Immigrants and Transportation: An Analysis of Immigrant Workers' Work Trips

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Abstract

A significant increase in immigrant populations in the United States poses various social and economic issues. Transportation mobility is one of the most crucial components for facilitating economic activities of new immigrants. Using the 2006 Integrated Public Use Microdata Series, this study analyzed the work-trip mode of new immigrants in comparison with nonimmigrants. This study found that workers' immigration history is associated with their work-trip modes and immigrants are still more likely to use nondrive-alone trip modes after controlling for various personal, household, and other characteristics. Female immigrants, however, are less likely to use public transit after adjusting various covariates, including household income and vehicle availability. Also, a lower propensity toward carpooling among highly educated immigrants is noteworthy. The notable increase in immigrant populations requires special efforts to support carpooling or community-based transit service and requires more attention in both research and practice.

Introduction

The United States has experienced a significant increase in immigrant populations in recent decades. One of the biggest challenges immigrants face in their process to assimilate into society is finding a job. Labor market conditions and job accessibility are important determinants of new immigrants' location choices (Jaeger, 2007); however, transportation is a critical element in job accessibility. A positive relationship between transportation access and economic welfare is evident for immigrants as well as nonimmigrants across all racial and ethnic groups. Blumenberg (2008) reported that one of the most significant determinants of employment for both immigrants and nonimmigrants who are on welfare assistance is unlimited automobile access (Blumenberg, 2008).

It is often believed that many immigrants reside in urban areas (Valenzuela, Schweitzer, and Robles, 2005), and they are increasingly segregated in residential location over the decades in general (Cutler, Glaeser, and Vigdor, 2008). A study in Los Angeles, California, however, reported substantial differences among ethnic groups in residential location patterns during their assimilation (Yu and Myers, 2007). A national study based on census data reported different residential location choices by national origin of immigrants, choices that are associated with the creation and growth of ethnic enclaves in major metropolitan areas in the United States (Borjas, 2002). Hanlon, Vicino, and Short (2006) reported that U.S. metropolitan areas are becoming less urban-suburban dichotomous and suburban communities are becoming increasingly diverse with the emergence of poor, African-American, and immigrant enclaves. Immigrants are not homogenous. Friedman and Rosenbaum (2007) reported that many foreign-born members of households reside in significantly better suburban neighborhoods than do their native-born counterparts, based on the 2001 panel of the American Housing Survey. They also reported that race/ethnicity is a more consistent predictor than nativity status for households' neighborhood conditions in general.

Existing studies on residential location or settlement of immigrants indicate that the immigrants are not necessarily urban residents, and, therefore, they may face the same transportation problems as nonimmigrants when they do not drive. Blumenberg (2008) reported that one of the greatest difficulties low-income immigrants face in travel for work is age-related unreliability of their vehicles. Existing studies on immigrants' transportation indicate that immigrants, new immigrants in particular, often heavily patronize public transit. One study reported that urbanized areas with more recent immigrants tend to have higher transit ridership (Taylor et al., 2009). Myers (1997) reported that new immigrants, regardless of their ethnic backgrounds, rely heavily on public transit based on cross-sectional 1980 and 1990 Census data. Myers (1997), however, also found that new immigrants' transit use declines dramatically after they gain an additional 10 years of residence in the United States. This change is especially substantial among women, who increase their rate of driving alone noticeably. This finding indicates that immigrants adopt their travel behaviors during assimilation as their economic conditions improve.

Several studies have reported that vehicle availability, income level, and limited accessibility or inadequacy of public transportation (particularly in suburban communities) are related to personal automobile use (for example, de Palma and Rochat, 2000). Travel behavior is related to the household's residential location (Srinivasan and Ferreira, 2002). In general, service frequency and fare levels are significant factors associated with transit use (Taylor et al., 2009). For bicyclists, hindrances in road use (that is, the number of stops bicyclists must make on their routes) and safety are important factors associated with bicycle use (Rietveld and Daniel, 2004). Other studies (for example, Ye, Pendyala, and Gottardi, 2007) have scrutinized the complex relationship between mode choice and trip chain. Work-trip mode is significantly associated with trip chain for other intermediate activities (Krygsman, Arentze, and Timmermans, 2007).

