (TAZ). The 2000 zone-to-zone commuting time matrices for auto users and transit users were provided by the Southern California Association of Governments (SCAG). The impedance functions ($f(C_{ij}^{auto})$ and $f(C_{ij}^{pub})$) are estimated using the simple travel time threshold function. When travel time between zone i and zone j is less than 30 minutes, the value used in the impedance function is set equal to one. The choice of the 30-minute threshold is made because, according to the 1990 Public Use Microdata Samples (PUMS), the average commute time for female householders in poverty with children less than six years of age (a group similar to the welfare population) who use auto or transit for commuting is 29 minutes in Los Angeles County.

The number of job opportunities for welfare recipients in zone i (O_i) is calculated using the following formula:

$$O_{i(t)} = \sum_n \left(E_{in} \times p_n\right),$$

where E_{in} is the number of jobs per square mile in occupation n in zone i, and p_n indicates the proportion of low-skilled female workers in occupation n. The formula is based on the assumption that the proportion of low-skilled female workers in each occupation is spatially homogeneous. If the proportion varies considerably within the metropolitan area, the calculated absolute values could be distorted. However, the relative values, which have greater meaning than the absolute values in this analysis, would be less affected.

Employment data on the number of jobs by occupation (E_{in}) are from 1998 American Business Information (ABI) data by census block group. To estimate the proportion of low-skilled female workers in occupation n (p_n) in Los Angeles County, the Current Population Survey (CPS) for 1998 is used (Table 1). Low-skilled female workers are defined as women in the labor force educated to the level of high school or less. The employment data by block group are aggregated to the TAZ level and then incorporated into the job-access formulas.

TABLE 1 Proportion of Low-Skilled Female Workers by Occupation in Los Angeles County

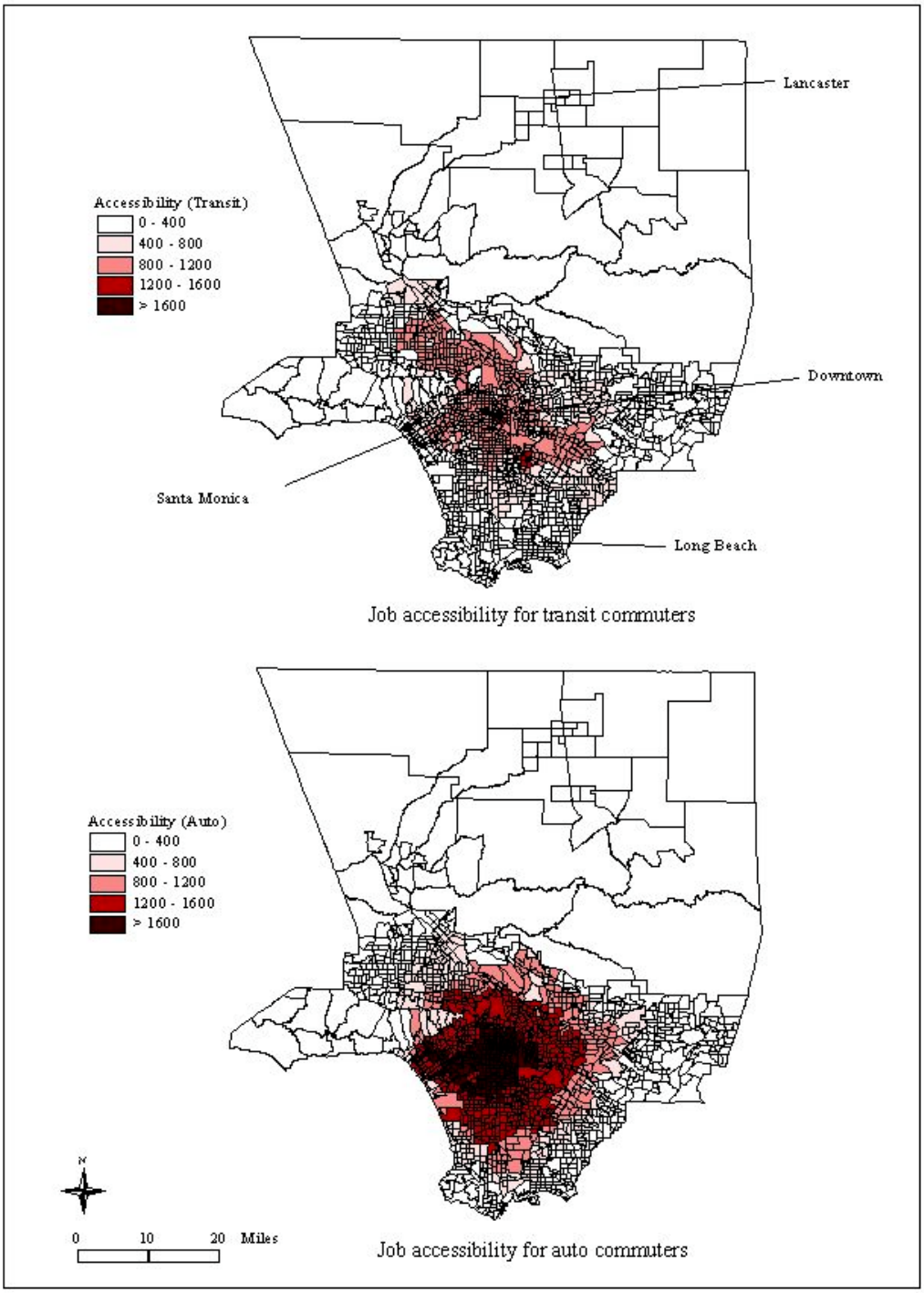
ABI Variable	ABI Label	CPS SOC code	Percentage of female workers with <= high school diplomas
O98EXEC	Executive and Managerial	003 - 042	9%
O98PROF	Professional	043 - 202	4%
O98TECH	Technical	203 - 242	16%
O98SALES	Sales	243 - 302	21%
O98CLER	Clerical	303 - 402	25%
O98PRHHD	Private Household	403 - 412	81%
O98PROT	Protective Services	413 - 432	8%
O98SERV	Services	433 - 472	36%
O98PRIM	Agriculture, Forestry, and Fishing	473 - 502	8%
O98PROD	Production and Related	503 - 702	5%
O98OPER	Operators	703 - 863	32%
O98MALA	Materials Handlers and Laborers	864 - 889	11%

