Making Invisible Riders Visible:
Motivations for Bicycling and Public Transit Use among Latino Immigrants

By

Jesus Miguel Barajas

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Committee in charge:

Professor Daniel G. Chatman, Chair
Professor Robert Cervero
Professor Paul Waddell
Professor Joan Walker

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Abstract

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Immigrants now comprise the largest share of the population of the United States since 1850, with continued increases projected into the foreseeable future. Most foreign-born residents come from Latin America and other developing countries. Nationwide, they tend to travel by cheaper and more sustainable modes of transportation upon arrival, gradually adopting American habits of driving over time. A challenge for planners concerned with reducing the impact of automobile travel and providing an equitable transportation system is to understand and capitalize on the motivations for immigrant travel that would allow them to meet their travel needs without relying on cars. In this mixed-methods dissertation, I investigate three questions about the nature of how immigrants travel in the San Francisco Bay Area, a fairly transit- and bicycle-friendly metropolitan region, with these sustainability and equity questions in mind:

1. How do travel patterns differ between low-income immigrants and other population subgroups?
2. What influences cycling among immigrants and non-immigrants? More specifically, to what extent do individual factors, the social environment, and the built environment predict bicycling, and how do their effects differ between immigrants and non-immigrants?
3. What factors contribute to the cycling experience for low-income Latino immigrants?

First, how do travel patterns differ between low-income immigrants and other population subgroups? I use a custom-designed intercept survey to describe the frequency of travel by each mode of transportation, in addition to individual perceptions and personal experiences related to public transit and bicycling. I find fairly small but statistically significant differences in mode use between immigrants and non-immigrants: immigrants travel up to a day per week less frequently than non-immigrants by each mode of transportation except walking. When controlling for socioeconomic and certain built environment characteristics, many differences between immigrants and non-immigrants diminish. Most significantly, however, Latin American immigrants substantially reduce their transit use as incomes rise, while Latina women of all income groups very rarely ride a bicycle. Certain perceptions and attitudes about transportation also differ significantly among

nativity groups. Low-income immigrants are least likely to perceive bicycling as an option to meet their travel needs. They are also less likely to take transit or ride a bicycle when they have an option to drive.

Second, to what extent do individual factors, the social environment, and the built environment predict bicycling, and do their effects differ between immigrants and non-immigrants? This question uses the dissertation conceptual framework to test how each of those three factors influence one another, and how they affect cycling. Relying on a subset of the same survey results as in the previous chapter, I use a set of structural equations models to estimate the likelihood of bicycling based on socioeconomic characteristics, including nativity, perceptions and attitudes, social networks, and urban form, accounting for the endogeneity of these influences. I find many similarities in what influences cycling among immigrants and non-immigrants. Unexpectedly, once perceptions and social factors are accounted for, objective measures of the built environment matter little in predicting bicycling. However, cycling is associated with positive perceptions of how the built environment supports cycling. Bicycling itself influences both perceptions of the difficulty of cycling and cycling social networks. Findings suggest two keys to supporting cycling: addressing how people view neighborhood safety and how well infrastructure meets cyclists' needs.

Third, what factors contribute to the cycling experience for low-income Latino immigrants? Interviews with about two dozen Latino immigrants reveal that a number of factors beyond cost, safety, and urban form encourage people to bicycle. People described cycling emotionally, empowering in the face of life obstacles. New immigrants can use bicycling as a means to learn their way around a new city, though some find it difficult to navigate when directions and information are not readily available in their native languages. But more than anything, benefits of bicycling were tied to certain social values that many interviewees held, such as a desire to protect future generations by traveling more sustainably. Some have the perception that bicycle planning has been fundamentally unfair to their community and other communities of color. Cycling investments that tie into social networks present in immigrant neighborhoods may motivate others to establish a bicycling habit.

Each chapter of this dissertation contributes to a different component of the literature on immigrants and travel. As a whole, the dissertation leads readers from a discrete choice view of travel behavior to one influenced by psychology and social and cultural elements of human environments. I argue that planning for sustainability and equity in transportation requires adoption of measures that address the soft influences on travel. While investing in infrastructure is important, it is not enough: increasing neighborhood and traffic safety and improving perceptions of transit and cycling relative to driving will help facilitate immigrant travel.

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Acknowledgements

People often say that the work of a PhD student is solitary and isolating, the product of many years of thought and quiet contemplation. That may be partially true, but a dissertation is really the cumulation of conversations with classmates, colleagues, mentors, and others, most of whose ideas have shaped my own, and most of whom have become dear friends along the way.

I have many people to thank who helped make this research possible. I must thank the Mineta Transportation Institute, including Karen Philbrick and her staff, and the University of California Center on Economic Competitiveness in Transportation for financial support for this work. Asha Weinstein Agrawal of San José State University contributed to the research and survey design for a related project from which the dissertation draws. Several research assistants helped recruit research participants, conduct interviews, administer the survey, and input data. Special thanks go to Darlene da Silva, Cecilia Chavez, Mar Velez, and Nestor Castillo for that work. I thank all the leaders and employees at the social service organizations who allowed us to recruit their members and use their facilities for interviews, including Oscar Grande, Jessie Fernandez, and Jacqui Gutierrez at PODER; Claudia Velasco at Monument Impact; Laura Lopez and Gabriella Garcia of the Street Level Health Project; Laura Camberos of *Mujeres Unidas y Activas*; Gabriel Hernandez and America Enciso of the Hayward Day Labor Center; and Lydia Guel of Sacred Heart Community Services. And, of course, thanks to the many individuals who volunteered their time to be interviewed and complete the survey.

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Lest one get the impression that I spent all my time on research, I need to also thank my friends and teammates at the San Francisco Bay Area Curling Club, who have become an extended family to me while here in Berkeley. My real family has provided support from afar. And finally, thanks to Kate Garfinkel whose love, support, and encouragement has never wavered. She has been the best partner I could hope for on this journey.

1 Introduction

America's face is changing. Population forecasters predict immigrants and their descendants will drive demographic shifts in the United States over the next 45 years. Immigrants currently make up 13% of the population, estimated to nearly double in number to become one in every five residents by 2060 (Colby and Ortman 2015). Although immigrants arrive from almost every country and span the socioeconomic spectrum, most come from Latin America (Brown and Patten 2014), often hold low-wage jobs, and bring few financial resources with them. They initially travel more by sustainable modes of transportation compared to their US-born counterparts, but eventually "assimilate" to the familiar American drive-alone pattern (Blumenberg 2009; Chatman 2014). For transportation planners concerned with reducing vehicle-kilometers traveled to slow the growth of greenhouse gas emissions, and for those concerned with providing equitable access to regional employment and other opportunities, it is critical to understand the motivations for immigrant travel to be able to forecast residents' needs accurately.

This dissertation explores questions related to the nature of immigrant travel behavior. It focuses on issues related to non-automobile travel—primarily bicycling—and on the experiences of low-income, Latino immigrants in the San Francisco Bay Area. Three research questions guide this mixed-methods study:

1. How do travel patterns differ between low-income immigrants and other population subgroups?
2. What influences cycling among immigrants and non-immigrants? More specifically, to what extent do individual factors, the social environment, and the built environment predict bicycling, and how do their effects differ between immigrants and non-immigrants?
3. What factors contribute to the cycling experience for low-income Latino immigrants?

This study adds to the literature on immigrant travel in a few key ways. First, much of what we know about immigrant travel comes from national travel data, such as the American Community Survey (ACS) and the National Household Travel Survey (NHTS). ACS data are nationally comprehensive, but limited in scope to the usual commute-to-work mode. Disaggregate data are readily available only at geographic areas containing about 100,000 people, limiting their usefulness for working with small-scale land-use characteristics or other built environment features. NHTS data encompass all trip purposes, but have few observations per census tract and underrepresent certain population groups because of its landline telephone–based sampling method (Blumberg and Luke

2011; Pucher et al. 2011). Furthermore, neither survey comprehensively asks questions related to attitudes or preferences, which several scholars argue are critical components of understanding travel behavior (Cao, Mokhtarian, and Handy 2009; van Acker, van Wee, and Witlox 2010; Dill, Mohr, and Ma 2014). In contrast, this dissertation uses a custom-designed intercept survey to gather data on travel frequency, travel attitudes and preferences, and residential location to enable small-scale spatial analysis. The survey is administered in a single metropolitan area, providing larger sample sizes at sub-metropolitan levels, but limiting its geographic scope.

Second, with a few exceptions, immigrant travel studies using both quantitative and qualitative methods have typically focused on motorized modes of travel: transit and auto use, including carpooling (e.g. Lovejoy and Handy 2007; Blumenberg and Smart 2013; Chatman 2014). Reporting on active travel modes is often ancillary to the main goals of the research and thus understudied. In this work, I focus primarily on the influences on and motivations for cycling. Although research on bicycle travel behavior is no longer as rare as it was even a decade ago, few have studied concerns that might be particular to members of disadvantaged communities. This is a critical oversight in light of concerns that bicycle planning efforts cater to white, politically-powerful advocates to the exclusion of the needs of poor, Black, and Latino cyclists (Lubitow and Miller 2013; Hoffmann and Lugo 2014).

Immigrants and travel in the San Francisco Bay Area: Study context

The San Francisco Bay Area is the setting for this study. The Bay Area is a nine-county region of nearly 7.5 million people, encompassing the three principal cities of San Francisco, Oakland, and San José, and their environs. This study focuses only on the five most populous counties in the central core of the region: Santa Clara, Alameda, Contra Costa, San Francisco, and San Mateo. I refer to this subregion as the central or core Bay Area.

Immigrants make up 34% of the central Bay Area population. This proportion is slightly more than in all of California, where 28% of people were born outside the country, and it is over two-and-a-half times the proportion of immigrants in the entire United States. Nearly half of the study area's immigrants come from Mexico, China, or India. About one quarter of the study area's immigrants are from Latin American countries, 19% of whom are from Mexico, the largest single country of origin (Ruggles et al. 2015). The region's immigrants live primarily in the urban centers of Alameda, Santa Clara, and San Francisco Counties. However, some neighborhoods in other core cities such as Richmond, Daly City, and South San Francisco, and in some outlying cities such as Concord and Bay Point, have relatively large concentrations of immigrants as well (U. S. Census Bureau 2015a).

The automobile dominates travel in the core region, regardless of birth country. The usual means to work for over three-quarters of the people in the study area is by car, with little difference between immigrants and non-immigrants (see Figure 1.1) (2014 PUMS estimates, Ruggles et al. 2015). However, immigrants are more likely to ride in carpools to work, and about one third more Latin American immigrants carpool than immigrants from other regions. Differences in other commute modes are fairly small but statistically significant. Transit use accounts for 14% of commute travel, walking 4%, and bicycling about 2%. Note that trips to work travel make up only 12%

of all travel purposes in the central Bay Area (California Department of Transportation 2013). In the aggregate, immigrants living in the core region bicycle less often than non-immigrants. When characterizing commute modes by nativity, about one-third as many immigrants usually commute by bicycle (1.6%) compared to people born in the US (2.4%). The difference between the proportion of Latin American immigrants who cycle to work and the proportion of other immigrants who do so is not statistically significant.

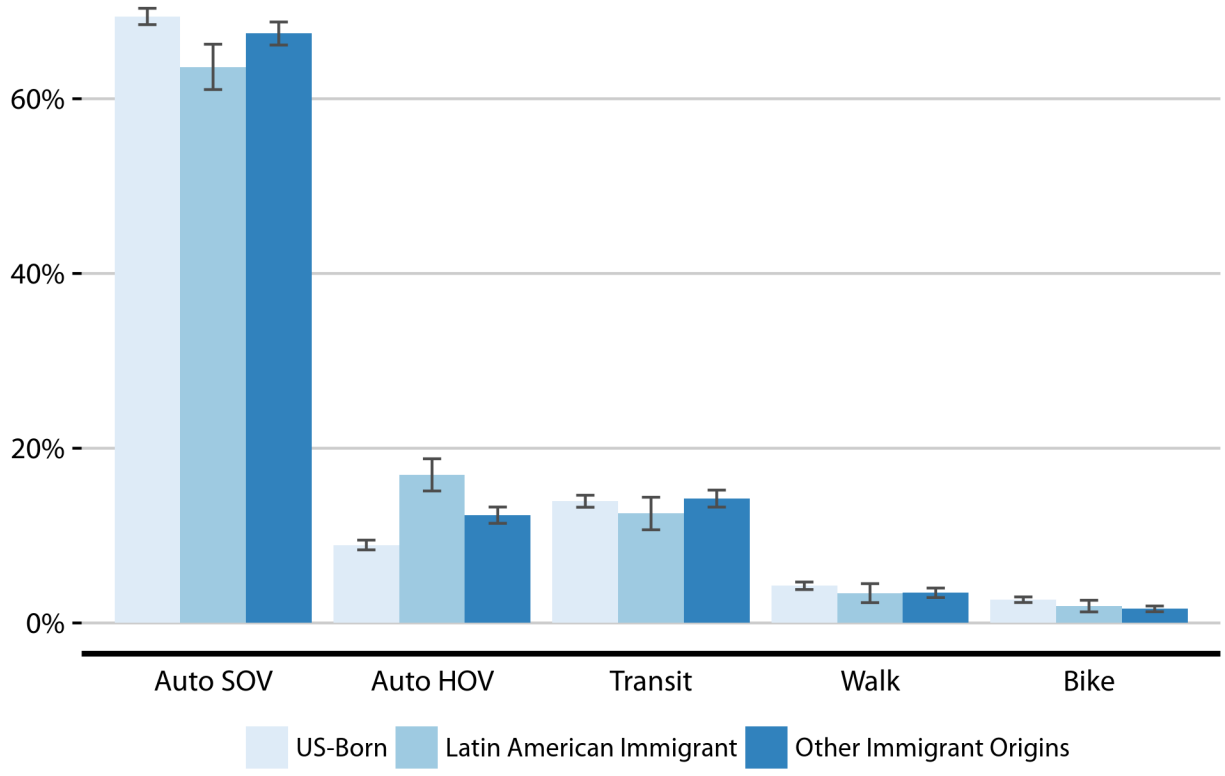

Figure 1.1: Commute mode choice by immigrant origins (2014 PUMS estimates, Ruggles et al. 2015)

Automobile travel still dominates across nativity groups in the study area when looking at all travel purposes according to the California Household Travel Survey (CHTS). Motor vehicles make up 68% of all trips for people 16 and older. As with usual commute trips, carpooling is more common among Latino immigrants[1] than other groups. Bicycling makes up 2.2% of trips for any purpose in the study area. Latino immigrants are less likely to bicycle compared to other groups, taking less than 1% of their trips on two wheels compared to about 2.5% for both non-immigrants and other immigrant ethnicities (see Figure 1.2). Of the trips made by bicycle, over two-thirds are for utilitarian purposes; that is, either for personal errands, work, or school trips. Latino immigrants are more likely to make these utilitarian trips compared to other groups, but they rarely cycle for recreational

[1]Note that CHTS does not provide country of origin data, unlike the US Census. *Latino immigrant* is a combination of immigrant status and ethnicity.

purposes (see Figure 1.3) (California Department of Transportation 2013). Thus, we see that Latino immigrants travel differently and have different reasons for choosing a mode of transportation.

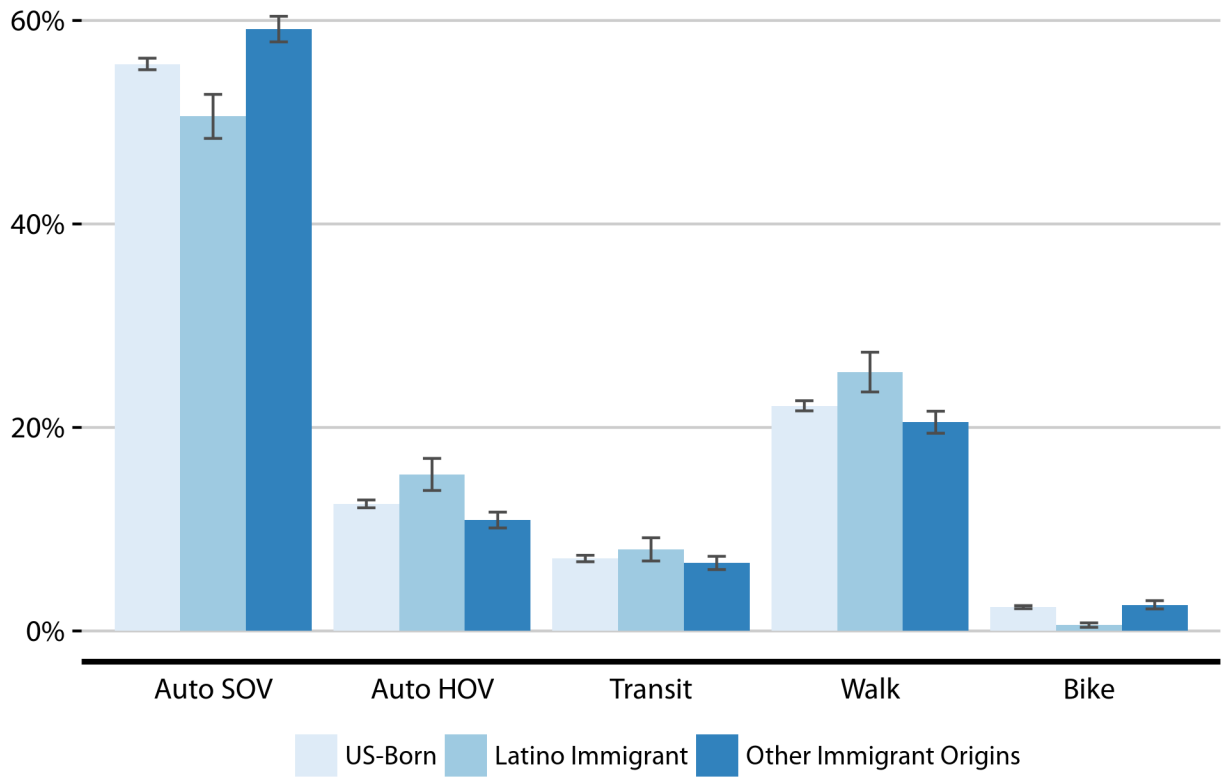

Figure 1.2: Mode choice (all purposes) by immigrant origins (California Department of Transportation 2013)

On the whole, aggregate mode choice by nativity in the San Francisco Bay Area reflects American travel patterns. Because of the variety of transportation infrastructure, land use, and population characteristics, the Bay Area makes a site of investigation that can provide broader lessons for locations beyond the region.

Toward a theoretical framework of immigrant travel

This dissertation is concerned with how and why some Latino immigrants travel the way they do. Travel behavior theories provide the foundation for the empirical analysis in later chapters. Although there is no unified theory of travel behavior, explanations of how people travel have evolved from research in the disciplines of economics, psychology, public health, and transportation planning itself. This section briefly introduces some of this research to lay the groundwork for the theoretical framework of this study—how individual characteristics, attitudes, social factors, and the built environment are dependent on each other to influence travel behavior.

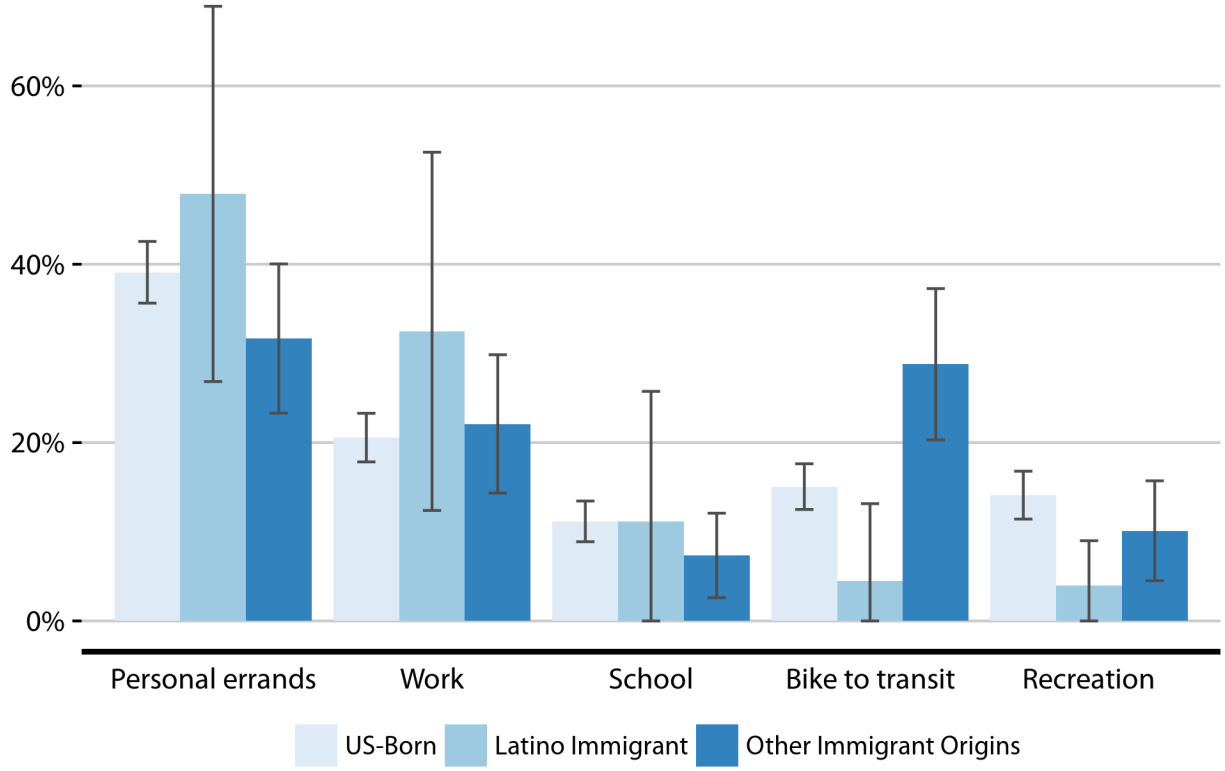

Figure 1.3: Bicycle trip purposes by immigrant origins (California Department of Transportation 2013)

Choices based on maximizing well-being within a budget

The econometric approach of random utility maximization forms the foundation of much of the current state of knowledge and practice on disaggregate travel behavior. The core concept proposes that individuals make travel choices based on which option gives them the highest utility, better understood as satisfaction or well-being. The observed part of that utility is generally based on a function of transportation mode attributes and personal characteristics—travel time, travel cost, household income, and the like. The function also includes a random error term, which accounts for unobserved characteristics that contribute to the total utility, but the error term is still assumed to follow a defined distribution (Train 2009; Ben-Akiva and Lerman 1985).

Advanced techniques for estimating random utility models improve on the standard formulation. These methods account for joint household decision making, random taste variation, latent preferences, and latent classes that categorize travelers into a typology not readily apparent from observation (Walker and Ben-Akiva 2002; Vij, Carrel, and Walker 2013). Latent classes, for example, have been used to typify and explain the commuting behavior of immigrants (Beckman and Goulias 2008). The advantage of using latent classes in a random utility framework is to allow researchers to abstract psychological factors that contribute to mode choice. For instance, bicycling requires people to exert more physical effort to use than other modes of travel, and so demands

behavior explanations beyond simple time and cost estimation. Some scholars have argued that these reasons account for an increasing use of latent classes as central components of bicycle travel choice research (Muñoz, Monzon, and Daziano 2016).

Choices based on psychological motivations

Many of the advanced concepts in random utility maximization are derived from psychological research about behavior. Psychologically-based theories help explain internal motivations relevant to travel decision making, often described as unobserved factors. Unobserved factors include preferences and attitudes toward a particular mode of transportation, rather than factors that can be directly measured such as household income or population density. An article that reviewed the role psychological and social factors play in utilitarian bicycling found positive perceptions of the cycling environment, positive attitudes toward cycling, and positive influences of social environments to correspond with a higher likelihood of cycling in nearly every study examined (Willis, Manaugh, and El-Geneidy 2015).

The most well-known psychological theory applied to travel behavior is the theory of planned behavior. The theory proposes that a behavior is a direct result of a person's intention to perform it. This intention is influenced by a person's attitude toward the behavior; subjective norms, or how decision makers and others close to them think about the behavior; and perceived behavioral control, or their perceptions of how easy or difficult it would be to complete the behavior (Ajzen 1991). The theory of planned behavior has been shown to predict mode choice better than unplanned, unreasoned action, such as habit (Bamberg, Ajzen, and Schmidt 2003). Research has shown the theory helps to explain both bicycle commuting (Muñoz, Monzon, and Lois 2013) and bicycle travel in general (Heinen and Handy 2012; Dill, Mohr, and Ma 2014).

Other scholars argue that the psychological motivations of travel are even more complex. A review of the motivations for behavior classifies them into intrinsic and extrinsic categories (Mokhtarian, Salomon, and Singer 2015). Intrinsic motivations include meeting basic human needs, achieving goals, and improving well-being, among others. Extrinsic motivations comprise the classical view of what influences travel as the utility maximization approach might do. Identifying intrinsic motivations for travel also recognizes that not all travel is undertaken to solely get from origin to destination, but that some travel might occur for its own sake (Mokhtarian and Salomon 2001; Ory and Mokhtarian 2005). For others, additional factors add to the complexity of understanding behavior. One conceptual model places a hierarchy of decisions at the center of travel behavior (van Acker, van Wee, and Witlox 2010). Short-term activity decisions, medium-term residential location decisions, and long-term lifestyle decisions all play a role in travel behavior. Those decisions affect and are affected by both rational decisions influenced by attitudes and preferences, and irrational decisions based on habit and impulsiveness. Finally, the decision-making system is enabled and constrained by individual factors, the social environment, and the spatial environment.

Other research on psychological applications to travel behavior have varying numbers of influences with varying degrees of model feedback. A conceptual model similar to the decision-hierarchy model, named the Perception–Intention–Adaptation model, recognizes the influence of adaptive feedback on cognitive processes when home and work locations or transportation options change (Spears, Houston, and Boarnet 2013). Yet another conceptual model of travel, named the Theory of Routine Mode Choice Decisions, claims to distill its components into elements that planners can

operationalize, consisting of both utilitarian motivations for travel, such as cost, convenience, and safety, and cognitive motivations, such as awareness of a mode, enjoyment, and habits (Schneider 2013). Each additional model introduces new nuances of behavior. However, with increasing complexity comes increasing difficulty in applying the models for planning purposes and the risk of explaining nothing by way of attempting to explain everything.

Choices based on interrelated life and policy factors

As a starting point, ecological models derived from public health research explicitly account for multiple levels of interrelated influences on active travel behavior, including the role of policy and external factors (Sallis et al. 2006; Sallis, Owen, and Fisher 2008). However, ecological models can encompass theories from other domains, such as utilitarian and psychological theories, which may help to explain particular levels in the overall framework (Sallis et al. 2006). Some scholars have simplified ecological models that explain cycling behavior to three critical interrelated components: individual factors, which include both observed socioeconomic characteristics and unobserved attitudes and preferences; the physical environment, including land use, transportation infrastructure, and natural features; and the social environment, including professional and personal social networks (Handy, Xing, and Buehler 2010; Handy and Xing 2011). This model is a good starting point because it considers both how each factor influences cycling, but also how each factor influences the others. For example, the model hypothesizes that land use affects cycling, but it also affects cycling preferences, which in turn affects land use and cycling. Thinking about travel in this way helps remind us that factors that cause behavior are not independent of each other. Policies that seek to change behavior must consider interventions across these multiple sources of influence.

Although immigrant travel behavior has not been studied using an ecological framework, the unique policy and environmental constraints immigrants face lend themselves to multilevel explanation across interrelated domains. For example, many have argued that immigrants' social ties uniquely encourage their travel patterns. Working or residing in immigrant enclaves enables access to resources or other transportation options through the accumulation of social capital in lieu of financial capital (Blumenberg 2009; Liu and Painter 2012; Blumenberg and Smart 2013; Smart 2015). Some have also argued that legal obstacles such as driver licensing regulations that require lawful presence delay or prevent driving for some, but not all, immigrants (Blumenberg 2009; Lovejoy and Handy 2007). Thus, responses to policy constraints manifest in behavior that can be observed in a disaggregate fashion.

Research design

Conceptual framework

This dissertation adapts and expands upon the ecological-based framework from Handy and Xing (2011) to explain motivations for immigrant travel (see Figure 1.4). The conceptual model proposes that socioeconomic characteristics—including immigrant status and transportation resource access—attitudes and preferences, social networks, and the built environment are interrelated in how they explain bicycling and public transit use among immigrants. The analysis presented later

does not test all the ways each factor affects the others, but does explicitly account for how the built environment influences both perceptions and behavior. Note also that travel behavior influences attitudes and perceptions, an important addition to the framework. The system of explanatory factors is embedded in policy and regulatory conditions, which are not explicitly tested in this study, but nonetheless materially impact the ability to travel. For example, driver licensing laws for undocumented immigrants vary by state and have the potential to change behavior and attitudes, even if other characteristics are the same.

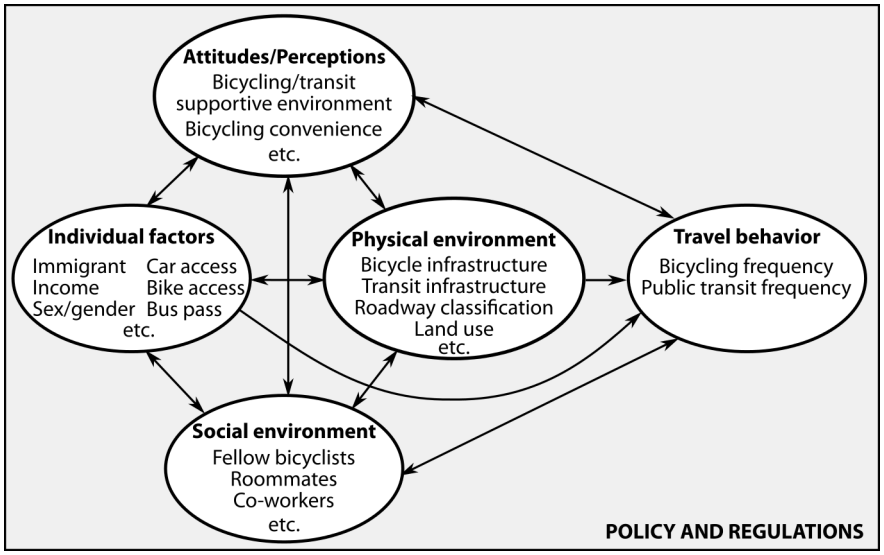

Figure 1.4: Conceptual framework. Adapted from Handy and Xing (2011).

Research methods overview

This study employs a mixed-methods, exploratory/explanatory research design (Figure 1.5). Mixed methods are appropriate when answering the whats, whys, and hows of a problem. In other words, researchers use mixed methods when attempting to generalize a phenomenon to a population, while also providing detailed insight on how people experience the phenomenon (Creswell 2009). In the case of this dissertation, I used quantitative analysis to answer the first two research questions about how often immigrants travel and what motivates it, and qualitative analysis to answer the third question about how Latino immigrants experience cycling. The research for this study proceeded in three phases—two qualitative phases and one quantitative phase. The survey data collection bridges the exploratory design, meant to develop the intercept survey instrument, and the explanatory design, meant to describe and probe immigrant travel behavior. The genesis of this dissertation was a related, grant-funded project designed to study how low-income immigrant transit riders use and experience public transit and bicycling (Barajas, Chatman, and Agrawal 2016). The research design for that project drove the choices in the first phase and a portion of the second phase of the dissertation research. For that reason, many of the exploratory interview questions focused on details about public transit, and most of the intercept survey sites were selected to be at major public transit hubs. In this study, I pivot from the related research report by shifting the focus to bicycling among

low-income and Latino immigrants. In the remainder of this section, I provide a brief overview of each phase of the dissertation research; additional details about the methods are located in each respective chapter.

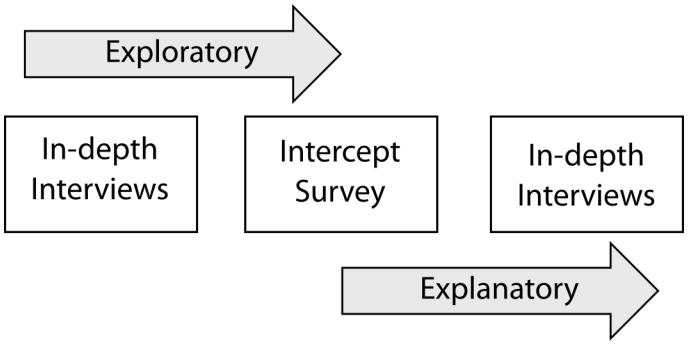

Figure 1.5: Dissertation research design

The first phase of research consisted of exploratory interviews. Interviews were designed to explore the nature of barriers to transit use and bicycling among Latino immigrants. Thirteen interviews came from this phase, recruited through several community-based organizations (CBOs) in the San Francisco Bay Area that provide services to low-income immigrants, such as language training, employment connections, and basic health care. Semi-structured interviews were conducted in Spanish and English with the assistance of a Spanish-speaking research assistant on site at the CBOs or, in one case, at the home of the interviewee. After the interviews were complete, they were transcribed and I coded them for analysis. I developed questions for an intercept survey from the main themes of the interviews. See Chapter 4 and Barajas, Chatman, and Agrawal (2016) for more details.

The second phase of research began by developing and administering a paper-based intercept survey at 44 locations across the San Francisco Bay Area. The survey methods sought a targeted sample, overrepresenting low-income Latino immigrants who use public transit and bicycle. Survey sites were in the four largest counties in the region, and were selected within census tracts that were in the top 66th percentile of a combination of the proportion of immigrants, proportion of immigrants who earned less than $25,000 per year, median household income, and the proportion of people who took public transit to work. Sites at transit stations were selected on the basis of high ridership based on transit agency data. Sites at businesses and public plazas were selected purposively, based on the likelihood of having substantial pedestrian traffic. I also selected a number of sites within day labor waiting zones (see Figure 1.6 and Appendix C). At the intercept locations, potential participants were randomly selected at high-traffic sites; at low-traffic sites, all passers-by were approached. Surveys were offered in English or Spanish. I received 2,087 responses to the survey. See Chapter 2 and Barajas, Chatman, and Agrawal (2016) for more details about survey administration and analysis.