A number of studies examined factors associated with work-trip mode choice and its effect on congestion. Vehicle availability is often considered one of the most significant factors in work-trip mode choice (Titheridge and Hall, 2006). Instant availability, convenience, flexibility, and high speed that automobiles offer are not comparable to other alternative transportation modes (Anable and Gatersleben, 2005; Kim and Ulfarsson, 2008). In addition, the automobile is an ideal mode

of transportation for trip chains. One study reported that people do not necessarily minimize their travel time or always choose the most cost-efficient mode or route, even when they are making work trips (Anable and Gatersleben, 2005). That study found that instrumental factors such as flexibility, convenience, cost, and predictability are important factors in work-trip mode choice, but affective factors such as a sense of control and freedom also are significantly relevant factors. Therefore, Anable and Gatersleben (2005) argued that nonautomobile modes need to increase their competitiveness to satisfy people who are considering the affective factors.

One study reported that sticks, such as congestion pricing and parking regulation, have greater influence than carrots, such as improving public transit service and other alternatives, on decreasing automobile use for work trips (O'Fallon, Sullivan, and Hensher, 2004). For nonmotorized transportation alternatives in work trips, one study reported that a completely segregated bicycle path, other en-route and trip-end facilities, and direct financial incentives (for example, daily payment to cycle to work) can significantly increase bicycle use for work trips (Wardman, Tight, and Page, 2007), and work trips on foot are significantly associated with the level of local job opportunities (Titheridge and Hall, 2006).

Urban form and land use characteristics have been reported as important factors in work-trip mode choice and in nonwork-trip mode choice. Schwanen and Mokhtarian (2005) reported that neighborhood physical structure or design, personality, and lifestyle are also associated with commuting mode choice. For example, consonant neighborhood type, proenvironment attitude, lower levels of adventure seeking, frustration, and status-seeking attitudes are associated with nonprivate automobile use.

Although the number and proportion of immigrants in U.S. society have been growing significantly, and the importance of transportation access is clear to immigrants, limited studies have examined immigrants' work trips, partly because of limited transportation survey data with detailed information on survey participants' immigration history. Immigrants are not homogenous. Better understanding of immigrants' travel behavior (work travel in particular) is important in the development of transportation systems and policy that accommodate transportation needs of this growing segment of population. By analyzing immigrants' commuting trip mode choice by their immigration tenure in comparison with nonimmigrants as a function of various personal, household, and residential environment factors, this study contributes to a deeper understanding of work-trip behavior in the increasing immigrant population.

Data and Methods

This study analyzed the 2006 Integrated Public Use Microdata Series (IPUMS) data that contain representative individual samples of U.S. populations along with various personal, household, employment, and housing characteristics information (Ruggles et al., 2008). The data also contain immigration history of individuals, including year of entry and citizenship status. The study classified individuals into four groups based on their immigration history: immigrants who entered the United States 1 year ago or less (new immigrants), more than 1 year ago and less than 5 years ago (intermediate-term immigrants), 5 years ago or more (long-term immigrants), and nonimmigrants. The data include 2,441 individual working-age individuals aged 18 to 64 among new immigrants.

Because these new immigrants are substantially fewer than other immigrants and nonimmigrants, a stratified random sampling method was used to select 2,441 samples from each group in the IPUMS data.

This study analyzes individuals' commuting mode choices using a robust statistical method. The analysis of mode choice for commuting trips uses a discrete choice modeling approach, the multinomial logit (MNL) model. The MNL model assumes each individual n associates a utility with each alternative mode i and that this utility is separable into an observable part $\beta_i \mathbf{x}_{ni}$ and unobservable part ε_{ni}, where β_i are estimable mode-specific coefficients; $\mathbf{x}_{ni}$ are observable characteristics of the modes, tripmakers, and environment; and the error terms ε_{ni} are on independently and identically distributed type 1 extreme value (the Gumbel distribution). The analysis also assumes that each individual tripmaker selects the mode with the highest utility. The probability of individual n selecting mode i out of I modes is:

$$P_{ni} = \frac{e^{\beta_i \mathbf{x}_{ni}}}{\sum_{i'=1}^{I} e^{\beta_{i'} \mathbf{x}_{ni'}}}. \tag{1}$$