Note: SOC: Standard Occupational Classification. Statistics take into account weighting.
The variable O98MASA combines O98MATER (materials handlers) and O98LABOR (laborers) because SOC for these two occupations are not clearly defined.

A visualization of the job-access data used in the statistical analysis appears in Figure 1. The two maps use the same equal interval classification, in order to clarify the difference in job accessibility between auto and transit users. These results indicate clearly that welfare recipients who depend on public transit face markedly lower levels of spatially accessible job opportunities than do welfare recipients who have access to autos. For example, in one section of Inglewood (a city in Los Angeles County), a neighborhood with a high concentration of welfare recipients, a typical welfare recipient who uses transit has an access measure of 400 jobs, whereas a typical recipient who uses an auto has an access measure of 1625 jobs. For both types of commuters, areas of relatively high-accessibility are spread around the south central sections of Los Angeles County, but accessibility-rich

areas for auto users are relatively concentrated in the southwestern sections of the county.

FIGURE 1: Job Accessibility for Low-skilled Women in Los Angeles



2.2 Models

This study employs multinomial logit (MNL) models to examine the job-access effect on the following two employment outcomes for autoless welfare recipients: the probability of employment and the probability of employment at the rate of $4,500 or more per year (this

figure represents median earnings of welfare recipients who have earned income in the sample). The linear-in-parameters MNL is given by:

$$P_n(i \mid C_n) = \frac{e^{\beta' x_{in}}}{\sum_{j \in C_n} e^{\beta' x_{jn}}},$$

where $P_n(i \mid C_n)$ is the probability that a given individual n chooses alternative i within the choice set C_n; β' represents a vector of coefficients; and x_{in} and x_{jn} are vectors describing the attributes of the decision-maker n.

Figure 2 illustrates the MNL structure for the employment model, and Figure 3 shows the MNL structure for the earnings model.

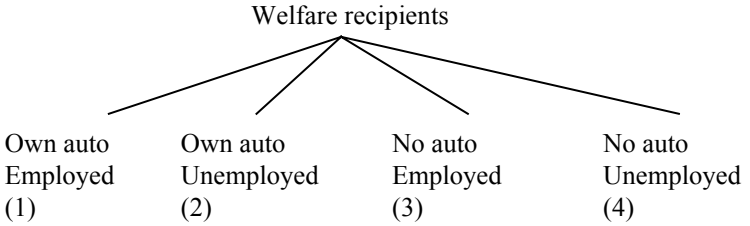


FIGURE 2: MNL structure for employment model.

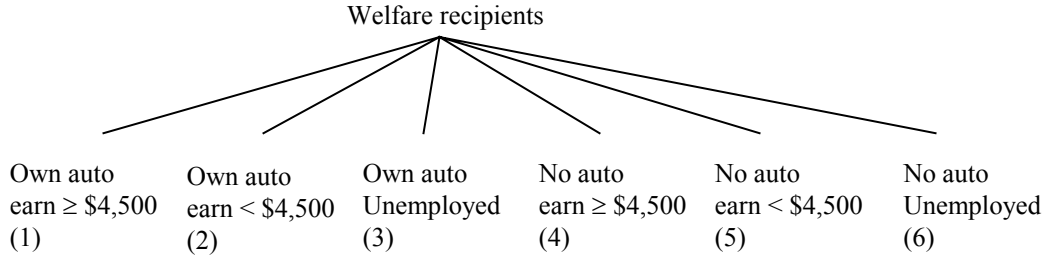


FIGURE 3: MNL structure for earnings model.