The final phase of the project includes analysis from an additional ten interviews administered after the completion of the second phase. Interviews in this phase were designed to explain bi-

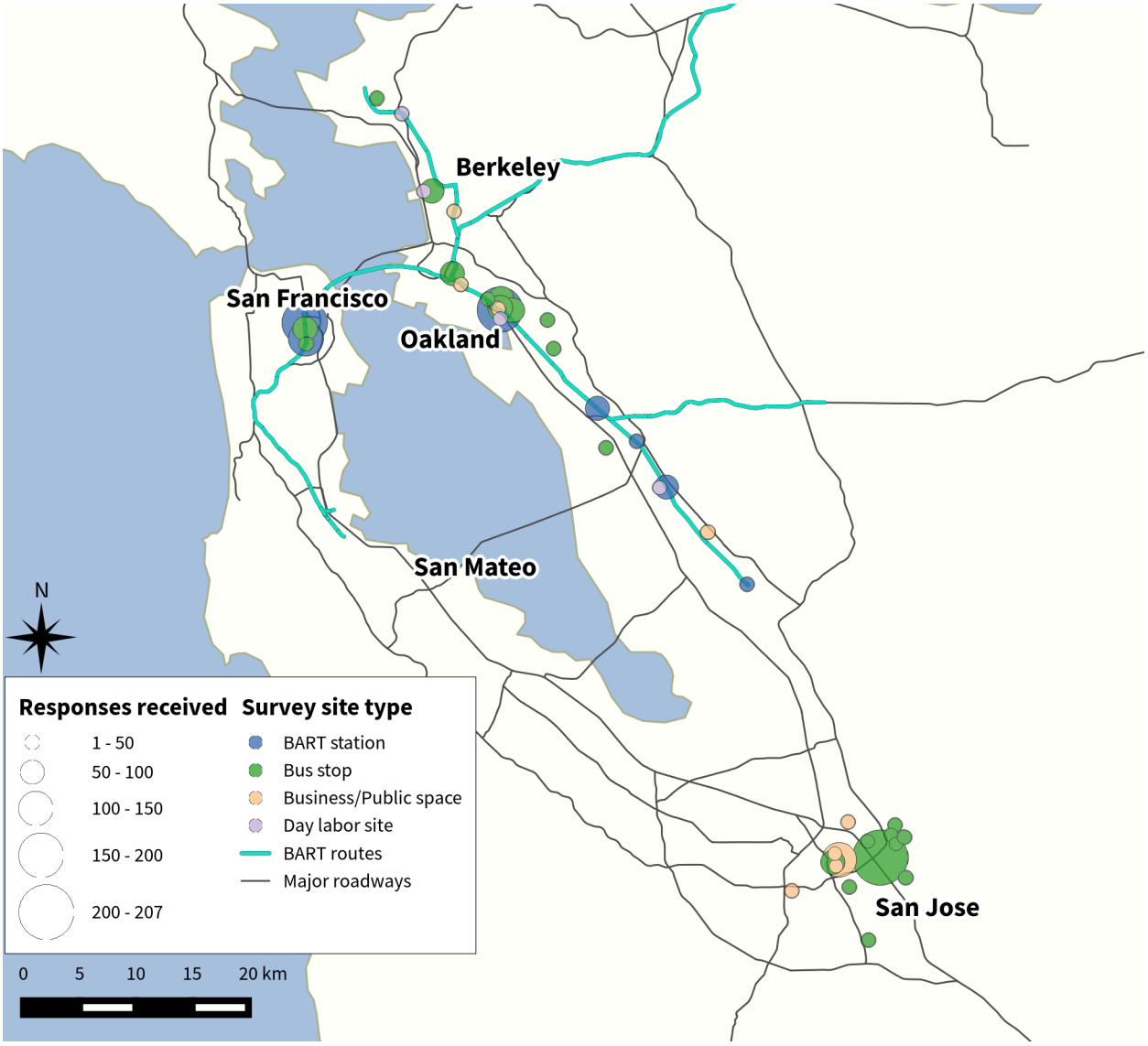

Figure 1.6: Survey sites by type and responses received

cycling behavior in more detail. Similar to the first phase, participants were recruited primarily through CBOs. Interviews followed a semi-structured interview guide. However, because coding and interviewing occurred in parallel in this phase of research, some questions were modified or added to establish more depth on themes developed from earlier interviews. I re-analyzed interviews from the first phase together with interviews from this phase of data collection, developing a completely new codebook appropriate for a self-contained analysis. See Chapter 4 for more details.

Dissertation structure

The remainder of this dissertation answers the research questions proposed earlier. Chapter 2 explores differences in travel and perceptions between the foreign-born and US-born survey respondents. The chapter shows how the determinants of immigrant travel as discovered through the intercept survey are different in some ways from what we have come to know about immigrant travel from nationally-representative datasets, mainly because of spatial and behavioral context. The chapter is also the first to introduce immigrants' perceptions of bicycling and public transit, and describes why immigrants may be more likely to drive when they have the chance to do so. Chapter 3 shifts the focus from general travel behavior to bicycling specifically. The analysis draws on the conceptual framework to more deeply understand the influences on cycling among immigrants, and how they differ for people born in the United States. The chapter walks through a series of structural equations models to show how attitudes and perceptions influence cycling and, critically, how cycling also influences certain attitudes and perceptions. The significant effects are not all that different between immigrants and non-immigrants, though a few important social factors are. Chapter 4 looks deeper at the immigrant cycling experience to hypothesize which other factors might account for the few differences in cycling perceptions and behavior found in earlier chapters. The chapter presents descriptive analysis of interviews with 23 Latino immigrants, and shows how certain qualitative factors such as empowerment and cultural identity resonate with interviewees as part of cycling practice. Chapter 5 concludes the work and ties the analysis together. It summarizes key findings and describes what they might imply for transportation planning and policy.

2 Immigrant Travel Patterns and Experiences

Data from national travel surveys show that immigrants travel less by driving alone and more by bicycling, walking, carpooling, and public transit than people born in the United States. This gap in sustainable travel remains when controlling for a variety of socioeconomic and urban form characteristics. Travel trends converge to US-born transportation patterns the longer immigrants remain in the US, but small differences persist after twenty years or more since immigration. Scholars debate the reason for both the initial difference and the change over time, though few studies venture beyond exploring automobile and public transit use.

But national data may not be enough to paint the picture. Travel behavior is affected by local contexts—transit service, employment access, and public policy, to name a few. Variation of travel within a region may yield insights for planners to address local concerns, particularly concerns for vulnerable groups whose choices are more constrained. This chapter address the first research question in the dissertation; that is, how travel patterns and experiences differ between low-income immigrants and other population subgroups, using a unique dataset collected within a large metropolitan region. To begin, I review the literature on immigrant travel. Three themes emerge that account for observed travel differences between immigrants and non-immigrants in the United States: socioeconomic factors, spatial factors, and what I call "immigrant experience" factors. These factors map closely with the conceptual framework of the dissertation presented in Chapter 1. Then, I analyze the results from the survey. I present basic comparisons of travel patterns, transportation resource availability, and experiences with transportation, categorized by nativity and income. In the last section, I present results from a multivariate analysis of the survey data that predicts frequency of travel by each mode, controlling for independent effects of other socioeconomic and spatial characteristics to understand their impacts on immigrant travel. I conclude with brief thoughts on the findings, more completely describing policy implications in Chapter 5.

Literature review: The determinants of immigrant travel

Socioeconomic characteristics

Income drives many travel decisions, no matter the traveler's country of origin. Owning a car has a large up-front expense, while public transit fares can add up. High costs limit both the ability to get places and the frequency of travel. Thus, low-income adults have lower rates of auto ownership, and also travel less than people earning higher incomes (Lu and Pas 1999; Morency et al. 2011; Blumenberg and Pierce 2012, 2014b). Relative spatial immobility from lack of a car can result in economic immobility. Low-income adults face better employment outcomes with full-time access to a vehicle, compared to using only public transit or getting rides (Cervero, Sandoval, and Landis 2002; Sanchez, Shen, and Peng 2004). Out-of-home subsistence activities are also constrained by lack of car ownership. Low-income adults often travel farther for better-quality groceries and face difficulties in accessing all their daily needs when solely relying on public transit (Clifton 2004; Hillier et al. 2011). Low-income adults can overcome these burdens through careful accounting and budgeting of transportation expenses (Blumenberg and Agrawal 2014), but the inability to be self-reliant places them at risk for stress and negative well-being (Delbosc and Currie 2011; Lowe and Mosby 2016).

These impacts are similar for immigrants. Low-income immigrants own fewer cars and drive less than higher-income immigrants, though the magnitude of these effects often vary by country of origin (Tal and Handy 2010; Chatman 2014). Low-income immigrants who have cars are more likely to be employed than those who do not (Clark and Wang 2010). Not having an automobile places significant constraints on immigrants with respect to employment. Lower-income immigrants use transit and carpool more often than higher-income immigrants (Liu and Painter 2012; Blumenberg and Smart 2010). Thus, they are more likely to lack the flexibility for new opportunities, such as finding work away from transit-accessible places or participation in after-work skills improvement classes (Bohon, Stamps, and Atiles 2008). One study finds that lower-income immigrants are more likely than non-immigrants to cycle (Smart 2010). Bicycling makes up a small fraction of travel, however, even among immigrants (Blumenberg 2009).

Income is not the only socioeconomic determinant of travel behavior among immigrants. Ethnic origin has some role in the differences in carpooling behavior, both in immigrants' higher overall propensity to carpool and Latino immigrants' higher propensity to form carpools with non-household members (Blumenberg and Smart 2010). Bigger household sizes, too, increase auto use and carpooling as immigrants' needs for more complex trip chaining on family-serving trips grow (Blumenberg and Smart 2010; Chatman and Klein 2013). Occupational classification, and particularly employment in ethnic niche industries, helps explain some differences in carpool and public transit use among immigrants (Chatman and Klein 2009; Liu and Painter 2012). Finally, sex and gender play a role in immigrants' travel. Immigrant women drive alone and ride bicycles substantially less than immigrant men (Blumenberg 2009; Smart 2010). Cultural explanations related to gender norms partially explain these patterns, discussed in more detail below.

Locational factors

Where people live and work is a second major determinant of travel behavior, particularly for immigrants and low-income adults. The foundational description of the role of location in disadvantage is the spatial mismatch hypothesis (Kain 1968). The original hypothesis posits that racial discrimination in housing markets segregated Black households in central city locations, thereby reducing their employment opportunities because of job suburbanization in the postwar period. Since then, scholars have expanded the spatial mismatch hypothesis to test its applicability to the concentration of poverty and the welfare of other racial and ethnic groups, though not everyone has agreed with the analysis and interpretation (see Kain 1992). Transportation plays a central role in a modified spatial mismatch hypothesis. Some scholars have argued that the spatial mismatch is exacerbated by a lack of mobility options to get to suburban jobs (Ihlanfeldt and Sjoquist 1998). Concern with connecting welfare recipients to job opportunities played a central role in transportation policy associated with welfare-to-work programs in the late 1990s. The Federal Transit Administration established the Jobs Access and Reverse Commute (JARC) program, meant to enable transit agencies to connect central city residents to the outlying job centers. However, JARC and similar programs had minimal or no impacts on welfare recipients' ability to successfully maintain employment; car ownership still prevails as a significant predictor in employment outcomes of the poor (Cervero, Sandoval, and Landis 2002; Ong and Houston 2002; Sanchez, Shen, and Peng 2004; Sanchez 2008; Blumenberg and Pierce 2016). Welfare recipients and low-income adults may benefit from being close to transit to help maintain jobs (Kawabata 2003), but car access helps them find them (Blumenberg and Pierce 2014a, 2016).

Increasingly, scholars argue that spatial mismatch theory is too simplistic. For one, poverty is no longer exclusive to central cities. In the first decade of the 21st century, poverty in the suburbs grew faster than in cities, resulting in the suburbs having the majority of people in poverty (Garr and Kneebone 2010; Raphael and Stoll 2010). Research in Los Angeles finds no evidence of spatial mismatch for low-income adults because of the suburbanization of both jobs and poverty (Hu 2015). Furthermore, many segments of the poor population have complex travel needs that go beyond home-to-work trips—particularly low-income women and mothers (Blumenberg 2004). Transportation scholars argue that modal mismatch is a better way to characterize the transportation challenges low-income workers face (Taylor and Ong 1995; Blumenberg and Manville 2004). For example, in metropolitan Detroit, a classic spatial mismatch city, research finds that people living in the central city have better accessibility to jobs in the region, but that the accessibility advantage is eliminated when comparing transit access to car access (Grengs 2010). Regional accessibility analyses using modal-based comparisons provide a fuller picture of the equity of homes, jobs, and the transportation system (Foth, Manaugh, and El-Geneidy 2013; Golub and Martens 2014).

For immigrants, locational influences on travel behavior extend beyond spatial mismatch. Immigrants' homes and jobs often concentrate in immigrant enclaves, which promote short travel distances and thus non-automobile travel. For Latino immigrants, this phenomenon has been dubbed "Latino Urbanism" (e.g. Rojas 2010). Some sociologists theorize that formation of ethnic enclaves promotes the strengthening of social ties and accumulation of social capital, which immigrants can turn into human capital, financial capital, and resource gain (Massey 1999; Coleman 1988). These reasons may account for the persistent concentration of co-ethnic immigrants in a handful of metropolitan areas across the country (Portes and Rumbaut 2014). Strong network ties in immi-

grant enclaves promote carpooling as immigrants pool resources, which is made easier as co-ethnics live in similar neighborhoods and commute to similar job centers (Blumenberg and Smart 2010, 2013). Focus-group research with Mexican immigrants finds a stronger likelihood of getting rides among people who have close family or strong social networks to draw upon (Lovejoy and Handy 2011). Some scholars find that living in an immigrant neighborhood predicts mode choice more strongly for immigrants who live there compared to non-immigrants who do, with the strongest influences associated with bicycling and walking (Smart 2015). Research describing social ties in other "neighborhoods of affinity" mirror this finding, such as gay men and lesbians living in neighborhoods with a high proportion of same-sex couples (Smart and Klein 2013; Klein and Smart 2016). Not all immigrants live in immigrant enclaves, however. Some move to suburbs, leading to more driving, while some move to the urban core, remaining close to and relying on public transit (Yu and Myers 2007).

For the most part, research on the impacts of locational factors on immigrant travel focuses on macro-level spatial influences. Few studies examine small-scale built environment characteristics known to affect behavior (e.g. Ewing and Cervero 2010; Heinen, van Wee, and Maat 2010). Using various methods, three studies explore immigrant commuting behavior at the PUMA level, geographies that encompass multiple census tracts containing a population of at least 100,000 people (Beckman and Goulias 2008; Chatman and Klein 2011; Liu and Painter 2012). Most other studies use the census tract as a unit of analysis but explore nationwide travel survey data, making it difficult to control for characteristics beyond population density, employment density, and MSA size (Tal and Handy 2010; Smart 2010, 2015; Blumenberg and Smart 2013). However, one study that was able to explore relationships between access, the built environment, and immigrant travel finds an association between rail access and less driving to work (Chatman 2014), suggesting the built environment matters when explaining immigrant travel behavior.

The immigrant experience

Immigrants are diverse in their income, education, home, and work locations. But one commonality is their birth in foreign countries with distinct prior experiences and cultural practices—especially those from outside Western Europe. Some scholars have argued that prior behavior has a strong effect on current travel choices (Møller and Thøgersen 2008; Thøgersen and Møller 2008; Weinberger and Goetzke 2010; Willis, Manaugh, and El-Geneidy 2015). Motor vehicle ownership per capita is far lower in developing countries than in the United States (International Road Federation 2011), where residents have fewer opportunities to drive and would have developed habits of non-automobile travel. These experiences may partially account for lower car ownership and less driving among immigrants upon first arriving to the United States. However, some argue that habits can be broken. Some scholars claim reasoned action has a stronger effect than habit on travel choices, particularly when introducing a policy intervention or change in lifestyle that might interrupt usual behavior (Gatersleben and Appleton 2007; Bamberg, Ajzen, and Schmidt 2003). In other words, habits may not transfer in the context of a new environment. One study found that Americans who temporarily moved to other countries adopted less auto-centric lifestyles while abroad, but failed to keep those travel habits upon moving back to the United States (Burbidge 2012). This may help explain the decline in alternative travel as immigrants remain in the United States and find the spatially-dispersed urban form to be better navigated by car.

Gendered cultural norms account for some immigrant travel behavior. Immigrant women drive less than men, and Latina women are less likely to have driver's licenses than Latino men (Tal and Handy 2010; Pisarski 1999). Traditional gender roles in historically patriarchal societies, where women rely on their husbands to participate in out-of-the-home activities, likely explain some of the difference (Evenson et al. 2002; Lovejoy and Handy 2011). The rigidity of those norms may be declining, however (Lovejoy and Handy 2011). Likewise, immigrant women from strict Islamic societies often face restrictions on independent mobility in their countries of origin, whose cultural practices may continue after moving. In the United States, both immigrant and non-immigrant women bicycle less than men (Smart 2010), which may be principally because of safety concerns (Garrard, Handy, and Dill 2012). In countries with high rates of cycling, such as the Netherlands, men and women cycle at nearly equal rates, attributed to infrastructure and policies that promote safety (Pucher, Dill, and Handy 2010; Pucher and Buehler 2008). Nevertheless, immigrant women in the Netherlands bicycle much less than both immigrant men and the native-born Dutch, explained partially as a result of cultural gender differences (van der Kloof 2015).

Other constraints on immigrant travel are tied to legal regulations. Thirty-eight states prohibit immigrants who do not have legal residency from obtaining driver's licenses (National Conference of State Legislatures 2015). These restrictions discourage immigrants from driving, though they do not necessarily prevent them from doing so (Lovejoy and Handy 2008). But in the face of increasing immigration enforcement, even those with legal authorization to live in the United States who hold valid licenses may fear or avoid driving. Law enforcement in some jurisdictions have been accused of racial profiling during traffic stops with the goal of referring undocumented immigrants to Immigration and Customs Enforcement for deportation (Romero 2006; Stuesse and Coleman 2014). For some, avoiding police makes public transit, walking, and bicycling better options.

Finally, other immigrant practices create unique constraints and opportunities for travel. In 2014, immigrants to the US sent $56 billion to their home countries, or an average of $1200 per person (World Bank 2016). Some scholars have hypothesized that remittances may account for low initial auto use and ownership by delaying immigrants' ability to purchase a vehicle (Chatman and Klein 2013). Several theories of international migration argue that sending remittances is a core element in a migrant's decision to immigrate (Massey et al. 1993), suggesting he or she would place a higher value on sending money to family back home than saving money to buy a car. Immigrants may also be constrained by their English-speaking ability, particularly on public transit. Although transit agencies typically provide multilingual informational materials, some immigrants with limited English proficiency face discrimination from transit operators when there is a communication barrier (Liu and Schachter 2007). Entrepreneurial immigrants have created immigrant-serving transportation options, such as *camionetas* for intercity travel, to capitalize on shared ethnic bonds and avoid issues of discrimination (Valenzuela, Schweitzer, and Robles 2005).

Research design

This chapter draws on descriptive, bivariate, and multivariate analysis of the survey results to explore differences in immigrant travel behavior. The survey represents a unique effort to understand travel of low-income immigrants within a major metropolitan region. Despite recent growth of immigration in non-traditional gateway cities in places such as the Southeast and Pacific Northwest

(Massey 2008), 65 percent of immigrants live in metropolitan areas of one million or more people (Migration Policy Institute 2015). Many are where immigrants have historically moved, such as New York, Los Angeles, Chicago, and San Francisco. The survey captures the variety of urban-dwelling immigrant experiences, which may have implications for other large cities and regions.

I begin this section by describing the data collection and questionnaire design. Next, I describe the sociodemographic characteristics and transportation experiences of the 2,087 survey respondents, both compared to the regional population and stratified by nativity and income group. Then, I compare the travel habits of low-income immigrants with three comparison groups: higher-income immigrants, low-income US-born respondents, and higher-income US-born respondents. Finally, I introduce a multivariate analysis that controls for socioeconomic and spatial factors to account for their independent effects on immigrant travel.

Survey administration

I administered a self-completion, paper-based intercept survey in English and Spanish at 44 sites across the San Francisco Bay Area over a 16-week period between October 2014 and March 2015, excluding the four weeks during the winter holidays (see Chapter 1 and Appendix C for locations, and see Barajas, Chatman, and Agrawal (2016) for additional description). Questionnaires were distributed during morning peak commute hours, late afternoon, evening peak commute hours, and on weekends, but only during daylight hours for safety reasons. Most surveys were returned during evening commute hours. The sampling strategy may have been somewhat biased toward people employed during standard working hours, though survey times and locations varied to ensure some representation from itinerant workers, shift workers, and the unemployed. The sample is also biased toward people with a higher propensity to take public transit, as most survey sites were bus stops or BART stations. Eligible respondents were 18 years of age or older.

The level of traffic at the survey sites dictated the sampling strategy used. At high-traffic sites, surveyors were instructed to approach every fifth person to ask him or her to take the survey. At lower traffic sites, such as most bus stops, surveyors approached every person. In all instances, surveyors were instructed to prioritize bicycle riders to achieve a sufficient sample of responses from those who used bicycles. To the extent possible, surveyors were sent out in pairs with at least one Spanish-speaking surveyor to personally engage potential respondents in their preferred language. The overall response rate (the number of people who completed a survey divided by the number of people surveyors asked to take the survey) was 33 percent, and 29 percent of respondents completed the survey in Spanish. The survey took approximately five minutes for each respondent to complete and was designed to be finished at the intercept site, although 4 percent of respondents mailed their surveys back. Surveyors offered each potential respondent a granola bar as an incentive to take the survey. Each respondent was given an additional form to complete if he or she was interested in participating in a follow-up interview, described in further detail in Chapter 4.

Although intercept surveys are not representative of the population, they are often better than random mail or phone surveys at reaching vulnerable population groups, such as undocumented immigrants, who are reluctant to respond to such survey requests (Wofinden 2003). The survey did not ask about legal immigration status so I do not know the extent to which the sample represents undocumented immigrants. However, 15 percent of respondents indicated they were born outside the US and earned less than $25,000 per year. Undocumented immigrants earn signifi-

cantly less household income than both US-born residents and documented immigrants (Passel and Cohn 2009), which suggests responses from the low-income immigrant group is likely to represent a meaningful proportion of undocumented immigrants.

Questionnaire

The survey asked questions in three categories: recent travel, transportation experiences, and personal information. (See Appendix B for the questionnaire.) In the *recent travel* section, people reported on their travel in the seven days prior to taking the survey. They noted how many days they drove, got a ride, bicycled, walked, or took public transportation. Respondents who traveled by bus or rail reported their access and egress modes. Respondents also reported the number of days they had access to a bicycle and a motor vehicle. The *transportation experiences* section included questions about attitudes toward, perceptions of, and constraints related to travel by bicycle and transit. It asked respondents to estimate how much more they would have taken public transit and cycled given hypothesized changes in transit cost, crime, bicycle infrastructure, and ease of using bicycles with transit. It also asked them to report how often they substitute one mode for another and how much they agree or disagree with statements about public transit and bicycling. The *personal information* section collected standard demographic and socioeconomic information, data about the number of cyclists respondents knew, whether they had a bus pass, and a home address or a nearby intersection.

The survey was pre-tested on a convenience sample of respondents in both English and Spanish, then field-tested at an intercept survey location. Initial drafts of the survey included more detailed questions about the trip; for example, trip purpose, origin, and destination. However, those questions were confusing to test participants who were not making a trip at the time (e.g. waiting for work or strolling through a plaza) and pushed the survey over an acceptable length. To avoid removing questions in the transportation experiences questions, the survey focused on general patterns of travel rather than specific trip mode choice.

Methodology

For this analysis, I define a low-income immigrant as someone not born in the United States who was living in a household that earned less than $25,000 in the year prior to taking the survey. The threshold defining a low-income respondent is for both theoretical and practical reasons. Although there is no universal definition of "low-income," federal guidelines provide two standards for assessing poverty or income status. The federal poverty guidelines, also known as the Federal Poverty Limit (FPL), set a nationwide standard for when a household is considered to be in poverty. The 2014 FPL was $23,850 for a family of four (U. S. Department of Health & Human Service 2015). A second set of guidelines follows the US Department of Housing and Urban Development (HUD) income thresholds for Section 8 programs. The thresholds are adjusted for the median family income in a HUD-defined statistical area, which is often a portion of a metropolitan statistical area. In the central San Francisco Bay Area, the HUD threshold for low-income families of four ranged from $67,600 in Oakland to $88,600 in San Francisco—much higher than the FPL. Extremely low-income families of four earned between $27,600 and $33,200 (U. S. Department of Housing and

Urban Development 2014). Because the average household size of the survey respondents was 3.6 and because the survey was targeted in low-income neighborhoods, I chose the income category that most closely matched the lowest levels of earnings as the low-income threshold. Practically, this also had the effect of splitting the dataset roughly in half with respect to low-income and higher-income respondents. In the multivariate regression models, I further split the higher-income category into groups above and below $100,000 to differentiate effects below and above the regional median household income.

Differences between groups were tested using standard t-tests for means, Wilcoxon rank-sum tests for count data, and chi-square tests for proportions, without correction for multiple comparison groups (Gelman, Hill, and Yajima 2012). These comparisons are similar to those found in Barajas, Chatman, and Agrawal (2016). The difference is in the sample used: this analysis makes comparisons using the entire set of respondents, while the referenced report analyzes only the responses from public transit riders. Finally, I estimated count regression models with the frequency of travel by each of the five modes as the dependent variable. In four of the five cases, the distribution of the dependent variable is overdispersed, so I estimated those using a negative binomial regression model. The model that includes days of transit use as a dependent variable is modeled instead as a Poisson regression, as a likelihood ratio test indicated no significant difference between a Poisson and negative binomial estimation of the model.

The selection of independent variables in the regression models is informed by the literature review in this chapter, using variables that have been shown to influence immigrant travel. The primary independent variables of interest are nativity by region (Latin America or other), household income, and the interaction between the two, to help understand the travel of low-income Latino immigrants in particular. Other socioeconomic characteristics include:

- *Years in the United States*. As discussed earlier, the longer immigrants remain in the US, they more likely are to "assimilate" to drive-alone transportation patterns. I also include a squared term to account for possible non-linear effects of length of residence in the US (see Descriptive statistics section).
- *Sex*. In the general population, women travel differently than men for a number of reasons related to household responsibilities and risk aversion, particularly for bicycling. Among immigrants, cultural norms may restrict women's travel even further. The models include an interaction term between nativity and sex to account for these possible differences.
- *Employment*. People who work are likely to have to travel farther and more often than those who do not. Occupational category is also likely to impact mode choice because of the spatial distribution of jobs in the region, but that information is not available in the survey. I proxy for occupational category partially by using the survey location type, because surveys were distributed at a number of day laborer waiting sites. I assume that all respondents surveyed at those locations are day laborers.

The multivariate models also control for transportation resource availability and certain spatial characteristics. Models include terms for whether respondents have access to a car, a bicycle, and a bus pass. ZIP code-level transit stop density, derived from General Transit Feed Specification (GTFS) data, is included as a proxy for transportation infrastructure availability (and correlates highly with population density), and ZIP code-level employment density is included to account

for access to employment (U. S. Census Bureau 2015b). I included variables indicating where the survey was administered to account for unobserved characteristics of the county and possible trip purpose on the day of the survey administration. Because of the likelihood that travel experiences and perceptions both influence and are influenced by travel frequency, I excluded the transportation experiences questions from the multivariate analysis. I discuss this choice in more detail in Chapter 3.

Results

Descriptive statistics

Immigrant origins, socioeconomic characteristics, and residential locations

The survey sample (N = 2,087) was nearly evenly split between immigrants and non-immigrants. Forty-five percent of respondents reported they were born outside the United States. Mexico was the most common country of origin, accounting for 45 percent of immigrant respondents who provided their home countries. Other frequently listed origins include China, India, the Philippines, and countries in the remainder of Central America. On average, immigrants reported having lived in the United States for 15 years, though 22 percent of immigrant respondents had arrived within the previous five years. Filtering to countries of origin represented by ten or more people, Guatemalans had migrated most recently on average (8.6 years), while Nicaraguan immigrants were the most settled (25.8 years).

Survey respondents had lower household incomes than the regional average, primarily because the research design oversampled transit users in lower-income neighborhoods. The median household income category of survey respondents who reported income was $15,000–$24,999, far below the regional median of $91,500 according to the PUMS 2014 one-year sample (Ruggles et al. 2015). Within the survey sample, immigrants tended to earn less than the US-born respondents. Nearly two-thirds of immigrants who reported income earned less than $25,000 per year, compared to less than half of US-born respondents (Table 2.1).

Survey respondents are unlike the average central San Francisco Bay Area resident according to other sociodemographic characteristics (Table 2.2). By design, the intercept survey was conducted to overrepresent Latino immigrants—half of all respondents identify as Hispanic or Latino, compared to 21 percent in the regional population. Several characteristics reflect survey respondents' lower socioeconomic status compared to regional averages as well. Survey respondents are less educated, less likely to be employed, and more likely to be renters compared to the population. They are seven years younger than the average central Bay Area resident and tend to have larger households. Immigrants who responded to the survey are newer to the United States, having been in the country an average of 15 years, eight fewer than the average immigrant in the region.

Among survey respondents, sociodemographic characteristics of low-income immigrants differed from those of other groups in a number of key ways (Table 2.3). They were more likely to be Hispanic or Latino compared to all other income and nativity groups, and more likely to be Asian than the US-born groups. Four out of five low-income immigrants are Latino, indicating that for the survey sample, Latino immigrants are nearly synonymous with low-income immigrants. About four in ten low-income immigrant respondents had less than a high-school education, over four times

Table 2.1: Income distribution of survey respondents

Income	Immigrant (N = 938)	US-born (N = 1,038)
$0–$4,999	15%	9%
$5,000–$14,999	13%	12%
$15,000–$24,999	13%	13%
$25,000–$49,999	12%	14%
$50,000–$74,999	6%	14%
$75,000–$99,999	4%	6%
$100,000–$149,999	2%	5%
$150,000–$199,999	1%	3%
$200,000 or more	1%	2%
Not reported	33%	23%

as many as the next highest group, which suggests fewer opportunities for economic advancement. They were less likely to be employed than both higher-income immigrant and US-born respondents, as well as less likely to be in school than those born in the United States. Lower employment rates and not attending school suggests low-income immigrants may make fewer trips and have different trip patterns than other groups. Fewer than one in ten low-income immigrants owned their homes, compared to a quarter of higher-income immigrants and a third of higher-income US-born respondents.

As one might expect, low-income immigrants had less access to transportation resources than other groups (Table 2.4). Nearly 70 percent lacked car access, compared to half of higher-income immigrants and 43 percent of higher-income US-born residents. Likewise, only 15 percent of low-income immigrants had full-time access to a vehicle, compared to a third of higher-income immigrants and 43 percent of higher-income US-born residents. Similarly, significantly fewer low-income immigrants had bicycles compared to all other income and nativity groups. Finally, low-income immigrants were significantly less likely than all other groups to have a bus pass. Slightly more than one-third did, compared to at least half of all other nativity and income groups. Less access to cars, bicycles, and transit suggests that low-income immigrants face more constraints on their travel frequency and mode choices than other immigrants or the US-born.

Survey respondents lived across the San Francisco Bay Area and beyond with 171 ZIP codes represented in the dataset. Not every respondent provided a ZIP code, but about 80 percent of respondents provided residential location for at least the city level. Nearly three quarters of those providing data lived in San Jose, Oakland, or San Francisco. For the most part, however, respondents' homes were concentrated near the intercept survey sites (Figure 2.1). The Fruitvale ZIP code in Oakland was the most represented neighborhood, where 11 percent of respondents lived. The second-most common ZIP code was the Mission District in San Francisco, where seven percent of respondents lived. About 20 percent of respondents lived in central and east San Jose neighborhoods.

Table 2.2: Sociodemographic characteristics of survey respondents compared to the central San Francisco Bay Area.

	Intercept survey respondents	Central SF Bay Area population
Proportions (%)		
Race/ethnicity		
Hispanic/Latino	50	21
White	14	40
Black	12	6
Asian	11	30
Two or more	2	3
Education		
Less than HS	15	12
High school/GED	28	17
More than HS	46	71
Employed	59	64
In school	24	11
Female	41	51
Renter	73	42
Means		
Years in US (immigrants)	15	22
Age	39	46
Household size	3.9	2.6
Under age 16	1.1	0.5
Age 16 and over	3.0	2.1
Median		
Median household income	$15,000–$24,999	$91,500

Sources: Survey and PUMS 2014 one-year estimates (Ruggles et al. 2015). *Note: Summary statistics for the SF Bay Area population are estimated from the Public Use Microdata Series (PUMS) data for Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara counties, using PUMS-provided household and person weights. Only the population 18 years of age or older are tabulated in the summary to match the survey eligibility criteria.*

Table 2.3: Sociodemographic characteristics, by nativity and income group (survey respondents)

	Immigrant		US-born		All resp.
Income:	Low	High	Low	High	
Proportions (%)					
Race/ethnicity					
Hispanic/Latino	81	**54**	**40**	**30**	50
White	1	**7**	**22**	**30**	14
Black	1	3	**22**	**19**	12
Asian	11	**30**	**4**	**6**	11
Two or more	1	1	**4**	**6**	2
Education					
Less than HS	43	**10**	**7**	**1**	15
High school/GED	31	28	**40**	**17**	28
More than HS	21	**59**	**51**	**80**	46
Employed	54	**78**	55	**80**	59
In school	19	25	**32**	**31**	24
Female	43	44	48	41	41
Renter	91	**73**	*85*	**66**	73
Means					
Years in US	15	16	NA	NA	15
Age (years)	42	41	**37**	**37**	39
Household size	3.6	3.4	3.7	3.1	3.9
Under age 16	1.4	1.2	**1.0**	**0.8**	1.1
Age 16 and over	2.8	2.6	3.0	2.6	3.0
Total responses	389	240	352	450	2,087

Note: Bold values indicate significant differences from low-income immigrant group ($p < 0.05$)

Mode use

The first question of the survey asked people to answer how many days in the previous week they drove, carpooled, walked, cycled, and took public transit. Among survey respondents, immigrants and non-immigrants differed little in whether they used a particular mode of transportation. A significant majority of respondents took public transit and walked in the week prior to taking the survey. About one-third carpooled, 30 percent drove, and 20 percent rode a bicycle. However, immigrants were less likely to travel by all modes of transportation than people born in the United States (Figure 2.2), suggesting they travel less overall, consistent with US data (Chatman and Klein 2009). It also suggests immigrants are less multimodal than people born in the United States. On average, US-born respondents used 2.7 modes of transportation the week prior, while immigrants used 2.4, a statistically significant difference ($p < 0.001$).

