



Contents lists available at ScienceDirect

Transport Policy

journal homepage: www.elsevier.com/locate/tranpol

US immigrants and bicycling: Two-wheeled in Autopia

Michael Smart*

UCLA Department of Urban Planning, 3250 Public Affairs Building, Los Angeles, CA 90095-1656, United States

ARTICLE INFO

Keywords:
Immigration
Bicycling
Assimilation
Mode choice modeling

ABSTRACT

Immigrants to the United States—particularly new immigrants—are more likely than the native born to travel by bicycle. This paper explores the extent to which the use of bicycles by immigrants can be explained by variables such as income, age, automobile availability, and neighborhood characteristics. Results from multinomial logistic mode choice models suggest that, even after controlling for these factors, a large and significant “immigrant effect” remains. The effect size is large for all immigrant groups by sending country, though some immigrant groups—such as those from East and Southeast Asia—are more likely than are others to use bicycles after controlling for other factors. Several avenues for further research are introduced, and policy implications are discussed.

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1. Introduction

The ways in which people travel can reveal a lot about their opportunities and constraints, as well as their preferences and habits. Research has found that immigrants in the United States travel differently than native-born Americans, though these differences appear to diminish over time (Blumenberg and Shiki, 2007; Myers, 1997). Overwhelmingly, research has shown that immigrants tend to travel *less* by single-occupant vehicle (SOV) than do the native born, and *more* by carpool, transit, bicycle, and on foot—and that this is especially true for new immigrants. Differences in travel patterns between native-born and foreign-born Americans may be due to basic differences between these two groups, such as levels of income, automobile availability, age distribution, residential density, and other factors known to influence mode choice. However, these differences may also be the result of less well understood behavioral incentives and disincentives, differential preferences, locational attributes, or barriers to the use of certain modes. This paper tests the extent to which immigrants’ increased propensity to use bicycles can be explained by the former set of variables and speculates about the pathways through which the latter factors may influence bicycle usage.

Using the US-based 2001 National Household Travel Survey (NHTS), I analyze the higher propensity of immigrants to use “alternative” (non-SOV) modes of transportation, focusing specifically on the determinants of cycling. While cycling accounts for only a minute fraction of all trips made by Americans, immigrants

are twice as likely to cycle (0.8% of all trips) as native-born Americans (0.4%). Particularly, low-income immigrants living in dense urban areas are much more likely to travel by bicycle than are all others. For example, immigrants earning less than \$35,000 and living in areas with residential densities greater than 30,000 persons/mile² make roughly 3% of all trips by bicycle. While this is still only a small fraction of trips, it represents over 10 times as many as are made by similarly situated native-born Americans. Even among non-drivers, native-born Americans make only 1% of trips by bicycle, while immigrants make 3% of trips by bicycle. But what factors are responsible for this increased propensity to cycle?

2. Literature review

Despite rapidly changing demographics due to immigration, research on the travel behavior of immigrants has lagged. Research has tended to focus on immigrants’ relatively high rates of public transportation usage and low automobile ownership rates, and has tended to rely on descriptive statistics (Myers, 1997; Rosenbloom, 1998; Purvis, 2003; Casas et al., 2004; Blumenberg and Evans, 2007; Blumenberg, 2009). These studies have largely found that immigrants own fewer cars than the native born, and travel more frequently by alternative modes of transportation such as carpools, public transportation, and non-motorized modes. While much of the research has been conducted using national datasets (typically, the Census), more recent scholarship has employed additional methodologies and datasets. For example, Lovejoy and Handy (2008) used focus groups to gain a richer understanding of Mexican immigrants’ travel experiences in California. They found that, while Mexican

* Tel.: +1 917 292 9703; fax: +1 310 206 5566.
E-mail address: msmart@ucla.edu

immigrants' travel needs were largely the same as those of the native-born population, many respondents' limited or partial access to a private automobile resulted in the use of alternative modes of transportation, primarily ride giving and receiving (for free and for pay). Bohon et al. (2008) conducted interviews and found that low levels of automobility in an environment with few transportation alternatives result in a significant obstacle to adjustment for Latino immigrants in Georgia. Beckman and Goulias (2008) use latent class analysis to account for immigrant heterogeneity in California, and identify several travel behavior typologies for immigrants, including transit users, early shift workers, and users of non-motorized modes.