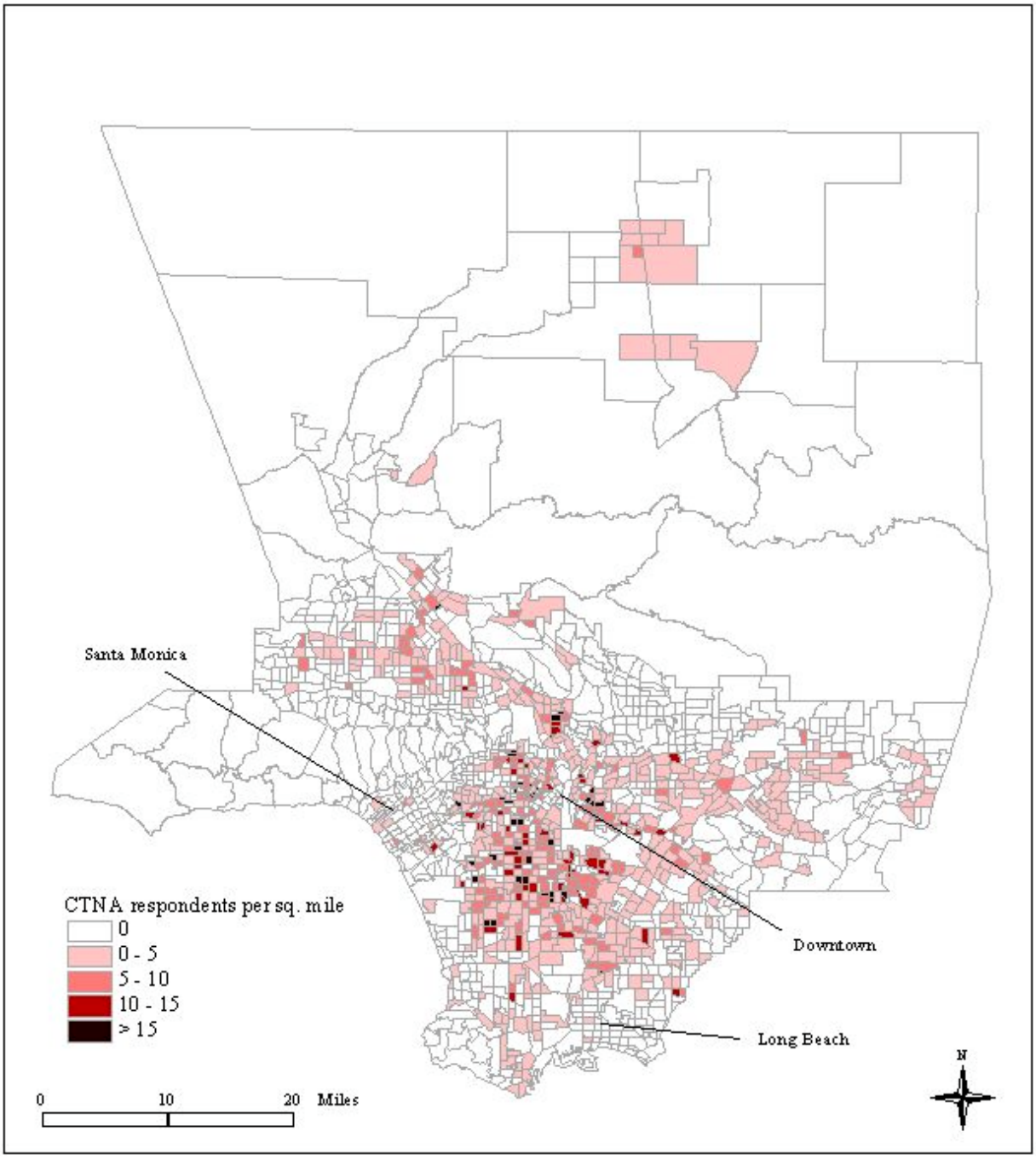
The use of MNL accounts for the selectivity bias, which arises from potential endogeneity between auto ownership and employment outcomes; that is, higher employment outcomes are likely to encourage auto ownership, and if a model is estimated only for those who have autos or for those who do not have autos, estimated parameters are likely to introduce selectivity bias.

2.3 Data

This study's data set combines three different groups of data: socioeconomic and transportation characteristics of individual adults on welfare, neighborhood characteristics,

and the job-access measures. The data on individual welfare-receiving adults are from the CalWORKs Transportation Needs and Assessment (CTNA) survey, conducted between late November 1999 and February 2000. This survey was designed by the Ralph & Goldy Lewis Center for Regional Policy Studies at the University of California, Los Angeles and was implemented by the Survey Research Center at the California State University, Fullerton. The sample includes over 1,500 welfare recipients who participated in the Greater Avenues for Independence (GAIN) welfare-to-work program in late 1999. The data made available for this study exclude personal identifiers and home addresses to protect confidentiality, but residential locations are provided both for census tracts and for TAZs. Figure 4 maps the distribution of CTNA respondents. Residential locations of CTNA respondents are widely spread out across the southern sections of Los Angeles County, although high concentrations are found mostly in south-central sections.