Because the data include no mode-specific information concerning utility, it is allowed to drop the index i on the observed data $\mathbf{x}_n$. In this case, the MNL model is unidentified up to a scale because it is sensitive only to differences in utility; therefore, one utility must be arbitrarily, and without loss of generality, fixed and is most conveniently set to zero. In this study, *Drive Alone* is chosen as the base case and other modes (*Carpool*, *Walk/Bike*, *Other*) are compared. The coefficients of the model can, therefore, be interpreted through their effect on the log-odds ratio of each alternative to the base case *Drive Alone*.

$$\ln \frac{P_{ni|i \neq 1}}{P_{n1}} = \ln \frac{e^{\beta_i \mathbf{x}_n}}{e^{\beta_i \mathbf{x}_n = 0}} = \beta_i \mathbf{x}_n. \tag{2}$$

The coefficients in this model are estimated using the method of maximum likelihood, which also provides standard errors of the estimates. To focus on the most statistically significant factors, we restrict coefficients that are not significantly different from zero at the 95-percent level of significance (p-value > 0.05).

The MNL model assumes that probabilities of the alternative choices are independent of each other. This property is called the independence of irrelevant alternatives (IIA). MNL models are valid when the outcome categories are plausibly distinct (McFadden, 1973). Hausman and McFadden (1984) proposed a Hausman-type test of the IIA property. The Hausman test for the MNL model was tested to see whether the IIA assumption holds. Also, various tree structures were tested in the nested logit (NL) model framework; however, in each tested NL model, a statistical test for the Inclusive Value (IV) parameter resulted in the legitimacy of the MNL model.

Descriptive Analysis

As seen in exhibit 1, which shows personal and household characteristics of the samples by their immigration history, the immigrant population in the United States is younger than the nonimmigrant population, and immigrant gender is predominantly male. Although the gap between male and female distribution narrows based on number of years in the country, nonimmigrants have the most equal gender distribution. Compared with nonimmigrants, the immigrant population has more people with Asian and other/mixed racial backgrounds. The largest population for both immigrants and nonimmigrants is White. The nonimmigrant population is predominantly non-Hispanic. These distributions are more equal in the immigrant population, in which Hispanics account for approximately one-half.

When compared with nonimmigrants, immigrants have a larger number of people with either very little education (*less than high school*) or the highest education (*college degree, graduate degree*), while nonimmigrants have higher distributions of people with *high school* or *some/tech college*. The largest immigrant population has *less than high school* education, while the largest nonimmigrant population has *high school* or *some/tech college*. When compared with nonimmigrants and other immigrant groups, new immigrants have the highest population with the highest education (*college degree, graduate degree*). Nonimmigrants have a larger population with *physical disability* than do

Exhibit 1

Characteristics of Workers by Immigration History (1 of 2)

		Immigrants ≤ 1 Year	Immigrants 1 < Years < 5	Immigrants ≥ 5 Years	Non-immigrants
Age	18–24	28.1%	28.2%	7.4%	12.6%
	25–49	66.2%	64.9%	67.6%	58.0%
	50–64	5.7%	6.9%	25.1%	29.4%
	Mean	31.3 yrs.	31.6 yrs.	41.0 yrs.	41.1 yrs.
	(std. dev.)	(9.5) yrs.	(9.9) yrs.	(11.1) yrs.	(12.3) yrs.
Gender	Female	30.3%	33.9%	43.0%	49.1%
	Male	69.7%	66.1%	57.0%	50.9%
Race	White	49.2%	46.0%	41.9%	85.2%
	African	6.5%	6.9%	8.8%	9.5%
	Asian	26.8%	22.7%	27.0%	1.1%
	Other or mixed	17.5%	24.5%	22.2%	4.2%
Ethnicity	Hispanic	42.8%	54.5%	43.5%	5.2%
	Non–Hispanic	57.2%	45.5%	56.5%	94.8%
Education level	Less than high school	26.3%	31.7%	24.9%	6.3%
	High school	19.2%	23.9%	22.2%	28.2%
	Some/tech college	11.0%	14.1%	20.5%	32.8%
	College degree	24.1%	16.6%	18.4%	20.0%
	Graduate degree	19.4%	13.7%	14.0%	12.7%
Physical disability	Yes	1.9%	3.0%	3.7%	6.0%
	No	98.1%	97.0%	96.3%	94.0%

Exhibit 1

Characteristics of Workers by Immigration History (2 of 2)