Indeed, as Beckman and Goulias show, special care must be taken not to equate immigrant status with a particular immigrant archetype. One typical conceptualization of the immigrant found in popular as well as scholarly literature is that of the poor man (or, less frequently, woman) who comes to a wealthy western country in search of a better life or, conversely, in order to escape from intolerable conditions. This conceptualization does, of course, align rather well with large numbers of immigrants (historical as well as contemporary), and it has become particularly canonized in the assimilation literature (e.g. Park, 1950; Gordon, 1964; Sandberg, 1974; Alba and Nee, 1997). Broadly speaking, researchers have tended to focus on poor, low-status immigrants, and their trajectory toward native-born norm(s), and transportation scholars have used the assimilation framework to examine a process of "transportation assimilation," (Blumenberg, 2009). Indeed, aggregate travel statistics for immigrants do show a remarkable and rapid assimilation toward native-born travel characteristics.

However, these aggregate statistics do a poor job of conveying the heterogeneity of immigrants in the United States. As such, one must take special care when considering the behavior of "immigrants." The NHTS dataset used in this analysis reports that 16% of foreign-born respondents over the age of 26 have a graduate or professional degree, while only 12% of native-born respondents do. On the other end of the spectrum, 19% of foreign-born respondents have no high-school degree or equivalent, compared to just 7% for native-born Americans (US Department of Transportation, 2001). Clearly, immigrants to the United States should not be analyzed as a unified bloc. Unfortunately, no clear method presents itself for delineating what Favell (2003) calls "ethnic" migrants (low-status) from transnational (high-status) migrants, and the NHTS dataset unfortunately does not allow for differentiation between documented and undocumented immigrants. However, controlling for variables such as income and education helps to limit this threat.

While no ideal dataset currently exists to examine immigrants' increased propensity to use bicycles, the NHTS dataset allows for a number of statistical controls for phenomena known to influence the use of non-motorized travel modes. These are described below.

2.1. Income and automobile access

One third of immigrant respondents to the 2001 NHTS had household incomes of less than \$30,000 per year, significantly more than the 21% of the native-born population for whom this was true. These lower incomes, in conjunction with administrative and legal barriers to automobile usage for some immigrants, may help contribute to the lower level of automobility among immigrants. Reduced access to automobiles likely contributes significantly to the increased usage of alternative modes of transportation. Even among those earning less than \$20,000 per year, the NHTS reports that native-born Americans have, on

average, 0.76 cars per adult household member, while foreign-born Americans have far fewer cars (0.45) per adult household member. While immigrant families tend to be significantly larger than native-born families, even among households of the same size, automobile availability rates are much lower for low-income immigrants (0.37 cars per adult for 4-person households) than they are for low-income native-born Americans (0.49). One might expect that those with fewer household automobiles per adult would use other modes of transportation more frequently, including bicycles.

Immigrants' lower access to automobiles—even controlling for income—may be due to poor access to mainstream sources of financing; most new low-status immigrants have no (or a very scant) credit history on file with credit bureaus in the United States. This causes a serious impediment for accessing mainstream sources of credit, which is often necessary for the purchase and insurance of an automobile (Stegman, 2001). Further, Cohen (2006) finds that ethnic minorities—coterminous with roughly two thirds of immigrants in the United States—face significant discrimination when purchasing an automobile, facing much higher finance markup rates than do whites. For example, he finds that Hispanics face, on average, a 63% finance markup on new automobiles, while the figure for whites is just 47%.