Patterns of mode use found in the survey characterized by the length of time immigrants have been in the United States do not mirror patterns found in US Census or NHTS data. For example, although bicycling declines for longer-tenured immigrants, carpooling and transit use increase from

Table 2.4: Comparison of survey respondents' access to transportation resources by nativity and income group

	Immigrant		US-born		All resp.
Income:	Low	High	Low	High	
Vehicle access					
0 days	69	**50**	69	**43**	62
1–6 days	16	17	13	15	13
7 days	15	**33**	18	**43**	24
Bicycle access					
0 days	80	*72*	*72*	**58**	71
1–6 days	5	5	3	5	5
7 days	16	*23*	**25**	**37**	24
Bus pass	38	**52**	**59**	**54**	51

Note: Values are percentages. Bold ($p < 0.01$) and italics ($p < 0.05$) indicate significant differences from the low-income immigrant group, using pairwise tests of proportions.

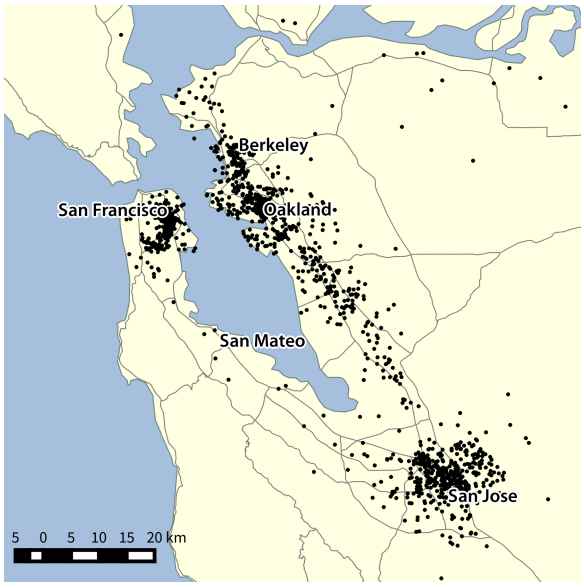

Figure 2.1: Home ZIP codes of survey respondents

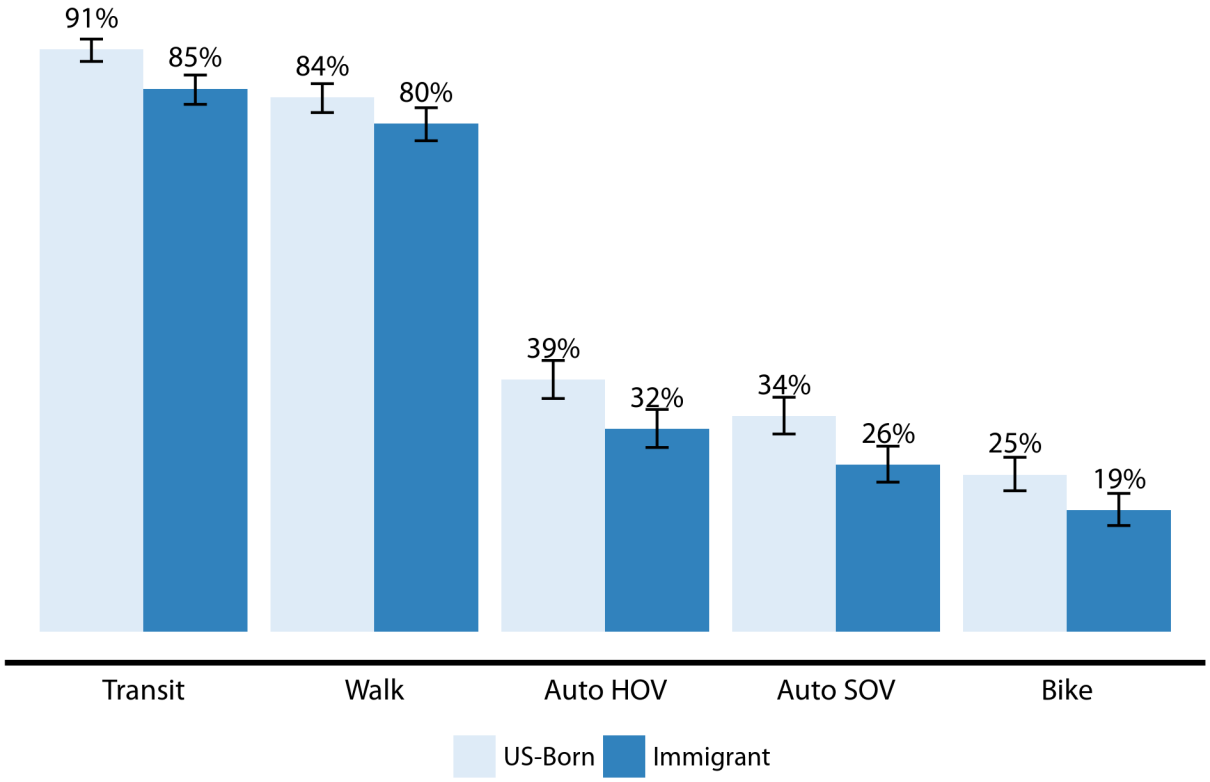

Figure 2.2: Proportion of each mode taken by nativity status

newly arrived to 20 years in the US. For immigrants in the US longer than 20 years, the likelihood of carpooling and transit decreases again to proportions below more recent immigrants (Figure 2.3). The location of survey sites and home locations is one possible reason for this difference. Although there was some variation in spatial characteristics of the dataset such as by by population density and land use characteristics (illustrated more fully in Chapter 3), national surveys have much more variation in the built environments of their samples and can capture immigrant suburbanization trends more robustly. In contrast, respondents to this survey lived and were surveyed primarily in the central portion of the region. Another likely reason for the difference when compared to national data sources is the way the travel mode question was asked in the survey. The intercept survey asked about the number of days someone used each mode of transportation in the previous week, while national travel surveys ask about the usual mode to work (US Census) or mode for a particular trip (NHTS). These differences further highlight the unique nature of this dataset.

On the whole, the differences in the number of days immigrants and non-immigrants used each mode of transportation were fairly small. This pattern reflects the higher likelihood of transit riders being selected for a survey, as about three-quarters of the surveys were administered at either BART stations or bus stops. Immigrants and non-immigrants drove, carpooled, and walked about the same average number of days in the week prior to taking the survey. Both groups drove and carpooled approximately one day on average, while they walked 2.3 days on average. However,

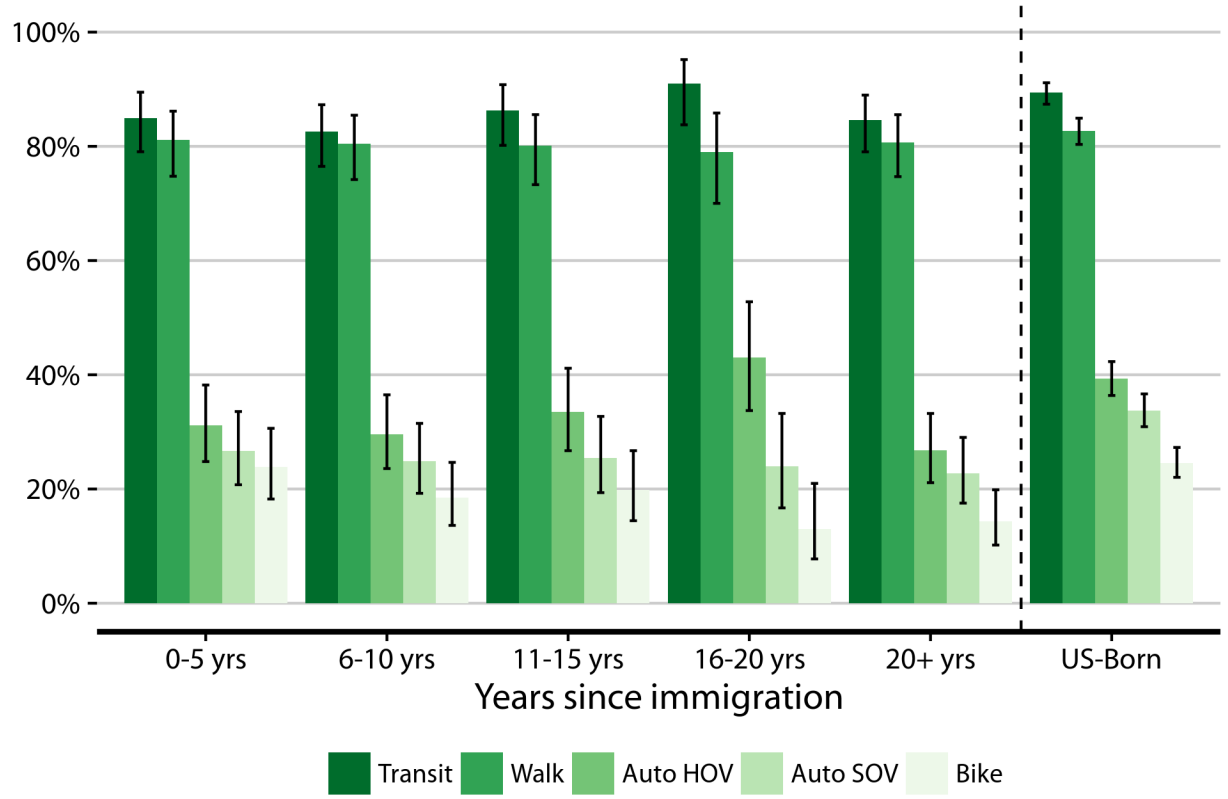

Figure 2.3: Proportion of each mode taken by length of time in the United States

immigrants bicycled and took public transportation less often than non-immigrants. Immigrants averaged 0.7 days on a bicycle compared to 0.9 for non-immigrants, while immigrants averaged 4.2 days on public transit compared to 4.6 days for non-immigrants. (Using the Wilcoxon rank-sum test, all differences except walking were statistically significant at $p < 0.05$ or better.) Most respondents were regular transit riders, with 54 percent of immigrants and 63 percent of non-immigrants using public transit at least five days per week. Walking among both groups exhibited a bimodal pattern. Half of immigrants never walked while 20 percent walked every day; 44 percent of non-immigrants never walked while 18 percent walked every day.

Likewise, there were almost no statistically significant differences between immigrants and non-immigrants in their modes of transit access. Walking was the most common means of getting to and from public transit; both groups averaged 3.4 days of walking to transit per week. Both groups less commonly drove (0.3 days) or carpooled (0.4 days). However, the difference in frequency of bicycling to transit was statistically significant ($p < 0.001$). US-born respondents bicycled to transit almost twice as much as immigrants, or 0.8 days and 0.4 days respectively. Similar to walking as a origin-to-destination mode of transportation, the distribution of responses to walking as transit access was bimodal. One quarter of both immigrants and non-immigrants walked to transit every day, while 31 percent of immigrants and 27 percent of non-immigrants never walked to transit.

But just as immigrants themselves are not a homogeneous group, neither are their patterns of

mode use when looking in further detail (Table 2.5). Low-income immigrants walked about a day more and drove about a day less than higher-income immigrants, though averages of other modes were about the same. Although the survey did not prompt for occupation type, surveyors visited day laborer waiting locations so I used the survey site type as a proxy for whether a respondent was a day laborer or other type of worker. Immigrants who were day laborers walked twice as often, bicycled more than twice as often, and took transit about two-thirds as often as non day-laborers. Immigrant women took transit and got rides more than immigrant men, while they drove, walked, and bicycled less. Immigrant women rarely bicycled; of the 423 people who reported bicycling, only 8 percent were immigrant women, while 17 percent were US-born women, a statistically significant difference ($p = 0.03$). Employed immigrants generally traveled more often than unemployed immigrants, except when it came to walking. Geography also played a role in significant differences in immigrants' mode use. Immigrants who took the survey in the East Bay drove and bicycled more than others, but took transit the fewest number of days per week.

Table 2.5: Differences in days of average mode use per week, immigrant respondents

	Drive	Ride	Walk	Bike	Transit	*N*
Income						
Low-income	0.8*	0.9	2.6*	0.7	4.1	389
Higher-income	1.7*	0.9	1.7*	0.7	4.0	240
Type						
Day labor	1.1	1.2	4.0*	1.5*	3.0*	138
Not day labor	1.0	0.9	2.1*	0.6*	4.3*	1,919
Sex						
Female	0.8*	1.1*	2.0*	0.2*	4.5*	851
Male	1.2*	0.8*	2.5*	1.1*	3.9*	1,107
Employment						
Employed	1.2*	1.0*	2.0*	0.8	4.4*	1,222
Unemployed	0.7*	0.7*	2.7*	0.6	3.8*	687
Region of origin						
Central America	0.9*	0.9	2.6*	0.8	4.1	616
South Eastern Asia	0.9	1.0	2.1	0.5	4.3	69
Eastern Asia	0.9	0.6	2.0	0.4	3.9	62
South Central Asia	1.5*	0.6	1.8*	0.4*	4.3	51
South America	1.7	0.9	1.7	1.5*	4.3	22
Survey region						
East Bay	1.3*†	1.0	2.3	1.0*†	3.6*†	1009
San Jose	0.9†	0.9	2.2*	0.5†	4.3†‡	442
San Francisco	0.5*	0.8	2.7*	0.4*	5.0*‡	606

Note: Matched symbol pairs indicate statistically significant differences ($p < 0.05$) within each variable by mode

Transportation experiences

The second main section of the survey asked respondents to answer questions about their experiences using public transit and bicycling. Many of these questions were derived from interviews conducted with low-income Latino immigrants (Barajas, Chatman, and Agrawal 2016). The purpose of these questions was to understand which barriers low-immigrants face when using those modes, and whether they differed by nativity or household income. Detailed summaries of responses to each question are in Appendix D.

What prompts more transit and bicycle use?

Given lower economic advancement, poorer neighborhoods, and immigrant-specific challenges, I expected immigrants in general and low-income immigrants in particular to face substantially greater barriers than their US-born counterparts to using public transit or bicycling more often. However, differences were fairly minor between immigrants and non-immigrants (Table 2.6). Respondents were first asked "How much more would you have [taken the bus or train/bicycled] in the past 7 days if the following were true?" Transit fare affordability was the primary concern for a majority of respondents. Immigrants were slightly more sensitive to costs than non-immigrants; 58 percent of immigrants compared to 51 percent of US-born respondents would have ridden transit at least one day more if fares were more affordable, a statistically significant difference ($p = 0.005$). A smaller proportion thought neighborhood crime prevented additional transit use, but immigrants were more likely to consider it a concern (43 percent) than the US-born (38 percent). But fewer respondents agreed that changes in cycling conditions would affect their cycling or transit-taking frequency, and there were no significant differences between immigrants and non-immigrants. Only about a quarter of respondents would have taken transit more if there were more bicycle parking at transit stops or space on transit for bicycles. About one third of respondents would have cycled more if there were better bike lanes or paths, more space on-board transit for bicycles, and more bicycle parking at transit stops. Slightly fewer people would have cycled more if crime were reduced.[1]

When characterizing respondents by both income and nativity categories, a slightly different picture emerges (Table 2.7). As in the previous comparisons, transit fare affordability prevents a majority of people from taking transit as much as they would like. Not surprisingly, both low-income groups were more likely than the high-income US-born group to respond that transit-fare affordability prevents taking transit more often. Unexpectedly, however, higher-income immigrants were equally constrained by transit fares as low-income immigrants were, and significantly more so than their US-born counterparts. There were no other significant differences between low-income immigrants and the other groups for the remainder of transit questions. There were differences in cycling responses between income groups, however. Fewer low-income immigrants compared to higher-income immigrants responded that they would have cycled more if there were good bike lanes or if bike parking were more plentiful at transit stops. Higher-income immigrants appear to

[1] It is likely some people interpreted the two questions as asking for a level of agreement with the statement, rather than a revealed preference as asked. For example, 25 percent of respondents gave an illogical response to how much more they would ride transit if fares were affordable: they responded that they would have taken transit eight days per week or more.

Table 2.6: Factors that would increase transit use and bicycling

	Change	Immigrant	US-born	p-value
Would ride transit more if:				
Fares affordable	No change	42	49	0.005
	1 day or more	58	51	
Little crime	No change	57	62	0.022
	1 day or more	43	38	
Space for bikes on-board	No change	72	70	0.304
	1 day or more	28	30	
Bike parking available	No change	77	74	0.272
	1 day or more	23	26	
Would cycle more if:				
Little crime	No change	71	73	0.347
	1 day or more	29	27	
Good bike lanes	No change	65	64	0.645
	1 day or more	35	36	
Space for bikes on-board	No change	67	65	0.366
	1 day or more	33	35	
Bike parking available	No change	69	70	0.528
	1 day or more	31	30	

Note: Values are percentages

have more latent demand for cycling than low-income immigrants, but barriers that prevent transit use are fairly consistent across all four comparison groups.

Switching modes and missing trips

As I showed in the section on mode use, immigrants bicycle less often than non-immigrants. Although bicyclists are in the minority among all respondents, immigrants less frequently cycle to save time or money than US-born respondents. They are substantially less likely to cycle when they have the option to drive. Only 16 percent of immigrants have ever switched to cycling when driving was an option, compared to 26 percent of non-immigrants. Over twice as many US-born respondents (14 percent) compared to immigrants (6 percent) bicycled when they had the option to drive more than once per week. Similarly, although it is more common than bicycling, substantially fewer immigrants substitute taking transit for driving compared to non-immigrants. About a quarter of immigrants did so at least once a week, while 40 percent of non-immigrants did so. A surprising number of respondents reported missing trips at least once a month for the reasons asked. Nearly half were unable to make a trip because they did not have a car available to them, while over half missed a trip at least once a month because the bus was unreliable. However, there was no statistical difference in the proportion of immigrants missing a trip compared to US-born respondents (see Table 2.8).

Categorizing respondents by income category revealed statistically significant differences among all questions (Table 2.9). Bicycling was not an attractive option for low-income immigrants. They were less willing than higher-income groups to ride a bicycle to save time, save money, or as a replacement for driving when they had access to a car. Driving was much more attractive to

Table 2.7: Factors that would increase transit use and bicycling, by income and nativity

Question	Immigrant		US-born	
	Low	High	Low	High
Would ride transit more if:				
Fares affordable	60*	58†	59‡	46*†‡
Little crime	44	51*	43	37*
Space for bikes on-board	26	32	33	30
Bike parking available	21	26	28	25
Would bike more if:				
Little crime	28	36	31	29
Good bike lanes	31*	44*	38	37
Space for bikes on-board	31	41	36	38
Bike parking available	27*	41*†‡	28†	33‡

Note: Values are percentages who answered "1 day more" or greater. Matched symbol pairs indicate statistically significant differences ($p < 0.05$).

Table 2.8: Proportion of people switching modes or missing trips

Question	Change	Immigrant	US-born	p-value
How often do you…?				
Take the bus when driving is option	Never	55	41	<0.001
	At least once per month	45	59	
Miss a trip because no car	Never	51	53	0.305
	At least once per month	49	47	
Miss a trip because bus doesn't come	Never	43	44	0.624
	At least once per month	57	56	
Bicycle to save money	Never	77	71	0.004
	At least once per month	23	29	
Bicycle to save time	Never	76	71	0.034
	At least once per month	24	29	
Bicycle when driving is option	Never	84	74	<0.001
	At least once per month	16	26	

Note: Values are percentages

low-income immigrants compared to taking transit as well. While over half of other income and nativity groups chose public transit when driving was an option at least once a month, only 42 percent of low-income immigrants did so. Put simply, low-income immigrants appear to be less willing to forgo driving when it is an option.

Table 2.9: Proportion of people switching modes or missing trips at least once per month, by income and nativity

Question	Immigrant		US-born	
	Low	High	Low	High
How often do you…?				
Take the bus when driving is option	42^{abc}	62^{ade}	53^{bdf}	70^{cef}
Miss a trip because no car	53^{ab}	44^{ac}	54^{cd}	42^{bd}
Miss a trip because bus doesn't come	59	56	63^{a}	53^{a}
Bicycle to save money	21^{ab}	27	31^{a}	33^{b}
Bicycle to save time	22^{a}	27	28	32^{a}
Bicycle when driving is option	14^{abc}	24^{ad}	23^{be}	34^{cdf}

Note: Values are percentages who answered "at least once per month" or greater. Matched superscript letters indicate statistically significant differences in each row ($p < 0.05$).

Transit and bicycling complexity

To test whether immigrants perceived they faced more barriers in their travel, the final group of questions asked respondents to convey their level of agreement with a number of statements about the difficulty of certain elements of taking public transportation or bicycling (Table 2.10). In general, most respondents did not find taking public transit or bicycling particularly difficult in the ways that we asked about, such as whether they found it hard to take transit or bicycle when traveling with others. Most differences between immigrants and non-immigrants were fairly small. The largest difference between immigrants and non-immigrants was with respect to transit information. One quarter of immigrants, or twice the proportion of non-immigrants, disagreed that information was available in their language. (Note that 13 percent of the US-born responded that transit information was not available in their language, suggesting that a small proportion of people could not find the information at all.) Among the bicycling questions, the single largest statistically significant difference was for those who found it hard to get around without using bicycles together with transit. Immigrants were 7 percentage points less likely to agree that it would be hard to get around without integrating the two modes. Unlike other questions in the survey, this group of questions had a "Doesn't apply" option. Most respondents answered that the bicycling questions did not apply to them. To see the effects of this response pattern, I re-estimated proportions for all questions using the total number of people who selected the other response choices as the denominator. Patterns among the transit questions did not change, but patterns to the cycling questions did. Immigrants and non-immigrants found it equally difficult to cycle with more than one person, but immigrants were now more likely to perceive it to be hard to cycle to more than one place.

Table 2.10: Proportion of people who somewhat or completely agree that taking transit or bicycling is difficult

Question	Immigrant	US-born	p-value	*N*
How much do you disagree or agree with the following?				
Hard to take transit with others	29	25	0.021	1974
Hard to take transit to more than one place	44	46	0.468	1974
Bus or train info is not available in my language	26	13	<0.001	1974
Hard to bike with others	18	23	0.008	1974
Hard to bike to more than one place	15	17	0.159	1974
Hard to get around without bikes and transit	17	24	<0.001	1974
Cannot quickly find bike parking at transit stop	15	19	0.024	1974
Base: Did not answer "Doesn't apply"				
Hard to take transit with others	33	27	0.002	1796
Hard to take transit to more than one place	49	49	0.879	1828
Bus or train info is not available in my language	29	16	<0.001	1695
Hard to bike with others	45	41	0.230	929
Hard to bike to more than one place	38	30	0.011	937
Hard to get around without bikes and transit	45	45	0.955	908
Cannot quickly find bike parking at transit stop	41	37	0.184	878

Note: Values are percentages. The scales of the questions asking about transit information and bike parking were reversed from the original to consistently report agreement with the difficulty of each element in the table.

Although I expected more low-income immigrants to agree with the difficulty of taking transit and cycling for each question, evidence suggests their perceptions are more complex (Table 2.11). There is not a consistent pattern in how low-income immigrants responded compared to other income and nativity groups, however. For example, low-income immigrants were more likely to agree that it is difficult to take transit with others compared to other low-income respondents, but less likely than higher-income respondents to agree that transit is difficult to take to more than one place. They were generally less likely to agree that bicycling was difficult, but most of those differences vanished when looking only at responses from people who considered the question to apply to them. In that instance, low-income immigrants were more likely than other groups to consider stopping at multiple places to be difficult. The difference was statistically significant only when compared to low-income US-born respondents. Experiences of difficulty traveling may be associated with other factors aside from immigrant status; for example, whether one usually takes trips with children or whether a trip is for commuting or non-work purposes.

Regression models

Frequency of travel by mode differs by both immigrant status and household income, but what influences these differences? The bivariate analyses and literature review suggest other factors may matter, such as sex, employment status, region of origin, and residential location. Analysis of transportation experiences suggests perceptions of neighborhoods and transportation service also play a role in how often people take transit or bicycle, though these are likely to be affected by spatial

Table 2.11: Proportion of people who somewhat or completely agree that taking transit or bicycling is difficult, by income and nativity

Question	Immigrant		US-born		N
	Low	High	Low	High	
How much do you disagree or agree with the following?					
Hard to take transit with others	31^{*}	$30^{\dagger}$	$22^{*\dagger}$	26	1431
Hard to take transit to more than one place	$41^{*\dagger}$	$50^{*\ddagger}$	$39^{\ddagger\S}$	$51^{\dagger\S}$	1431
Bus or train info is not available in my language	$24^{*\dagger}$	$26^{\ddagger\S}$	$16^{*\ddagger}$	$13^{\dagger\S}$	1431
Hard to bike with others	$14^{*\dagger}$	$26^{*\ddagger}$	$19^{\ddagger\S}$	$29^{\dagger\S}$	1431
Hard to bike to more than one place	14^{*}	18	$14^{\dagger}$	$21^{*\dagger}$	1431
Hard to get around without bikes and transit	$16^{*\dagger}$	$21^{\ddagger}$	23^{*}	$28^{\dagger\ddagger}$	1431
Cannot quickly find bike parking at transit stop	15	16	20	20	1431
Base: Did not answer "Doesn't apply"					
Hard to take transit with others	$34^{*\dagger}$	32	23^{*}	$27^{\dagger}$	1329
Hard to take transit to more than one place	$44^{*\dagger}$	$53^{*\ddagger}$	$41^{\ddagger\S}$	$53^{\dagger\S}$	1356
Bus or train info is not available in my language	$26^{*\dagger}$	$30^{\ddagger\S}$	$17^{*\ddagger}$	$16^{\dagger\S}$	1264
Hard to bike with others	42	51^{*}	$33^{*\dagger}$	$49^{\dagger}$	721
Hard to bike to more than one place	40^{*}	$36^{\dagger}$	$25^{*\dagger}$	33	733
Hard to get around without bikes and transit	48	43	43	45	711
Cannot quickly find bike parking at transit stop	44	33	38	35	687

Note: Values are percentages. Matched symbol pairs indicate statistically significant differences in each row ($p < 0.05$). The scales of the questions asking about transit information and bike parking were reversed from the original to consistently report agreement with the difficulty of each element in the table.

characteristics or mode use itself.

I estimated a series of regression models to test whether an effect of immigrant status remains in explaining frequency of mode use after controlling for socioeconomic and spatial characteristics presented earlier in the bivariate analyses. Note that because of the possible simultaneous influence of perceptions and travel frequency on each other, I omitted those factors from this analysis and present a different multivariate analysis that includes them in Chapter 3. Results from each estimated model are in Table 2.12. Coefficients in the table represent incidence rate ratios, or the odds of the specified group using the specified mode one additional day divided by the odds of the same increase in the base group (or the increased odds given a one unit increase in a continuous predictor). The 95 percent confidence intervals are also reported.

Overall, there were few differences between immigrants and non-immigrants in the frequency of each mode taken when controlling for other factors in the model. When looking at factors influencing the frequency of driving, higher-income groups were more likely to drive than the lowest-income group. Households earning over $100,000 drove over twice as much as households earning less than $25,000. Unsurprisingly, people with access to a car were far more likely to drive than those without, while those holding bus passes drove about one-third as often as those without. However, access to a bicycle did not seem to have an effect on driving. The coefficients associated with having access to transportation resources may reflect the effects of sunk costs on travel. In other words, people who have spent time to arrange access to a car or purchase a bus pass have already invested

in taking those modes, and would be more likely to want to recoup the investment. The survey location also mattered when predicting driving. People surveyed away from transit stops drive more frequently than those surveyed at BART, with day laborers driving over twice as much as people surveyed at BART. The nature of day labor work—variable locations and times, and the possibility of hauling goods and materials to work sites—may account for this finding. Finally, consistent with theory, driving is more frequent in less dense locations.

Some of the carpooling results are surprising, running counter to prior research, but may reflect the unique nature of this dataset. Immigrants carpool about half as much as non-immigrants, which does not vary by region of origin or income category. Furthermore, immigrants appear to carpool more often the longer they have been in the United States, though the squared term is slightly less than 1.0 indicating that the effect declines over time. Because most respondents were surveyed at transit stops while they were making a transit trip, the findings may reflect the possibility that carpooling and transit use are more likely to substitute for one another for immigrants compared to non-immigrants. These findings may also be a result of the unit of analysis, which measures frequency rather than choice. Few other variables were statistically significant, though people with car access carpooled about twice as often as carless households. Additionally, higher employment densities at the ZIP code level corresponded with less carpooling, suggesting the possibility that jobs are easier to access by other modes in more job-rich areas.

Few variables significantly predicted walking, except survey location and car access. Day laborers and bus riders walked more often than BART riders, while people who had access to cars walked less often than those without.

Many of the characteristics related to bicycling are expected, though some are new findings. For example, immigrants appeared to bicycle less often than US-born respondents, though the differences were not statistically significant at the customary 95 percent confidence interval. Women cycled about two-thirds less often than men, consistent with prior research, and Latina women cycled even less often. On the other hand, Latin American immigrants who did not report income bicycled more frequently than low-income Latin American immigrants, a finding difficult to interpret further given the unknown income levels. Bicycling frequency declined with age, while employed people bicycled nearly twice as much as the unemployed. This suggests that work trips are common among cyclists surveyed. Note that bicycle access and the interaction between nativity and income were removed from the model estimation because there were too few observations in the "no bike access" category and several interacted categories for the model to converge.

Although there was no significant difference between low-income immigrants and the low-income US-born with respect to how frequently they took transit, interaction effects between Latin American immigrants and income were significant. Higher income Latino immigrants took transit less frequently compared to both lower-income groups. Similar to the effects of residence in the US on carpooling, transit use increased among immigrants the longer they remained in the US, though at a declining rate over time. The effects of transportation resource access were stronger for taking transit than for other modes. Bus pass holders took transit about 30 percent more often than non-pass holders, while people with cars and bicycles took transit less often. Curiously, transit stop density had no discernible effect on the frequency of taking transit.

Table 2.12: Regression models of frequency of travel by mode

	Days drive	Days carpool	Days walk	Days bike	Days transit
Immigrant: Latin America	0.95 (0.43, 2.10)	0.53* (0.26, 1.10)	1.23 (0.76, 1.99)	0.57 (0.24, 1.40)	0.89 (0.76, 1.05)
Immigrant: Other region	1.25 (0.49, 3.30)	0.46* (0.19, 1.11)	1.17 (0.63, 2.25)	0.40* (0.14, 1.17)	0.86 (0.70, 1.05)
Income: $25k–$100k	1.26 (0.87, 1.83)	0.90 (0.64, 1.27)	0.98 (0.76, 1.25)	1.29 (0.82, 2.02)	0.99 (0.92, 1.08)
Income: $100k or more	2.35*** (1.42, 3.95)	1.01 (0.61, 1.70)	0.82 (0.56, 1.21)	1.28 (0.65, 2.61)	0.95 (0.83, 1.07)
Income: Missing	0.96 (0.60, 1.53)	1.25 (0.83, 1.90)	0.98 (0.72, 1.33)	1.12 (0.68, 1.90)	1.03 (0.93, 1.13)
Immigrant × years in US	0.96 (0.90, 1.02)	1.09*** (1.02, 1.16)	1.00 (0.96, 1.04)	1.04 (0.96, 1.14)	1.02** (1.00, 1.03)
Immigrant × years in US^2	1.00 (1.00, 1.00)	1.00*** (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00** (1.00, 1.00)
Female	0.92 (0.68, 1.26)	1.32* (0.99, 1.75)	0.96 (0.78, 1.18)	0.35*** (0.22, 0.54)	0.96 (0.90, 1.02)
Age	0.99* (0.98, 1.00)	0.98*** (0.97, 0.99)	1.00 (0.99, 1.00)	0.98*** (0.96, 0.99)	1.00 (1.00, 1.00)
Employed	1.12 (0.84, 1.49)	0.92 (0.71, 1.20)	0.91 (0.75, 1.10)	1.90*** (1.24, 2.90)	1.12*** (1.05, 1.19)
Survey area: San Francisco	0.90 (0.59, 1.40)	0.93 (0.62, 1.39)	1.11 (0.85, 1.47)	0.45*** (0.25, 0.82)	1.09* (0.99, 1.19)
Survey area: San Jose	0.69** (0.48, 0.99)	0.88 (0.62, 1.23)	0.95 (0.75, 1.20)	0.74 (0.42, 1.30)	0.98 (0.90, 1.06)
Survey location: Bus stop	0.99 (0.70, 1.41)	1.06 (0.77, 1.44)	1.32** (1.05, 1.66)	0.71 (0.44, 1.16)	0.95 (0.88, 1.03)
Survey location: Business	1.58** (1.06, 2.38)	1.00 (0.68, 1.46)	1.12 (0.85, 1.48)	0.69 (0.39, 1.25)	0.86*** (0.78, 0.94)
Survey location: Day labor site	2.41*** (1.31, 4.52)	1.24 (0.72, 2.16)	1.63** (1.10, 2.46)	1.58 (0.72, 3.77)	0.69*** (0.59, 0.80)
Has car access	7.21*** (5.63, 9.28)	1.96*** (1.55, 2.47)	0.78*** (0.65, 0.94)	0.89 (0.60, 1.32)	0.78*** (0.73, 0.82)
Has bike	0.80 (0.59, 1.09)	0.91 (0.68, 1.21)	0.92 (0.75, 1.13)		0.91** (0.85, 0.98)
Has bus pass	0.64*** (0.50, 0.82)	0.83 (0.65, 1.05)	0.89 (0.75, 1.06)	0.85 (0.58, 1.26)	1.30*** (1.23, 1.38)
Transit stop density	0.10** (0.02, 0.52)	2.43 (0.41, 14.47)	2.42 (0.74, 8.06)	1.10 (0.09, 14.37)	1.10 (0.74, 1.63)
Employment density (log)	0.99 (0.84, 1.16)	0.86* (0.73, 1.01)	1.05 (0.93, 1.18)	1.24 (0.95, 1.62)	1.02 (0.98, 1.06)
Immigrant (LA) × moderate income	2.03* (0.99, 4.20)	1.43 (0.74, 2.78)	0.88 (0.54, 1.44)		0.81** (0.69, 0.96)
Immigrant (Other) × moderate income	1.61 (0.60, 4.27)	1.45 (0.58, 3.58)	0.68 (0.36, 1.27)		0.87 (0.71, 1.08)
Immigrant (LA) × high income	2.44 (0.64, 11.38)	0.88 (0.22, 4.05)	0.96 (0.35, 3.01)		0.73* (0.49, 1.04)
Immigrant (Other) × high income	1.08 (0.28, 4.67)	0.54 (0.12, 2.39)	0.34* (0.11, 1.04)		1.06 (0.75, 1.48)
Immigrant (LA) × missing income	0.51 (0.23, 1.16)	0.89 (0.44, 1.79)	0.98 (0.60, 1.60)		0.87 (0.74, 1.03)
Immigrant (Other) × missing income	0.95 (0.31, 2.86)	0.87 (0.32, 2.33)	0.58 (0.29, 1.17)		0.98 (0.78, 1.22)
Immigrant (LA) × Female	1.40 (0.75, 2.63)	0.84 (0.48, 1.48)	0.74 (0.50, 1.11)	0.07*** (0.01, 0.26)	1.06 (0.93, 1.21)
Immigrant (Other) × Female	0.88 (0.42, 1.81)	1.29 (0.64, 2.64)	1.17 (0.71, 1.93)	2.10 (0.71, 6.28)	0.98 (0.84, 1.16)
Constant	0.70 (0.36, 1.35)	2.23*** (1.23, 4.09)	2.09*** (1.37, 3.20)	1.49 (0.63, 3.57)	4.10*** (3.56, 4.73)
Observations	1,240	1,240	1,240	1,242	1,240
Log Likelihood	−1,420.57	−1,563.64	−2,472.26	−1,168.30	−2,760.65
θ	0.40*** (0.04)	0.39*** (0.03)	0.63*** (0.04)	0.14*** (0.01)	
Akaike Inf. Crit.	2,899.15	3,185.29	5,002.52	2,380.60	5,579.31

*Note: Coefficients represent incident rate ratios. Values in parentheses are 95% confidence intervals. LA - Latin American. Base categories: Immigrant - US-born; Income - Less than 25,000 (low-income); Survey area - East Bay; Survey location - BART station. *p<0.1; **p<0.05; ***p<0.01*

Interaction effects

I added interaction terms in the models to test whether effects of sociodemographic and spatial characteristics varied by country of origin and income. Interaction effects in regression models are difficult to interpret in a straightforward manner; plotting them is often the best way to understand the influence of the independent variables on the outcome of interest. Plots of the predicted values of mode use frequency along each of the interacted variables in the regression equations are depicted in Figure 2.4. Each other variable is held at its mean or modal value to generate the effects. Wide confidence intervals for most of the comparisons prevent many definitive statements about the differences between groups, though a few stand out. The most striking differences among immigrants, income groups, and sex are in the frequency of bicycling. Within the same immigrant group, the effects of household income on bicycling frequency is negligible. However, when controlling for all other variables, US-born and Latin American immigrant women bicycle an average of two days per week less than men. In other words, controlling for the other independent variables, Latin American immigrant women almost never bicycle. The same difference does not hold for immigrants from other origins, though, because both men and women bicycle about one day a week. This suggests that cultural differences around cycling for women remain after controlling for other socioeconomic and spatial factors. Further research on immigrants with other origins would help explain what accounts for the lack of difference between men and women. Note that the "other" category contains immigrants from a variety of world regions.