FIGURE 4: Distribution of CTNA Respondents by Census Tract in Los Angeles.



The neighborhood characteristics are drawn from the PL94-171 data, which were released prior to the complete Summary Tape File 3A of the 2000 Census. The neighborhood data and the computed job-access measures are converted to give tract-level data, and then combined with the data on individual welfare recipients.

Table 2 lists the definition and descriptive statistics of the variables. The dependent variables for the employment model and earnings model are EMPLOY and EARNING, respectively, and are also shown in Figures 2 and 3. Job accessibility is incorporated into the MNL models in the form of a ratio of transit to auto job-access measure. The use of the ratio captures the large disparity in the values and variability of job accessibility for auto users and transit users. Personal, household, and neighborhood characteristics are also included, in order to control for the influence of these factors on the employment outcomes. Observations with missing values in any of the variables are excluded.

Note that even for welfare recipients, the majority own autos, accounting for 58% of welfare recipients in the sample. This auto ownership rate may be surprisingly high, but recent studies give similar figures. Green et al. (2000), for example, report that about half of welfare recipients in Alameda County in California have autos available for use. The 1990 PUMS data indicate that of female householders in the labor force living below the poverty line with children under the age of six (as proxy for the welfare population), 69% have autos in Los Angeles County. Ownership of an auto, however, does not necessarily mean that a welfare recipient has dependable mobility. Due to limited means, many welfare recipients have autos that are old and undependable. Indeed, 69% of vehicles owned by CTNA respondents are 10 years old or older, and at high risk for mechanical problems.

TABLE 2 Variable Definitions and Descriptive Statistics

Variable	Description	Statistics	
Dependent Variables		*Count*	*Percentage*
EMPLOY	1: Auto, employed	496	33%
	2: Auto, unemployed	378	25%
	3: No auto, employed	276	18%
	4: No auto, unemployed	368	24%
EARNING	1: Auto, earned >= $4,500 per year	284	19%
	2: Auto, earned < $4,500 per year	209	14%
	3: Auto, unemployed	381	25%
	4: No auto, earned >= $4,500 per year	170	11%
	5: No auto, earned < $4,500 per year	162	11%
	6: No auto, unemployed	312	21%
Explanatory Variables		*Mean*	*Std. Dev.*
AGE18_25	1: 18-25 years old; 0: otherwise	0.22	0.42
AGE45_	1: >=45 years old; 0: otherwise	0.12	0.33
BLACK	1: Non-Hispanic African-American; 0: otherwise	0.28	0.45
HISPA	1: Hispanic; 0: otherwise	0.51	0.50
OTHERR	1: Other minority race; 0: otherwise	0.00	0.05
NOHI	1: Less than high school degree; 0: otherwise	0.41	0.49
SINGLEP	1: Single-parent household; 0: otherwise	0.77	0.42
KIDUND6	1: With child under 6 yrs. old; 0 otherwise	0.35	0.48
JOBACCTD	Ratio of transit to auto job accessibility	0.58	0.43
PCTBLACK	% Blacks	16	20
PCTHISPA	% Hispanics	57	25
Number of observations		1,518	

Note: Observations that have null values in the listed variables are excluded.

3. EMPIRICAL RESULTS

3.1 Results for Employment Probability

Table 3 presents the MNL estimates for employment where the dependent variable is EMPLOY (listed in Table 2) and the base case is alternative 4 (no auto, unemployed). Note that when interpreting MNL coefficients, what matters is *difference* between their values, not the values, *per se*. To clarify each variable's effect, the data given in Table 4 show the extent to which the conditional probability of employment given auto ownership varies when each variable is changed. (These data are calculated for an average welfare recipient in the sample.) The reported significance level of each variable for those who own autos is given by the significance of alternative 1 (auto, employed) relative to alternative 2 (auto, unemployed). The job-access effect is also illustrated in Figure 5.