2.2. Neighborhood effects

In addition to these financial and legal barriers to the use of the automobile, immigrants may also simply live in neighborhoods that are more amenable to the use of alternative modes of transportation. This may either be due to the provision of transit service, pedestrian and bicycle friendliness of the neighborhood, or through active or passive discouragement of automobile use through high congestion levels and expensive or scarce parking. While the transit-, bicycle-, and pedestrian friendliness of built environments cannot be tested using the NHTS, residential and employment densities give important insight into the likelihood of having activity sites within a walking or cycling distance. Indeed, most immigrants live in neighborhoods where residential and employment densities are high, and short trips may be more likely. With an average of 9200 inhabitants/mile², immigrants' home Census tracts are, on average, over twice as dense as those of the native born (4300/mile²; US Department of Transportation, 2001). Poorer immigrants are especially likely to live in high-density neighborhoods, with those earning below \$20,000 living at an average residential density of over 10,000 inhabitants/mile². Furthermore, immigrants are more likely to live in neighborhoods with more jobs per resident (1.5) than are native-born Americans (1.1 jobs per resident). More abundant and proximate jobsites may similarly proxy for activity sites, thus making shorter trips more likely.

Both higher density and diverse-use environments are associated with fewer single-occupant vehicle trips, and with more frequent use of transit, bicycles, and walking (Frank and Pivo, 1995; Cervero and Kockelman, 1997; Cervero, 2002; Ewing, 2005; Chen et al., 2008). Certainly, immigrants' increased residential density and high jobs-to-residents ratio raise the likelihood that a trip purpose can be achieved within a walking or biking distance,¹ while simultaneously lowering the utility of the automobile by increasing the likelihood of traffic congestion. Including residential density and the jobs-to-workers ratio as explanatory variables

¹ However, employment density may not be a good proxy for the likelihood of having proximate commute destinations, especially for low-income immigrants working in spatially dispersed employment sectors such as domestic and construction workers.

will help to disentangle neighborhood effects from other effects associated with immigrant status.

2.3. Past travel behavior

Cultural aspects and past travel habits may also influence immigrants' travel behavior in new environments. For example, the role of gender in some cultures may reduce the likelihood that some immigrant women will make trips by single-occupant vehicle. Similarly, immigrants may also have preferences that differ substantially from those of native-born Americans. For instance, it is conceivable that migrants from, on average, more bicycle-friendly or environmentally conscious places may have a greater preference for non-polluting modes such as the bicycle. Pucher and Buehler (2008), for example, point to several European cities as bicycle-friendly environments, where bicycle usage rates are remarkably high. Similarly, in many parts of Asia, bicycles (and increasingly, electric bicycles) are the predominant mode of personal transportation, though the mode's predominance is slipping (Worldwatch Institute, 2000; Hook and Replogle, 1996; Esfehiani, 2003). Past travel behavior may play a significant role in determining mode choice, and this may help to explain immigrants' use of bicycles in the United States. Indeed, research has shown that travel behavior is influenced by one's past travel behavior, or habits (Gärling and Axhausen, 2003), though it appears that this behavior is quite adaptable over time to new situations (Fuji and Kitamura, 2003), especially when the change in situation involves moving to a new place of residence (Bamberg et al., 2003). Thus, the initial differences between immigrants' and native-born Americans' travel patterns, and the rapid assimilation of immigrants to the native-born mean, may be partially explained by previous travel behavior in the sending country.

3. Dataset and methodology

The analysis was conducted using the US-based 2001 National Household Travel Survey (NHTS). The NHTS is a nationally representative survey that asks participants to detail their travel for one full day. The analysis uses all intrametropolitan (less than 75 miles) trips made by adults (18 years old or greater) in the survey. A small number of cases (8%) had data missing. After determining that these cases were missing at random, they were dropped, for 160,707 trip records available for analysis. Of these trip records, 667 trips were conducted by bicycle, and 75 of these trips were undertaken by immigrant cyclists.

Table 1 shows the modal distribution for all trips by immigrant status and tenure in the United States. These data confirm that

immigrants tend to use alternative (non-SOV) transportation much more frequently than do native-born Americans, but that this tendency decays over time. New immigrants travel by SOV much less frequently (30.7% of all trips) than do native-born Americans (49.6%); however, after 10+ years in the United States, SOV use nears native-born usage rates (41.6%). Use of bicycles similarly decays over time, though one must note the small number of cases in each of the two early immigrant categories.