For both walking and riding transit, the controlled effect of income on frequency of use is quite significant for different groups. For both men and women, the US-born and the foreign-born, walking declines slightly as incomes increase. However, the effects of income are much more pronounced among immigrants from non-Latin American countries, as the high-income group walks almost three days less than the low-income group. Some of the difference is accounted for by increased driving. A similar effect is observed for transit use among Latin American immigrants. As incomes rise, transit use declines and driving increases. In this case, travel patterns for some immigrants reflect the common narrative of "making it" in America: rising incomes offer the opportunity to achieve the goal of car ownership and transportation self-reliance.

Conclusions

Although the intercept survey responses used for this analysis are not statistically representative of the San Francisco Bay Area population as a whole, they are still useful in making comparisons among low- and higher-income, immigrant and US-born residents of the areas targeted by the survey in the central San Francisco Bay Area. The low-income group in this study is roughly equivalent to households in poverty, making understanding their travel behavior a critical equity issue. Furthermore, the methods used in this analysis provide an opportunity to answer different questions than are possible using conventional travel surveys; namely, prevalence of mode use over a week-long period and the relationship between immigrant status, income, and travel experiences in a large urban area.

The analysis in this chapter suggests low-income immigrants are at a significant disadvantage when it comes to transportation access. They have less access to cars, bicycles, and bus passes than

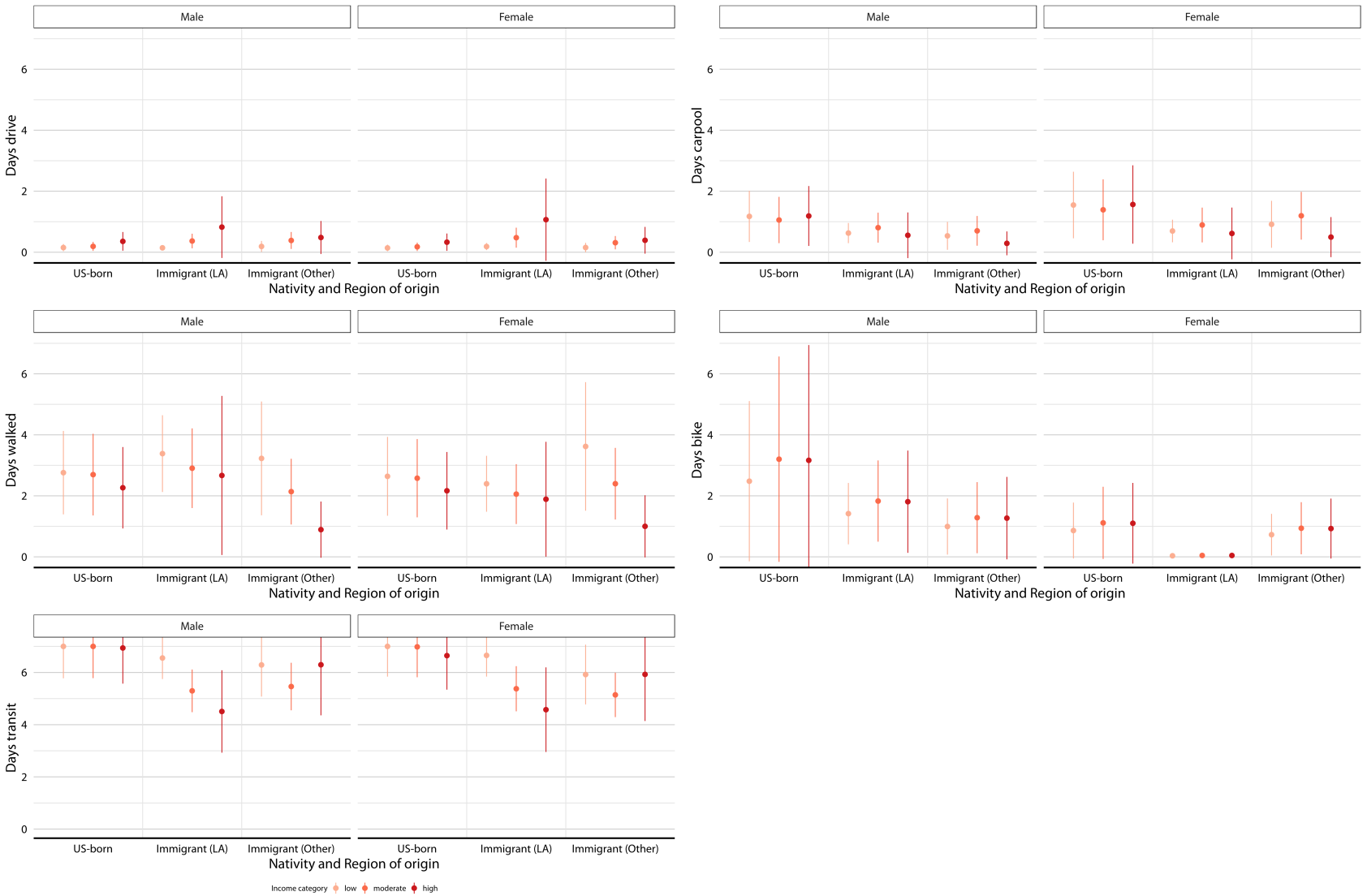

Figure 2.4: Effects of nativity, household income, and gender on frequency of mode use

other groups, consequently traveling less than most others by those modes. Multivariate analysis reveals that many differences in travel frequency can be explained by availability of transportation resources, employment status, and spatial characteristics of the survey location and home. Nevertheless, some differences among nativity groups remain after controlling for those other factors. In particular, Latino immigrants are more likely to drive and less likely to take transit compared to other groups as their incomes rise, while Latin American immigrant women of any income are far less likely to cycle than others. Cultural narratives may play a role in both these instances. Economic advancement may motivate immigrants to fulfill dreams of car ownership even when they live in a transit-rich region, while patriarchal norms may discourage cycling, even beyond other reasons for gender differences in cycling (see Chapter 4 for more details about this argument). Reasons such as these are difficult to capture in traditional travel surveys. They suggest a need for customized data collection to understand the basis for demographic differences as analysis inputs, and a role for targeted outreach that understands how cultural differences impact travel choices as planning and research outputs.

Questions about respondents' transportation experiences add further context to the findings in the bivariate and multivariate analyses. Principally, most low-income immigrants did not consider bicycling to be a travel option for them. Most did not respond to the questions asking them to agree or disagree with statements about bicycling. They were also the least likely to want to bicycle more for the reasons asked about, to see it as a money- or time-saving option, or to substitute bicycling for driving if it were available. Driving and car access are even more important for low-income immigrants when considering that over half have missed a trip in the last month because they did not have a car, and less than half would take transit if they had a car available to them. Even among those with irregular access to vehicles, driving remains a critical link in fulfilling mobility needs (e.g. Lovejoy and Handy 2008). The implication for planning is to carefully consider how to meet those needs by reducing the lack of appeal of alternative options to the car.

3 To Cycle or not to Cycle: The Role of Attitudes and Perceptions on Immigrant Bicycling

In the previous chapter, I found that immigrants cycle less than people born in the United States. The difference persisted when controlling for other sociodemographic and spatial characteristics of survey sites and residential ZIP codes, albeit with wide margins of error. This is partly because fewer immigrants had bicycles, and partly because immigrants were more likely to walk or drive than to cycle to transit. Within the immigrant cohort, differences in cycling frequency varied by sex, residential county, and by whether the respondent worked as a day laborer. Perceptions toward cycling also varied by immigrant status. In particular, low-income immigrants were less likely to agree with positive statements toward bicycling. They rarely chose to cycle when the option to drive was available—much less than the comparison groups. These findings contrast with research based on national datasets, which finds that immigrants cycle more, all else equal (Blumenberg 2009; Smart 2010, 2015).

Why would urban-dwelling immigrants cycle less? They may live in neighborhoods with more robust transit infrastructure that makes it easier to take a bus or train, as was the case in this dataset. Suburban job locations of occupations immigrants typically hold may make it less feasible for central-city residents to commute by bicycle, while those who live and work in immigrant enclaves may be *too* close to work to bicycle. Less cycling may be a self-reinforcing pattern, in that immigrants who do not see their friends or acquaintances cycling may view it as an activity that belongs to other people. And as we saw earlier, immigrants may not consider cycling to be a viable transportation option because of their perceptions of neighborhood quality or accessibility needs. Thus, I ask whether the findings related to cycling in Chapter 2 hold when controlling for the built environment, attitudes and perceptions, and social factors. Whether or not they do hold, what are the strongest influences on a person's decision to bicycle? And, do those factors vary between immigrants and non-immigrants? If factors beyond infrastructure play a role encouraging bicycling, it would suggest new or enhanced roles for transportation agencies to undertake: from planner as urban designer and travel forecaster to planner as promoter, marketer, and outreach coordinator. Likewise, differences in cycling perceptions by demographic groups would provide strong evidence for marketing programs to be targeted to a variety of communities and constituencies.

This chapter begins with a review of the literature on factors associated with bicycle travel. The review focuses how psychological factors influence cycling, and on the analytical approaches researchers use to explore those influences. Then, I describe the methods of this study and present analysis that investigates the relationships I proposed in the conceptual model in Chapter 1. Finally, I discuss the results and briefly suggest implications for policy based on the findings.

Literature review: A framework for understanding active travel behavior

Why do people bicycle?

Although a variety of factors could influence behavior, some scholars have described the choice to bicycle as the outcome of physical environment factors, individual characteristics, and the social environment (Handy, Xing, and Buehler 2010). The physical environment includes characteristics such as density, cycling infrastructure, topography, and land use. Individual factors include both demographic characteristics, such as age and gender, as well as perceptions and attitudes related to travel, such as liking to bicycle. The social environment describes the interaction between the individual and his or her interpersonal relationships. A father might bicycle his daughter to school, establishing a positive social norm where bicycling is encouraged in the family. On the other hand, if showing up to the office with helmet hair earns the boss's ire, the social norm around being presentable at work discourages cycling. These three interrelated factors are derived from social ecological models in the public health literature (Sallis, Owen, and Fisher 2008). In one version of an ecological model, Sallis et al. (2006) describe a variety of factors that could be involved in encouraging active living. A person wanting to bicycle, for example, must be physically able to do so; must perceive it to be comfortable, safe, and convenient; must have access to a bicycle and a neighborhood with good bicycle accessibility; and must benefit from urban policies that make bicycling an viable transportation option.

Certain urban form and infrastructure characteristics make it easier to bicycle. Metropolitan areas with greater density of both dedicated and separated bicycle lanes have more bicycling (Dill and Carr 2003; Dill 2009; Buehler and Pucher 2012), but it is likely to be a reciprocal relationship. More bicycle infrastructure drives cycling in part because people prefer designated facilities to cycling in mixed traffic (Buehler and Dill 2016), and in part because cities with higher numbers of cyclists may demand more infrastructure. Cycling is more common in areas with higher land use mixes because those areas bring origins and destinations closer together (Cervero and Duncan 2003; Heinen, van Wee, and Maat 2010; Forsyth and Krizek 2010; Winters, Brauer, et al. 2010). Synergies in amenities available in the built environment, such secure bicycle parking at transit stations, drive higher levels of cycling in transit-served areas by making it more convenient to bike-and-ride (Barajas 2012; Cervero, Caldwell, and Cuellar 2013). Moreover, cities and regions that package bicycle infrastructure with a wide range of public policies and investments, such as by providing parking, coordinating transit access, and introducing automobile restrictions, have higher rates of cycling because they make it much more convenient relative to other modes (Pucher and Buehler 2008; Pucher, Dill, and Handy 2010).

Some individual characteristics also play an indirect role in motivating bicycling. Women, for example, are much less likely to bicycle than men, hypothesized to be a result of greater household burdens and a higher aversion to perceived risk (Garrard, Rose, and Lo 2008; Garrard, Handy, and Dill 2012). Other socioeconomic characteristics seem to be less influential. Scholars do not find a consistent effect of income on bicycling. Studies variously tie cycling to both high and low household incomes, or find income is not associated with cycling likelihood at all (Heinen, van Wee, and Maat 2010). However, there is some evidence that low-income immigrants in the United States are more likely to bicycle than other nativity or income groups (Smart 2010). Racial and ethnic identity do not explicitly motivate or discourage cycling *per se*, but may play a role in casting it as an abnormal activity when racial and ethnic minorities are also in the cycling minority. The face of cycling is becoming more diverse as the highest growth in cycling rates in the last decade is among people of color, but Whites still make roughly three-quarters of the bicycle trips in the US (Pucher, Buehler, and Seinen 2011).

Thus, the relationship between personal identity and the social environment is a critical factor in understanding cycling motivations. In a qualitative study with residents of two bicycle-friendly cities—Davis, California, and Delft, Netherlands—scholars found that living in those cities encourages residents to bicycle because city residents generally hold a favorable view of cycling as an everyday activity. However, the Americans faced anti-bicycling sentiment outside of Davis, while the Dutch were still encouraged to cycle outside of Delft, revealing how the impact of social influence on behavior is embedded in multiple contexts (Heinen and Handy 2012). Children's active travel to school is another area where social norms influence behavior. In a study of 16 elementary schools in California, family approval of their child walking to school increased the odds of their child's walking and cycling by nearly 50% when controlling for the effects of the caregiver's perceptions of neighborhood safety, distance to school, and attitudes toward driving (McMillan 2007). Similarly, parents' negative perceptions about safety and few children around were more strongly associated with lack of walking to elementary schools in Australia than the children's own perceptions (Timperio et al. 2006).

Attitudes, perceptions, and preferences

Increasingly, research that explores what motivates active travel, or walking and cycling, looks at the role of attitudes, perceptions, and preferences. The theory of planned behavior (TPB) is one theory that helps explain why such psychological constructs would explain travel behavior (Ajzen 1991; Bamberg, Ajzen, and Schmidt 2003). In the theory, attitudes—which are measures of how good or bad one views a behavior—influence intentions to perform that behavior, which in turn cause the behavior. How other people think of the behavior (subjective norms) and whether a person thinks he or she can do it (perceived behavioral control) also predict behavior in TPB. In other words, if someone thinks bicycling is good for her health, her friends agree that bicycling is a healthy activity, and she has access to a bicycle and knows how to ride, she has a higher likelihood of planning to bicycle and executing her plan. Other theories have evolved that blend both psychological and physical constructs to explain travel behavior such as bicycling, acknowledging that there is a feedback loop between one's internal evaluation of mobility choices and the access and convenience provided by infrastructure linking services nearby (e.g. Schneider 2013; van Acker, van Wee, and Witlox 2010; Spears, Houston, and Boarnet 2013; Mokhtarian, Salomon, and Singer 2015).

Public health research has long explored the link between affective evaluations and walking and cycling, consistently finding aesthetic neighborhood perceptions, social support, and bicycling and walking preferences to be strong predictors of physical activity (Giles-Corti and Donovan 2002; Pikora et al. 2003; Haughton McNeill et al. 2006; Pichon et al. 2007; Trapp et al. 2011). In the urban planning literature, connecting links between travel behavior and the built environment have been the norm, with most findings pointing toward higher density and accessibility causing reductions in miles driven (Ewing and Cervero 2001, 2010) or increases in bicycling (Heinen, van Wee, and Maat 2010). Research that explores the effect of both attitudes and the built environment on bicycling typically finds attitudes to be more strongly associated with greater levels of bicycling than urban form and infrastructure characteristics are (Kitamura, Mokhtarian, and Laidet 1997; Dill and Voros 2007; Handy, Xing, and Buehler 2010; Dill, Mohr, and Ma 2014). Many times, a person simply agreeing that he or she likes bicycling is one of the most significant associations with whether he or she travels by bicycle (Xing, Handy, and Mokhtarian 2010; Handy and Xing 2011).

But that is not to say either type of study has definitively concluded that either the built environment or attitudes matter more in predicting travel behavior. A significant issue in understanding the relationship is endogeneity in the empirical models because nearly all studies involve cross-sectional designs or exclude potentially causally-related factors (Handy, Cao, and Mokhtarian 2006; Mokhtarian and Cao 2008). Some of the influence of the built environment on bicycling may be due to residential self-selection effects otherwise unaccounted for in the models—just one mechanism by which preferences and attitudes relate to travel. The self-selection hypothesis proposes that attitudes and preferences manifest themselves in residential location choice. For example, people who prefer to bicycle for transportation would choose to live in a neighborhood with supportive built environment features that promote cycling. Thus, they would cycle more often. In that case, a model that estimates the effect of built environment characteristics on travel without accounting for those preferences may overestimate their effects, because they would be highly correlated with residential preferences. On the other hand, it is possible a model would underestimate their effects if mode preferences are strong enough to counteract the negative impact of not being able to move to a preferred residential neighborhood (Chatman 2009). It is also possible that positive attitudes toward cycling can result from living in a bicycle-friendly neighborhood or from bicycling more (Cao, Mokhtarian, and Handy 2009), suggesting that modeling the relationships can be fraught with difficulty.

Empirical approaches to modeling attitudes, the built environment, and travel

Given the challenges, then, how have researchers approached the complexity inherent in understanding how attitudes and the built environment work together to explain travel behavior? With respect to the residential self-selection literature, Mokhtarian and Cao (2008) describe several statistical methods researchers have used. Longitudinal, experimental designs are the gold standard in research, but cross-sectional studies are far more common, and the authors describe four such model types: statistical controls, instrumental variables, jointly-estimated discrete choice, and structural equations. Each of the methods has its strengths and drawbacks. For example, hypothesizing causal influences and interpreting results from regression models are relatively straightforward tasks, but it is not possible to estimate simultaneous or mediating relationships in a single equation model.

Structural equations models (SEMs) are multiple equation models that can test multiple directions of influence and intervening variables. Formally, SEMs are systems of equations where a vector of endogenous variables appears on both sides of the equation representing both explanatory variables and response variables (Mokhtarian and Ory 2009). SEM has been applied to travel behavior modeling since the 1980s, in contexts ranging from travel demand modeling, influences of attitudes and perceptions on choice, residential location and self-selection, organizational behavior, driver behavior, and TPB as it applies to bicycling and walking (Golob 2003; van Acker, Witlox, and van Wee 2007; Mokhtarian and Cao 2008; Dill, Mohr, and Ma 2014). The SEM specification allows analysts to better estimate the effects of the built environment and attitudes on travel behavior. It can account for the fact that travel behavior may affect attitudes and preferences, that expected reported travel patterns or attitudes may affect the chosen built environment (via residential self-selection), and that one's residential neighborhood may affect one's attitudes about travel as well as one's travel patterns. SEMs can lend themselves to establishing causal relationships, but, as with any model type, they require an appropriate behavioral theory to do so (Crane 2000; Kline 2011). Without one, an SEM is simply a diagram of boxes, arrows, ovals, and numbers.

Other types of simultaneous modeling approaches exist for testing the influence of attitudes on travel choice. Some jointly- and hierarchically-estimated discrete choice models, also known as integrated choice and latent variable models, have been used to understand values, attitudes, and lifestyles in context of a utilitarian travel behavior framework (e.g. Walker and Ben-Akiva 2002; Vij, Carrel, and Walker 2013; Paulssen et al. 2014). These model types have the capacity to estimate the simultaneity of influences in a more sophisticated manner than SEM. However, they are computationally complex, do not yet have wide application, and are more appropriate when producing estimates in the context of a full choice set.

Methods

Based on the characteristics of the methods I reviewed in the previous section, in this chapter I estimate the impact of individual factors—including socioeconomic status, attitudes, and preferences—social factors, and the built environment on bicycling using structural equations models. The SEMs account for probable endogeneity of travel influences and allows me to test hypotheses about their causal pathways and differences between population groups. Before explaining how I specified the models, I describe geocoding procedures of the survey data, and secondary data selection, collection, and processing below.

Geocoding procedures

As described in Chapter 2, the questionnaire asked respondents to provide home location information in the form of an address or nearby intersection. Nearly 80% of respondents (1,647) provided some form of address information that could be geocoded by the Google Maps Application Programming Interface (API). After I cleaned erroneous data, the Google Maps API geolocated 770 addresses in the San Francisco Bay Area to exact addresses, intersections, landmarks, or address ranges—about one-third of the total sample. Those responses formed the basis for further analysis.

I post-processed the usable data by snapping each point to the nearest road network segment in a spatially-enabled database management system (PostGIS 2.1).

Omitting records from analysis is one potential source of bias in this analysis; only one-third of returned surveys had enough information to collect built environment data near respondents' homes. I tested potential bias in three categories: immigrant status, income category, and bicycle riders. Immigrants are slightly underrepresented in the geocoded sample compared to the full dataset. Forty-four percent of US-born respondents provided usable addresses, while only thirty-four percent of immigrants did so, a statistically significant difference ($p < 0.001$). Low-income respondents were more likely to provide address information (44% vs. 33%, $p < 0.001$), though the difference vanishes when excluding people who did not provide household income from the total number of respondents. Roughly equal proportions of bicycle riders and non-riders provided their addresses (36% vs. 40%, $p = 0.15$). Therefore, the geocoded subsample is likely to underrepresent immigrants by a small amount compared to the full dataset. However, most of the missing records come from non-cyclists because immigrant cyclists comprise 8% of the total number of respondents in both samples.

Secondary data processing

Relationships found significant in previous research on the built environment and travel and immigrant travel guided secondary data variable selection (Brownson et al. 2009; Winters, Brauer, et al. 2010; Smart 2010; Liu and Painter 2012). The following list describes the data and why each variable matters:

- *Socioeconomic characteristics*. Census tract-level socioeconomic composition is likely to impact how respondents perceive the quality of their neighborhood, influencing their transportation attitudes. Data were obtained from the 2010–2014 American Community Survey five-year estimates (U. S. Census Bureau 2015a). For each census tract, I tabulated population density, the share of immigrants, racial and ethnic composition, and median household income. Socioeconomic characteristics match to survey records by census tract.

- *Ethnic enclaves*. Ethnic enclaves reflect characteristics of the social environment, and it is possible that immigrants who live there are more likely to cycle if their co-ethnic neighbors do. I determined whether each respondent's census tract was a Latin American immigrant enclave by calculating a location quotient that measures Latino immigrant residential concentration. Concentration is given by the ratio of the proportion of Latin American immigrants in the census tract to the proportion of Latin American immigrants in the five-county study area. Following Liu and Painter (2012), I defined any census tract with a proportion of Latin American immigrants at least one-and-a-half times as great as proportion of immigrants in the region as an immigrant enclave. High-concentration enclaves are those with a location quotient greater than 2. Because Latin American immigrants comprise 77% of the immigrants in the sample, it was more appropriate to identify Latin American immigrant enclaves rather than generic immigrant enclaves.

- *Employment density*. In areas with more jobs, potential employment opportunities are closer, so it should be easier to reach them by bicycle. Employment data from 2013 at the census

block level were obtained from the Longitudinal Employer-Household Dynamics database (U. S. Census Bureau 2015b). I tabulated employment density as the total number of jobs within each census block contained by each of three network distance buffers around the respondent's address (see below), divided by the land area of the census blocks.

- *Road network*. In general, bicyclists would prefer to cycle on quiet roads than busy arterials; greater density of higher volume roadways near home may reduce the likelihood of cycling in the first place. The California Department of Transportation (Caltrans) provided centerline road network files from 2015 (Caltrans 2015). I categorized the road network into four roadway types—highways, arterials, collectors, and local roads—and calculated the proportion of each roadway type within each buffer. The roadway categories are simplifications of the Federal Highway Administration classification system (FHWA 2013). They serve as proxies for intensity of road use (i.e. volume), data for which are not uniformly available across the region.

- *Network connectivity*. More connected networks mean people can reach places by bicycle more easily, and I expected higher network connectivity to predict more cycling. The Caltrans road network provided the source for roadway intersections. I identified intersections by creating a road network topology using the pgRouting library in PostGIS ("pgRouting" 2015), removing limited-access roads, and identifying vertices connecting three or more links. I calculated two measures related to network connectivity: the intersection density in each buffer area, and the proportion of four-way intersections in each buffer area. The proportion of four-way intersections was calculated by counting the number of vertices with four or more links attached and dividing by the total number of intersections in each buffer.

- *Bicycle facilities*. As described elsewhere, previous research has established an association between more bicycle lanes and more cycling, and results from Chapter 2 indicate that more bicycle infrastructure would motivate some people to bicycle more. Data about bicycle facilities in 2012 were obtained from the Metropolitan Transportation Commission, the regional MPO (MTC 2015). Facilities are categorized into three classes: off-road bike paths, on-street bike lanes, and bicycle routes, which are shared facilities marked by signs, shared lane markings ("sharrows"), or bicycle boulevard treatments. I calculated several different measures of bicycle facility coverage within each buffer: length of bicycle facilities in total and by class, density of bicycle facilities in total and by class, and categorical variables of bicycle infrastructure presence.

- *Land use*. Mixed land uses create higher levels of accessibility by bringing origins and destinations closer together. I expected greater land use mix to encourage more bicycling. A data extract of land use characteristics from 2011 at the parcel level was obtained from the Association of Bay Area Governments. The database contains seven generic types, plus two categories for "other" or "unknown." After cleaning unknown and miscategorized types, I recategorized land uses into the following types: single-family residential, multi-family residential, retail, office, industrial, and other. I calculated two measures of land use. The first is the proportion of each known land-use type with each buffer zone. The second is the land use mix, measured by an entropy index. The index is given by the formula $-\Sigma_k(p_i)\ln(p_i)/\ln k$,

where p is the proportion of each land use i in the buffer area, and k is the number of land uses included in the calculation (Cervero and Duncan 2003; Winters, Brauer, et al. 2010). Values closer to 1 indicate a perfect mix of selected land uses, while values closer to 0 indicate one land use type dominates over another. The index gives a sense of the variation of activity types in an area, but cannot convey which is most prevalent. I selected the four most common known land uses in the database as the denominator for the land use mix: residential, industrial, retail, and office.

- *Transit characteristics*. Greater transit density might reduce bicycling by providing more alternatives—travelers may choose to take transit instead of cycling if bus or rail routes just as likely to get them to their destination. People might also be less likely to cycle to transit if they live closer to a transit top. Living within bicycling distance of a rail station may encourage access by bicycle, but living too close may make walking a better alternative. I obtained the latest General Transit Feed Specification (GFTS) files for each of the major transit agencies in the five-county area. I tabulated the number of bus stops and whether there was a rail stop (BART, Muni, or Caltrain) within each buffer area.

- *Bicycle crashes*. People who perceive cycling as unsafe are less likely to bicycle, so I expected a greater number of crashes to reduce the likelihood of cycling. The UC Berkeley Safe Transportation Research and Education Center (SafeTREC) provided locations of the bicycle-involved collisions reported to police in 2013 (SafeTREC 2016). Although bicycle collisions are typically underreported (Stutts et al. 1990; Sciortino et al. 2005; Juhra et al. 2012), the measure is an objective proxy for relative safety.

For each of variables derived from sources other than the US Census, I constructed 400-meter, 800-meter, and 1600-meter road network buffers around each residential location to aggregate the data. Technically, I created the buffers by identifying all the network nodes within the specified distance of each respondent's address and enclosing them in a concave hull with a target value of 0.99.[1] Compared to airline distance buffers, network distance buffers more accurately represent the places and characteristics people experience as they are constrained by the physical road network and reflect true distances along that network. I call these buffers "home-area" or "residential" in the analysis.

Data imputation and recoding

Of the 770 geocoded records, 577 respondents provided complete responses to all questions. Tests for missingness revealed that the missing responses were not missing completely at random. For example, respondents who left the attitudinal and perception questions about bicycling blank were far less likely to bicycle than those who answered the questions. Listwise deletion of missing responses could introduce additional bias to model estimates. Instead, I imputed and recoded responses to the survey questions using standard techniques. For the socioeconomic characteristics except income,

[1] One can visualize a concave hull by imagining a boundary being shrink-wrapped around a set of points (PostGIS Project 2015). Conversely, a convex hull is akin to wrapping a rubber band around the set of points. There are multiple concave hulls but only one convex hull for every set of points. The target value is the proportion of the convex hull's area covered by the concave hull.

I performed multiple imputation using the full response dataset as input to the imputation models. The *mi* package in R computes imputes values using Bayesian regression techniques. The algorithm chooses the appropriate function based on the variable type, using all other variables as regressors (see Su et al. (2011) for technical details). Nearly 20% of respondents left the income question blank, so missing values were entered in models explicitly as such rather than being imputed. The rate of item-nonresponse for other questions was 3% or less.

I treated missing values in attitudinal responses in a different manner. Question 8 ("Do you disagree or agree with the following statements?") has a five-point Likert-type scale with an option for "Doesn't apply." I recoded missing values as "Doesn't apply," which I further recoded for the analyses in this chapter as the midpoint neutral response, combining it with "Neither agree/disagree." Questions 5 ("How much more would you have taken the bus or train in the past 7 days if the following were true?"), 6 ("How much more would you have bicycled in the past 7 days if the following were true?"), and 7 ("How often do you…?") were scaled on a four-point ordinal scale that reflected frequency of a habit rather than agreement with a statement. This means there is no midpoint to which to recode missing values. I imputed these responses in a second stage after having imputed the socioeconomic characteristics in the first stage, using them as regressors for the imputation equations. After cleaning, imputing, and recoding, 763 valid observations remained for analysis.

Model selection and estimation

To test relative influences of the individual, social environment, and built environment characteristics, I fit a set of three structural equation models (SEMs) as suggested by the conceptual framework in Chapter 1. Each model used the same basic framework; specific differences are described below. The primary dependent variable is whether the respondent bicycled in the previous week. (Note that it is the "primary" dependent variable because multiple variables can be specified as dependent in SEMs.) I considered the alternative approach of directly entering of the number of days each respondent cycled as a count variable to retain complete information about cycling frequency. An advantage of specifying the variable dichotomously is that it combines information about cycling for an entire trip and cycling to transit into one variable. If a respondent cycled for an entire trip one day and cycled to transit one day, we would not know if those were on two separate days. The bivariate approach reduces margins of error compared to the count variable approach because only a minority of the sample cycled in the previous week (21%); 30 or fewer respondents in the sample each cycled between one and six days, leaving very few values in each cross-tabulated cell. Furthermore, the lavaan software package in R used to estimate the SEMs in this analysis cannot model count variables as such (Rosseel 2012).

The models included sociodemographic and transportation perceptions from the survey, and the secondary data described in the previous section (see Figure 3.1). I expected positive perceptions and attitudes toward bicycling to increase the likelihood of bicycling. Bicycling supportive built environment characteristics—land use, density, bicycle infrastructure, and roadway characteristics—would predict more bicycling directly and as mediated by positive perceptions. On the other hand, I expected that higher transit density would decrease the likelihood of cycling because it would make taking transit easier and allow it to substitute for cycling. Supportive social environments, such as immigrants living in immigrant enclaves and knowing other cyclists, should

also increase the likelihood of cycling directly. To reduce model complexity, I included only the secondary data characteristics that showed a bivariate association with cycling.

The first step in fitting the models was estimating a confirmatory factor analysis (CFA) using the "transportation experience" responses to specify attitudes and preferences related to cycling. CFAs, also known as measurement models, identify how measured indicators correspond with a hypothesized latent factor. Attitudes and preferences are latent psychological traits that cannot be observed or measured directly like annual household income or density of bicycle infrastructure. Instead, multiple survey questions are used to represent the dimensions of each attitude or preference. CFAs model correlations among factors but do not model causal links, except from factors to indicators. Path analysis adds the causal links, and path analyses that include both latent factors and observed variables (such as the ones in this study) are known as structural regression models (Kline 2011).

Because early exploratory interviews suggested how the factors might predict the indicators (see Chapter 4), I chose a confirmatory rather than exploratory factor analysis.[2] I estimated the CFA using the imputed dataset as defined earlier in the section on recoding and imputation. The attitudinal variables were treated as ordered categorical variables, so the model was fit using diagonally weighted least squares estimation. The best fitting model yielded five factors, described below. Once the best fitting CFA was determined, I added the structural component of the full SEM described later and examined the measurement portion of the model again. The fit suggested that a simpler model, rather than one that allowed indicators to load on multiple factors, best described the attitudes and preferences.

The second step in model fitting was to estimate the path analysis portion of the three SEMs. The first model is the hypothesized model described earlier and shown in Figure 3.1. The second model tests the endogeneity of bicycling with respect to the perception and attitudinal factors; in other words, whether cycling influences perceptions *in addition to* perceptions influencing cycling. The third model tests whether there are differences in the significant factors between immigrants and the US-born. The model separately estimates the path coefficients of the subsample of immigrants and the subsample of the US-born using the same path structure. Significant differences between groups are determined by comparing a version of the model where the tested variable is constrained to be equal between groups with one where it is allowed to vary freely.