		Immigrants ≤ 1 Year	Immigrants 1 < Years < 5	Immigrants ≥ 5 Years	Non-immigrants
Ability to speak English	English as first language	11.7%	9.3%	17.0%	93.8%
	Very well	25.1%	20.4%	37.6%	5.3%
	Well	19.8%	18.2%	22.5%	0.5%
	Not well	17.0%	26.2%	16.6%	0.3%
	Not at all	26.5%	25.9%	6.4%	0.0%
Family size (number of people)	One	33.8%	24.1%	11.7%	19.9%
	Two	19.0%	21.3%	19.6%	28.5%
	Three	14.6%	17.6%	19.3%	21.8%
	Four or more	32.7%	37.0%	49.4%	29.8%
Household income	Less than $30,000	32.1%	22.7%	16.3%	12.0%
	$30,000–$49,999	23.0%	23.5%	20.9%	17.9%
	$50,000–$74,999	17.7%	22.6%	21.2%	23.7%
	$75,000–$99,999	10.7%	14.7%	13.9%	17.7%
	$100,000 or more	16.5%	16.6%	27.8%	28.7%
	Mean	$59,475	$65,113	$83,175	$86,965
	(std. dev.)	($57,837)	($50,976)	($76,286)	($73,559)
Home-ownership	Own	17.6%	24.6%	65.5%	79.1%
	Rent	82.4%	75.4%	34.5%	20.9%
Residential building: year built	2000 or later	13.2%	11.6%	11.9%	11.6%
	1980–1999	31.6%	28.8%	28.5%	31.4%
	1960–1979	31.1%	31.2%	26.4%	25.5%
	1940–1959	12.2%	14.8%	20.1%	16.3%
	Before 1940	11.9%	13.6%	13.2%	15.2%
Employment sector	Private	88.2%	88.2%	78.0%	72.6%
	Public	7.1%	6.6%	10.9%	19.2%
	Self-employed	4.4%	5.0%	11.0%	8.1%
	Work without pay	0.3%	0.2%	0.2%	0.1%
Employment industry	Administration	1.4%	1.1%	2.6%	6.1%
	Agriculture	4.2%	3.5%	2.0%	1.0%
	Construction	14.0%	16.9%	9.3%	7.2%
	Education	8.3%	5.8%	6.0%	11.2%
	Entertainment	13.0%	14.5%	10.2%	6.3%
	Extraction (oil/mine)	0.7%	0.4%	0.3%	0.3%
	Finance	3.2%	3.7%	6.3%	7.4%
	Media/information	1.8%	1.2%	1.8%	3.1%
	Medical	6.1%	6.4%	11.3%	10.8%
	Manufacturing	13.3%	12.3%	14.7%	11.1%
	Professional	16.1%	14.0%	9.7%	9.3%
	Retail	7.8%	7.9%	8.7%	11.3%
	Service	4.5%	5.6%	6.9%	3.4%
	Transportation	1.7%	2.6%	4.1%	4.5%
	Wholesale	3.0%	2.9%	3.8%	3.9%
	Other (military, utility, etc.)	1.0%	1.2%	2.2%	3.1%

immigrants. Most nonimmigrants and only a small percentage of immigrants speak English as a first language. About one-fourth of new and intermediate-term immigrants speak no English.

Immigrants tend to have larger families than do nonimmigrants. More new and intermediate-term immigrants have families of one person than do nonimmigrants, but long-term immigrants are least likely to have families of one. Average household income increases based on the number of years in the country for immigrants and is highest for nonimmigrants. The largest population of new immigrants earns less than $30,000 a year, while the largest population of nonimmigrants earns $100,000 or more. Nonimmigrants and long-term immigrants have a comparable percentage earning $100,000.

Homeownership also increases the longer an immigrant is in the country; homeownership is highest for nonimmigrants. Both immigrants and nonimmigrants tend to live in residential buildings built between 1980 and 1999, with the exception of intermediate-term immigrants, who tend to live in buildings built between 1960 and 1979. Higher percentages of immigrants live in buildings dating from 2000 or later and those built between 1960 and 1979 than do nonimmigrants.

Both immigrants and nonimmigrants are more likely to work in the private sector, although percentages decrease the longer an immigrant has lived in the country; nonimmigrants have the lowest percentage. Nonimmigrants are more likely to work in the public sector than are immigrants. Compared with all other groups, long-term immigrants are more likely to be self-employed. Immigrants also have relatively high employment distributions in entertainment and manufacturing. New and intermediate-term immigrants tend to have relatively high employment in construction and professional industries, while nonimmigrants are employed in the education, medical, manufacturing, and retail industries. Long-term immigrants have a higher percentage of employment in the medical industry than do nonimmigrants.