Table 2 shows summary statistics for all variables included in the regression model. Immigrants tend to be younger, are more likely to be persons of color, and live in somewhat larger households than native-born Americans. Immigrants are also somewhat less likely to be licensed drivers, and have appreciably lower access to automobiles (cars per adult household member). Further, immigrants tend to live in far denser neighborhoods than non-immigrants do, as well as in neighborhoods with more renters, and with more jobs per worker.

I use a multinomial logit mode choice model to estimate the effects of variables included in the model on the choice of travel mode. Specifically, the following variables relate to the following hypotheses.

Income: Higher income is typically associated with higher automobile usage rates, even controlling for other factors. Higher-income individuals may therefore also be less likely to use bicycles.

Immigrant income (interaction): Financial barriers to automobile ownership (and insurance) are likely one determinant of the reduced usage of automobiles among immigrants to the United States, and the concomitant increased propensity to use alternative modes, including bicycles. The inclusion of an interaction variable between immigrant status and income attempts to test this hypothesis, with the assumption that the income hurdles to automobile ownership and use are higher for foreign-born Americans than for the native born. Additionally, undocumented immigrants are unable to obtain drivers' licenses in most states, and this further increases the likelihood of using alternative modes of transportation. Unfortunately, immigrants' legal status is not included in the NHTS dataset, and this hypothesis cannot be tested.

In New York City (dummy variable): As New York City represents a significant outlier in the United States in terms of urban form and transportation network composition (for example, over one third of the nation's public transportation trips take place in New York City), a dummy variable is useful in accounting for fixed effects.

Automobile availability: A variable representing the ratio of household vehicles to household adults (age 16+) is included in

Table 1

Weighted^a percentage distribution of mode by respondent's immigrant status and tenure in United States, all trips, 2001.
Source: 2001 National Household Travel Survey.

	Immigrant, 0–4 years	Immigrant, 5–9 years	Immigrant, 10+ years	Not an immigrant	Total
SOV (%)	30.7	34.0	41.6	49.6	48.5
Household carpool ^b	34.3	30.1	32.8	28.4	28.9
External carpool ^b	13.9	14.0	13.8	12.9	13.0
Transit	4.7	5.7	2.3	1.3	1.5
Walk	14.5	15.6	9.2	7.3	7.7
Bicycle	1.8	0.4	0.5	0.4	0.5
Total (%)	100	100	100	100	100
N	1822	1837	9796	147,252	160,707

^a Using NHTS-provided weights to account for differential response rates by metropolitan area, race, and other factors; nativity was not considered explicitly in the NHTS reweighting scheme.

^b Household carpools are all trips made in automobiles by two or more members of the same household; external carpools are all trips made in automobiles by two or more people from different households.

Table 2
Weighted summary statistics of variables included in the regression model with equality of mean and proportion tests, trips by adult trip maker's nativity, 2001. Source: 2001 National Household Travel Survey.

	Native born (N=147,252)	Immigrants (N=13,455)	Sig.
Median years in United States	–	19	
Median age at immigration	–	19	
Median age at survey	41	38	***
Female (%)	53	48	***
Household size	3.1	3.7	***
Median income (\$)	57,500	47,500	***
Driver (%)	97	90	***
Autos per adult	0.87	0.63	***
Census tract characteristics			
% renter	29	43	***
Res. density (1000s/mile ²)	4.3	9.2	***
Jobs-to-workers ratio	1.1	1.5	***
Living in NYC (%)	2	8	***
Mean trip (miles)	8.0	7.7	***
Highest degree achieved			
Less than high school (%)	7	19	***
High school (%)	53	40	***
College (%)	40	41	***
Total (%)	100	100	
Trip purpose			
Family/personal (%)	31	32	**
Work (%)	20	22	**
Shop (%)	20	22	***
Social (%)	7	7	
Recreational/other (%)	22	18	***
Total (%)	100	101	
Race			
White (%)	79	31	***
Black (%)	11	8	*
Hispanic (%)	7	43	***
Asian (%)	1	15	***
Multiple/other (%)	2	3	***
Total (%)	100	100	

Asterisks indicate statistical significance: ***($p < 0.01$), **($p < 0.05$), *($p < 0.10$).

the model. As this ratio increases, one would expect more automobile-based trips, including carpool trips.