TABLE 3 Estimation Results of Multinomial Logit Model for Employment

Variable	Coefficient estimate		*t*-statistic
[Appearing for numbered choice]			
Constant [1]	2.078	***	6.42
Constant [2]	1.981	***	5.92
Constant [3]	-0.875	**	-1.99
AGE18_25 [1]	-0.237		-1.22
AGE18_25 [2]	-0.133		-0.64
AGE18_25 [3]	-0.065		-0.30
AGE45_ [1]	-0.133		-0.56
AGE45_ [2]	0.021		0.08
AGE45_ [3]	0.146		0.55
BLACK [1]	-0.827	***	-2.96
BLACK [2]	-1.318	***	-4.33
BLACK [3]	0.073		0.22
HISPA [1]	-0.320		-1.29
HISPA [2]	-0.463	*	-1.79
HISPA [3]	0.276		0.89
OTHERR [1]	0.630		1.07
OTHERR [2]	0.068		0.11
OTHERR [3]	1.343	**	2.04
NOHI [1]	-0.765	***	-4.74
NOHI [2]	-0.471	***	-2.74
NOHI [3]	-0.447	**	-2.49
SINGLEP [1]	-1.002	***	-4.83
SINGLEP [2]	-1.355	***	-6.46
SINGLEP [3]	0.626	**	2.08
KIDUND6 [1]	-0.390	**	-2.28
KIDUND6 [2]	-0.116		-0.64
KIDUND6 [3]	-0.355	*	-1.82
JOBACCTD [1]	0.357	*	1.85
JOBACCTD [2]	0.237		1.15
JOBACCTD [3]	0.457	**	2.12
PCTBLACK [1]	-0.004		-0.81
PCTBLACK [2]	0.004		0.79
PCTBLACK [3]	-0.002		-0.38
PCTHISP [1]	-0.003		-0.78
PCTHISP [2]	-0.003		-0.86
PCTHISP [3]	-0.001		-0.25
Number of observations	1,518		
Log likelihood when parameters set to zero	-2,104		
Log likelihood at convergence	-1,952		
ρ^2	0.07		
Adjusted ρ^2	0.06		

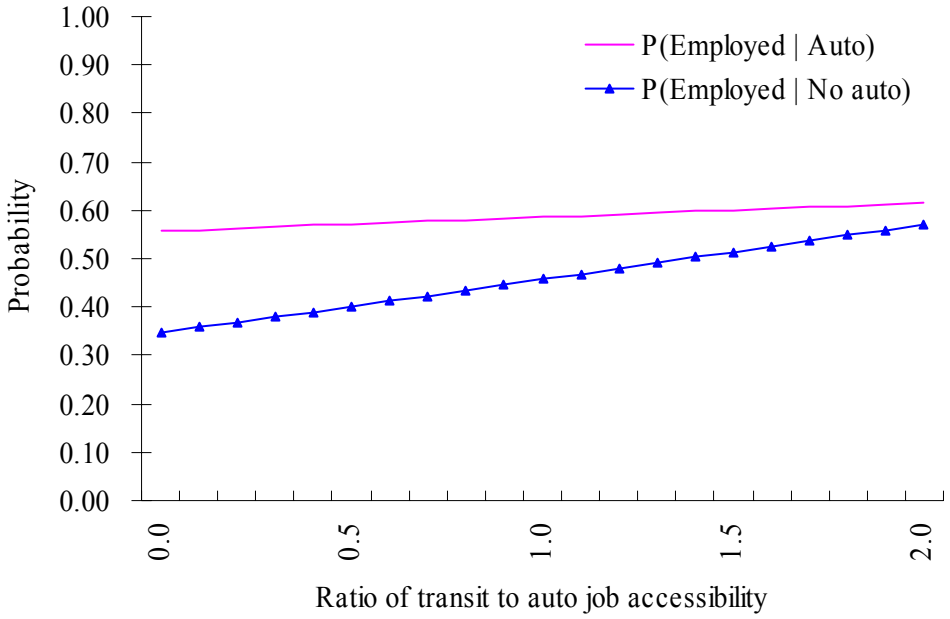
*Note: ***Significant at the 0.01 level; **significant at the 0.05 level; *significant at the 0.10 level.*

TABLE 4 Effects of Changes in Variables on Employment Probabilities by Auto Ownership

Variable	Description	Changes in P(Employed) Auto		Changes in P(Employed) No auto	
AGE18_25	1: 18-25 years old; 0: otherwise	-0.03		-0.02	
AGE45_	1: >=45 years old; 0: otherwise	-0.04		0.04	
BLACK	1: Non-Hispanic African-American; 0: otherwise	0.12	*	0.02	
HISPA	1: Hispanic; 0: otherwise	0.04		0.07	
OTHERR	1: Other minority race; 0: otherwise	0.13		0.32	**
NOHI	1: Less than high school degree; 0: otherwise	-0.07	*	-0.11	**
SINGLEP	1: Single-parent household; 0: otherwise	0.09	**	0.15	**
KIDUND6	1: With child under 6 yrs. old; 0 otherwise	-0.07	*	-0.08	*
JOBACCTD	Ratio of transit to auto job accessibility	0.03		0.09	**
PCTBLACK	% Blacks	-0.08		-0.02	
PCTHISPA	% Hispanics	0.01		-0.01	

*Note: ***Significant at the 0.01 level; **significant at the 0.05 level; *significant at the 0.10 level.*
Continuous variables were changed one standard deviation on either side of the mean vector of the variables.

FIGURE 5: Effect of Job Access on Conditional Probability of Employment given Auto Ownership.



Overall, the results of the estimates indicate that transit-based job accessibility has a significant and positive effect on the employment probability for autoless welfare recipients. Further, job accessibility has a greater effect for autoless recipients than for auto-owning recipients. For autoless welfare recipients, job accessibility is indeed one of the most significant factors in determining employment. Among the observable variables

included in the model, the accessibility effect shows the second strongest significance, following low-level education (no high school diploma). The positive effect of transit-based job accessibility for auto-owning recipients is probably related to the fact that not all auto-owning recipients have full access to reliable autos for daily use. For recipients who do not have constant auto access, higher job accessibility levels for transit users would be helpful in obtaining employment.