Exhibit 2 shows a descriptive analysis of commuting travel characteristics of individuals by their immigration history. In transportation, immigrants are increasingly likely to have two or more vehicles in their households the longer they have been in the country, and nonimmigrants have the highest percentage of two or more vehicles. Nonimmigrants also have shorter average commuting times than do immigrants.

For both immigrants and nonimmigrants, those who drive alone spend about 23 to 25 minutes on their commute. Average carpooling commute time increases for immigrants according to length of time in the country and is greatest for nonimmigrants. Long-term immigrants spend more time commuting on public transit than do nonimmigrants and the other immigrant populations. New and intermediate-term immigrants spend more time commuting by bicycling or walking than do long-term immigrants and nonimmigrants.

Immigrants and nonimmigrants work about the same number of hours per week, close to the standard 40 hours per week. A slightly higher percentage of the immigrant population works the 40-hour week than does the percentage of the nonimmigrant population. Both immigrants and nonimmigrants tend to arrive at work between 6:00 and 8:59 a.m.

Exhibit 2

Work Trip Characteristics by Immigration History

		Immigrants 1 Year	Immigrants 1 < Years < 5	Immigrants 5 Years	Non-immigrants
Number of vehicles in household	None	26.7%	16.1%	6.7%	2.8%
	One	37.2%	33.3%	21.1%	17.7%
	Two or more	36.1%	50.5%	72.2%	79.5%
Commuting mode	Drive alone	30.5%	45.0%	69.3%	82.5%
	Carpool	31.4%	28.7%	15.4%	10.5%
	Public transit	17.2%	14.0%	10.1%	3.2%
	Walk/bike	16.5%	8.4%	3.9%	2.7%
	Other	4.3%	3.9%	1.4%	1.1%
Commuting time	1–15 min.	41.7%	38.0%	35.3%	43.8%
	16–30 min.	36.5%	37.0%	36.7%	32.6%
	31–60 min.	10.2%	13.2%	14.3%	13.4%
	More than 60 min.	11.7%	11.8%	13.7%	10.2%
	Mean	25.9	27.1	29.1	25.6
	(std. dev.)	(21.0) min.	(21.3) min.	(23.5) min.	(23.5) min.
Commuting time by mode: mean (std. dev.)	Drive alone	23.5 (17.4) min.	23.0 (16.2) min.	25.3 (18.3) min.	24.3 (20.8) min.
	Carpool	25.7 (19.3) min.	29.3 (23.8) min.	29.9 (22.5) min.	31.2 (25.1) min.
	Public transit	41.3 (27.2) min.	42.2 (24.8) min.	49.9 (27.2) min.	47.2 (30.3) min.
	Walk/bike	14.4 (10.8) min.	14.8 (10.2) min.	12.8 (9.3) min.	11.1 (8.7) min.
	Other	26.3 (21.6) min.	34.5 (36.3) min.	29.7 (30.8) min.	42.9 (51.8) min.
Work hours per week	Less than 30	10.6%	11.9%	9.2%	11.3%
	30–39	11.1%	11.1%	11.1%	12.9%
	40	52.3%	53.5%	53.2%	46.0%
	41–50	16.4%	14.7%	16.4%	19.6%
	51 or more	9.7%	8.7%	10.1%	10.2%
	Mean	40.5	39.8	40.9	40.4
	(std. dev.)	(11.7) hrs.	(11.6) hrs.	(11.5) hrs.	(11.6) hrs.
Arrival time at work	3:00 a.m.–5:59 a.m.	8.0%	8.0%	9.3%	8.6%
	6:00 a.m.–8:59 a.m.	63.2%	60.8%	61.2%	68.2%
	9:00 a.m.–2:59 p.m.	20.1%	19.5%	21.1%	15.2%
	3:00 p.m.–5:59 p.m.	4.2%	6.8%	4.5%	4.0%
	6:00 p.m.–8:59 p.m.	2.4%	2.0%	1.5%	1.8%
	9:00 p.m.–2:59 a.m.	2.1%	3.0%	2.3%	2.3%