Results

Descriptive statistics

Socioeconomic, transportation, and land use qualities of the home-area census tracts and buffers for the sample of 770 respondents[3] vary considerably (Tables 3.1 and 3.2). On the whole, the neighborhoods reflect the central urban character of where surveys were distributed. Home census tracts

[2] In exploratory factor analyses, eigenvalues greater than one often help the researcher decide how many factors to include in the model. In confirmatory factor analyses, the number of factors are selected *a priori*, and other model fit statistics help adjust the relationship between factors and indicators as needed.

[3] The summary statistics in this chapter refer to the imputed dataset of survey respondents who provided address information rather than the full sample as in Chapter 2.

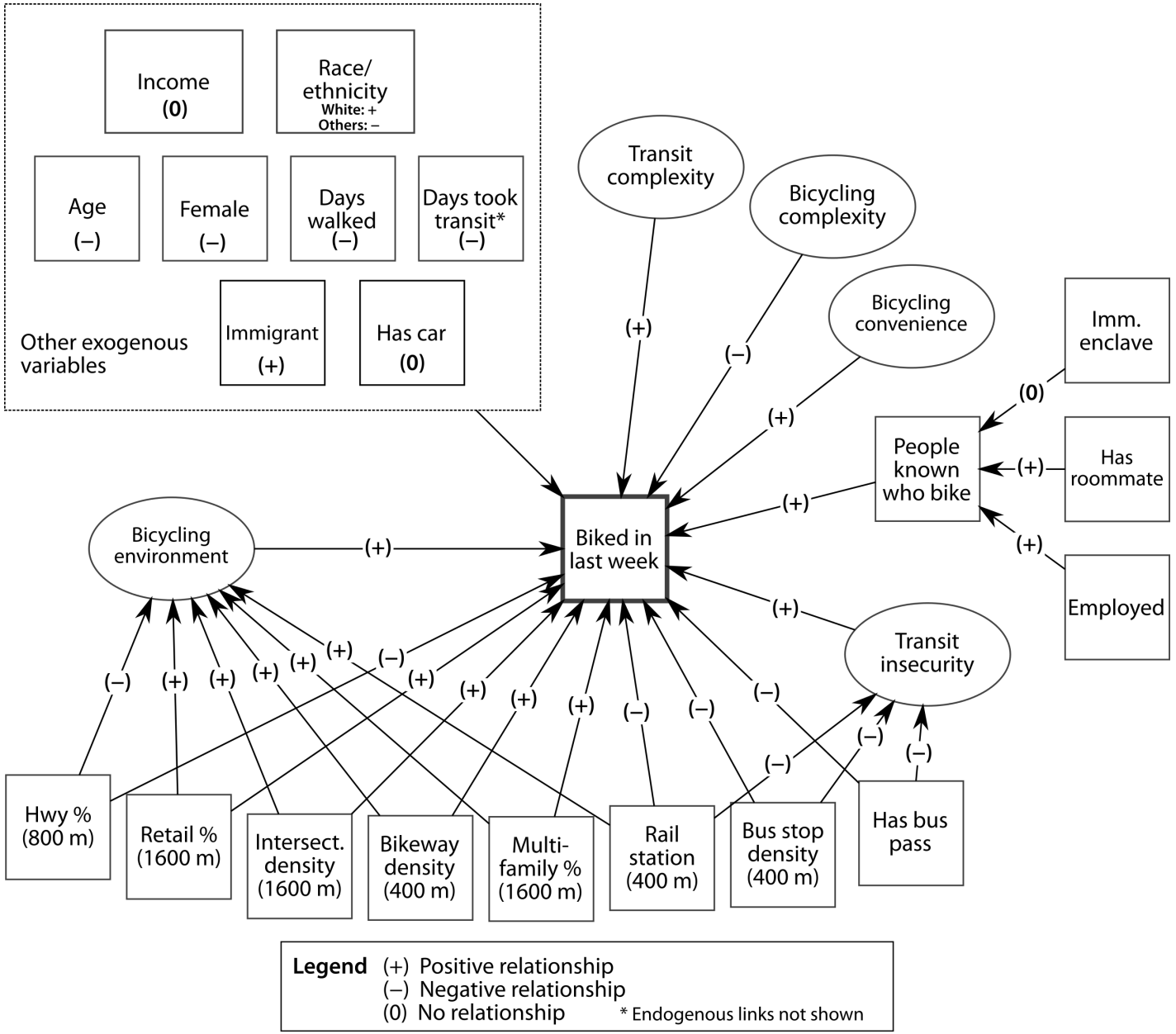

Figure 3.1: Initial structural equation model with hypothesized directions of influence

had higher population density, about twice the share of Latino immigrants, and a substantially lower median income than regional averages. Just over half of respondents lived in Latino immigrant enclaves, compared to about one-quarter of the five-county Bay Area population. Population density near respondents' homes was nearly three times the population-weighted average employment density in the study area.

Table 3.1: Socioeconomic characteristics of respondents' neighborhoods tabulated by census tract

	Geocoded Responses		Central SF Bay Area	
Variable	Mean	SD	Mean	SD
Population density (per ha)	67	50	45	47
Employment density (per ha)	50	113	18	64
Proportion immigrants	38%	13%	33%	14%
Proportion Latino immigrants	17%	13%	9%	10%
Median income	$61,843	$27,196	$90,237	$38,444
Share in Latino immigrant enclaves	52%		23%	
Share in high-concentration enclaves	44%		16%	

Sources: Survey instrument and U. S. Census Bureau (2015a). SF Bay Area summaries are population weighted by census tract population. Neighborhood refers to residential census tract. SD = Standard deviation SD = Standard deviation.

Survey respondents in the subsample live in denser neighborhoods than the regional average. Respondents have about half the proportion of highways near their homes but twice the proportion of arterial roads compared to the region, though smaller roads make up the majority of roadway length. This suggests a greater likelihood of bicyclists interacting with vehicles, with potential negative safety impacts. (The average number of bicycle crashes within the 400 m buffers in 2013 was 1.7.) The bicycle network is far denser in the study area compared to the region, and 60% of respondents had some form of bicycle infrastructure within 400 m of their homes. The land use of the study area is primarily residential in nature. Land uses are moderately mixed in the residential-area buffers. The average land use mix value is the equivalent of a buffer divided equally between two land-use types: multifamily housing and retail shops, for example. Some home-area summary statistics, such as the length of bikeways and number of transit stops, are not comparable to regional averages in a meaningful way.

The survey subsample reflects more ethnic diversity and lower socioeconomic attainment of respondents compared to the population of the central San Francisco Bay Area (Table 3.3). The sample had slightly fewer immigrants compared to the proportion of immigrants in the region. However, half the sample is Latino, compared to about one-fifth of the regional population. Likewise, the proportion of white survey respondents is about half the regional proportion. Survey respondents were less formally educated and their households earned far less than the median income of the region. About a quarter of the sample had bicycled in the previous week, and those who cycled did so an average of four days out of seven. This value is not strictly comparable to household travel survey data, but about 6% of San Francisco Bay Area residents in the California Household Travel Survey bicycled at least once on the survey day (California Department of Transportation 2013). A nationally representative survey conducted in 2012 found that 13% of people 16 years of age or older

Table 3.2: Transportation and land-use variable summaries

	Geocoded Responses		SF Bay Area
Variable	Mean	SD	Mean
Road network (proportions)			
Highway	3%	9%	6%
Arterial	29%	15%	14%
Collector	7%	9%	8%
Local	61%	16%	72%
Network connectivity			
Intersection density (per ha)	1.4	0.7	0.3
Proportion four-way intersections	67%	48%	25%
Bicycle facilities			
Bikeway density (km/ha)	0.17	0.33	0.01
Class 1 length (m)	11	81	–
Class 2 length (m)	654	1914	–
Class 3 length (m)	554	1689	–
Land use (proportions)			
Single family	28%	23%	17%
Multifamily	29%	21%	33%
Retail	14%	16%	1%
Office	5%	7%	1%
Industrial	4%	10%	18%
Land use mix	0.41	0.26	–
Transit			
Proportion with rail stop	10%	30%	–
Number of transit stops	7	5	–

Sources: Survey instrument and U. S. Census Bureau (2015a). Geocoded responses are aggregated to 400 m network distance buffers. Central SF Bay Area totals refer to the regionwide average, not tabulated by census tract.

rode at least once in the previous week (Schroeder and Wilbur 2013), or about half as frequently as those in this study.

Individual characteristics and the neighborhood environment

Each of the individual, social environment, and built environment variables described earlier are likely to influence cycling. But to reduce potential multicollinearity in the later models, I began with bivariate comparisons between cyclists and non-cyclists in the full dataset and among immigrants (Tables 3.4 and 3.5). I retained variables with statistically significant differences for the multivariate models that follow.

Many of the sociodemographic differences between cyclists and non-cyclists were consistent with findings from the literature. Bicyclists were more likely to be employed, male, higher educated,

Table 3.3: Select demographic characteristics, survey respondents (non-imputed) and regional average

Variable	Sample	Central SF Bay Area
Immigrant	37%	41%
Avg years in US	15	22
Hispanic/Latino	50%	21%
White	22%	40%
Black/African American	12%	6%
High school or less	42%	29%
Employed	68%	64%
Median income	$15k–$25k	$91,500
Biked in last week	24%	6% [a]
Days biked (cyclists)	4	–

Sources: Survey instrument; U. S. Census Bureau (2015a) and California Department of Transportation (2013). Note that five-county SF Bay Area totals refer to the regionwide average, not tabulated by census tract.

[a] Biked during California Household Travel Survey day

younger, wealthier, and white compared to non-bicyclists. Similar to the results in Chapter 2 but contrary to prior research (cf. Smart 2010), a slightly lower share of bicyclists were immigrants, although the difference was not statistically significant ($p = 0.11$). Among immigrants, only gender was significantly different between cyclists and non-cyclists. Immigrant cyclists were one-third as likely to be female as immigrants who did not cycle, a substantially wider margin compared to all respondents.

Access to other transportation resources—cars and bus passes—was slightly different for immigrant cyclists than for all cyclists. While the same share of immigrant cyclists and non-cyclists had access to a car, access to a car was more common among all respondents who cycled compared to non-cyclists. Likewise, immigrant cyclists drove about the same amount as their non-cycling counterparts, but among all respondents cycling was associated with more frequent driving. Bicycle trips do not appear to replace car trips for non-immigrants. The opposite may be true for having access to a bus pass. Cyclists of any nativity took transit less frequently and were less likely to have a bus pass than non-cyclists.

Surprisingly, only 3% of people who did not bicycle in the week prior to the survey reported having access to a bicycle. Reliable estimates of the proportion of adults in the US who have a bicycle are difficult to find, but an estimate based on survey data in Schroeder and Wilbur (2013) suggests that roughly one quarter of people who do not ride bicycles regularly still have access to one.[4] It is unclear why the proportion in the survey sample is so low. Because of this, the bike access variable is highly collinear with the variable for bicycling in the last week and does not allow the SEM estimation to converge in later steps. Thus, I leave analysis of the relationship between bicycle access and bicycling for future work.

A supportive social environment has a positive effect on bicycling, suggested by various psy-

[4]This calculation assumes that most people who have ridden a bicycle within the last year still have a bicycle. The report indicates 23% of people rode a bike in the previous year, but not in the previous week.

chosocial theories as reviewed earlier (e.g. Handy and Xing 2011; Dill, Mohr, and Ma 2014; Muñoz, Monzon, and Daziano 2016). Social factors have been measured in the literature in various ways, such as perceptions of whether coworkers cycle or how often others cycle (Dill and Voros 2007; Handy and Xing 2011), if others encourage someone to cycle or accompany someone while cycling (de Geus et al. 2008; De Bourdeaudhuij and Sallis 2002), or whether children ride in the neighborhood (Handy, Xing, and Buehler 2010). Most surveys include multiple measures of the social environment. However, given constraints on the survey length in this study I represented the social environment primarily through the number of people who bicycle. I expected that knowing more people who bicycled represented a more supportive social environment for cycling, therefore encouraging more cycling. Survey responses indicated this was the case, as respondents who bicycled also reported knowing more people who bicycled. Almost one third of respondents who did not cycle reported that they did not know other bicyclists. In the immigrant group, twice as many non-cyclists compared to cyclists reported not knowing anyone else who bicycled (41% vs. 20%, $p = 0.005$).

Differences in the average neighborhood environment characteristics were mostly small or statistically insignificant between cyclists and non-cyclists (Table 3.6). Even fewer were significantly different for immigrants (Table 3.7). None of the land use variables aggregated to 400 m buffers was significantly different, though there were small and significant differences in the 800 m and 1600 m buffers. Immigrant cyclists were more likely to live in census tracts with a smaller share of immigrants, suggesting ethnic enclaves may not influence cycling after all. They also tended to live in areas with a higher share of industrial land uses, but less bicycle infrastructure. Within the whole sample, proximity to a rail station was the most substantially different between cyclists and non-cyclists. About 5% of cyclists had a rail station within 400 m of their homes, compared to twice as many non-cyclists.

Structural equations models

Measurement model

Confirmatory factor analysis yielded five factors, which I have labeled *bicycling environment*, *bicycling convenience*, *bicycling complexity*, *transit insecurity*, and *transit complexity*. Factor labels are a convenient shorthand for the combination of responses, or indicator variables, of which they consist. Bicycling environment includes six indicators:[5] how much more the respondent would have bicycled if (a) there were little crime, (b) there were good bike lanes or paths, (c) transit vehicles always had space for bicycles, (d) there was enough bicycle parking at transit stops; and how much more the respondent would have taken transit if (e) transit vehicles always had space for bicycles, and (f) there was enough bicycle parking at transit stops. This factor reflects perceptions of how important certain neighborhood characteristics are in supporting bicycling. Standardized loadings are fairly high (> 0.8), which suggests the factor correlates well with each indicator. Bicycling convenience has three indicators: how often the respondent (a) cycled instead of took transit to save money, (b) cycled instead of took transit to save time, and (c) cycled when the respondent had the option to drive. It reflects perceptions of cycling as being more convenient than other modes, or as a convenient travel option itself. Bicycling complexity consists of three indicators: agreement with

[5] See Appendix B for precise question wording.

Table 3.4: Bivariate comparisons of survey respondents by cyclist status

Variable	Non-cyclists	Cyclists	p-value
Immigrant	43%	36%	0.11
Employed	59%	76%	<0.001
Female	46%	25%	<0.001
Lives with roommates	59%	68%	0.049
Income			
$0–$24,999	43%	34%	0.036
$25,000–$99,999	30%	37%	0.114
$100,000 or more	6%	13%	0.004
Missing	20%	16%	0.224
Education			
Less than HS	19%	17%	0.771
High school	28%	19%	0.029
Some college	29%	29%	1
Bachelor's degree	14%	19%	0.184
Graduate school	10%	16%	0.045
Race/ethnicity			
Asian	11%	9%	0.506
Black	12%	6%	0.037
Hispanic	53%	49%	0.473
Other	8%	6%	0.614
White	17%	30%	<0.001
Has a bicycle	3%	100%	<0.001
Has a car	34%	45%	0.007
Has a bus pass	58%	37%	<0.001
Knows people who bike			
None	31%	12%	<0.001
1-10	53%	53%	1
11-20	9%	19%	<0.001
21 or more	7%	16%	<0.001
Age	40	35	<0.001
Days took transit	4.6	4.0	0.001
Days walked	2.6	2.2	0.185
Days drove	0.9	1.2	0.089

Table 3.5: Bivariate comparisons of immigrant survey respondents by cyclist status, significant differences

Variable	Immigrant Non-cyclists	Immigrant Cyclists	p-value
Female	40%	14%	<0.001
Has a bicycle	2%	100%	<0.001
Has a bus pass	46%	31%	0.046
Knows 0 people who bike	41%	20%	0.005
Days took transit	4.2	3.4	0.035
Days walked	2.8	1.8	0.023

Table 3.6: Bivariate comparisons of physical environmental characteristics of home areas by cyclist status

Variable (buffer size)	Non-cyclists	Cyclists	p-value
Share of immigrants (tract)	38%	35%	0.002
Share White population (tract)	23%	27%	0.048
Share Black population (tract)	10%	12%	0.022
Share Latino population (tract)	39%	34%	0.015
Share Asian population (tract)	24%	23%	0.263
Share multifamily housing (800 m)	28%	31%	0.049
Share multifamily housing (1600 m)	28%	31%	0.048
Share retail (800 m)	10%	8%	0.025
Share retail (1600 m)	7%	6%	0.023
Share industrial (800 m)	3.6%	4.3%	0.454
Intersection density (800 m) (per ha)	1.04	1.13	0.01
Intersection density (1600 m) (per ha)	0.88	0.97	<0.001
Share limited-access highways (800 m)	6%	5%	0.041
Bikeway density (400 m) (km/ha)	0.19	0.12	0.003
Bike path + lane density (1600 m) (km/ha)	1.1	1.0	0.211
Rail station within 400 m	11%	5%	0.045

Table 3.7: Bivariate comparisons of physical environmental characteristics of home areas by cyclist status, immigrant respondents, significant differences

Variable (buffer size)	Immigrant Non-cyclists	Immigrant Cyclists	p-value
Share of immigrants (tract)	41%	36%	0.013
Share Black population (tract)	9%	13%	0.016
Share Asian population (tract)	25%	20%	0.022
Share industrial (800 m)	5%	8%	0.035
Bike path + lane density (1600 m)	1.13	0.86	0.036

(a) finding it hard to cycle when traveling with others, (b) finding it hard to cycle when traveling to more than one place, and (c) finding it hard to travel if the respondent could not use a bicycle with transit. In the initial model specification, the standardized covariance between the bicycling convenience and complexity factors was moderately high (0.66), suggesting a low level of discriminant validity between the two. (In other words, the factors were possibly measuring the same latent construct.) I tested a four-factor model without the bicycling complexity factor, but it fit substantially worse than the five-factor model.

Although exploring the factors associated with transit behavior is not the focus of this chapter, I included the transit-related factors in the CFA to ensure the model measured the relationship between transit and cycling perceptions. The two transit factors have two indicators each. Transit insecurity is composed of how much more the respondent would have taken transit if (a) fares were affordable, or (b) there were little crime. In this case, insecurity suggests that external factors impede a person's transit use. Transit complexity shares a similar definition to its bicycling-related counterpart. Transit complexity is agreement with finding it hard to take the transit when (a) traveling with other or (b) stopping at more than one place. When comparing immigrants and non-immigrants, the loadings of the two indicators on the transit complexity factor were constrained to be equal to assist with model identification. In cases where a factor only has two indicators, an equality constraint can help prevent inadmissible solutions in subsequent estimation (Kline 2011).

As a final step in fitting the measurement model, I tested the latent variables for measurement invariance to assess construct bias. The test determines whether the factors measure the same concepts across the nativity groups by examining the difference in fit statistics in a model where factor loadings are constrained to be equal and another where they can vary (Kline 2011). In a five-factor, fifteen-indicator CFA, the change in comparative fit index (CFI) should be less than 0.002 and the change in McDonald's noncentrality index (MFI) should be less than 0.009 to consider the model measurement invariant (Meade, Johnson, and Braddy 2008). The model initially failed the test when all five factors were constrained to be equal. The model passed when the bicycling complexity factor was allowed to vary (ΔCFI = 0.000, ΔMFI = 0.004). Factor loadings are higher for immigrant respondents, which suggests they view complicated trips on bicycle—those requiring more stops or requiring transit to complete—as more onerous than non-immigrants do.

Structural regression model

After estimating the CFA, I fit a three structural regression models that test the relationships among cycling, the new factors that measure perceptions, social factors, and the built environment. As described earlier, I hypothesized an initial SEM as depicted in Figure 3.1. (For simplicity, the indicators for each factor have been removed from the diagrams. See Appendix E for full model coefficients.) Because the built environment is likely to influence both cycling and perceptions, and because perceptions are also likely to influence cycling directly, I treated perceptions of the bicycling environment as endogenous in the model. This improves on model specifications in prior research on cycling. Note that the first and second models include immigrant status directly, which I removed in the third model when I explored differences in model effects between immigrants and non-immigrants.

The estimated model is depicted in Figure 3.3, with insignificant paths left unlabeled. Model fit statistics indicate an acceptable fit, though there is room for improvement ($\chi^2 = 2896$, df =

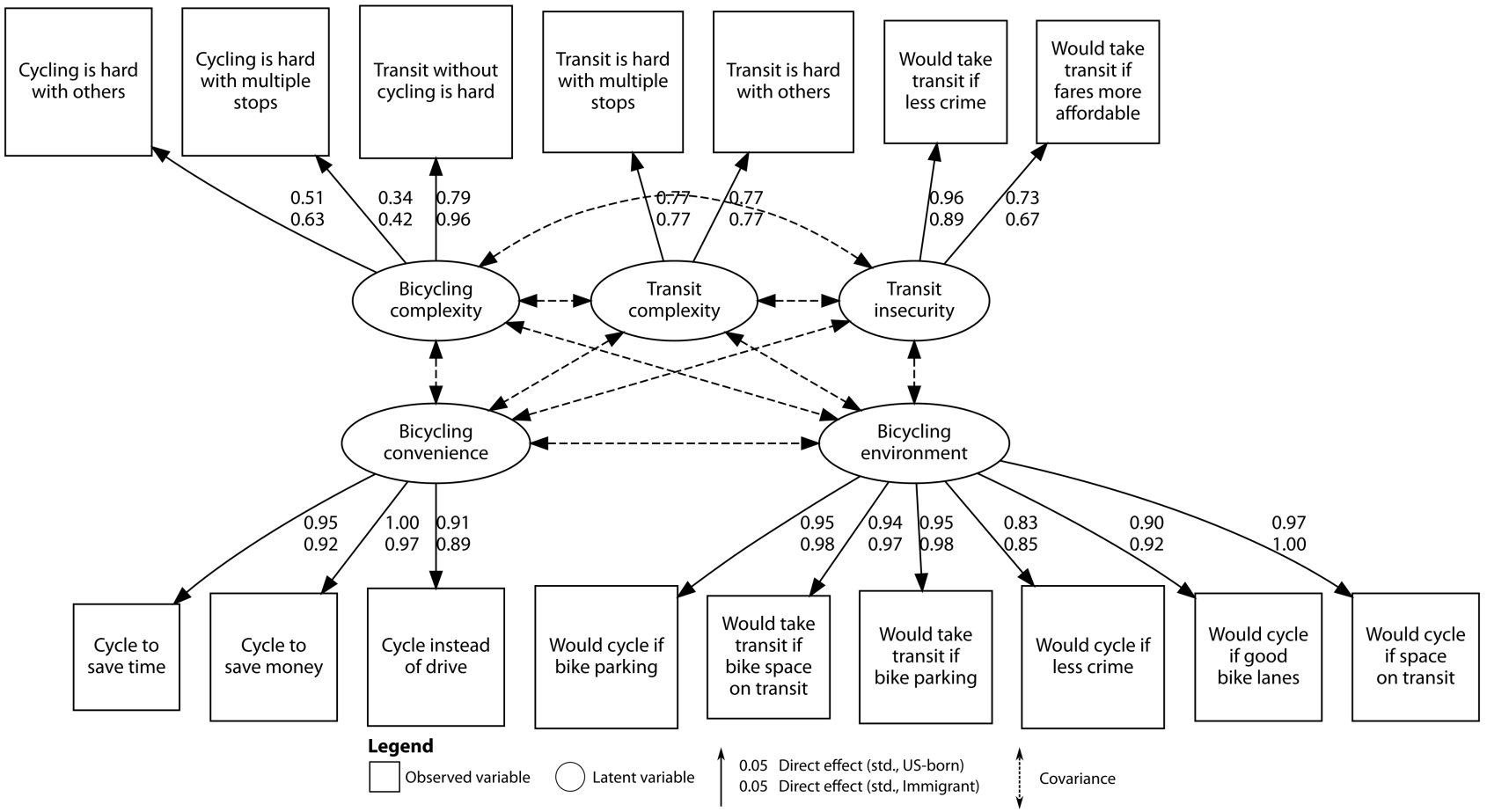

Figure 3.2: Final measurement model. Standardized estimates shown.

545, $p < 0.001$; RMSEA = 0.076 [0.073–0.078]; CFI = 0.89).[6] The influence of socioeconomic characteristics on cycling generally conform with expectations. Cyclists are more likely to be men, younger, and white. Income does not have a relationship with cycling. Contrary to expectations, immigrant status is not associated with cycling when controlling for other factors, suggesting that perceptions play a role in understanding immigrant travel. Travel frequency by other modes and transportation resources are generally not associated with bicycling, though having a bus pass is correlated with a lower likelihood of cycling. This is expected as bus passes represent a periodic investment that typically requires holders to ride transit a minimum number of times per month. It suggests that cycling and transit are competitive modes of travel.

The social environment is strongly correlated with cycling. The more friends or acquaintances a person has who bicycles, the more likely he or she is to bicycle. This finding is consistent with the literature on the role social networks and norms play in encouraging bicycling. Having roommates and being employed predict a stronger bicycle social network, while living in a Latino immigrant enclave has no effect.

The strongest predictors of cycling in this model, however, are the perception and attitude factors. Agreeing that bicycling is a convenient mode of travel has the strongest association with cycling among all variables in the model. People who more strongly agree that the neighborhood and transit environments are important in encouraging cycling are also more likely to cycle. Bicycling complexity also significantly predicts bicycling, but in an unanticipated direction. The standardized estimate suggests that people who think it is difficult to travel by bicycle are more likely to do so. This may mean cycling frequency also predicts attitudes and is endogenous to the model, an assumption I test next. People who find bicycling complex could just more familiar with bicycling and have an informed opinion about why it is harder to travel by bicycle.

In contrast to other variables, none of the built environment features significantly predict bicycling in this model ($p < 0.05$), though having a rail station within 400 m of home lessens the likelihood of bicycling to a small degree. Similarly, none of the built environment variables are significant predictors of the perceptions of the bicycling environment, except the proportion of highway miles and bikeway density are associated with the perception that the neighborhood environment does not support cycling ($p < 0.10$).

In the second model, I tested the assumption that bicycling frequency may predict social networks and attitudes or perceptions in a mutually-reinforcing relationship (Figure 3.4). The specification remains the same as in the first model, except now cycling also influences each of the five latent factors and the number of cyclists the respondent knew. Model fit statistics indicate this specification is an improvement over the first and is a good fit ($\chi^2 = 1441$, df = 542, $p < 0.001$; RMSEA = 0.046 [0.043–0.049]; CFI = 0.96). As in the first model, immigrant status is not associated with cycling. However, there are several changes to the interpretation of the model from the first one. First, only age remains as a statistically significant sociodemographic predictor of bicycling. It is surprising that sex or gender no longer predicts cycling given that women in the US are far less likely to cycle than men (Garrard, Handy, and Dill 2012). It may be that the model is capturing an effect of how cycling changes attitudes equally for men and women, and that women who cycle

[6] A variety of fit statistics can be used to assess model fit. The most commonly reported are the χ^2 statistic, the root mean square error of approximation (RMSEA), and the comparative fit index (CFI). The χ^2 statistic is inappropriate to assess model fit as it is sensitive to sample size. A good model will have RSMEA < 0.05 and CFI > 0.9, while models with RMSEA < 0.10 have acceptable fits (Kline 2011).

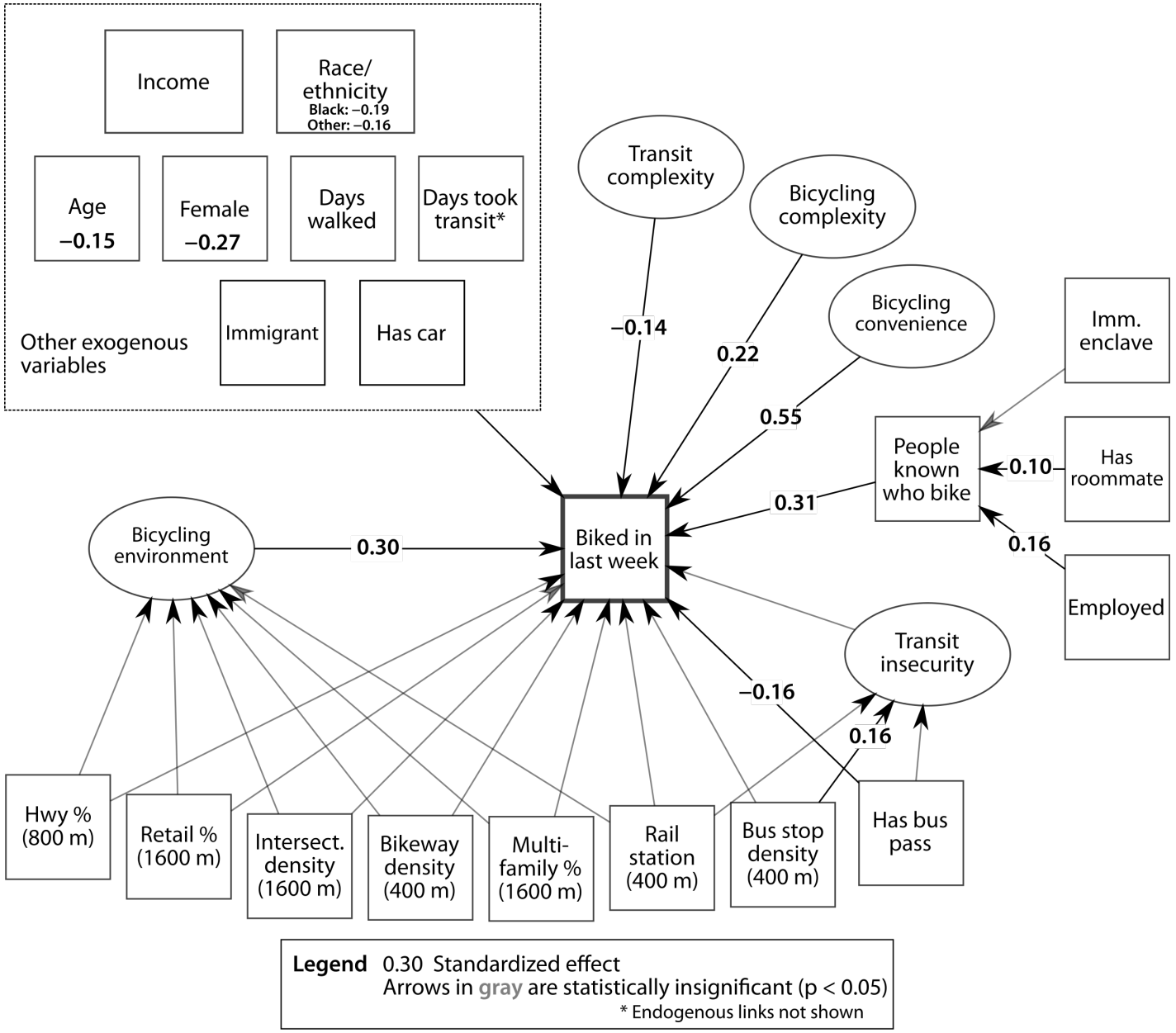

Figure 3.3: Initial SEM with standardized estimates

are more likely to have favorable attitudes. Second, higher intersection density now significantly predicts a greater likelihood of bicycling, though other built environment characteristics remain statistically insignificant. Third, the social network measure no longer predicts bicycling, but being a cyclist does predict knowing a greater number of people who cycle. It suggests that there is a strong social element to cycling, but perhaps there is a better way to measure the influence of the social environment on cycling.

Finally, being a cyclist is also a significant predictor of certain attitudes toward cycling and adds explanatory power to the model. For example, it confirms the hypothesis that being familiar with cycling influences whether a person views it as a complex mode of travel, not the other way around. Similarly, the estimates between cycling and the bicycling environment factor suggest that perceptions of the environment are strong predictors of bicycling—the largest standardized estimate in this model. On the other hand, cycling does not appear to influence how one views neighborhood factors. Bicycling convenience remains significant but the effect becomes negative. The reverse effect—from cycling to the perception of convenience—is positive and larger, indicating it is stronger.

In the third model, I removed nativity as an exogenous variable and tested how the effects of each group of predictors differs between immigrants and non-immigrants (Figure 3.5). At the outset, I expected the directions of influence to be the same between the two groups. But given the role that social networks play in immigrants' travel behavior (e.g. Blumenberg and Smart 2010; Smart 2015), I expected the social environment variable to be have a larger effect for immigrants. The model fit remains good ($\chi^2 = 1841$, df = 1060, $p < 0.001$; RMSEA = 0.044 [0.041–0.048]; CFI = 0.96).

The estimates and interpretation change little between the second and third models. Age remains the only significant sociodemographic predictor of cycling in the US-born group, while none are significant for immigrants. As in the combined model, having a bus pass discourages cycling among the US-born group, but it is insignificant for immigrants. This finding is somewhat surprising and is counter to other findings in this dissertation that bicycling and transit are more likely to be substitutive modes for immigrants (Chapter 2). One possible explanation is that immigrants are more likely to purchase day passes rather than monthly passes, and so would not have a pass on a day they bicycled, but it remains unclear. As in previous models, the built environment remains mostly insignificant as a predictor of cycling, except for intersection density in the US-born group. Transit density and highway miles influence perceptions of the bicycling environment for immigrants but not for the US-born group. The social environment is again insignificant in predicting cycling, but immigrants who are employed or have roommates know more people who bicycle, unlike the US-born. This may reflect immigrants' reliance on people in kin networks who share similar interests to help find jobs and housing after arriving in the US (e.g. Alba and Nee 2003).