Among personal and household characteristics, those of education, single parenthood, and the presence of a child under six years of age significantly affect employment for both autoless and auto-owning welfare recipients. As expected, the lack of a high school diploma strongly reduces the probability of being employed. Single parenthood, on the other hand, significantly increases the employment probability, suggesting that single parents have a strong work incentive to support their families. Welfare recipients with a child under six years of age are significantly less likely to be employed than to be unemployed, which suggests the difficulty of working while taking care of a young child. Interestingly, minority welfare recipients in Los Angeles, overall, do well in employment. This result may be related to the high degree of racial diversity in Los Angles, where 59% of total population in 1990 is non-white. It is also interesting to find that for autoless welfare recipients, the job-access effect has greater significance than do the neighborhood variables, further supporting the conclusion that transit-based job accessibility is indeed an important determinant of employment for autoless welfare recipients.

3.2 Results for Earnings

Table 5 shows the estimation results of the MNL earnings model where the dependent variable is EARNING (reported in Table 2) and the base case is alternative 6 (no auto, unemployed). Table 6 presents a simulation of each variable's effect on the conditional probability of earning $4,500 or more per year given auto ownership. (The probabilities are calculated for an average welfare recipient in the sample.) The significance of each variable for autoless welfare recipient is given by the significance of alternative 4 (no auto, earned ≥ $4,500) relative to alternative 6 (no auto, unemployed), and the significance for welfare recipients with autos is given by the significance of alternative 1 (auto, earned ≥ $4,500) relative to alternative 3 (auto, unemployed).

TABLE 5 Estimation Results of Multinomial Logit Model for Earnings

Variable	Coefficient estimate		*t*-statistic
[Appearing for numbered choice]			
Constant [1]	1.478	***	3.91
Constant [2]	1.450	***	3.71
Constant [3]	2.409	***	6.89
Constant [4]	-0.678		-1.36
Constant [5]	-1.601	***	-2.63
AGE18_25 [1]	-0.309		-1.30
AGE18_25 [2]	0.299		1.23
AGE18_25 [3]	-0.161		-0.72
AGE18_25 [4]	0.025		0.10
AGE18_25 [5]	0.327		1.31
AGE45_ [1]	-0.530	*	-1.93
AGE45_ [2]	-0.542	*	-1.74
AGE45_ [3]	-0.017		-0.07
AGE45_ [4]	-0.047		-0.16
AGE45_ [5]	-0.827	**	-2.09
BLACK [1]	-0.516		-1.54
BLACK [2]	-0.872	**	-2.49
BLACK [3]	-1.247	***	-4.08
BLACK [4]	0.344		0.84
BLACK [5]	0.152		0.37
HISPA [1]	0.067		0.23
HISPA [2]	-0.233		-0.78
HISPA [3]	-0.524	**	-2.00
HISPA [4]	0.510		1.35
HISPA [5]	0.367		0.96
OTHERR [1]	-0.022		-0.04
OTHERR [2]	-0.644		-1.01
OTHERR [3]	-0.239		-0.48
OTHERR [4]	-0.371		-0.43
OTHERR [5]	0.539		0.76
NOHI [1]	-0.682	***	-3.57
NOHI [2]	-0.599	***	-2.93
NOHI [3]	-0.624	***	-3.47
NOHI [4]	-0.515	**	-2.39
NOHI [5]	-0.188		-0.87
SINGLEP [1]	-1.533	***	-6.32
SINGLEP [2]	-1.149	***	-4.39
SINGLEP [3]	-1.450	***	-6.25
SINGLEP [4]	-0.468		-1.52
SINGLEP [5]	0.892	*	1.91
KIDUND6 [1]	-0.275		-1.36
KIDUND6 [2]	-0.321		-1.47
KIDUND6 [3]	-0.170		-0.89
KIDUND6 [4]	-0.220		-0.95
KIDUND6 [5]	-0.243		-1.04
JOBACCTD [1]	0.192		0.91
JOBACCTD [2]	0.129		0.56
JOBACCTD [3]	0.119		0.58
JOBACCTD [4]	0.192		0.79
JOBACCTD [5]	-0.015		-0.05
PCTBLACK [1]	0.002		0.37
PCTBLACK [2]	-0.002		-0.29
PCTBLACK [3]	0.001		0.27
PCTBLACK [4]	-0.001		-0.19
PCTBLACK [5]	0.003		0.48
PCTHISP [1]	0.003		0.59
PCTHISP [2]	-0.003		-0.69
PCTHISP [3]	-0.003		-0.76
PCTHISP [4]	0.005		1.04
PCTHISP [5]	-0.001		-0.13
Number of observations	1,518		
Log likelihood when parameters set to zero	-2,722		
Log likelihood at convergence	-2,515		
ρ^2	0.08		
Adjusted ρ^2	0.05		