Model Results

Exhibit 3 shows the results of the MNL model on work-trip mode choice of the samples by work-ers' immigration history. Various covariates, shown in exhibits 1 and 2, and a series of interaction variables with immigration history were tested in the model to identify the effects of immigration background on work-trip mode choice. *Drive alone* is the base case in the model. All the coef-

Exhibit 3

Multinomial Logit Analysis of Workers' Commuting Mode Choice (1 of 2)

	Carpool		Public Transit		Walk/Bike		Other	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Constant	– 1.073	0.150 ‡	– 2.955	0.239 ‡	– 2.005	0.253 ‡	– 5.603	0.464 ‡
Immigration								
Immigrants (≤ 1 year)	1.394	0.146 ‡	2.395	0.230 ‡	2.266	0.205 ‡	2.810	0.268 ‡
Immigrants (1 < years < 5)	0.626	0.133 ‡	1.476	0.215 ‡	1.177	0.211 ‡	1.859	0.256 ‡
Immigrants (≥ 5 years)			0.499	0.235				
Age	– 0.021	0.003 ‡	– 0.021	0.004 ‡	– 0.025	0.004 ‡	– 0.015	0.007
Household income ($1,000)								
*Immigrants (≥ 5 years)	0.002	0.000 †			– 0.005	0.002	0.004	0.001 †
*Nonimmigrants	– 0.005	0.001 ‡			– 0.007	0.002 †		
Race								
African	0.359	0.087 ‡	0.405	0.124 †	– 0.956	0.203 ‡		
Asian			0.334	0.090 ‡				
Ethnicity								
Hispanic							0.866	0.156 ‡
*Immigrants (≤ 1 year)	0.497	0.124 ‡						
*Immigrants (1 < years < 5)	0.442	0.122 ‡						
*Immigrants (≥ 5 years)	0.385	0.115 ‡						
Gender								
Female	– 0.317	0.061 ‡						
*Immigrants (≤ 1 year)			– 0.391	0.123 †				
*Immigrants (≥ 5 years)			– 0.423	0.154 †				
Vehicle availability	– 0.238	0.042 ‡	– 0.549	0.053 ‡	– 0.386	0.052 ‡	– 0.371	0.075 ‡
(number of vehicles	– 0.277	0.039 ‡	– 0.588	0.049 ‡	– 0.423	0.056 ‡	– 0.386	0.075 ‡
in household/	– 0.258	0.043 ‡	– 0.532	0.055 ‡	– 0.396	0.079 ‡	– 0.618	0.091 ‡
number of adults)	– 0.171	0.072	– 0.804	0.099 ‡	– 0.598	0.109 ‡		
*Immigrants (≤ 1 year)								
*Immigrants (1 < years < 5)								
*Immigrants (≥ 5 years)								
*Nonimmigrants								
College or graduate	– 0.451	0.119 ‡					– 1.044	0.268 ‡
degree	– 0.472	0.130 ‡						
*Immigrants (≤ 1 year)	– 0.586	0.154 ‡						
*Immigrants (1 < years < 5)								
*Immigrants (≥ 5 years)								
*Nonimmigrants			0.699	0.238 †				

Exhibit 3

Multinomial Logit Analysis of Workers' Commuting Mode Choice (2 of 2)

	Carpool		Public Transit		Walk/Bike		Other	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Physical disability								
*Immigrants (≥ 5 years)	0.660	0.230 †						
*Nonimmigrants	0.973	0.222 ‡						
Residential building: year built								
Before 1960								
*Immigrants (≥ 5 years)			0.786	0.156 ‡	0.452	0.224		
*Nonimmigrants					0.698	0.236 †		
1980 and after					−0.473	0.093 ‡		
*Immigrants (≤ 1 year)	−0.357	0.103 ‡	−0.628	0.132 ‡				
*Immigrants (1 < years < 5)			−0.648	0.143 ‡				
*NonImmigrants			−0.832	0.272 †				
Ability to speak English								
Not well or not at all	0.376	0.076 ‡	0.339	0.089 ‡	0.566	0.233		
*Immigrants (≥ 5 years)								
Arrival time at work								
9:00 a.m.–2:59 p.m.	−0.357	0.077 ‡						
*Nonimmigrants					0.575	0.272		
Work hours								
Full-time (40+ hrs.)	0.147	0.070			−0.511	0.089 ‡		
Employment industry								
Agriculture	0.687	0.141 ‡	−1.739	0.468 ‡				
Construction	0.697	0.082 ‡	−0.608	0.149 ‡	−0.656	0.169 ‡		
Manufacturing			−0.760	0.126 ‡	−0.497	0.140 ‡		
Retail	−0.243	0.103						
Service and entertainment					0.260	0.097 †		
Region								
Northeast			1.584	0.091 ‡	0.947	0.106 ‡	1.087	0.367 †
West			0.474	0.094 ‡	0.441	0.095 ‡	0.964	0.341 †
South							1.043	0.336 †

SE = Standard error.