Household Size: All else equal, larger households may cycle less, as larger households make multiple-occupant vehicle trips more productive (chauffeur, carpooling, etc.).

Residential density: Higher-density neighborhoods contain more destination opportunities within a fixed distance than do lower-density neighborhoods, thus increasing the viability of slow-moving forms of transportation. Therefore, residents of higher-density neighborhoods may be expected to use bicycles more often than residents of lower-density places, though for recreational trips this relationship likely does not hold.

Jobs-to-workers ratio: Similarly, neighborhoods with high jobs-to-workers ratios may see higher rates of bicycle usage. Presumably, the ability to conduct part of one's life by bicycle increases as the number of activity sites in one's neighborhood increases, all else equal.

Trip miles: Due to the physical exertion required for cycling, longer trips should be less likely made by bicycle.

Place of origin: Because I hypothesize that some aspects of travel behavior are carried forward from the sending environment (country/region of origin), detailed knowledge of the sending environment should be included in the model, ideally at the level of the city region. However, while the NHTS collects immigrants' place of origin at the level of the country, it reports these data at the level of the global region. These regions are included in Model 2 below as proxies (albeit imperfect proxies) for origin-specific modal preferences.

Origin-specific gender effects: A straightforward dummy variable for women is included in the model to account for the lower

Table 3
Percentage distribution (weighted) of region of origin, immigrant adults, 2001. Source: 2001 National Household Travel Survey.

	%
Canada, Europe, Australia	27
Mexico, Central and South America	39
East- and Southeast Asia	11
Caribbean	9
All other	14
Total	100
N	13,455

overall propensity of women to use bicycles. Ideally, interaction variables would be included for women from each of the sending regions, with the assumption that, in some sending countries, it is more or less likely for women to use cycles, and that this behavior carries over post-migration. For example, women in Japan use bicycles more frequently than do Japanese men (Leblanc, 1999), and we might expect this difference to survive among Japanese immigrants in the United States. Unfortunately, due to the relatively small number of female respondents who travel by bicycle, the inclusion of interaction variables with sending regions produces unstable estimates. Thus, a simple interaction variable between immigrant status and gender is included.

Finally, as a catch-all variable for unobserved covariates with immigrant status, a dummy variable for immigrant status is included in the model. To account for adjustment over time, the model also includes a log-transformed measure of the length of time spent in the United States. The log transformation is derived from the hypothesis that the first years in the United States will see much more marked changes than will later years.

I first estimate a model that includes the variables described above, with no differentiation between immigrant subgroups, and then estimate a second model that disaggregates immigrants into several large regions of origin, in the hope that this will provide a more nuanced view of the effect of region of origin as a proxy for cultural differences and differences in immigrant subgroups' reception and experiences in the United States. Table 3 shows the distribution of immigrants by these broad immigrant origin categories. Approximately one third of all immigrants to the United States comes from Canada, Europe, and Australia, while another one third comes from Mexico, Central America, and South America. The remaining third comes from East and Southeast Asia, the Caribbean, and "all other" origins. Among these subgroups, there are significant differences in relevant variables. For example, the mean income of immigrants from Canada, Europe, and Australia is nearly \$90,000, while the figure for immigrants from Mexico, and Central and South America is just under \$50,000. Similarly, Canadian, European and Australian immigrants live in households with, on average, just 3 members, while Mexican and Central and South American immigrants live in households with 4.2 members on average. I expect that the differences between these groups extend far beyond the differences observable given the variables included in the dataset, and thus expect to observe significant differences between these groups (Model 2).

4. Analysis

Table 4 shows the results of the models, reporting relative risk ratios (RRRs), or the multiplicative contributions to odds that an individual will select that mode for a particular trip as compared to the base case, the single-occupant vehicle (SOV). For example, the relative risk ratio associated with "female" for bicycle is about

Table 4
Relative risk ratios of determinants of bicycle usage, other modes not included, US adults 2002 (N=160,707). Source: 2001 National Household Travel Survey.