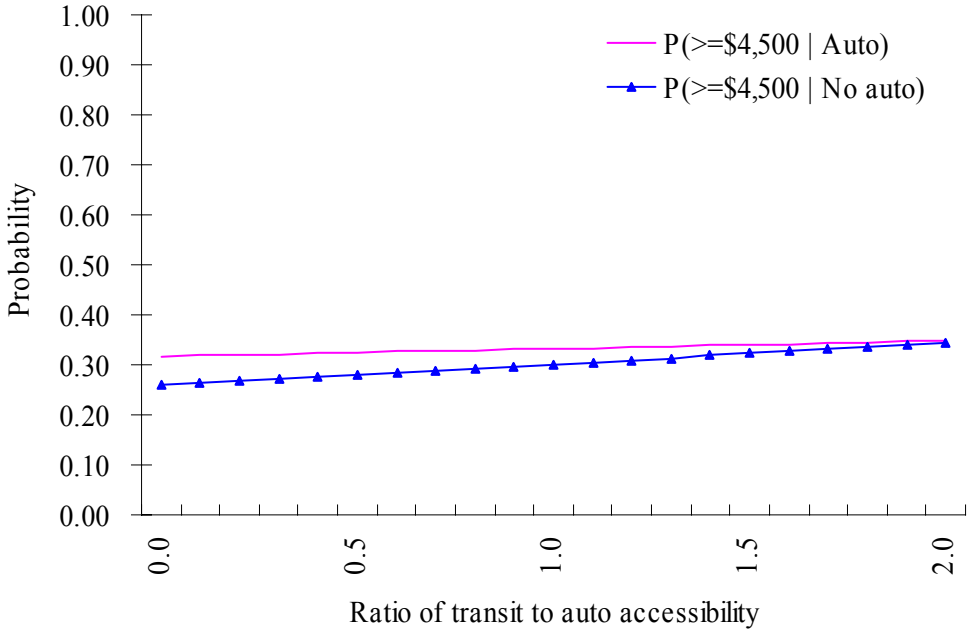
*Note: ***Significant at the 0.01 level; **significant at the 0.05 level; *significant at the 0.10 level.*

TABLE 6: Effects of Changes in Variables on Probabilities of Earning $4,500 or More per Year

Variable	Description	Changes in P(>=$4,500) Auto		No auto	
AGE18_25	1: 18-25 years old; 0: otherwise	-0.07		-0.02	
AGE45_	1: >=45 years old; 0: otherwise	-0.07	**	0.03	
BLACK	1: Non-Hispanic African-American; 0: otherwise	0.13	**	0.06	
HISPA	1: Hispanic; 0: otherwise	0.11	**	0.08	
OTHERR	1: Other minority race; 0: otherwise	0.08		-0.10	
NOHI	1: Less than high school degree; 0: otherwise	-0.01		-0.09	**
SINGLEP	1: Single-parent household; 0: otherwise	-0.04		-0.15	
KIDUND6	1: With child under 6 yrs. old; 0 otherwise	-0.01		-0.03	
JOBACCTD	Ratio of transit to auto job accessibility	0.01		0.03	
PCTBLACK	% Blacks	0.02		-0.02	
PCTHISPA	% Hispanics	0.06		0.06	

*Note: ***Significant at the 0.01 level; **significant at the 0.05 level; *significant at the 0.10 level.*
Continuous variables were changed one standard deviation on either side of the mean vector of the variables.

FIGURE 6 Effect of Job Access on Conditional Probability of Earning $4,500 or more per year Given Auto Ownership



The job-access effect is further illustrated in Figure 6. As in the case of the employment model, transit-based job accessibility has a positive effect on the likelihood of earning $4,500 or more per year for both autoless and auto-owning welfare recipients, although the effect is not statistically significant. This result suggests that improving job accessibility for transit users would help autoless welfare recipients obtain jobs, but it would not give significant advantage in obtaining full-time work. In fact, among the observable characteristics, only educational attainment matters significantly for autoless welfare recipients. If an average autoless welfare recipient does not have a high school diploma, her probability of attaining annual earnings of $4,500 or higher would be lessened by 0.09.

It is interesting to find that among autoless welfare recipients, those who place themselves in the category of *other-race* (other than white, African-American, Hispanic, and Asian, listed as OTHERR in Table 2) experience a decreased probability of earning at least $4,500 per year (this effect is not statistically significant) but experience a significantly increased probability of employment. This result suggests that other-race welfare recipients without autos are significantly more likely to get jobs but are less likely to obtain and keep full-time work. A similar result is found for single parenthood. For both autoless and auto-owning welfare recipients, single parenthood significantly increases the probability of employment but lowers the likelihood of earning $4,500 or more per year (although the latter effect is not statistically significant). Single parents tend to work to support their families, but perhaps holding full-time work is a difficult task.