* Interaction terms.

† for p-value <0.01. ‡ for p-value <0.001.

Obs = 9764, $\chi^2(82)$ = 4344.18. LL w/ constants only = – 11595.85. LL at convergence = – 9423.75. Adjusted pseudo-R^2 = .1855.

Notes: Drive alone is the base case. All coefficients are statistically significant at the 0.05 level.

ficients are statistically significant at the 0.05 level; insignificant covariates at the significance level were dropped from the model.

Exhibit 3 shows that immigrants have higher propensities toward the use of carpool, public transit, walk/bike, and other modes (for example, moped, motorcycle) for work trips compared with nonimmigrants. The propensities become weaker, however, as the years of residency increase. The propensities toward the use of carpool, walk/bike, and other modes disappear among long-term immigrants. These results indicate that the adoption of drive-alone travel behavior among immigrants occurs gradually; however, the results also indicate that immigrants are more likely to patronize public transit as a means of work-trip mode compared with nonimmigrants.

The age variable indicates that older workers are more likely to drive alone (base case). The analysis also tests interaction terms with immigration history; however, none of the interaction terms are significant. This result suggests that age in general is associated with greater odds of driving alone, regardless of immigration history.

Household income is positively associated with carpool use; however, the interaction terms with immigration history indicate that nonimmigrants are less likely to carpool. Walk/bike use is negatively associated with household income among long-term immigrants and nonimmigrants. Other modes are positively associated with household income among the long-term immigrants. These results show that household income plays a different role in work-trip mode choice throughout workers' immigration history.

People with African heritage are more likely to use public transit and less likely to walk/bike. This finding is consistent with existing studies. People with Asian heritage are more likely to carpool and use public transit. Interaction terms with immigration history are not statistically significant at the 0.05 level. People with a Hispanic background are more likely to use other modes; however, the interaction terms with immigration history have a higher propensity toward carpooling among Hispanic immigrants, even though the propensity becomes weaker as years of residency increase.

Gender is a statistically significant factor associated with work-trip mode choice. Overall, females are less likely to carpool; however, female immigrants tend to have lower propensities toward public transit. This finding is consistent with the finding of Myers (1997).

Vehicle availability has long been considered a significant factor in mode choice. In this study, the coefficients of vehicle availability (in number of vehicles in household minus number of adults in household) indicate that workers are more likely to drive alone when vehicles are available, regardless of their immigration history. The effects, however, are somewhat different between immigrants and nonimmigrants. For example, for carpools, the magnitude of the vehicle availability variable coefficient among nonimmigrants is smaller than that of immigrants for carpooling and larger for public transit and walk/bike. This finding indicates that immigrants are less likely to carpool and more likely to use public transit or walk/bike when vehicles are available, compared with nonimmigrants. Overall, these results show that immigrants are more likely to use nonautomobile modes compared with nonimmigrants with the same level of vehicle availability.

Immigration history interaction terms with educational background are significant. Nonimmigrants with a college or graduate degree are more likely to use public transit, compared with immigrants; however, immigrants with a college or graduate degree are less likely to carpool, compared with

nonimmigrants. This propensity gets stronger as the number of years of residency in the United States increases.

The model also tested for the effect of workers' physical disabilities. As shown in exhibit 1, immigrants are less likely to have a physical disability. The model results indicate that long-term immigrants and nonimmigrants are more likely to carpool than are new and intermediate-term immigrants. People who have a limited ability to speak English are also more likely in general to carpool or use public transit. Long-term immigrants with limited English skills, however, are more likely to walk/bike to work.