	Model 1 LR-164,809		Model 2 LR-164,764 ^a	
	RRR	p	RRR	p
Immigrant	41.127	< 0.001		
Imm – Can/Eur/Aus			56.692	< 0.001
Imm – Mex/CA/SA			37.316	< 0.001
Imm – SE Asia			75.889	< 0.001
Imm – other origin			14.283	< 0.001
ln(years in US)	0.614	0.001	0.611	< 0.001
Education (no HS reference)				
High school	0.595	0.003	0.589	0.003
College	0.730	0.065	0.724	0.064
Trip purpose (family reference)				
Work	1.169	0.370	1.190	0.316
Shop	0.834	0.307	0.835	0.309
Social	2.213	< 0.001	2.216	< 0.001
Recreational/other	6.638	< 0.001	6.603	< 0.001
Race (white reference)				
Black	0.158	< 0.001	0.176	< 0.001
Hispanic	0.408	< 0.001	0.478	0.001
Asian	0.357	0.014	0.307	0.005
Multiple/other	0.792	0.390	0.815	0.451
Ratio of veh./adults	0.360	< 0.001	0.356	< 0.001
Female	0.563	< 0.001	0.562	< 0.001
Female*immigrant	0.508	0.042	0.496	0.037
ln(residential density (1000/mi ²))	1.510	< 0.001	1.510	< 0.001
Jobs to workers ratio	0.986	0.750	0.978	0.624
Household size	0.866	0.001	0.862	0.001
ln(HH income (\$1000s))	0.862	0.030	0.867	0.037
ln(HH income)*immigrant	0.610	0.004	0.606	0.005
Age	0.985	< 0.001	0.985	< 0.001
ln NYC	2.262	0.002	2.445	0.001
Trip miles	0.847	< 0.001	0.846	< 0.001

^a Represents a statistically significant improvement in the model; $Pr(D) < 0.001$; both models represent a significant improvement over a constant-only model (LR -194914).

0.50, indicating that the odds (not probability) that women commute by bicycle rather than by SOV are about half the corresponding odds for men, controlling for all other variables in the model. While only the bicycle mode is included here, other modes were modeled as well: single-occupant vehicle (the base case), carpooling, walking, and public transit. However, in the interest of space, only the mode of primary interest is shown here.

The variables included in the models carry the expected sign. For example, residents of high-density areas are more likely to cycle than are residents of less dense areas. Similarly, higher-income individuals are less likely to cycle than are lower-income individuals, controlling for other variables in the model. The model also suggests that aging reduces the likelihood of using bicycles, while shorter trips are more likely taken by bicycle than are longer trips. Finally, social and other/recreational trip purposes are more likely served by bicycle than are other trips.

Immigration-related variables are significant predictors of cycling. Immigrant status itself has a relative risk ratio of 41.127, indicating that (controlling for other variables in the model) the newest immigrants in the United States have over 41 times the odds of choosing cycling over driving as the odds of native-born Americans choosing cycling over driving. However, the relative risk ratio associated with years spent in the United States indicates that this heightened propensity to use bicycles decays rapidly, with the odds roughly halving in the first 4 years. Immigrant women appear half as likely to choose bicycles over cars as native-born women (both of whom cycle less than do men). As incomes rise, individuals appear to replace cycling with the use of other modes (including SOV). Interestingly, this

relationship appears especially strong for immigrants, contrary to the *a priori* expectation.

The inclusion of origin-specific variables for immigrant groups in Model 2 improves the model fit significantly. The inclusion of these origin-specific variables for immigrants highlights the variability across groups in the propensity to use bicycles. Holding other variables constant, immigrants from East and Southeast Asia have much higher odds of choosing to cycle over the automobile than do other immigrant groups and native-born Americans. Canadian, European, and Australian immigrants, as well as those from Mexico, Central America, and South America, similarly show an increased propensity to use bicycles, controlling for other variables. This finding may lend moderate support to culturally based hypotheses, suggesting that some aspect of origin-specific cultural difference—either carried over from abroad or created in the United States—may account for a portion of the difference in bicycle mode choice. However, the relationship between large geographic categories and cultural aspects is tenuous at best, and the differences may be attributable to other unmeasured covariates.