As in the other models, attitudes and perceptions remain the most significant predictors of cycling—particularly perceptions of the bicycling environment. Both immigrants and non-immigrants are more likely to cycle if they believe a supportive neighborhood environment is important for cycling. Unexpectedly, the influence of the bicycling complexity factor is different for immigrants and non-immigrants. The US-born who think bicycling is difficult are less likely to bicycle, while immigrants who hold the same perceptions are more likely to bicycle. Reverse causality is a factor in both instances; that is, cycling predicts more agreement with bicycling complexity. Thus, immigrants are willing to bicycle in spite of the difficulty of cycling with others or to multiple places; non-immigrants less so. This could reflect greater constraints on immigrant travel, requiring them to use bicycles when it would be easier to use another mode. Alternatively, it

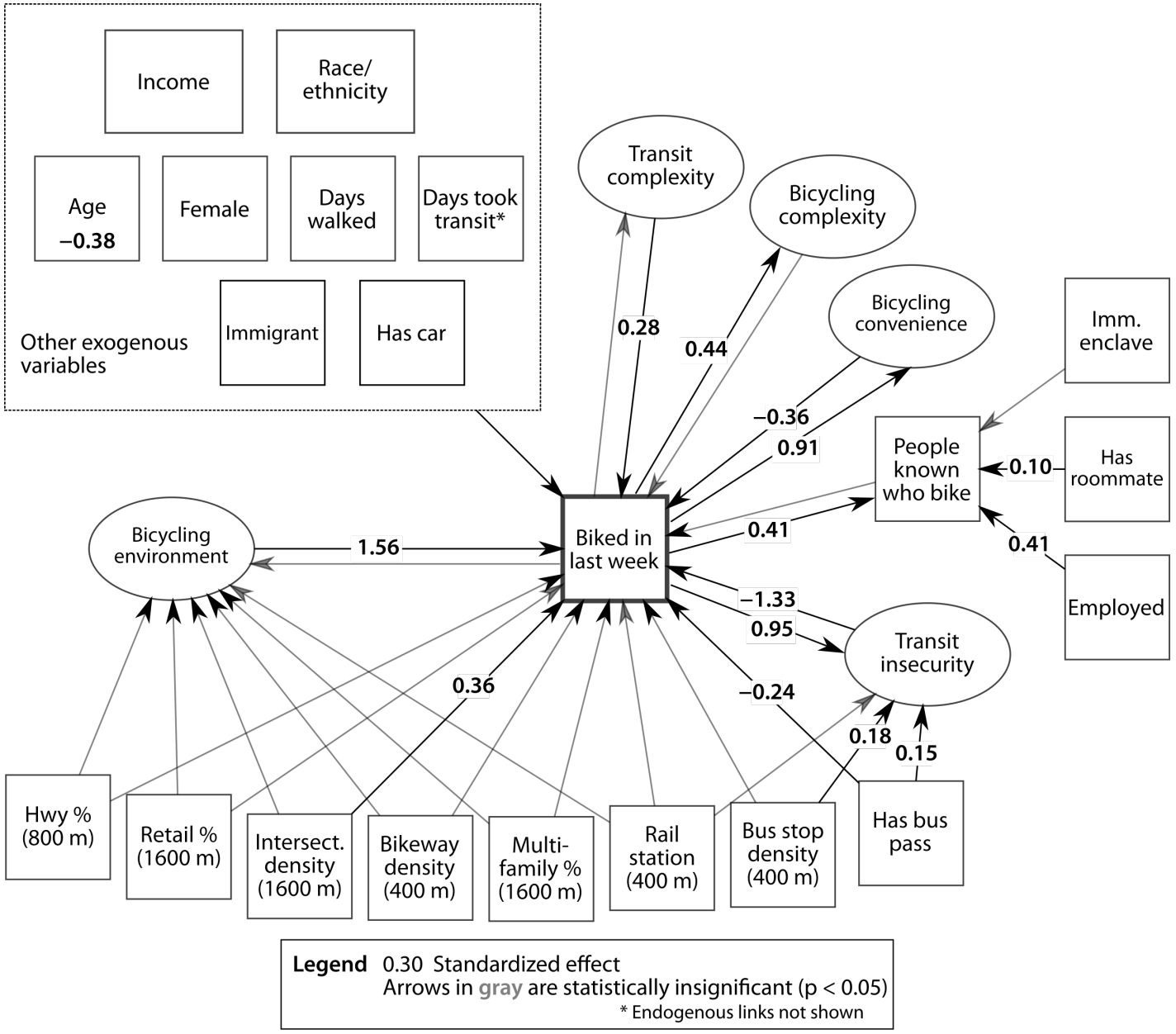

Figure 3.4: SEM with cycling as endogenous

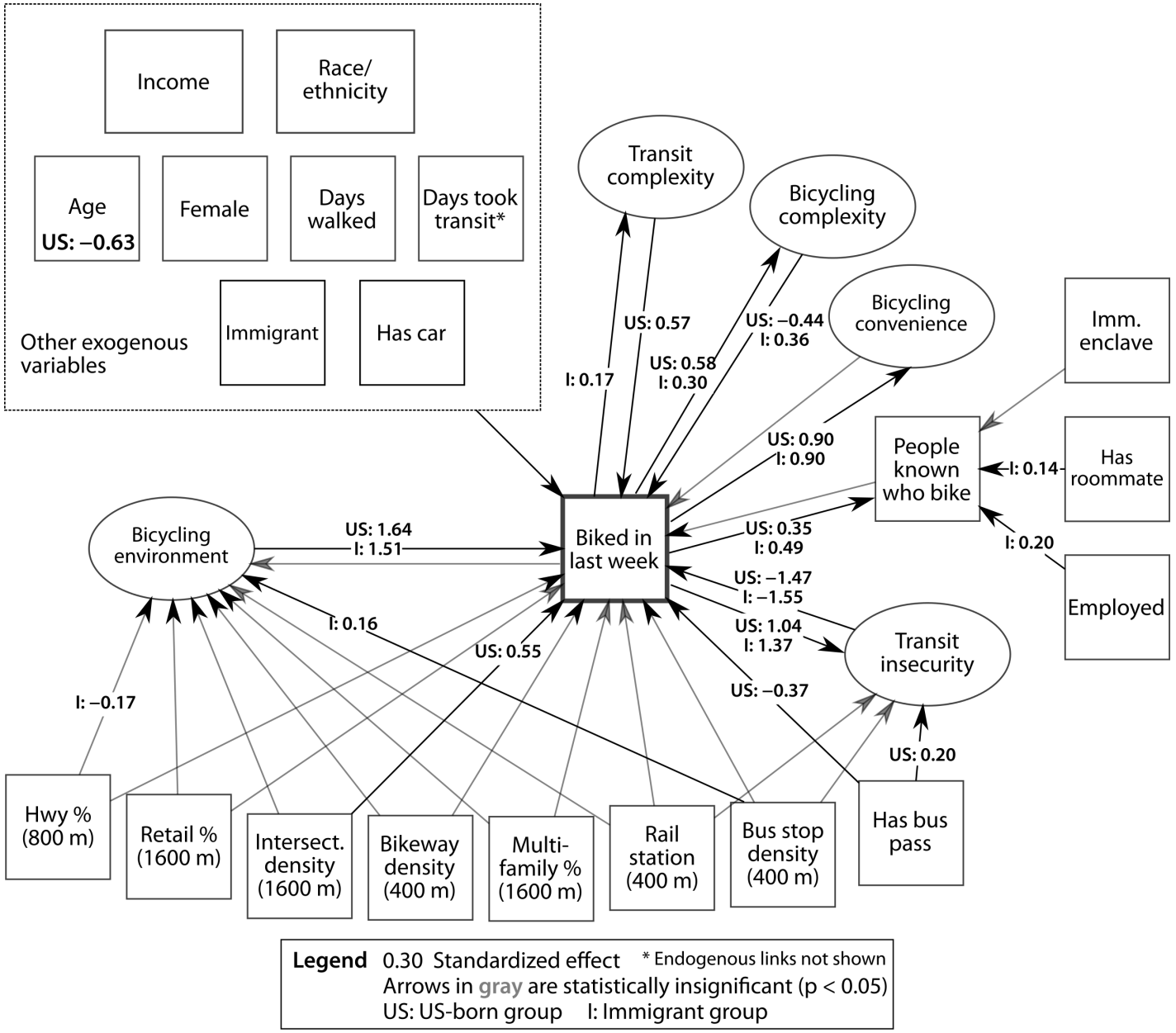

Figure 3.5: SEM with immigrant and non-immigrant group differences

could reflect a greater propensity for non-immigrants to bicycle recreationally. Finally, immigrants and non-immigrants differ in how they view bicycling relative to public transit. Immigrants who find transit difficult to take are no more likely to bicycle, but cycling seems to change their views on taking transit to a small degree. The causality is reversed for non-immigrants. Those who view transit as onerous to take are more apt to be cyclists, but cycling does not change their attitudes toward transit. This finding suggests immigrants may be more transit dependent and less willing to cycle, despite the associated challenges.

Although the model estimates suggest built environment factors have a minimal effects on cycling, the spatial aggregation limits how strongly I can make this claim. The residential area buffers used in this study may omit route-level factors that impact perceptions, for example. It is likely that potential cyclists consider the quality of travel between locations when deciding how to travel (Winters, Teschke, et al. 2010). Other research using residential-area buffers similarly finds minimal effects of the built environment on cycling (Moudon et al. 2005). To some extent, however, I capture a sense of the effects of route-level measures in the bicycling convenience factor, which includes an indicator of bicycle infrastructure perceptions where the respondent typically travels. Future work should investigate the impacts using objective route-level measures.

Conclusions

I began the chapter asking whether, after controlling for neighborhood perceptions, sociodemographic characteristics, social influences, and the built environment, immigrants cycle less than people born in the United States. The analysis in this chapter suggests they do not. Immigrants are about as likely as non-immigrants to bicycle, all else equal. These findings appear to be in contrast to prior research that finds that immigrants cycle more than the US-born, when controlling for many of the same factors (e.g. Smart 2010, 2015). But upon deeper reflection, this study answers a new set of questions. First, the research design focuses data collection in urban, transit-rich neighborhoods in a single metropolitan region. Thus, I implicitly control for transportation alternatives (few lack transit access) and the policy context. I am more directly comparing differences between city-dwelling immigrants and city-dwelling non-immigrants. Second, this study asks about cycling frequency over a week rather than mode choice for an individual trip. The survey recruited people who cycle but are not everyday cyclists, who thus would have had a lower likelihood of reporting cycling on a particular day's travel diary entry in a household survey. This could produce a wider variety of experiences among the cyclists in the sample. Finally, this study controls for attitudes, preferences, and perceptions, which, as we have seen, are associated with cycling for both immigrants and the US-born. Many others do not.

Although there was not a difference in the likelihood of being a cyclist based on immigrant status, not every factor influenced cycling in the same way for immigrants and the US-born. The effects of the social environment on the propensity to bicycle operate in slightly different ways for immigrants and the US-born. Although social networks as I measured them do not directly affect cycling, cycling does influence the social network. Among immigrants, being employed and having roommates contributes to knowing more cyclists, but this is not true for people born in the United States. This may reflect the way lower-wage Latino immigrants incorporate into American life after their arrival to the country. They tend to rely on social capital as a substitute for lower human and

financial capital (Alba and Nee 2003). This social capital may involve calling on family, friends, and acquaintances to acquire housing, bringing them into contact with cyclists whom they know from other contexts. The corollary may also be true when immigrant cyclists bring their travel behavior from their home country and introduce it to their new roommates, as I will describe in the following chapter. Furthermore, this pattern recalls other work that finds co-ethnic relationships and the accumulation of social capital important in determining carpooling (Charles and Kline 2006; Blumenberg and Smart 2013).

Variation in the motivation for cycling between immigrants and non-immigrants is not limited to social factors. Overall travel patterns also suggest differences between the two groups in the way they view travel choices, though the significance of these differences diminish when controlling for other factors. For immigrants, cycling appears to substitute for travel by other modes. For those born in the United States, cycling is a complementary mode of travel. It suggests for some segments of the population, people are willing to make additional trips by bicycle. For example, bicycling to transit is higher among non-immigrants, so this may spur cycling for extra trips beyond the station. But it also suggests that immigrants who switch to less sustainable modes of travel may not be willing to go back to cycling. Because immigrants still cycle when they view it as difficult, it suggests that policies that easing the burden of bicycle travel in immigrant neighborhoods when trips are not direct and non-stop may remove barriers to cycling.

Finally, certain attitudes and perceptions have the strongest impact on the decision to bicycle when accounting for the endogeneity of those factors with travel and the built environment by means of the structural equation model. Perceptions of the neighborhood environment as being supportive of cycling strongly influence the likelihood of cycling for both immigrants and non-immigrants. Other research also finds attitudes and perceptions to be critical explanatory factors for travel behavior, mitigating most of the independent effects of the built environment (Spears, Houston, and Boarnet 2013; Ma, Dill, and Mohr 2014). But this chapter goes a step further by emphasizing that cycling also influences perceptions. Moreover, the reciprocal influence changes how to interpret the finding that perceptions matter. It suggests the need to carefully consider how investment in hard and soft infrastructure work together for cycling promotion, and how different community groups would be impacted. Future research on the role of attitudes, perceptions, and preferences on cycling need to consider causal influences in both directions.

4 Bicycling Is Freedom: A Qualitative Analysis of Immigrant Cycling Experiences

In the previous two chapters, I explored the relationships between travel mode frequency, nativity, and income for San Francisco Bay Area survey respondents. Immigrants had less access to transportation resources, traveled less frequently than non-immigrants, and were less willing to substitute bicycling or riding public transit for driving. Controlling for socioeconomic characteristics and neighborhood built environment characteristics, driving increased and transit use declined for Latino immigrants as incomes rose—a more pronounced effect than for non-immigrants or immigrants from other countries of origin. Latina immigrant women were less likely than other groups to ride a bicycle as well, all else equal. For bicycling, overall, there were few differences between immigrants and non-immigrants when looking at the interrelationship between attitudes and preferences, the social environment, and the built environment. For both groups positive perceptions of bicycling were more likely to predict bicycling. For immigrants, however, it appears that social-environment factors such as having roommates or knowing many people who bike had more positive influence on their likelihood of bicycling compared to non-immigrants.

Exploratory interviews prior to conducting the survey suggested two main themes about cycling for Latino immigrants. First, their experiences cycling in the US may be different from both cycling in their birth countries and from other groups' experiences. Second, their motivations for cycling stretched beyond income, attitudes, social networks, and urban form—the factors I explored in Chapters 2 and 3. In this chapter, I ask what Latino immigrants' cycling experiences are, and what factors are potentially unique in contributing to those experiences. I present an in-depth, qualitative understanding of immigrant cycling based on semi-structured interviews with 23 Latino immigrants. I begin with a review of factors associated with travel that are difficult to model, such as emotion and cultural motivations, which situates the interview results in the broader transportation literature. Next, I present findings from the interviews, which convey how emotions, cultural and social considerations, unique safety and cost concerns, and spatial awareness contribute to the immigrant cycling experience. Finally, I consider how those experiences inform planning and policy.

Literature review

Both utilitarian and psychological reasons for cycling are covered elsewhere in this dissertation (Chapters 2 and 3). A literature review by Heinen, van Wee, and Maat (2010) summarizes many of the directly observable influences thoroughly: built environment characteristics, such as dense urban form, that promote cycling shorter distances; bicycle facilities both on-road and at destinations; flatter terrain and good weather; and household structure such as fewer children and lower socioeconomic status. Likewise, a favorable disposition and positive perceptions toward bicycling encourage one to take up or continue bicycling (Gatersleben and Appleton 2007; Dill and Voros 2007; Xing, Handy, and Mokhtarian 2010; Handy and Xing 2011; Ma, Dill, and Mohr 2014; Dill, Mohr, and Ma 2014). But bicycling evokes more visceral emotions; municipal bicycle plans often have images of smiling bicycle riders, families with small children on training wheels, mass cycling events, and pristine natural landscapes juxtaposed with more ordinary planning language (e.g. Los Angeles Department of City Planning 2011; San Francisco Municipal Transportation Authority 2009). They try to built connections between cycling and a positive travel experience.

However, the experience of traveling can vary drastically depending on neighborhood conditions, socioeconomic position, and personal need. Some scholars have argued that transportation planning abstracts individual travel experiences to present a neat and tidy picture of a transportation system (e.g. Hine and Mitchell 2001; Blumenberg 2004; Nostikasari 2015). A bus trip, for example, may meet level of service expectations for a transit agency, but might be an unpleasant and abusive experience for a rider or inaccessible for a person with disabilities (Hine and Mitchell 2001; Liu and Schachter 2007; Barajas, Chatman, and Agrawal 2016). Cycling experiences vary widely too. Personal connections with other cyclists and expertise about cycling in the city can promote or reflect positive experiences (Lugo 2013), while negative perceptions of cycling safety change depending on time spent cycling and comfort (Sanders 2015). In other words, travel choice is motivated by much more than time, cost, and access.

In this section, I review the intangible factors associated with the travel experience to frame findings from the interviews in this chapter. I begin broadly with a look at the connections between travel, affect, and well-being, questions of which have recently emerged in transportation scholarship. I then discuss Latino immigrants' social consciousness and its connection to environmentally-conscious behavior, including sustainable transportation. Finally, I review how safety concerns motivate and deter individuals from bicycling. Reviewing each of these topic areas helps foreground findings that emerged from interviews with Latino immigrants, which I describe later.

Travel, affect, and well-being

Transportation economists generally view travel as a derived demand with a negative utility (e.g. Small and Verhoef 2007); in other words, there is no reason we would travel unless we have someplace to go. Given that 70 percent of our trips are for utilitarian purposes like work, school, and errands (Santos et al. 2011), it is likely true that most of our travel occurs to serve some other purpose. But research also points to a connection between affect—or a temporary emotional state—and travel, arguing that some proportion of travel is undertaken for its own enjoyment (Mokhtarian, Salomon, and Redmond 2001; Mokhtarian and Salomon 2001). This might be self-evident just by

looking through a dictionary: English terms just as joyride, Sunday drive, and cruising all connote positive experiences associated with moving about, particularly in cars.

Bicycling, too, may be enjoyed for its own sake. A study with commuters found bicycling to meet needs such as flexibility, cost, and convenience as well as other modes did, but that affective evaluations of bicycle commutes were generally higher than for motorized modes (Anable and Gatersleben 2005). Interviews with cyclists in two bike-friendly cities found many people bicycled because it was pleasurable, even if it was not as fast as other modes. Interviewees used terms like "energetic," "relaxing," "relieves stress," and "freedom" to describe some reasons why they bicycled (Heinen and Handy 2012). Commuters in the UK who found their trips to be relaxing and exciting were more likely to be bicyclists or walkers than to have taken other modes (Gatersleben and Uzzell 2007). And researchers looking at the relationship between positive affect and bicycling in Rome found that people who anticipated that bicycle commuting would make them feel happy, excited, relaxed, or some other positive emotion were more likely to express desire for taking up bicycle commuting than others (Passafaro et al. 2014). It is worth noting that all these studies rely on convenience samples and relatively small sample sizes, limiting the generalizability of their findings.

Even still, others relying on larger datasets find a relationship between bicycling and positive emotions, albeit less significantly so. Bicyclists in three principal Swedish cities had higher levels of satisfaction with their commutes compared to drivers and public transit users (Olsson et al. 2013). Two studies use American Time Use Survey data of commuting to explore the relationship between mood and mode. Although the authors do not find a statistically significant correlation between commute travel and either positive or negative affect, they do find that mood during travel is about the same as average and not worse, casting further doubt on the idea that the negative utility of travel is absolute (Morris and Guerra 2015b). Moreover, bicycle commuters are more likely to be in a good mood while commuting than those who use other modes, though again the difference is not statistically significant. A second study parallels the first. It finds that although longer distance bicycle commutes are associated with significantly more stress, being a bicyclist is associated with greater happiness, higher overall affect, lower stress, and lower fatigue after controlling for distance (Morris and Guerra 2015a). Finally, looking at non-motorized modes together, a representative survey in the San Francisco Bay Area found that people who liked to walk or bike to work were more likely to take trips just to think more clearly, to explore new places, to have pro-environmental attitudes, and to live family- or community-oriented lives (Ory and Mokhtarian 2005).

Feeling good while traveling is only one element of the intrinsic motivations for travel (Mokhtarian, Salomon, and Singer 2015), which includes subjective well-being. Some scholars argue that transportation policy has a central role to play in promoting well-being and quality of life by providing access to opportunities, options for mobility, infrastructure for health and activity, and the reduction of vehicle traffic (Delbosc 2012; Lee and Sener 2016). Well-being is also influenced by social exclusion, transport disadvantage, and the capacity to move around (de Vos et al. 2013). Those who suffer from both social exclusion and transport disadvantage are more likely to hold lower measures of well-being than those who suffer from one or the other or neither (Delbosc and Currie 2011). Others suggest that socioeconomic disadvantage adds stress to travel through inability to pay for transportation, unreliability of public transit, and lack of independence by not owning a car (Lowe and Mosby 2016). Some research suggests bicycling as a way to improve quality of life and psychological well-being (Crane et al. 2014), while the physical health and well-being benefits of bicycling have been well-documented elsewhere (e.g. de Hartog et al. 2010).

Social awareness

Bicycling is motivated by personal connections with others, and, for some, being good stewards of a shared environment. The literature on how immigrants rely on social networks for transportation is covered more extensively elsewhere in this dissertation (Chapters 2 and 3). In short, strong network ties among immigrants facilitate pooling of resources, extending the practice of getting rides to and from work, shopping, and errands (Blumenberg and Smart 2010, 2013; Lovejoy and Handy 2011). For example, Latino immigrants in New Orleans who were able to evacuate during Hurricane Katrina relied on both close and distal networks to gain access to transportation to leave the city (Messias, Barrington, and Lacy 2012). Immigrants who live in immigrant neighborhoods may be more likely to bicycle because of stronger social ties with neighborhood bicyclists, while non-immigrants in the same neighborhoods may be dissuaded from bicycling because they view the activity as something "other people" do (Smart 2015). The strength of social networks in influencing travel mode is not unique to immigrants; scholars have found similar in-group/out-group dynamics among bicyclists and non-bicyclists in workplaces (Skinner and Rosen 2007) and in gay and lesbian neighborhoods (Klein and Smart 2016). Family members and close social contacts play a role in encouraging people to take up regular cycling (Sherwin, Chatterjee, and Jain 2014).

Among Latino immigrants in particular, views toward social connections may be embodied in attitudes toward environmentalism. For Latinos in the US, and Mexican-origin people in particular, concern about the environment is closely linked with social impacts and their political history, tied to modern struggles of environmental justice and legacies of colonialism and land rights (Lynch 1993; Peña 2005). Empirical research suggests that Latinos participate less in certain environmental activities than whites—measured as recycling, nature-participating, environmental reading, and joining environmental groups (Johnson, Bowker, and Cordell 2004). However, these types of activities do not account for different socially- and community-oriented beliefs about the environment. Concern for how the negative impacts to the environment affect others has increased among California Latinos over the past several decades (Whittaker, Segura, and Bowler 2005). Similar concerns led to the split between the Anglo-dominated environmental movement, focused primarily on the natural environment, and the environmental justice movement led by people of color, more concerned with degradation of the built environment (Marquez 2012). Empirical research based on the General Social Survey suggests that Mexican immigrants, in particular, are willing to drive less and make other personal sacrifices to protect the environment more so than other US-born or immigrant groups, consistent with theory of "ecological assimilation" (Macias 2016). These pro-environmental community-based attitudes and practices offer a hypothesis for higher sustainable travel among Latinos and other immigrants. On the other hand, desire for economic advancement and the narrative of the dream of car ownership may temper these effects.

Safety

Finally, personal danger invokes strong opinions about bicycling as a suitable, everyday mode of transportation. Safety is consistently ranked as one of the top deterrents to bicycling regularly (Dill and Voros 2007; Akar and Clifton 2009; Winters et al. 2011). Crashes and near-misses alike make bicyclists feel unsafe about the activity and discourage them from cycling more (Sanders 2015). Whereas the total number of traffic fatalities decreased by about 25 percent between 2004 and 2013,

the number of bicyclist fatalities increased by 2 percent during the same time period (National Highway Traffic Safety Administration 2015). Although risk from motorcycling far exceeds risk for all other modes of transportation, bicycling carries the second-highest risk of injury or death per person-trip (Beck, Dellinger, and O'Neil 2007). Serious injury or death while bicycling almost always results from collisions with motor vehicles caused by high vehicle speed, driver intoxication, and low visibility in darkness and weather (Kim et al. 2007).

Bicycle safety concerns may be more acute for immigrants and their descendants. Latinos in the US are involved in a disproportionate number of bicycle crashes because they are more likely to ride during darkness and may be less familiar with traffic laws (Knoblauch, Seifert, and Murphy 2004). In New York City, researchers found census tracts with higher proportions of both Latin American immigrants and newer immigrants to have more bicycle and pedestrian crashes, controlling for built environment characteristics (Chen, Lin, and Loo 2012). Dangers are greater for children as well. Latino children are less likely than non-Hispanics to wear bicycle helmets (Dellinger and Kresnow 2010; Sullins et al. 2014), which have been shown to reduce the severity of head injury for those involved in crashes (Attewell, Glase, and McFadden 2001; Elvik 2013). Latino children are more likely to walk and bicycle to school than other racial and ethnic groups, primarily because they are more likely to live closer to school than their counterparts, and may therefore be at greater risk of injury (McDonald 2008).

Some safety problems may be improved by installing bicycle infrastructure (Buehler and Dill 2016; Götschi, Garrard, and Giles-Corti 2016). Some studies have found that separating bicycle movement from motor vehicle traffic is the safest form of bicycle infrastructure (Wegman, Zhang, and Dijkstra 2012; Lusk et al. 2013), while others also find lower crash incidence along bike lanes, bike boulevards, and traffic calming features (Reynolds et al. 2009; Minikel 2012; Teschke et al. 2012; Hamann and Peek-Asa 2013). Those improved safety outcomes are likely to shift bicycle traffic onto those type of facilities. In Portland, Oregon, a city with an extensive network of bicycle facilities, one study found about half of all bicycling was done on roads with bike lanes (Dill 2009). In Vancouver, British Columbia, another cycling-oriented city, bicyclists were willing to detour nearly a mile from their shortest distance path to get to a bike route, and would detour about a half mile to avoid an arterial road without bicycle infrastructure (Winters, Teschke, et al. 2010). However, in some communities of color, bicycle lanes have come to be seen as symbols of gentrification, not meant for the long-term residents of those neighborhoods (Lubitow and Miller 2013; Lugo 2013; Hoffmann 2016). Resistance to bicycle improvement projects may mean potential safety gains go unrealized in communities that need them.

Data collection and methods

How do Latino immigrants experience cycling, and what lessons do those experiences offer for planning and policy? I explore these questions through in-depth personal interviews. The interviews for this chapter were conducted in two phases. The first phase interviews were meant to explore questions related to barriers for public transit and bicycle use and to design the intercept survey described earlier. For those reasons, eligible participants were any low-income Latino immigrant age 18 or older, regardless of usual mode of travel. The analysis in this chapter excludes participants who both had no personal experience bicycling and had no intention of bicycling. First phase in-

terviewees were recruited exclusively with the help of several social service organizations: a health services provider, a day labor center, a women's community group, and an integrated community services provider. The organizations either allowed us to recruit at their members' meetings or notified their membership themselves and invited us to interview them at a coordinated time. Interviews were conducted on site at the social service organizations in Oakland, Hayward, and San Jose in spring and summer 2014. Participants were offered a pair of movie tickets as an incentive to participate.

Interviews from the second phase were designed as follow-up interviews to interrogate the findings from the intercept survey and to explore additional motivations for bicycling that were not asked about in the survey. In this case, eligible participants had to meet the same criteria as the first phase interviews, but also had to have ridden a bicycle within the last year. Interviewees were recruited through a wider variety of methods for this phase of research. Participants who filled out additional information forms after completing the intercept survey were invited to participate. I also intercepted individuals at one of the previous survey sites to arrange interviews for a later time. Two immigrant empowerment groups also assisted with recruiting. Participants were offered a $20 gift card as an incentive to participate. The second phase of interviews was originally meant to produce comparative work, exploring differences in motivations for bicycling between immigrants and non-immigrants. The primary method of recruitment for non-immigrants was by means of the follow-up forms participants filled out during the survey effort. However, only one person out of approximately 20 responded to my requests for an interview. To avoid further delays in the interview schedule and to focus the research findings, I modified the research design to include only Latino immigrants. Interviews were conducted in cafés in Concord and Oakland and on-site at the social service agency in San Francisco in winter and spring 2016. Research assistants and I interviewed 26 people.

Interviews were semi-structured with open-ended questions focused around topics of the neighborhood environment, experiences with various modes of travel, and recommendations for planning improvements (see Appendix F). For the first set of interviews, the topic guide was designed to encourage participants to talk in detail about their transportation experiences related to public transit and cycling. In the first part of each interview, the questioner prompted interviewees about recent trips and incidents to connect them to specific experiences rather than generalizations. Participants were asked to describe their travel from start to finish on a particular day, to recount a recent time taking transit, and to talk about why they did or did not cycle. Each question featured a number of prompts to help propel the conversation and keep it on track, but they were not exhaustively followed. The final interview questions explicitly asked participants to bring up topics that were not discussed previously, and to offer suggestions for how planners could address their transportation needs. The topic guide for Phase 2 was similar in design but broader in scope. The first portion of the topic guide focused on neighborhood perceptions to encourage interviewees to think about the connection between their neighborhoods and transportation. The second set of questions was similar to those asked in Phase 1 about transportation experiences, focusing more extensively on cycling perceptions and experiences. The final set of questions asked about cost trade-offs people make when making travel decisions, class differences in travel behavior, and community planning and policy needs. Because participants in the first few Phase 2 interviews talked in detail about emotional and cultural aspects of cycling, in later interviews I added questions about how cycling made people feel and whether participants thought of cycling as an activity many Latino

immigrants took up. Importantly, the semi-structured nature of the interviews and purposefully designed open-ended questions allowed participants to bring up topics that were important to them; the interviewers followed participants' leads if they fit within the conversation.

Each participant provided written (Phase 1) or oral (Phase 2) informed consent prior to the interviews.[1] Discussions lasted between 45 minutes and an hour. A fluent Spanish speaker translated the two topic guides and conducted the 21 Spanish-language interviews while I was present to take notes and ask follow-up questions. Five participants asked to be interviewed in English; I led those interviews. A total of 23 interviews are used in this analysis: 13 from the first phase and 10 from the second phase. Two interviews conducted during the first phase were excluded because they did not address bicycling. One interview conducted during the second phase was excluded because the participant was not eligible given the revised research criteria. Interview participants ranged in age from 18 to late 60s. Length of time in the country varied from two weeks to over 20 years. All participants were originally from Mexico, El Salvador, or Guatemala.[2] In the text, all participants are identified by pseudonym that either I assigned or they selected.

I relied on grounded theory methods in part to construct the analysis, although this study is not strictly a grounded theory study. Grounded theory methodology distinguishes itself from other qualitative methods in two primary ways. First, data categories are generated during analysis rather than in advance, in a process known as open coding. Second, analysis and data collection are done hand-in-hand, so that the researcher can follow new themes as they arise during interviews (Corbin and Strauss 2014). The initial interviews were transcribed, which I then coded without a prior codebook. I coded these first interviews line by line, generating 121 initial codes. Most codes were descriptive: "Bicycling is healthy," "Bicycling is environmentally friendly," "Infrastructure improvements would promote cycling." Some were in-vivo, or directly quoted, codes ("Bicycling is freedom") and a few were analytical ("Conflicted feelings"). I searched for these same ideas in the transcribed text of later interviews and added new codes as they appeared. I developed eight general themes from the initial coding in an intermediate coding process, later synthesized into the analytical headings presented below. I also used the intermediate codes to focus questioning in later interviews to understand the relationships in those categories better (Birks and Mills 2011). As interviews continued, I used field notes from previous interviews to help identify themes to interrogate further. At the conclusion, all interviews were transcribed for coding. Interviews and all stages of coding were iterative processes. The RQDA package in R provided the software tool for data analysis. I coded the transcripts in the original interview language.

The methodology introduces a few limitations to the study. Most study participants I recruited had some connection with a community-based organization. Three of those organizations advocate for immigrant rights and empowerment, so interviewees affiliated with them may be more knowledgeable about social justice and community issues than other Latino immigrants. I did not recruit non-immigrants for the study, so it is not possible to distinguish fully between the experiences of immigrants and non-immigrants. Furthermore, only immigrants from three countries participated in the study, whose experiences may not reflect those of other prominent immigrant groups in the

[1] The San Jose State University Institutional Review Board approved the protocol for the first phase of research, which was funded by the Mineta Transportation Institute. They required written consent prior to participation. The University of California, Berkeley Committee for the Protection of Human Subjects approved the protocol for the second phase of research, which I conducted for the dissertation. They required only oral consent prior to participation.

[2] One participant was born in Cuba but raised in Mexico.

San Francisco Bay Area. Nevertheless, reflections on interviewees' daily experiences with bicycling speak to unique factors that contribute to travel decisions, many of which are not traditionally considered in transportation planning applications (e.g. Nostikasari 2015).

How do Latino immigrants experience cycling?

This section describes findings from the interviews. I categorize cycling experiences into five major themes: emotions and empowerment, culture and identity, cost, safety, and spatial awareness. These themes represent common ideas in each conversation, but are not a quantitative accounting of the most numerous codes I developed. Instead, they reflect possibilities of how the immigrant cycling experience is unique. I also focus the findings on how motivations might differ from more conventional understandings of bicycling mode choice.

Despite speaking of an "immigrant cycling experience," it is not possible to draw universal generalizations. Interviews were as varied as the participants themselves. Several were short and matter-of-fact; participants had little to say beyond the fact that they bicycled, faced few barriers, and could not think of many ways to improve their experiences. A few meandered, which made it difficult to get interviewees to talk about specific instances in response to the questions. But for the most part, the conversations were rich and often emotional. It was clear that they had given thought to their mobility options and needs. In particular, interviewees living in San Francisco were passionate about their neighborhoods and how neighborhood change affected their lives. And everyone talked not just about bicycling, but about transportation in general and its impacts on themselves and, if they had one, their family.

Emotions, empowerment, and self-improvement

Almost universally, participants talked about bicycling in positive, emotional language. In the words of María, a Mexican woman in her 60s, bicycling enables "freedom" and "independence"; freedom from relying on others to give them rides, freedom from waiting on a bus schedule, freedom from having to circle the block for a parking spot. Many interviewees concurred. When asked why he felt more comfortable riding a bicycle than using other modes of transportation, David, 20s, put it this way:

> I think that you go by yourself and you can stop wherever you want. And sometimes I think it's not so complicated—you go and don't have to go at a certain speed. You can go at the speed you want, and because of this, it feels good.

Many described joy in being able to get around traffic congestion quickly, and for short trips, found bicycling to be much quicker and more convenient than taking the bus. Others described the usefulness and practicality of bicycling in emotional terms. Gabriela, a young mother who lives in Oakland, found bicycling to be "marvelous" because her job was a 15-minute bicycle ride from her house. She could bicycle home on her lunch break "for half an hour, sometimes to eat, sometimes to see my children—but it was good to be able to use my bicycle."

For many interviewees, bicycling boosted mental energy. A few talked of the "mind-clearing" effects of bicycling. For José, a young Guatemalan immigrant, bicycling helped him "freshen up,"

taking his mind off of difficult things. "I like [bicycling] a lot, I don't know, but I like it a lot," he said. "My mind is always awake, always when I'm on my bike—I do it every day." Gabriel G. responded similarly about bicycling as a way to "concern [his] mind with other things, feeling at ease also." Some people had immigrated to the United States unaccompanied, leaving their families back home. Bicycling was an emotional link to remember them by, such as when Gabriel used to ride his bike with his family in Mexico, and then took them to a regional lake to bicycle when they came to visit. And the positive emotions associated with bicycling could simply result from the psychological effects of physical activity. Nearly every respondent liked to ride their bicycle as a form of exercise, and some connected the dots between the physical and the mental. Gabriel G., a car mechanic, described how he felt before he starting bicycling regularly about ten months earlier:

> Before, I had a lot of cars and I almost never used my bicycle. Physically—I didn't feel good, because [using cars] makes you lazy when going to the store, going to whichever place. Even though it might be around the corner from house, getting the car and going—we're not exercising.