The effect of the built environment or land use on work-trip mode choice was assessed in this study. The year the residential building was built as a proxy of the built environment was tested, as in previous studies (Berrigan and Troiano, 2002; Kim and Ulfarsson, 2008). A more recent year built indicates more new neighborhoods or low-density suburban neighborhoods, while an earlier year built indicates more old neighborhoods or high-density urban neighborhoods. The results indicate that, among those who live in old neighborhoods (built in 1960 or before), both long-term immigrants and nonimmigrants are more likely to walk/bike. The long-term immigrants in the old neighborhoods are also more likely to use public transit for their work trip. Overall, people who live in new neighborhoods (built in 1980 or later) are less likely to walk/bike. The interaction terms with immigration history reveal more findings. First-year immigrants are less likely to carpool compared with other immigrants and nonimmigrants. Also, nonimmigrants and first-year immigrants are less likely to use public transit in the neighborhoods compared with long-term immigrants. This finding may indicate that long-term immigrants in new suburban neighborhoods have somewhat different travel behavior than others.

People who arrive at work during nonpeak times (9:00 a.m. to 2:59 p.m.) are less likely to carpool. This result is intuitive because carpooling can have significant advantages for commuting during peak time. Nonimmigrants who arrive during nonpeak times, however, are more likely to walk/bike. Regarding work hours, full-time employees are more likely to carpool and less likely to walk/bike than are part-time employees. The interaction terms with immigration history are not significant.

The model in this analysis also tested employment industry to examine its effect on work-trip mode. In general, workers in the agricultural and construction industries are more likely to carpool and less likely to use public transit. Also, people who are in the construction and manufacturing industries are less likely to walk/bike to work. These findings are likely associated with location of their work place and commute distance. Workers in the retail industry are less likely to carpool, and people in the service and entertainment industry are more likely to walk/bike to work. The interaction terms with immigration history are all insignificant at the 0.05 level. By region, workers in more densely developed regions are more likely to use a nonautomobile mode of transit.

Discussion and Conclusions

This study found that immigrants, newer immigrants in particular, have significantly different characteristics for transportation modes, as well as in personal and household backgrounds, com-

pared with nonimmigrants, as shown in exhibits 1 and 2; however, immigrants themselves are not homogenous. New immigrant workers are younger and more racially diversified. They also have either very low or very high educational levels. Their household income, ability to speak English, residential neighborhoods, vehicle ownership, and commuting mode also vary. These differences also change throughout their immigration history. The MNL model results shown in exhibit 3 indicate that workers' immigration history is associated with their work-trip modes. It is challenging to develop any policy to accommodate the needs of these diverse groups of the population to facilitate their assimilation to the society.

This study found that the availability of nondrive-alone work-trip modes is important for new immigrants. Immigrants are still more likely to use public transit after controlling for various personal, household, and other characteristics. As Myers reported, sustained high immigration can bolster the ridership base of public transit (Myers, 1997). Habits are important elements in work-trip mode choice (Klöckner and Matthies, 2004). Immigrants may not have the negative perception of public transit, bus transit in particular, that is deeply rooted in U.S. culture and society. How to develop public transit to be competitive enough to retain immigrants should be an important issue to address. Resolving this issue may require more than simple physical infrastructure upgrades of transit systems. It is imperative to understand what immigrants need and expect from public transit.

The results of this study also indicate that special efforts to support carpooling or community-based transit service are needed among new immigrants. Often, new immigrants tend to have strong ties with their ethnic communities. As Valenzuela, Schweitzer, and Robles (2005) argued, however, community-based transportation service needs to be given more attention for new immigrants because they often face mobility problems resulting from various barriers, such as limited public transit service, language, culture, and even immigration status. Strategies to target and improve carpooling services for Hispanic immigrants are warranted.

This study also found that female immigrants are still less likely to use public transit after adjusting various covariates, including household income and vehicle availability. Also, a lower propensity toward carpooling for work trips among highly educated immigrants is noteworthy. The reasons for these results need further research. This study found that workers who cannot speak English adequately are more likely to carpool and use public transit. This finding may reflect the fact that the language barrier may discourage people who are mostly immigrants from getting a driver's license. Public transit policy may need to consider ways to alleviate language barriers for new immigrants so that they may use the system comfortably.

Finally, studies on how different modes affect new immigrants' job accessibility and nonwork-related travel need are necessary. One way to handle this need is by including a more detailed immigration history of survey participants in traditional national and regional travel surveys. Because of a significant increase in immigrant populations, issues of immigrant transportation require more attention and effort in both research and practice, which is challenging. This challenge, however, also can be an opportunity to develop a better nonautomobile transportation system and structure in society.

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