5. Discussion

The results of the models estimated here indicate that immigrants are more likely to travel by bicycle than are native-born Americans, even when controlling for standard mode choice control variables such as income and residential location type. The residual “immigrant effect” represents a yet unexplained phenomenon, around which further hypotheses can be built. While the NHTS dataset used here does not provide enough detail to answer some of the more challenging questions about the determinants of increased bicycle usage (for example, legal status), the literature suggests other hypotheses that should be explored further. Because current datasets do not include the variables necessary to answer these questions, additional data collection—perhaps most fruitfully through ethnographic work—will be necessary to capture more nuanced motivations for immigrants’ mode choice.

First, let us reconsider the hypothesis that immigrants may face financial constraints in purchasing, insuring, and using an automobile. As discussed above, many immigrants may face financial hurdles that native-born Americans do not. However, the model results suggest that the transition from using bicycles to the use of automobiles is more income-sensitive for immigrants than for the native born, suggesting that financial hurdles—where faced—are not insurmountable for a large segment of the immigrant population.

In addition to financial barriers to automobile usage, many undocumented immigrants are unwilling to drive (or to drive frequently) because it increases the likelihood of coming into contact with police through the enforcement of moving violations (Santos and Rodríguez Garavito, 2005). It is plausible that the effect of undocumented immigrants’ lower willingness to use automobiles—even controlling for automobile availability—may be subsumed in the model by several strong covariates with undocumented status—low incomes, Hispanic ethnicity, and youth (Passel, 2006; Hoefer et al., 2008; Weeks et al., 2009).

Indeed, local policy arenas such as policing and landlord-tenant relations are increasingly sites of immigration control, leading to hostile environments for undocumented immigrants, who search for ways to reduce their exposure to police. For example, Garni and Miller (2008) describe the situation of an undocumented worker in Los Angeles who finds his automobile commute “terrifying” in the face of police crackdowns on unlicensed drivers, and has considered renting a small apartment

near his jobsite to minimize his commute to and from the suburbs. He subsequently dropped this consideration on learning that landlords, too, are increasingly checking tenants' backgrounds to determine legal residency.

Garni and Miller further write of another undocumented worker:

“For Hector, the four additional hours added to his work day when using public transportation eventually prompted him to buy a used car and drive to work without a license. But after being cited by a police officer, paying nearly \$1000 in citations and fines, having his car impounded and being unable to pay the fee necessary to retrieve it, he reverted to public transportation. The time lost in travel was so great that this episode eventually led him to quit his job and find another, closer to home. He now uses a bicycle and hopes to save enough money to buy another used car.” (Garni and Miller, 2008, p. 446)

Clearly, bicycle is an attractive option for people attempting to avoid contact with law enforcement. However, even cyclists are subject to moving violations, and cycling has become, at least in one California town, a “risky” mode of transport for undocumented immigrants, as illustrated by the highly publicized arrest of Marcelino Tzir Tzul in 2007 for riding his bicycle on the wrong side of the road in Costa Mesa, California. In accordance with the city’s “crackdown” on illegal immigration, Tzir Tzul, an undocumented migrant, was turned over to federal authorities and now faces deportation (Delson, 2007).

There may be additional factors stemming from the spatial and economic differentiation of low-status immigrants in ethnic enclaves. Esser (2004) describes a model of immigrant assimilation and differentiation in which the individual migrant makes a bounded-rational decision either to invest time and human capital in participating in the economic life of the host society (risking rejection due to discrimination or lack of appropriate skills) or to invest time and human capital in a differentiated ethnic economy, risking marginalization from the host society. Indeed, one can observe a high degree of economic differentiation among many immigrant groups, resulting in the creation of large immigrant clusters within metropolitan areas—both residential and commercial. One need only think of the numerous Chinatowns across the United States, or the large Mexican and Korean neighborhoods of Los Angeles, to understand that immigrants have a heightened propensity to co-locate with co-ethnics (Portes, 1987; Light, 1984; Light and Bhachu, 1993; Light and Bonachich, 1988; Lee, 1992; Portes and Jensen, 1987). Yet largely unexplored are the consequences of this spatial clustering on travel behavior, though one might easily surmise that clustering would lead to an increased likelihood that the accomplishment of trip ends (commute, shopping, social/recreational) would be similarly spatially constrained. Spatial constraint, of course, leads to shorter trip lengths and, thus, greater relative usefulness of non-motorized (bicycle, pedestrian) travel.