It should be noted that potential endogeneity between residential choices and employment outcomes presents a limitation in the analysis. To the extent that an improvement in employment outcomes enables welfare recipients to change their residential locations, the estimated job-access effect is biased. In order to avoid this endogeneity problem, a number of spatial mismatch studies focus on youths living at home, because youths' residential locations are largely predetermined by their parents (e.g., Ihlanfeldt and Sjoquist, 1991; Raphael, 1998). The inclusion of only welfare recipients, however, is likely to reduce this bias, as welfare recipients have limited resources to finance transaction costs associated with moving.

4. CONCLUSIONS

The results of the empirical analysis indicate that improving job accessibility for transit commuters makes a significant difference in facilitating welfare-to-work transition for autoless welfare recipients. They show that for welfare recipients without autos, transit-based job accessibility has a significant and positive effect on the employment probability, although the job-access effect on the probability of earning $4,500 or more per year is not statistically significant. The study further reveals that job accessibility has a greater effect for autoless welfare recipients than for recipients who own autos.

Take, for example, an area in Inglewood that has a relatively high concentration of welfare recipients. Suppose that job accessibility for transit users in this area is improved from the current low level of 400 to 1284, which yields a relatively high ratio of transit to auto job accessibility for a section in Century City. A simulation based on the estimates indicates

that if, for instance, a typical Hispanic welfare recipient did not have an auto, her employment probability would increase by 0.06. If the same Hispanic welfare recipient had an auto, on the other hand, her employment probability would also increase, but by the smaller probability of 0.01.

An important policy implication of this study is that greater efforts must be made to improve job accessibility for people who do not have access to autos. The job-access measures computed by travel mode exhibited a considerable disparity in the number of accessible job opportunities for transit users and auto users, suggesting that current levels of transit mobility and job accessibility are inadequate. Given the continuing trend of job suburbanization, already low levels of job accessibility for people who depend on public transit are likely to decline further, and the auto/transit disparity is likely to broaden.

Note that improvements in transit job accessibility will be helpful not only for autoless welfare recipients (a rather small population), but also for larger populations including low-skilled workers as a group. The author finds, for example, that greater transit-based job accessibility significantly enhances employment outcomes for low-skilled autoless and auto-owning workers in San Francisco and Los Angeles (Kawabata, 2002). To be sure, the population who would benefit most would be those who depend on public transit, but people who have autos but cannot use them at all times would also benefit greatly.

This study also provides perspectives on the following two most common approaches to improving job accessibility for transit users: economic development and improvements in transportation mobility. Economic development aims to improve job accessibility by increasing the number of job opportunities. While economic development in transit-rich urban areas is helpful, economic development in low-density suburban areas is unlikely to be effective for people without access to autos; newly created suburban jobs would be practically inaccessible. When economic development programs are combined with job-access planning, however, it can boost job accessibility over time.

Improvements in transportation mobility, on the other hand, augment the ability to move between places, which in turn enhances job accessibility. To improve mobility for transportation-disadvantaged people, researchers typically favor either programs to facilitate auto ownership (e.g., Ong, 1996; Taylor and Ong, 1995) or programs to improve public transportation services (e.g., Hughes, 1995; Lacombe, 1998). Programs facilitating auto ownership are a short-term solution**,** and access to an auto can dramatically increase the number of accessible job opportunities, as this study's job-access measures indicate. Using public funds to promote auto ownership, however, is politically controversial. Additionally, increasing numbers of planners and policy makers support the ideas of smart growth and transit-oriented development, which may make the encouragement of auto ownership an unfavorable option.

A well-supported alternative option is the provision of vanpooling and ridesharing services. These services may not be as convenient as auto ownership, but they can offer some of the flexibility and rapid access of automobiles. Moreover, these services can be adjusted to meet specific transportation needs such as childcare stops. They can also offer guaranteed-

ride-home programs, which reimburse travel expense for emergency transportation. Such services might be especially valuable for welfare mothers with young children.

There is clearly a great need for improvements to transit services, including increased frequency of services, extended service hours, expanded service areas and routes, simplified fare structures, and improved information on available transportation resources. A unique new service is Bus Rapid Transit (BRT), which is being planned and implemented in major U.S. metropolitan areas including Los Angeles and Boston. As it combines the flexibility of buses and the quality of rail transit, BRT enhances transit mobility and connectivity. These improvements in transit services can be used not only by welfare recipients but also by the general public. The improved services would also facilitate non-work trips, such as trips to job training, schools, childcare, and shops. Furthermore, they would give employers access to a larger pool of potential employees.

Because transportation needs vary for different individuals in different locations, planners must consider a wide range of flexible and sustainable transportation options. Transportation needs and concerns change as people proceed from job training to part-time, full-time, and long-term jobs. Moreover, transportation is not the only barrier. Among welfare recipients, the problem of multiple barriers, such as skills, race, and health, is also common (Danziger et al., 2000; Zedlewski, 1999). In urban settings, then, in which job accessibility depends so strongly on transportation, job-access planners must collaborate closely with existing human resource and social service organizations to better serve the needs of disadvantaged people trying to advance in the labor market.

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