Likewise, Donaji used bicycling as therapy when troubled by her son's health issues:

> The thing about the bicycle also is that, for me, it started as a form of relief, because they had just diagnosed my son with leukemia for the third time and apart from that he has Down syndrome, so there were a lot of things going on at home. And I know that exercising helps me a lot to feel less depressed, less bad about things. Then I began to grab my bike and sometimes I went out to the [waterfront], sometimes until two at night, when I couldn't sleep or I felt bad. And it helped me a lot.

Even those who had not ridden a bicycle recently imagined that it would be a positive experience for them to start. Alejandra, a Guatemalan woman in her 30s, wanted to ride more because her husband and friends told her how easy it was to get around San Francisco. Guadalupe, who had not ridden a bicycle before, said that "it had been her dream since [she] was a little girl" to ride a bicycle. She continued:

> I used to hang out with a girl who took her bicycle and I said "one day I will have one, some day." It has always called out to me and now I have the possibility, like I say "maybe I can't," but only because I haven't tried—but I know that I can.

She imagined that if she picked up bicycling she would ride her bike for work and to her favorite place—around Oakland's Lake Merritt for exercise. But Guadalupe's story was also emblematic of the conflicted feelings people have toward bicycling. Her remarks suggested that she thought one had to learn bicycling as a child to be able to do it as an adult. People told her how she could build her own bicycle using the free bike workshops, or how it is a practical mode of transportation and invited her to come, but she thought that the time for riding a bicycle had "already passed [her] by." Gabriela, who had stopped riding a bicycle recently, also described conflicted emotions about bicycling: "the truth is it makes me afraid. I am afraid [to bicycle] because of safety….But I love bicycling." Others described bicycling in largely positive terms, but added that they had never been

in a crash "thanks to god," acknowledging an ever-present danger and undercurrent of fear when cycling.

For a rare few, bicycling was pure joy. María offered how strongly bicycling can be tied to positive emotions, describing it as a "something special that we humans must learn to value"—something that allows her to be "in communion with nature." She continued this way:

> To me, I find the coexistence between the bicycle and people to be very healthy. It is like a friend, it is like a tool, it is like a mode of transportation, it is like a helper. That's my feeling. It's that for me, a bike—well, I have seen it, I have used it, I have touched it, I care for it….If they made a monument to the bicycle, it would be good.

Culture and identity

Several aspects of Latino immigrants' culture and identity spoke to their cycling experience according to many interviewees. The first was a strong sense of dedication to and primacy of family and community, a cultural norm anthropologists have called *familismo* (Sabogal et al. 1987; Smith-Morris et al. 2013). Several interviewees were motivated to bicycle for environmental reasons, but tied them to broader social and cultural concerns. Gabriel G. thought that he and "all other [bicyclists] also have those thoughts about the environment, that they are trying to protect it a little bit." Vico, a regular cyclist from Guatemala, felt that if there were "a global culture of using bicycles instead of combustion-engine vehicles," it would make "a fairly important difference" in terms of environmental consequences. Gabriel M., a recently-arrived immigrant from Guatemala, considered that environmental awareness and concern for others should start at an early age by introducing bicycling programs in schools. Bicycling as a response to environmental problems would thus be imprinted upon people at an early age:

> Well I think that the awareness…when children receive it at that age is when it stays with them the most, let's say. Children would get an awareness about future generations. Listen, if they tell us that now, "No, if you don't use a bike…you are going to contaminate the world and all this," it is much more difficult when someone has never used a bike and begins to use one. But yes, when they begin to impress that culture on you from when you're a child…when they become adults, it's not going to cost them anything because they're already accustomed to it. Riding a bicycle is basically going to be part of their culture.

Some interviewees thought community-oriented events organized by and targeted to Latino immigrants could encourage more cycling. Many talked about Critical Mass events, group bicycle rides for recreation, and family activities as having an impact on how their friends and families saw bicycling. One participant, for example, said he brought a friend who had never ridden a bicycle before on a community-organized ride to the beach. He reported that his friend now has taken up bicycling more regularly. Interviewees knew about community build-a-bike programs, often aimed at immigrants and designed so that low-income earners can get free bikes by volunteering time with the organization. They thought that type of program was beneficial in encouraging more bicycling.

Second, some interviews spoke more directly about the role of identity as an Latino immigrant played in the cycling experience. Many perceived that Latinos cycled far less frequently than whites.

For example, Kevin, a young Salavadoran immigrant, estimated that 90 percent of the people he saw on bicycles did not match his cultural background. He attributed the absence of Latino bicyclists to a lack of investment in bicycle infrastructure in Latin American countries:

> I come from El Salvador but from Mexico to the rest of Latin America, people have never been incentivized to use a bicycle for transportation, only for recreation….People use it less than here, because in our countries bike lanes and safety measures for bicyclists don't exist. Neither does accessibility or having a bicycle….Someone grows up with that and when he comes to a country like this, a first-world country like the United States, he is used to using the bus and doesn't look for other modes of transportation.

Others agreed, suggesting that bicycling in their home countries was seen only a children's activity, used "more than anything for fun and by young people—children, basically" (Vico). Still others tied less frequent cycling to occupations immigrants traditionally held. Gabriel G., a manual laborer, described his coworkers as not wanting to cycle because they were it would make them more tired after a long day. Donaji, a mother of two who lives in San Francisco, could get to work on a bicycle, but it would be impossible for some of her friends:

> For example, I work [in a neighborhood about four miles from home] but I just take care of a patient. I'm the only one who has to go. But I have friends who clean houses and sometimes they have to bring vacuum cleaners and things like that. How do you do that on a bicycle? Or the men who have to carry tools? Or if you have two young kids? So, bicycling is a good alternative but it's not for everybody.

Others thought that bicycling was an activity Latino immigrants were wont to leave behind, if they picked it up at all. Vico talked of the narrative of economic achievement associated with car ownership as something Latino immigrants come to the United States to pursue, which discouraged bicycle use:

> I feel that it can be economic and also cultural aspects, right? Because the idea of what it means to be prosperous and all that has taken over the media. It is having a vehicle, having, like, the ability to buy expensive vehicles and, then, that's what people look for, right? And then the bicycle is seen as something, like a hobby or simply for fun…. For me it's not only that but it is something that is driven by the community.

But simply seeing more people like oneself on bicycles could be encouraging. Donaji proposed public cycling events where Latinos and other people of color were visible could regularized bicycling:

> I have seen that every month some bicycle marches go by…. If there were more things like that with people of color, where a ton of people go together and they can go places like that, I also think that would encourage people to ride bikes more.

Finally, some interviewees spoke specifically of how traditional women's roles and cultural narratives prevent Latina women from cycling. For the women who discussed it, safety issues were the primary reasons for not cycling more. Others described being primary caretakers of their children, which prevented them from cycling. But María also attributed it to outmoded values:

> When I have tried to teach women [to bicycle]—adults—they say, "I'm afraid, I'm afraid. I have never done it before." And sometimes, it's that—among Latinos, among Latinos it is said a lot, "Don't ride a bike, don't ride a horse, because then you won't be a virgin and no one is going to want you." That is, they are ancestral taboos from I don't know how many hundreds of years ago. "Women shouldn't use a bicycle, women shouldn't ride a horse, women shouldn't do this thing." Without realizing in reality that we are in the 21st century, we are in the United States, we have another way of seeing life. For many women, we cling to our roots and we don't use bicycles out of fear.

Cost

Although cost was not the primary motivation for bicycling for most of the people I talked to, saving money substantially factored into their transportation decision-making. Typically, interviewees quickly calculated the money they would save per week or per month by choosing to ride a bicycle over paying public transit fares or parking fees when asked about reasons they cycled or about transportation costs. One participant found bicycling necessary because he did not work a regular schedule and could not afford to use an alternative, saying "I don't have stable work and I don't have money to pay for the bus all the time….I use my bike the most" (Francisco). Eduardo, a Cuban-Mexican immigrant living in San Francisco, saved money on transit fares when going long distances by using his bike together with BART: "When I don't want to pay a lot, I get off at [the first stop in] Oakland…and I go pedaling along the same route as BART." Others spoke of the sacrifices they would have to make for their families if they relied on public transit more often. "If I go and come back by bicycle, look, those five dollars will let me buy milk and eggs for my children," Donaji said about saving money on bus fares. One participant spoke about how saving money on transit fares allows him to send money back home for his children's food and university tuition.

But bicycling was not immune to cost pressures. A few participants were surprised at the cost of obtaining a bicycle. One participant thought that the rising popularity of certain types of bicycles was pushing prices for all bicycles up: "Before they were cheaper but suddenly the prices started to rise because they were other brands of bicycles, either European brands, or Italian brands or…the classic brands that everyone is using nowadays and wants to buy" (Alejandra). For many, theft was a real concern tied to the cost of bicycle ownership. Gabriel M., who had immigrated less than a month earlier, described a stark contrast in his perception of the security of unattended bicycles between his home country and his adopted one:

> A negative factor that I've found that hasn't happened to me yet, but there is a lot of fear in the risk that they are going to steal your bicycle. It's a little— Well, I come from a third-world country, in Guatemala, then, the city is dangerous and they steal but here people are afraid of leaving their bicycle and so they use those big padlocks and such. In my home city I would put a cable on it and leave it locked to a tree. There is more respect.

Another participant knew firsthand about bicycle theft after a friend showed him how easy it would be to steal with the proper tools. If his schedule allowed, he preferred to take the ferry across the bay with his bicycle for that reason: "It has a place to put bicycles, a place to hang them up….And

you can leave them there without a lock or anything….There isn't a way for them to steal it from you. Where will they take it?" (Eduardo).

Traffic safety

Unsurprisingly, safety was a major concern participants had about bicycling, even for those who rode a bicycle almost daily. Interviewees expressed concern about cars that passed too close, drivers who were distracted by cell phones, and heavy traffic. Many had to live in and travel to low-income neighborhoods, which in some cases had little bicycle infrastructure and whose roads were poorly maintained. One interviewee tried to avoid a busy street by riding on the sidewalk, but found even that was not safe:

> Because I'm afraid of the highway, because of the traffic—but yes, I go slowly [on the sidewalk]. But even when I go slowly little children come running out of a store toward me and I have to stop myself and it's dangerous. (Francisco)

Several interviewees thought safety was in their own hands because they were less likely to know traffic laws and responsibilities as immigrants. They talked about the actions they needed to take to avoid collisions. One participant was in a serious bicycle crash with another car during a dark, rainy morning and placed blame for the incident entirely on herself for not knowing the rules of the road well. She described the incident as "the life lesson that I needed to know which things I must have for my own safety" (María), and emphasized that bicycling safety education would help others avoid collisions, know their rights, and stay within the law. One participant bemoaned the practice of hanging a helmet from the handlebars while riding, noting that bicycles didn't need a helmet for protection, but people did. Another described the complexity of managing to stay safe in heavy traffic, requiring coordination and mutual understanding between parties:

> I think there are a lot of neighborhoods where there is a lot of heavy traffic but also—they give you signs like, if you're crossing, you're asking to go left and there is a truck that's coming behind you and then you're looking at the driver, and he is also signaling that he is going to cross to the right, then what he is telling you is that he is going to cover so that you can pass by. "First you go, then I go" (Eduardo).

However, bicycle safety extends beyond road conditions. Several talked about being victim to or witnessing assaults and thefts while riding bicycles. Violent events caused people to fear for their personal safety, in some instances preventing them from riding a bicycle again.

> **Gabriela**: It's the safety in Oakland. Unfortunately, I happened to see someone getting his bicycle stolen. The person was going along very peacefully, riding his bicycle, when only one person stopped him, did this with his hand [*holds hand straight out*], and knocked him over. And before the man got up from the blow, the other person took the bicycle and ran off. That left me terrified.
>
> **Interviewer**: Before that, did you use to ride a bike?
>
> **Gabriela**: I used to ride a bike. Before that, yes, I used to ride a bike.

On the other hand, some spoke of the advantage of being on a bicycle when encountering dangerous situations, allowing then a speedier escape than if they were on foot.

Spatial awareness

Interviewees seemed to hold opposing views about the ease with which a bicyclist could navigate the city. Some found that bicycling around the city would aid in understanding an unfamiliar place, giving them more confidence to continue to do so. Several talked about how paying attention to street signs while bicycling is key to navigating. María described her own learning process this way:

> I didn't come to the United States to get a car or anything. A bicycle. Yes, and you know more, much more. When someone rides a bike he learns directions better. You learn the street names, you sometimes learn how to tell time….Just because you're riding with the angle of the sun—you ride around watching.

Some participants talked about using public transit to learn their way around the city first, and then starting to cycle farther afield from their own neighborhoods. One interviewee who had arrived less than a month earlier began bicycling from place to place using the maps on bus shelters to help learn directions and navigate to new destinations.

But not everyone thought the street signs and bicycle markings were so helpful, having the effect of deterring bicycling because of their confusion or absence. Some participants thought bilingual signs were necessary and would make it easier for them to know where bicycle routes went. Still others thought undocumented immigrants would be particularly discouraged from bicycling if they didn't understand the rules and norms:

> Another thing is that there should be access, signs and all that, if they were very clear for bicyclists, so that people could understand them very well, people wouldn't be afraid. It is terrible that if you also have an immigration status that isn't up to date, then you can't go around how you like because whatever small error you commit will become a bigger complication for you and your family (Donaji).

Several interviewees spoke of the lack of signs and infrastructure in broader terms of social injustice against Latinos and other marginalized communities. This was particularly true for interviewees who lived in San Francisco, who are often reminded of the pressures of gentrification and displacement in their daily lives. Many spoke of the contrast in investment in bicycle infrastructure between neighborhoods like the Financial District and the Mission District with higher income residents and workers, and the Bayview, a neighborhood that has one of the lowest median household incomes in San Francisco (San Francisco Planning Department 2011). By the time the city installed bike lanes in the Mission District, it had already undergone demographic changes that displaced many of the former residents, who could not benefit from them. Donaji, who lives near Valencia Street in the heart of the Mission District, described it this way:

> My neighborhood is more [bike] accessible [than my old neighborhood] because Valencia Street has a bicycle route along the whole street but— These contradictions are very hard. Now that they have put more bike lanes in the neighborhood, the families

and children that need them aren't here anymore. The same has happened with public transportation….It is super unjust.

Discussion and conclusions

In general, convenience drives a large part of why people cycle according to the interviews in this study. Bicycling costs less than other modes and can save time over short distances, particularly in congested neighborhoods where vehicle parking is neither free nor plentiful. It can be combined with public transit to make farther destinations more accessible, and it is more reliable than waiting on the bus. Cycling promotes physical activity and associated health benefits, both in body and in mind. Safe bicycling routes and a knowledge of the city make getting around by bicycle easier and more enjoyable.

Participants used emotionally-charged language to describe their cycling motivations and experiences, offering evidence that perceptions of cycling strongly figure in their decision making. The psychological feelings seemed to act in both directions, with people speaking passionately about how cycling made them feel in the moment and how they told others in their social networks about the positive benefits of cycling. This mirrors the findings from Chapter 3, in which I found perceptions and attitudes to both influence and be influenced by cycling. Fear was a prominent negative emotion associated with cycling, usually associated with traffic danger, which hampered enjoyment, preventing cycling along certain routes, and, in some cases, preventing cycling at all. Not all were gripped by fear, overcoming it by actively taking measures to prevent collisions as much as possible, such as defensive cycling and wearing lights and helmets while riding.

Many of the findings in this study can apply to immigrants and non-immigrants equally, but some of the cycling experience appears to be unique to the Latino immigrants interviewed. A significant example is a relatively consistent concern for socially-based sustainability. In other words, Latino immigrants were motivated to bicycle in part because of its environmental benefits, but they were not using the bicycle as a political statement of an environmental politics (cf. Horton 2006). Instead, environmental motivations were tied closely to concern for the welfare of their own families and society at large. These findings comport with anthropological observations about the centrality of *familismo* in Latino cultures as described earlier. *Familismo* operates beyond environmental issues, helping bicycling to become an important family activity that everyone could do, regardless of ability or distance from home. Even concerns about costs were often tied together with a sense of obligation to one's family through sending remittances or purchasing food and necessary goods.

Conversely, issues specific to immigrant groups hinder bicycling from becoming a normalized mode of transportation for them. First, identity plays a key role in understanding who cyclists are (Skinner and Rosen 2007). Most interviewees observed few other Latinos cycling. Not seeing familiar faces among cyclists in the city can reduce their likelihood of considering it as a mode of transportation they can use (Steinbach et al. 2011). Likewise, cycling is a gendered mode of transportation, at least in the United States (e.g. Garrard, Handy, and Dill 2012). The gender differences in cycling frequency among Latinos and Latinas are even more disparate (Smart 2010, and Chapter 2), which partially result from cultural norms toward women's roles in households. Second, navigating unfamiliar territory—a new country with information posted in a foreign language—may induce a fear of getting lost or placing oneself in danger. For undocumented immigrants, who al-

ready live their lives in under the precarity of extra-legal status, the fear of committing a traffic infraction out of ignorance introduces additional, unwanted opportunities for interacting with law enforcement (cf. Romero 2006). Bicycling does not offer a chance to stay out of the spotlight; cyclists are more visible because of cycling's rarity. Finally, immigrants may perceive that bicycle planning efforts are either not targeted at them or have systematically excluded them from receiving the benefits. These perceptions echo arguments that advocates in marginalized groups across the country debate about how bicycle planning and infrastructure is implicated in social injustice and gentrification (Hoffmann and Lugo 2014; Lubitow and Miller 2013; Applebaum et al. 2011). Whether the perceptions are true in actual fact, they can have the effect of discouraging immigrants from seeing bicycling as a mode of transportation they are welcome to use.

In the final chapter, I place these results in context with the findings from the previous dissertation chapters, discussing the potential implications for planning and policy.

5 Conclusion

The landmark Immigration and Nationality Act of 1965 irrevocably changed migration trends to the United States, shifting the balance of sending countries southward from Europe and Canada to Latin America and Asia. With the bulk of new immigrants coming from the developing world, a large share relies on cheaper modes of transportation. But many hold out hope that they can eventually own and drive a car. The potential shift of a substantial fraction of the immigrant population from sustainable transport modes to single-occupancy vehicles figures to test the limits of the transportation system's growth. Furthermore, meeting the current travel needs of a low-resourced population is an equity issue, requiring careful consideration under the law.

This mixed-methods dissertation has explored the travel behavior of a portion of the immigrant population in the San Francisco Bay Area, focusing particularly on Latino immigrants and bicycling. I have sought to answer three questions related to immigrant travel, including (1) how their travel patterns differ from non-immigrants, (2) how the relationship among preferences, attitudes and the built environment impact bicycling habits, and (3) how the experiences of Latino immigrants might shape their views of bicycling. In this final chapter, I briefly summarize the findings from the three previous chapters and discuss the implications for transportation planning and policy.

Summary of key findings

In an intercept survey of 2,087 respondents in the central San Francisco Bay Area, 45 percent of whom were immigrants, the differences in travel frequency and perceptions toward public transit and bicycling between immigrants and non-immigrants were fairly small. Low-income Latino immigrants were less mobile than other nativity and income groups in the region. They had less access to transportation resources, traveled fewer days per week, and were more likely to take just one mode of transportation in a week than others. When controlling for sociodemographic and built environment characteristics at the ZIP code level, many differences in mode use remained. For example, higher incomes had stronger effects for Latino immigrants in how much more they drove and how much less they took public transit than other groups. This may reflect the result of the popular narrative that success as an immigrant means car ownership. It may be also be a result of changing household circumstances that go along with earning more money—working at more than one place, or moving to more suburban, less-transit accessible neighborhoods. On the other hand, walking declined much more precipitously among immigrants from outside Latin America

than the rest. And consistent with findings from other research, women bicycled less often. Latina immigrants, in particular, almost never rode a bicycle regardless of income, all else equal. Safety is a fear for many women of all backgrounds, but as some women pointed out in our interviews, traditional cultural norms may also discourage women from cycling.

Certain transportation experiences also seemed to reflect immigrants lower access to transportation resources. Both low-income and higher-income immigrants were more sensitive to fares and the perception of neighborhood crime when asked if they would take public transit more often, but there were no differences when it came to riding a bicycle more often. In fact, low-income immigrants were less willing to ride a bike for any of the reasons the survey asked. Because the majority of respondents were frequent transit users, it may be that the types of trips immigrants take are more amenable to transit than cycling. Low-income immigrants were also less willing to substitute another mode for driving when they had the option to do so. This suggests that cars serve a particular purpose for low-income immigrants in this sample. They normally depend on public transit but arrange to drive when they need to, such as to buy groceries in bulk or visit the doctor. Driving is rarely an option, so they cannot afford to not use a car when it is.

Among survey respondents, perceptions of and attitudes toward bicycling appear to play a central role in determining whether a person bicycles. Although this echoes findings elsewhere, previous research treating attitudes and perceptions as causative factors has not accounted for the possibility that bicycling may itself cause perceptions and attitudes—a gap that I remedied in this analysis. Controlling for this reciprocal relationship, the more people reported that neighborhood environment factors were important to cycling, the more likely they were to cycle. This was equally true for immigrants and non-immigrants. People who cycled were more likely to consider cycling a convenient means of travel, but the reverse effect was insignificant. The relationship between finding it difficult to bicycle and having cycled was curious. For both immigrants and non-immigrants, having cycled in the previous week meant they found it hard to get around when cycling with others or to multiple places. We might expect this relationship, because the more one cycles, the more varied experiences one gains in terms of the places traveled and companions brought along. But in the opposite direction, US-born respondents who thought it difficult to cycle were less likely to cycle, while immigrants were *more* likely to. It suggests immigrant cyclists are more likely to be bicycle-dependent, unable to choose alternatives that would make travel easier.

Both the social environment and the built environment were less important to cycling for both immigrants and non-immigrants. Knowing many cyclists did not influence the likelihood of cycling, but being a cyclist affected how many cyclists a respondent knew. The effect was slightly stronger for immigrants. Furthermore, other social characteristics—having roommates and being employed—also increased the number of cyclists an immigrant knew. While cycling can be a social activity for everyone, the results parallel other research that shows a strong link between immigrants' social networks and travel. However, few measures of the built environment affected cycling directly or indirectly (as mediated by attitudes and perceptions). This helps point to the importance of perceptions in understanding cycling. But as I suggested in Chapter 3, it may also be that cycling routes rather than neighborhood areas impact cycling, as suggested by other empirical work.

Finally, for the Latino immigrants I interviewed, motivations to bicycle extend beyond objective measures of the built environment, cost, or even basic attitudes toward bicycling. Many described their cycling experiences emotionally, in both positive and negative terms. Several spoke of their cultural values that promote social awareness and an obligation to family as motivations to cycle.

But fear was also a strong deterrent to bicycling for many. Some were afraid of collisions in traffic, others were afraid of being vulnerable in the face of neighborhood crime, and still others were afraid that inability to understand bicycling laws could place them at risk of being subject to immigration enforcement. Most would still be unwilling to bicycle, but reducing the otherness of bicycling and promoting equitable bicycle planning can promote more bicycling among Latino immigrants.

Policy implications

One recurring theme throughout this dissertation is the role that characteristics aside from the built environment play in motivating bicycle travel. Perceptions of a bicycling-friendly environment and bicycling as a convenient mode of travel are more directly associated with a greater likelihood of bicycle use, while infrastructure and urban form features take a minor role. What is more, particularly for immigrants, social connections matter substantially. Cities can take advantage of these influences by investing in programmatic elements that promote bicycle travel. One way to do this is to invest in community-based organizations that build neighborhood connections and provide incentives for bicycling among youth and adults, such as the *Bicis del Pueblo* program run by PODER targeted to Latino immigrants in San Francisco or the Scraper bike shed at the Oakland Public Library targeted to young adults of color. Public events like bike-to-work days and *ciclovía* events build on human connections to make bicycling gain the perception of a social activity done by regular people, not just spandex-clad athletes. The key here is to ensure participation includes immigrants and other people of color, so that cycling does not continue to be an activity that is "othered."

A second approach to improving perceptions of cycling is to take a holistic look at the bicycle network. It is quite likely that the reasons that measures of bicycle infrastructure, for example, were not significantly associated with bicycling in this study is that they only considered where bike lanes are, not where they go. According to the analysis in Chapter 2, slightly more than one-third of survey respondents reported that better bicycle lanes and paths would encourage them to cycle more. Thus, planners will want to ensure that bicycle networks connect homes to important destinations, that they provide safety and comfort throughout, and that they are equitably distributed across neighborhoods of all socioeconomic statuses. Spatial methodologies such as the level of traffic stress tool (Mekuria, Furth, and Nixon 2012) and an index-based bicycle equity calculation (Prelog 2015) offer broad overviews of how bicycle networks affect various constituencies in a city. However, quantitative tools only supplement the need to gain diverse perspectives in the bicycle planning process, a criticism often aimed toward efforts that appear to deprioritize the needs of immigrants, people of color, and low-income earners.

Those perspectives build upon the idea of transportation equity, a second theme this dissertation addresses. As the analyses in Chapters 2 and 3 illustrate, there are small but significant differences in the way low-income immigrants and non-immigrants use transportation and report their experiences. One simple way to prevent differences from becoming inequities is by collecting data on transportation users' nativity status. Although regional travel surveys often collect nativity, public transit and planning agencies often do not. This information is necessary to ensuring the transportation systems meet their constituents' needs. Results from Chapter 4 point to the importance of continuing to invest in and expanding multilingual resources for basic transportation informa-

tion and navigation purposes. Those resources increase the likelihood that immigrants will take up cycling by reducing the fear they are breaking a law or traveling in the wrong direction. Finally, bicycling is an activity that cuts across income groups and countries of origin. Some low-income immigrants ride bicycles as part of their overall cost-cutting strategies. Continued investment in bicycling with public transit helps them reach places are otherwise inaccessible and can reduce fare payments by avoiding transfers or exiting trains at an earlier stop.

This research is based in a metropolitan area sometimes considered to be an outlier in progressive transportation policy. But the policy implications still hold for other urban areas not as accessible by alternative transport modes. Mexico is the top country of origin for immigrants in 33 states, and other Latin American countries form the majority in still five more (Pew Research Center 2015). Many of the struggles Latino immigrants face in the San Francisco Bay Area will be similar to those living in other regions: financial constraints, legal barriers, language difficulties, and accessibility needs better met by private vehicles. Even when provided with a fairly robust public transit and bicycle network, their status as "invisible riders" adds to their perceptions that their transportation needs are not being met. Addressing transportation challenges of the nation's immigrants must be a central component of any plan toward a more sustainable and bike-friendly future.

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A Table of Abbreviations

Abbreviation	Definition
ACS	American Community Survey
AC Transit	Alameda-Contra Costa Transit
BART	Bay Area Rapid Transit
CFA	Confirmatory Factor Analysis
CBO	Community-based organization
CFI	Comparative fit index
CHTS	California Household Travel Survey
FPL	Federal Poverty Level
GFTS	General Transit Feed Specification
HUD	Housing and Urban Development
JARC	Jobs Access and Reverse Commute
MFI	McDonald's noncentrality index
NHTS	National Household Travel Survey
PUMA	Public Use Microdata Area
PUMS	Public Use Microdata Sample
TPB	Theory of Planned Behavior
VTA	Valley Transportation Authority

B Survey Instruments

TRANSPORTATION SURVEY

Thank you for agreeing to take this voluntary survey. Your answers will help researchers at San José State University and the University of California, Berkeley understand how people travel. Your answers are important to us even if you don't use many different kinds of transportation. The survey will take about five minutes. There are no right or wrong answers to the questions, and you can skip any question. Your responses are anonymous.

SECTION A: YOUR RECENT TRAVEL

1. In the past 7 days, how many days were you away from the Bay Area? _____ days

Think about the travel you did during the past 7 days IN THE BAY AREA. Do not count walking or biking you did ONLY for exercise or fun, such as walking a dog or taking a long bike ride. ***Write "0" if you did not travel by that mode.***

2. In the past 7 days, how many days did you:

i. Drive? _____ days
ii. Carpool or get a ride? _____ days
iii. Walk all the way somewhere? _____ days
iv. Bike all the way somewhere? _____ days
v. Take public transportation? _____ days

If you took public transportation, go to 2a.
If not, skip to question 3.

2a. **For only the days you took public transportation** in the past 7 days, how many days did you:

i. Drive to or from the stop? _____ days
ii. Carpool or get a ride to or from the stop? _____ days
iii. Walk to or from the stop? _____ days
iv. Bike to or from the stop? _____ days

3. How many days did you have access to a working BICYCLE? _____ days
4. How many days did you have access to a working MOTOR VEHICLE like a car, truck, or motorcycle that you can use either as a driver or passenger? (Exclude taxis.) _____ days

SECTION B: EXPERIENCES WITH TRANSPORTATION

We'd like to learn about your experiences and feelings toward taking the bus or the train, and bicycling. By "train" we mean BART, VTA light rail, MUNI light rail, Caltrain, ACE, or Amtrak. Your answers are important to us even if you don't take the bus or train, or ride your bike.

5. How much MORE would you have taken THE BUS OR THE TRAIN in the past 7 days if the following were true?

	No change	1 day more	2-3 days more	4+ days more
a. Affordable bus or train fares or passes.	☐	☐	☐	☐
b. Little crime near the places you go.	☐	☐	☐	☐
c. Buses or trains always have space to carry your bike.	☐	☐	☐	☐
d. Enough bike parking at the bus or train stops you use.	☐	☐	☐	☐

6. How much MORE would you have BICYCLED in the past 7 days if the following were true?

	No change	1 day more	2-3 days more	4+ days more
a. Little crime near the places you go.	☐	☐	☐	☐
b. Good bike lanes or paths where you go.	☐	☐	☐	☐
c. Buses or trains always have space to carry your bike.	☐	☐	☐	☐
d. Enough bike parking at the bus or train stops you use.	☐	☐	☐	☐

7. How often do you…

	Never	At least once per month	At least once per week	More than once per week
a. Take the bus or train when you have the option to drive?	☐	☐	☐	☐
b. Miss a trip because you don't have a car available?	☐	☐	☐	☐
c. Miss a trip because a bus passes you by or never comes?	☐	☐	☐	☐
d. Bicycle instead of taking the bus or train to save money?	☐	☐	☐	☐
e. Bicycle instead of taking the bus or train to save time?	☐	☐	☐	☐
f. Bicycle when you have the option to drive.	☐	☐	☐	☐

PLEASE TURN OVER FOR NEXT PAGE

8. How much do you disagree or agree with the following statements?	Completely disagree	Somewhat disagree	Neither agree/disagree	Somewhat agree	Completely agree	Doesn't apply
a. I find it hard to take the bus or train when I travel with others.	☐	☐	☐	☐	☐	☐
b. I find it hard to take the bus or train when I need to stop at more than one place.	☐	☐	☐	☐	☐	☐
c. Bus or train information is available in my language.	☐	☐	☐	☐	☐	☐
d. I find it hard to bicycle when I need to travel with others.	☐	☐	☐	☐	☐	☐
e. I find it hard to bicycle when I need to stop at more than one place.	☐	☐	☐	☐	☐	☐
f. I would have a hard time getting to places I regularly go if I could not take my bike with me on the bus or train.	☐	☐	☐	☐	☐	☐
g. I can quickly find a spot to park my bike at the bus or train stop.	☐	☐	☐	☐	☐	☐

SECTION C: ABOUT YOU

Please answer the following questions. There are no right or wrong answers, and you can skip any question.

9. Were you born in the US?
☐ Yes ☐ No

9a. **If no**, what is your country of origin?
_____

9b. **If no**, how many years have you lived in the US?
_____ years

10. Are you of Hispanic, Latino, or Spanish origin?
☐ Yes ☐ No

11. What is your race? *Select all that apply.*
☐ White
☐ Black/African American
☐ Asian
☐ Native Hawaiian or Pacific Islander
☐ American Indian or Alaska Native
☐ Other: _____

12. What is the highest level of school you have completed?
☐ Less than high school
☐ High school, GED, or equivalent
☐ Some college or Associate's degree
☐ Bachelor's degree
☐ Graduate or professional school

13. Are you employed?
☐ Yes ☐ No

14. Are you in school?
☐ Yes ☐ No

15. What is your age? _____

16. What is your sex?
☐ Male ☐ Female

17. Is your home owned or rented?
☐ Owned ☐ Rented

18. Do you have a bus pass?
☐ Yes ☐ No

19. About how many people do you know who bike to work, to school, or for personal errands?
☐ None ☐ 1–10 ☐ 11–20 ☐ 21 or more

20. In what city and ZIP code is your home?
_____

21. What is your home address or the nearest cross streets to your home?
_____
(ex.: 222 Main St OR *2nd and Main)*

22. Do you live with one or more roommates?
☐ Yes ☐ No

23. INCLUDING YOURSELF, how many people live with you in your household?
Under age 16: _____ 16 years or older: _____

24. What was the approximate total combined income of all working adults in your household last year? *EXCLUDE income from roommates.*
☐ $0–$4,999
☐ $5,000–$14,999
☐ $15,000–$24,999
☐ $25,000–$49,999
☐ $50,000–$74,999
☐ $75,000–$99,999
☐ $100,000–$149,999
☐ $150,000–$199,999
☐ $200,000 or more

COMMENTS

Please write comments, especially to explain changes that would make it easier for you to get places you need to go. Thank you!

Survey location: _____

ENCUESTA DE TRANSPORTE

Gracias por acceder tomar esta encuesta voluntaria. Sus respuestas ayudarán a los investigadores de la Universidad Estatal de San José y de la Universidad de California, Berkeley a entender como la gente usa el transporte. Sus respuestas son importantes aunque no use todas las formas de transporte. La encuesta solo tomará aproximadamente 5 minutos. No hay respuestas correctas ni incorrectas. Puede omitir cualquier pregunta. Sus repuestas son anónimas.

SECCIÓN A: SUS RECIENTES VIAJES

1. En los últimos 7 días, ¿cuántos días estuvo usted fuera del Área de la Bahía? _____ días

Piense en los viajes que hizo en el ÁREA DE LA BAHÍA en los últimos 7 días. Omita el caminar o el uso de bici SÓLO por recreación, tal como caminar el perro o tomar paseos largos en bici. ***Escriba "0" si no usó ese modo.***

2. En los últimos 7 días, ¿cuántos días usted:

i. Manejó? _____ días
ii. Compartió el carro o alguien lo/la llevó? _____ días
iii. Caminó todo el camino a algún lugar? _____ días
iv. Usó su bici todo el camino a algún lugar? _____ días
v. Tomó el transporte público? _____ días

Si tomó el transporte público, vaya a la 2a.
Si no, pase a la pregunta 3.