Unmeasured variables related to the built environment may also explain immigrants' increased propensity to use bicycles. Bicycle friendliness of the environment in which travelers live significantly influences the likelihood of individuals choosing to cycle (Pucher et al., 2010). Unfortunately, little is known about the bicycle friendliness of the neighborhoods in which immigrants settle, and the NHTS does not provide any further illumination on this point. If immigrant cyclists settle in neighborhoods that are more bicycle friendly than those in which native-born cyclists live, then their high propensity to use bicycles may be explained by this. If, however, immigrant cyclists live in neighborhoods that

are less bicycle friendly than those of native-born cyclists, then their increased propensity to cycle is more remarkable yet.

Finally, the model provides some support for the hypothesis that unexplored cultural attributes may explain some of the differences in travel behavior among immigrant groups. Certainly, the strong effect of the interaction variable between gender and immigrant status indicates that the role of women in some cultures may have a strong effect on the use of certain modes. Further, the variation in the coefficients associated with interaction variables between immigrant status and region of origin may suggest that either culturally based preference or previous travel patterns habituated in the sending country may have strong effects on mode choice, though these differences appear to decay quickly over time. Certainly, many low-income immigrants did not use automobiles in their sending countries; they might rely on modes that they are familiar with while transitioning to more typical American travel patterns. Again, the dataset does not allow for extrication of these specific influences, and further (perhaps ethnographic) research work is required to illuminate them further.

6. Conclusion

While the relative infrequency of bicycle travel in general may appear to limit the importance of this finding, the model results shed light on a very important phenomenon among new immigrants to the United States. This paper has demonstrated that the high observed rates of bicycle usage among immigrants are only partially explainable by socioeconomic, demographic, and locational variables typically associated with bicycle usage. Indeed, other covariates associated with the residual “immigrant effect” appear to influence bicycle usage strongly. There may be several yet-unexplored factors that account for the immigrant effect, and further research would likely benefit from more extensive quantitative data (with a larger sample of immigrant cyclists) and the use of richer and more contextual qualitative methodologies.

A better understanding of the factors that influence immigrants' use of bicycles—above and beyond the factors already measured here—would help to illuminate, where these factors are benign, avenues through which bicycling may be promoted in the population at large. On the other hand, additional research may highlight ways in which immigrants are not using bicycles as a result of preference, but instead as a reaction to discriminatory practices or a transportation system inappropriate for their needs. This would highlight ways in which policymakers could reduce barriers to the exercising of immigrants' travel preferences.

Finally, this research serves to highlight that transportation planning agencies should include immigrant communities in the planning of bicycle networks and facilities. There is little evidence that this is currently the case. In Los Angeles, a city with one of the largest concentrations of immigrants in the United States, the city's recently released draft Bicycle Master Plan Update was crafted without targeted outreach to immigrant communities, and indeed the most significant element of the public participation process was an internet survey (City of Los Angeles et al., 2009). While the survey did not ask respondents questions related to immigration, the public participation process on the whole does not appear to include input from low-income individuals such as low-income immigrants. In fact, the opposite appears to be the case, with nearly 85% of all respondents to the survey having had a college degree—and nearly half of those respondents had post-graduate degrees. One survey respondent remarked:

“We figure in your results because we are in some manner organized as cyclists, or have friends who are on mailing lists etc.... You may imagine [other] cyclists, but you will hardly get hold of them.(City of Los Angeles et al., 2009)”

Similarly, a recent citywide bicycle survey in New York City was conducted online, in English only, and a majority of its respondents (55%) were members of bicycle advocacy groups (City of New York, 2007). Indeed, as many have noted, typical public participation processes such as community meeting and public review processes tend to attract the attention and input of organized and relatively powerful special-interest groups, while failing to receive meaningful input from others—even when the issue at hand is important to those individuals (see, for example, Rydin and Pennington, 2000; Flyvbjerg, 1998). Transportation planning agencies may therefore need to use targeted outreach processes in order to receive meaningful input from immigrant cyclists on bicycle-related questions.

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