2a. **Solo por los días que tomó el transporte publico** en los últimos 7 días, ¿cuántos días usted:

i. Manejó desde o hasta la parada? _____ días
ii. Compartió el carro o alguien lo/la llevó a la parada? _____ días
iii. Caminó desde o hasta la parada? _____ días
iv. Usó la bici desde o hasta la parada? _____ días

3. ¿Cuántos días tuvo acceso a una BICICLETA que funciona? _____ días
4. ¿Cuántos días tuvo acceso a un VEHICULO MOTORIZADO que funciona, tal como un carro, camioneta, o motocicleta que usted pudriera usar o bien como chofer o pasajero? (Excluya los taxis.) _____ días

SECCIÓN B: EXPERENCIAS CON EL TRANSPORTE

Nos gustaría aprender sobre sus experiencias al usar el autobús o tren, y el andar en bicicleta. Cuando usamos la palabra "tren" nos referimos a BART, la estación de tren ligero de VTA o MUNI, Caltrain, ACE, o Amtrak. Sus repuestas son importantes aunque usted no tome el autobús o tren, ni use su bici.

5. ¿Cuánto MÁS hubiera tomado el AUTOBÚS O TREN en los últimos 7 días si lo siguiente fuera cierto?	No cambio	1 día más	2-3 días más	4+ días más
a. Tarifas o pases de autobuses o trenes económicos.	☐	☐	☐	☐
b. Poco crimen cerca de los lugares al cual usted va.	☐	☐	☐	☐
c. Autobuses o trenes siempre tuvieran espacio para llevar su bici abordo.	☐	☐	☐	☐
d. Suficiente parking para bicis en las paradas de autobús o tren.	☐	☐	☐	☐

6. ¿Cuánto MÁS hubiera usado su BICICLETA en los últimos 7 días si lo siguiente fuera cierto?	No cambio	1 día más	2-3 días más	4+ días más
a. Poco crimen cerca de los lugares al cual usted va.	☐	☐	☐	☐
b. Buenos carriles o caminos para bicis por donde usted va.	☐	☐	☐	☐
c. Autobuses o trenes siempre tuvieran espacio para llevar su bici abordo.	☐	☐	☐	☐
d. Suficiente parking para bicis en las paradas de autobús o tren.	☐	☐	☐	☐

7. ¿Con qué frecuencia…	Nunca	Al menos 1 vez/mes	Al menos 1 vez/semana	Más de 1 vez/semana
a. Toma el autobús o tren cuando tiene la opción de manejar?	☐	☐	☐	☐
b. Pierde un viaje por no tener un vehículo disponible?	☐	☐	☐	☐
c. Pierde un viaje por causa de que lo pasó el autobús sin parar o que nunca pasó el autobús?	☐	☐	☐	☐
d. Usa su bici en vez de tomar el autobús o tren con el propósito de ahorrar dinero?	☐	☐	☐	☐
e. Usa su bici en vez de tomar el autobús o tren con el propósito de ahorrar tiempo?	☐	☐	☐	☐
f. Usa su bici cuando tiene la opción de manejar?	☐	☐	☐	☐

POR FAVOR DAR LA VUELTA A LA PÁGINA SIGUIENTE

8. ¿Cuánto está en desacuerdo o en acuerdo con lo siguiente?	Muy en desacuerdo	Algo en desacuerdo	Ni de acuerdo/ en desacuerdo	Algo en acuerdo	Muy en acuerdo	No aplica
a. Me resulta difícil tomar el autobús o tren cuando viajo con otros.	☐	☐	☐	☐	☐	☐
b. Me resulta difícil tomar el autobús o tren cuando necesito tomar un viaje con varias paradas.	☐	☐	☐	☐	☐	☐
c. Información sobre el autobús o tren está disponible en mi idioma.	☐	☐	☐	☐	☐	☐
d. Me resulta difícil usar mi bici cuando viajo con otros.	☐	☐	☐	☐	☐	☐
e. Me resulta difícil usar mi bici cuando necesito tomar un viaje con varias paradas.	☐	☐	☐	☐	☐	☐
f. Me resultaría difícil ir a los lugares que frecuento si no pudiera llevar mi bici abordo del autobús o tren.	☐	☐	☐	☐	☐	☐
g. Puedo encontrar rápidamente un espacio para estacionar mi bici en la parada de autobús o tren.	☐	☐	☐	☐	☐	☐

SECTION C: SOBRE USTED

Por favor responda a lo siguiente. No hay respuestas correctas ni incorrectas. Puede omitir cualquier pregunta.

9. ¿Nació usted en los EE.UU.?
☐ Sí ☐ No

9a. **Si no**, ¿cuál es su país de origen?
_____

9b. **Si no**, ¿cuántos años ha vivido en los EE.UU.?
_____ años

10. ¿Es usted de origen hispano, latino, o español?
☐ Sí ☐ No

11. ¿Cuál es su raza? *Marque todas las que apliquen.*
☐ Blanca
☐ Negra/africana americana
☐ Asiática
☐ Nativa de Hawaii or de las islas del Pacífico
☐ India americana o nativa de Alaska
☐ Otra: _____

12. ¿Cuál es el nivel escolar más alto que ha completado?
☐ Menos que la escuela secundaria
☐ Graduado de escuela secundaria o diploma equivalente
☐ Algunos créditos de universidad o título asociado
☐ Título de licenciatura
☐ Escuela graduada o profesional

13. ¿Tiene empleo?
☐ Sí ☐ No

14. ¿Asiste a la escuela?
☐ Sí ☐ No

15. ¿Cuál es su edad? _____

16. ¿Cuál es su sexo?
☐ Masculino ☐ Femenino

17. ¿Es usted dueño/a de la casa, o la alquila?
☐ Dueño/a ☐ La alquila

18. ¿Tiene usted un pase de autobús?
☐ Sí ☐ No

19. ¿Alrededor de cuánta gente conoce que usa su bici para ir al trabajo, la escuela, o para diligencias personales?
☐ Ninguna ☐ 1–10 ☐ 11–20 ☐ 21 o más

20. ¿En qué ciudad y código postal está su casa?
_____

21. ¿Cuál es su dirección o las calles más cercanas a su casa?
_____
(ex.: 222 Main St O 2nd y Main)

22. ¿Vive con uno o más compañeros de cuarto?
☐ Sí ☐ No

23. INCLUYÉNDOSE A USTED, ¿cuánta gente vive con usted en su hogar?
Menores de 16: _____ 16 años o mayores: _____

24. ¿Aproximadamente cuál fue el ingreso anual total combinado de todos los adultos que trabajan y viven en su hogar en el año pasado? *EXCLUYA ingresos de sus compañeros de cuarto.*
☐ $0–$4,999
☐ $5,000–$14,999
☐ $15,000–$24,999
☐ $25,000–$49,999
☐ $50,000–$74,999
☐ $75,000–$99,999
☐ $100,000–$149,999
☐ $150,000–$199,999
☐ $200,000 o más

COMENTARIOS

Por favor escriba sus comentarios, especialmente para explicar los cambios que le resultaría más fácil viajar y llegar a donde necesita ir. ¡Gracias!

Survey location: _____

C Survey Sites and Responses Received

Survey Site	City	Site type	Responses
King and Story	San Jose	Bus stop	207
Mission and 16th St	San Francisco	BART	179
Fruitvale BART	Oakland	BART	174
Mission and 24th St	San Francisco	BART	133
Grocery Outlet	San Jose	Business/Public plaza	125
Foothill Blvd and Fruitvale Ave	Oakland	Bus stop	95
International Blvd and 34th Ave	Oakland	Bus stop	90
Mission and 19th St	San Francisco	Bus stop	87
Broadway and 13th St	Oakland	Bus stop	68
First St and Santa Clara	San Jose	Bus stop	61
San Pablo Ave and University Ave	Berkeley	Bus stop	57
Bay Fair BART	San Leandro	BART	56
South Hayward BART	Hayward	BART	53
Foothill Blvd and High St	Oakland	Bus stop	52
Eastridge Transit Center	San Jose	Bus stop	47
Fremont BART	Fremont	BART	44
Hayward BART	Hayward	BART	40
Bike Clinic, 2nd St	San Jose	Business/Public plaza	39
Cesar Chavez btw Valencia and Folsom	San Francisco	Day labor	39
12th St and Fruitvale Plaza	Oakland	Business/Public plaza	36
Berkeley Flea Market	Berkeley	Business/Public plaza	36
First St and Alma	San Jose	Bus stop	35
Alum Rock Transit Center	San Jose	Bus stop	35
International Blvd and 23rd Ave	Oakland	Bus stop	35
Fourth St and Hearst Ave	Berkeley	Day labor	33
South Hayward BART/Tennyson Ave	Hayward	Day labor	32
Home Depot/McDonald's	Oakland	Day labor	27
Laney College Flea Market	Oakland	Business/Public plaza	25
Fruitvale Village	Oakland	Business/Public plaza	24

Survey Site	City	Site type	Responses
Berryessa Flea Market	San Jose	Business/Public plaza	16
King and Alum Rock	San Jose	Bus stop	12
Capitol Expressway and Story Rd	San Jose	Bus stop	11
Valley Medical Center	San Jose	Business/Public plaza	11
23rd St and Clinton Ave	Richmond	Bus stop	8
Shorty Garcia Park	Union City	Business/Public plaza	8
Capitol Expy and Copperfield Rd	San Jose	Bus stop	7
Eastmont Transit Center	Oakland	Bus stop	7
Home Depot	El Cerrito	Day labor	7
N 6th St and Julian St	San Jose	Business/Public plaza	6
Alum Rock Ave and White Rd	San Jose	Bus stop	3
Mission and Cesar Chavez	San Francisco	Bus stop	3
White and Story	San Jose	Bus stop	2
Hesperian and A St	Hayward	Bus stop	1
International Blvd and 98th Ave	Oakland	Bus stop	1
Unknown mailback			11
Total			2078

D Tables of Responses to Selected Survey Questions

This appendix lists detailed responses to each question from Section B of the survey ("Experiences with Transportation"). Each table contains the number proportion of responses for each income and nativity category, for respondents who did not provide both income and nativity, and the total response proportions.

Q5: How much more would you have taken the bus or the train in the past seven days if the following were true?

A. Affordable bus or train fares or passes

	No change		1 day more		2-3 days more		4+ days more		Total
	n	%	n	%	n	%	n	%	n
Low-income immigrant	152	39	55	14	64	16	110	28	389
Higher-income immigrant	98	41	37	15	33	14	67	28	240
Low-income US-born	143	41	44	12	56	16	107	30	352
Higher-income US-born	242	54	46	10	61	14	101	22	450
Immigrant (missing income)	138	45	35	11	53	17	74	24	307
US-born (missing income)	117	50	21	9	33	14	59	25	236
Not identified	38	34	9	8	23	20	29	26	113
Total	928	44	247	12	323	15	547	26	2087

B. Little crime near the places you go

	No change		1 day more		2-3 days more		4+ days more		Total
	n	%	n	%	n	%	n	%	n
Low-income immigrant	206	53	45	12	54	14	60	15	389
Higher-income immigrant	110	46	28	12	40	17	48	20	240
Low-income US-born	198	56	35	10	55	16	57	16	352
Higher-income US-born	282	63	45	10	46	10	73	16	450
Immigrant (missing income)	189	62	44	14	28	9	34	11	307
US-born (missing income)	152	64	21	9	21	9	32	14	236
Not identified	52	46	14	12	11	10	16	14	113
Total	1189	57	232	11	255	12	320	15	2087

C. Buses or trains always have space to carry your bike

	No change		1 day more		2-3 days more		4+ days more		Total
	n	%	n	%	n	%	n	%	n
Low-income immigrant	250	64	24	6	23	6	42	11	389
Higher-income immigrant	147	61	13	5	26	11	29	12	240
Low-income US-born	224	64	24	7	35	10	49	14	352
Higher-income US-born	304	68	32	7	41	9	55	12	450
Immigrant (missing income)	192	63	26	8	20	7	22	7	307
US-born (missing income)	151	64	15	6	16	7	22	9	236
Not identified	58	51	5	4	13	12	17	15	113
Total	1326	64	139	7	174	8	236	11	2087

D. Enough bike parking at the bus or train stops you use

	No change		1 day more		2-3 days more		4+ days more		Total
	n	%	n	%	n	%	n	%	n
Low-income immigrant	267	69	19	5	20	5	32	8	389
Higher-income immigrant	160	67	10	4	17	7	28	12	240
Low-income US-born	239	68	24	7	27	8	42	12	352
Higher-income US-born	318	71	26	6	33	7	49	11	450
Immigrant (missing income)	193	63	22	7	16	5	24	8	307
US-born (missing income)	158	67	15	6	12	5	17	7	236
Not identified	62	55	5	4	8	7	12	11	113
Total	1397	67	121	6	133	6	204	10	2087

Q6: How much more would you have bicycled in the past seven days if the following were true?

A. Little crime near the places you go

	No change		1 day more		2-3 days more		4+ days more		Total
	n	%	n	%	n	%	n	%	n
Low-income immigrant	245	63	27	7	22	6	47	12	389
Higher-income immigrant	134	56	21	9	26	11	29	12	240
Low-income US-born	225	64	28	8	25	7	47	13	352
Higher-income US-born	297	66	30	7	41	9	51	11	450
Immigrant (missing income)	190	62	19	6	12	4	30	10	307
US-born (missing income)	164	69	11	5	8	3	13	6	236
Not identified	56	50	8	7	9	8	15	13	113
Total	1311	63	144	7	143	7	232	11	2087

B. Good bike lanes or paths where you go

	No change		1 day more		2-3 days more		4+ days more		Total
	n	%	n	%	n	%	n	%	n
Low-income immigrant	234	60	14	4	38	10	51	13	389
Higher-income immigrant	116	48	18	8	31	13	43	18	240
Low-income US-born	202	57	27	8	44	12	53	15	352
Higher-income US-born	263	58	33	7	50	11	74	16	450
Immigrant (missing income)	167	54	20	7	20	7	42	14	307
US-born (missing income)	139	59	16	7	22	9	20	8	236
Not identified	53	47	5	4	11	10	14	12	113
Total	1174	56	133	6	216	10	297	14	2087

C. Buses or trains always have space to carry your bike

	No change		1 day more		2-3 days more		4+ days more		Total
	n	%	n	%	n	%	n	%	n
Low-income immigrant	232	60	27	7	30	8	49	13	389
Higher-income immigrant	122	51	14	6	34	14	36	15	240
Low-income US-born	208	59	34	10	29	8	52	15	352
Higher-income US-born	259	58	37	8	59	13	65	14	450
Immigrant (missing income)	174	57	22	7	24	8	27	9	307
US-born (missing income)	141	60	17	7	20	8	19	8	236
Not identified	51	45	5	4	15	13	11	10	113
Total	1187	57	156	7	211	10	259	12	2087

D. Enough bike parking at the bus or train stops you use

	No change		1 day more		2-3 days more		4+ days more		Total
	n	%	n	%	n	%	n	%	n
Low-income immigrant	246	63	24	6	27	7	38	10	389
Higher-income immigrant	121	50	19	8	28	12	38	16	240
Low-income US-born	229	65	24	7	24	7	43	12	352
Higher-income US-born	281	62	38	8	43	10	56	12	450
Immigrant (missing income)	174	57	25	8	18	6	28	9	307
US-born (missing income)	146	62	15	6	15	6	20	8	236
Not identified	58	51	6	5	13	12	8	7	113
Total	1255	60	151	7	168	8	231	11	2087

Q7. How often do you…

A. Take the bus when you have the option to drive?

	Never		At least once per month		At least once per week		More than once per week		Total
	n	%	n	%	n	%	n	%	n
Low-income immigrant	218	56	47	12	24	6	88	23	389
Higher-income immigrant	88	37	32	13	24	10	90	38	240
Low-income US-born	160	45	34	10	26	7	122	35	352
Higher-income US-born	131	29	40	9	57	13	214	48	450
Immigrant (missing income)	195	64	30	10	15	5	55	18	307
US-born (missing income)	121	51	19	8	19	8	66	28	236
Not identified	48	42	6	5	7	6	24	21	113
Total	961	46	208	10	172	8	659	32	2087

B. Miss a trip because you don't have a car available

	Never		At least once per month		At least once per week		More than once per week		Total
	n	%	n	%	n	%	n	%	n
Low-income immigrant	175	45	100	26	47	12	49	13	389
Higher-income immigrant	128	53	45	19	36	15	21	9	240
Low-income US-born	159	45	107	30	37	11	42	12	352
Higher-income US-born	259	58	100	22	52	12	33	7	450
Immigrant (missing income)	156	51	69	22	35	11	39	13	307
US-born (missing income)	124	53	54	23	20	8	29	12	236
Not identified	40	35	16	14	7	6	13	12	113
Total	1041	50	491	24	234	11	226	11	2087

C. Miss a trip because a bus passes you by or never comes?

	Never		At least once per month		At least once per week		More than once per week		Total
	n	%	n	%	n	%	n	%	n
Low-income immigrant	152	39	107	28	61	16	55	14	389
Higher-income immigrant	102	42	65	27	42	18	21	9	240
Low-income US-born	128	36	118	34	60	17	41	12	352
Higher-income US-born	205	46	139	31	61	14	35	8	450
Immigrant (missing income)	131	43	93	30	37	12	37	12	307
US-born (missing income)	108	46	58	25	29	12	26	11	236
Not identified	33	29	20	18	11	10	11	10	113
Total	859	41	600	29	301	14	226	11	2087

D. Bicycle instead of taking the bus to save money?

	Never		At least once per month		At least once per week		More than once per week		Total
	n	%	n	%	n	%	n	%	n
Low-income immigrant	283	73	21	5	21	5	33	8	389
Higher-income immigrant	156	65	16	7	21	9	21	9	240
Low-income US-born	229	65	27	8	34	10	40	11	352
Higher-income US-born	286	64	38	8	36	8	65	14	450
Immigrant (missing income)	201	65	18	6	10	3	32	10	307
US-born (missing income)	160	68	12	5	9	4	18	8	236
Not identified	58	51	3	3	4	4	12	11	113
Total	1373	66	135	6	135	6	221	11	2087

E. Bicycle instead of taking the bus to save time?

	Never		At least once per month		At least once per week		More than once per week		Total
	n	%	n	%	n	%	n	%	n
Low-income immigrant	278	71	24	6	17	4	36	9	389
Higher-income immigrant	157	65	17	7	16	7	24	10	240
Low-income US-born	236	67	20	6	31	9	41	12	352
Higher-income US-born	291	65	38	8	39	9	60	13	450
Immigrant (missing income)	193	63	22	7	11	4	32	10	307
US-born (missing income)	155	66	11	5	13	6	19	8	236
Not identified	55	49	4	4	4	4	14	12	113
Total	1365	65	136	7	131	6	226	11	2087

F. Bicycle when you have the option to drive?

	Never		At least once per month		At least once per week		More than once per week		Total
	n	%	n	%	n	%	n	%	n
Low-income immigrant	305	78	17	4	15	4	16	4	389
Higher-income immigrant	161	67	16	7	17	7	18	8	240
Low-income US-born	253	72	17	5	18	5	42	12	352
Higher-income US-born	280	62	36	8	38	8	71	16	450
Immigrant (missing income)	222	72	10	3	7	2	17	6	307
US-born (missing income)	167	71	4	2	10	4	16	7	236
Not identified	57	50	5	4	0	0	15	13	113
Total	1445	69	105	5	105	5	195	9	2087

Q8. How much do you disagree or agree with the following statements?

A. I find it hard to take the bus or train when I travel with others.

	Neither agree/disagree		Completely disagree		Somewhat disagree		Somewhat agree		Completely agree		Doesn't apply		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n
Low-income immigrant	13	3	156	40	60	15	56	14	63	16	29	7	389
Higher-income immigrant	18	8	93	39	39	16	32	13	39	16	11	5	240
Low-income US-born	50	14	144	41	59	17	47	13	30	9	15	4	352
Higher-income US-born	59	13	171	38	85	19	70	16	45	10	16	4	450
Immigrant (missing income)	16	5	127	41	30	10	47	15	38	12	13	4	307
US-born (missing income)	22	9	84	36	38	16	38	16	27	11	8	3	236
Not identified	2	2	10	9	5	4	11	10	4	4	4	4	113
Total	180	9	785	38	316	15	301	14	246	12	96	5	2087

B. I find it hard to take the bus or train when I need to stop at more than one place.

	Neither agree/disagree		Completely disagree		Somewhat disagree		Somewhat agree		Completely agree		Doesn't apply		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n
Low-income immigrant	24	6	113	29	66	17	67	17	91	23	17	4	389
Higher-income immigrant	23	10	59	25	24	10	52	22	68	28	3	1	240
Low-income US-born	33	9	102	29	63	18	76	22	63	18	11	3	352
Higher-income US-born	35	8	105	23	64	14	126	28	102	23	15	3	450
Immigrant (missing income)	11	4	82	27	31	10	55	18	81	26	11	4	307
US-born (missing income)	18	8	56	24	29	12	45	19	64	27	4	2	236
Not identified	1	1	9	8	7	6	6	5	9	8	2	2	113
Total	145	7	526	25	284	14	427	20	478	23	63	3	2087

C. Bus or train information is available in my language.

	Neither agree/disagree		Completely disagree		Somewhat disagree		Somewhat agree		Completely agree		Doesn't apply		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n
Low-income immigrant	36	9	63	16	29	7	80	21	145	37	25	6	389
Higher-income immigrant	16	7	48	20	15	6	28	12	104	43	18	8	240
Low-income US-born	28	8	46	13	9	3	34	10	199	57	27	8	352
Higher-income US-born	32	7	50	11	10	2	20	4	272	60	58	13	450
Immigrant (missing income)	15	5	67	22	17	6	45	15	113	37	12	4	307
US-born (missing income)	17	7	15	6	7	3	12	5	123	52	29	12	236
Not identified	5	4	7	6	1	1	4	4	13	12	2	2	113
Total	149	7	296	14	88	4	223	11	969	46	171	8	2087

D. I find it hard to bicycle when I need to travel with others.

	Neither agree/disagree		Completely disagree		Somewhat disagree		Somewhat agree		Completely agree		Doesn't apply		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n
Low-income immigrant	23	6	36	9	17	4	28	7	28	7	207	53	389
Higher-income immigrant	18	8	34	14	8	3	23	10	40	17	90	38	240
Low-income US-born	43	12	62	18	28	8	42	12	24	7	127	36	352
Higher-income US-born	57	13	57	13	21	5	73	16	59	13	153	34	450
Immigrant (missing income)	17	6	40	13	6	2	20	7	27	9	122	40	307
US-born (missing income)	20	8	35	15	7	3	17	7	19	8	80	34	236
Not identified	2	2	3	3	1	1	4	4	1	1	15	13	113
Total	180	9	267	13	88	4	207	10	198	9	794	38	2087

E. I find it hard to bicycle when I need to stop at more than one place.

	Neither agree/disagree		Completely disagree		Somewhat disagree		Somewhat agree		Completely agree		Doesn't apply		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n
Low-income immigrant	17	4	38	10	26	7	21	5	32	8	207	53	389
Higher-income immigrant	16	7	49	20	12	5	21	9	23	10	91	38	240
Low-income US-born	45	13	77	22	28	8	32	9	17	5	131	37	352
Higher-income US-born	44	10	91	20	51	11	55	12	38	8	144	32	450
Immigrant (missing income)	8	3	41	13	13	4	18	6	22	7	128	42	307
US-born (missing income)	22	9	39	17	7	3	15	6	19	8	79	33	236
Not identified	4	4	4	4	2	2	2	2	1	1	15	13	113
Total	156	7	339	16	139	7	164	8	152	7	795	38	2087

F. I would have a hard time getting to places I regularly go if I could not take my bike with me on the bus or train.

	Neither agree/disagree		Completely disagree		Somewhat disagree		Somewhat agree		Completely agree		Doesn't apply		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n
Low-income immigrant	16	4	34	9	17	4	23	6	40	10	218	56	389
Higher-income immigrant	19	8	34	14	13	5	18	8	32	13	94	39	240
Low-income US-born	43	12	46	13	18	5	36	10	45	13	143	41	352
Higher-income US-born	59	13	59	13	33	7	50	11	76	17	151	34	450
Immigrant (missing income)	14	5	34	11	10	3	16	5	29	9	127	41	307
US-born (missing income)	20	8	25	11	4	2	17	7	28	12	85	36	236
Not identified	2	2	3	3	3	3	4	4	2	2	14	12	113
Total	173	8	235	11	98	5	164	8	252	12	832	40	2087

G. I can quickly find a spot to park my bike at the bus or train stop.

	Neither agree/disagree		Completely disagree		Somewhat disagree		Somewhat agree		Completely agree		Doesn't apply		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n
Low-income immigrant	25	6	41	11	16	4	19	5	28	7	220	57	389
Higher-income immigrant	23	10	31	13	7	3	24	10	30	12	95	40	240
Low-income US-born	57	16	42	12	29	8	34	10	24	7	146	41	352
Higher-income US-born	61	14	51	11	40	9	45	10	60	13	170	38	450
Immigrant (missing income)	15	5	34	11	12	4	11	4	27	9	130	42	307
US-born (missing income)	26	11	28	12	6	3	14	6	18	8	85	36	236
Not identified	2	2	5	4	1	1	2	2	4	4	15	13	113
Total	209	10	232	11	111	5	149	7	191	9	861	41	2087

E Structural Equations Model Results

Table E.1: Model 1: Initially hypothesized model

Endogenous variable	Variable	Estimate	SE	Std. est.	$P(>\|z\|)$
Cycled in last week	Female	-0.683	0.135	-0.270	0.000
	Age	-0.013	0.005	-0.154	0.008
	Immigrant	-0.157	0.148	-0.062	0.290
	Income				
	Income (middle)	0.108	0.132	0.042	0.413
	Income (high)	0.333	0.210	0.078	0.112
	Income (missing)	-0.103	0.162	-0.033	0.527
	Race/ethnicity				
	Latino	-0.271	0.181	-0.109	0.133
	Black	-0.772	0.251	-0.189	0.002
	Asian	-0.303	0.252	-0.073	0.230
	Other	-0.674	0.234	-0.163	0.004
	Days walked	-0.033	0.022	-0.073	0.143
	Days took transit	-0.037	0.023	-0.066	0.108
	Has car	0.134	0.130	0.052	0.303
	Has bus pass	-0.401	0.125	-0.161	0.001
	People who bike	0.382	0.054	0.313	0.000
	Rail within 400 m	-0.378	0.221	-0.091	0.088
	Transit stop density (400 m)	-0.026	0.015	-0.099	0.090
	Intersection density (1600 m)	0.297	0.256	0.071	0.245
	Bikeway density (400 m)	-0.181	0.270	-0.048	0.502
	Highway % (800 m)	-0.461	0.693	-0.038	0.506
	Retail % (1600 m)	0.628	1.444	0.027	0.664
	Multifamily % (1600 m)	0.609	0.410	0.083	0.138
	Bicycling complexity	0.403	0.094	0.222	0.000
	Bicycling environment	0.458	0.063	0.303	0.000
	Bicycling convenience	0.744	0.042	0.552	0.000
	Transit insecurity	-0.035	0.076	-0.025	0.644
	Transit complexity	-0.260	0.118	-0.138	0.028
People who bike	Immigrant enclave	-0.058	0.094	-0.028	0.537
	Has roommates	0.207	0.089	0.099	0.019
	Employed	0.333	0.095	0.158	0.000
Days took transit	Transit insecurity	0.052	0.100	0.021	0.605
	Transit complexity	-0.026	0.134	-0.008	0.846
	Has car	-1.051	0.170	-0.227	0.000
	Has bus pass	1.196	0.167	0.268	0.000
Transit insecurity	Has bus pass	-0.054	0.086	-0.030	0.536
	Transit stop density (400 m)	0.030	0.011	0.164	0.007
	Rail within 400 m	-0.233	0.147	-0.079	0.114
Bicycling environment	Rail within 400 m	-0.096	0.126	-0.035	0.445
	Retail % (1600 m)	-0.267	0.780	-0.017	0.732
	Intersection density (1600 m)	0.103	0.165	0.037	0.532
	Bikeway density (400 m)	-0.217	0.124	-0.087	0.080
	Multifamily % (1600 m)	-0.255	0.254	-0.053	0.316
	Highway % (800 m)	-0.732	0.410	-0.091	0.074
	Transit stop density (400 m)	0.011	0.009	0.066	0.191

Table E.2: Model 1: CFA

Latent variable	Variable	Estimate	SE	Std. Est.	$P(>\|z\|)$
Bicycling complexity	Cycling hard with others	1		0.685	
	Cycling hard with multiple stops	0.716	0.053	0.49	0
	Need cycling with transit	0.963	0.068	0.66	0
Bicycling environment	Cycle if little crime	1		0.819	
	Cycle if good bike lanes	1.087	0.028	0.89	0
	Cycle if space for bikes on transit	1.186	0.029	0.969	0
	Cycle if bike parking at transit	1.149	0.028	0.939	0
	Take transit if space for bikes	1.14	0.028	0.932	0
	Take transit if bike parking	1.157	0.029	0.946	0
Bicycling convenience	Cycle instead of transit to save money	1		0.925	
	Cycle instead of transit to save time	1.025	0.031	0.948	0
	Cycle instead of drive	0.905	0.028	0.837	0
Transit insecurity	Take transit if fares affordable	1		0.875	
	Take transit if little crime	0.837	0.337	0.734	0.013
Transit complexity	Transit hard to take with others	1		0.661	
	Transit hard to take with multiple stops	1.331	0.154	0.88	0

Table E.3: Model 2: SEM with cycling as endogenous

Endogenous variable	Variable	Estimate	SE	Std. Est.	$P(>\|z\|)$
Cycled in last week	Female	-0.123	0.160	-0.074	0.441
	Age	-0.020	0.006	-0.379	0.001
	Immigrant	-0.115	0.200	-0.070	0.566
	Income				
	Income (middle)	0.082	0.172	0.049	0.633
	Income (high)	-0.117	0.285	-0.042	0.681
	Income (missing)	-0.045	0.198	-0.022	0.820
	Race/ethnicity				
	Latino	-0.294	0.243	-0.180	0.225
	Black	-0.373	0.302	-0.140	0.217
	Asian	0.042	0.330	0.015	0.899
	Other	-0.273	0.298	-0.100	0.360
	Days walked	0.004	0.028	0.015	0.876
	Days took transit	-0.004	0.030	-0.012	0.888
	Has car	0.248	0.168	0.146	0.141
	Has bus pass	-0.391	0.153	-0.239	0.010
	People who bike	0.055	0.073	0.071	0.452
	Rail within 400 m	-0.435	0.229	-0.160	0.058
	Transit stop density (400 m)	0.014	0.016	0.084	0.363
	Intersection density (1600 m)	0.988	0.306	0.361	0.001
	Bikeway density (400 m)	-0.088	0.227	-0.036	0.699
	Highway % (800 m)	-1.450	0.794	-0.183	0.068
	Retail % (1600 m)	-0.944	1.446	-0.061	0.514
	Multifamily % (1600 m)	-0.462	0.468	-0.096	0.323
	Bicycling complexity	-0.183	0.131	-0.131	0.162
	Bicycling environment	1.535	0.188	1.558	0.000
	Bicycling convenience	-0.316	0.143	-0.355	0.027
	Transit insecurity	-1.553	0.201	-1.333	0.000
	Transit complexity	0.374	0.129	0.280	0.004
People who bike	Immigrant enclave	-0.038	0.093	-0.018	0.682
	Has roommates	0.204	0.088	0.095	0.020
	Employed	0.306	0.094	0.141	0.001
	Cycled in last week	0.527	0.071	0.410	0.000
Days took transit	Transit insecurity	0.020	0.143	0.006	0.891
	Transit complexity	-0.124	0.141	-0.034	0.379
	Has car	-1.051	0.170	-0.227	0.000
	Has bus pass	1.190	0.167	0.267	0.000
Transit insecurity	Has bus pass	0.217	0.109	0.154	0.047
	Transit stop density (400 m)	0.026	0.012	0.179	0.024
	Rail within 400 m	-0.013	0.158	-0.005	0.936
	Cycled in last week	0.818	0.167	0.953	0.000
Bicycling environment	Rail within 400 m	-0.113	0.133	-0.041	0.396
	Retail % (1600 m)	-0.309	0.826	-0.020	0.708
	Intersection density (1600 m)	0.138	0.186	0.050	0.458

(Continued)

Endogenous variable	Variable	Estimate	SE	Std. Est.	$P(>\|z\|)$
	Bikeway density (400 m)	-0.230	0.129	-0.092	0.075
	Multifamily % (1600 m)	-0.282	0.266	-0.058	0.289
	Highway % (800 m)	-0.812	0.451	-0.101	0.071
	Transit stop density (400 m)	0.011	0.009	0.064	0.219
	Cycled in last week	-0.076	0.137	-0.075	0.578
Bicycling convenience	Cycled in last week	1.015	0.087	0.905	0.000
Bicycling complexity	Cycled in last week	0.317	0.052	0.443	0.000
Transit complexity	Cycled in last week	0.087	0.052	0.116	0.096

Table E.4: Model 2: CFA

Latent variable	Variable	Estimate	SE	Std. Est.	$P(>\|z\|)$
Bicycling complexity	Cycling hard with others	1		0.581	
	Cycling hard with multiple stops	0.633	0.06	0.37	0
	Need cycling with transit	1.41	0.161	0.813	0
Bicycling environment	Cycle if little crime	1		0.824	
	Cycle if good bike lanes	1.077	0.027	0.886	0
	Cycle if space for bikes on transit	1.173	0.028	0.964	0
	Cycle if bike parking at transit	1.143	0.027	0.939	0
	Take transit if space for bikes	1.141	0.027	0.938	0
	Take transit if bike parking	1.151	0.028	0.945	0
Bicycling convenience	Cycle instead of transit to save money	1		0.853	
	Cycle instead of transit to save time	1.04	0.034	0.883	0
	Cycle instead of drive	0.957	0.031	0.821	0
Transit insecurity	Take transit if fares affordable	1		0.67	
	Take transit if little crime	1.308	0.108	0.851	0
Transit complexity	Transit hard to take with others	1		0.612	
	Transit hard to take with multiple stops	1.553	0.54	0.949	0.004

Table E.5: Model 3: Group SEM

		US-born				Immigrant			
Endogenous variable	Variable	Estimate	SE	Std. Est.	$P(>\|z\|)$	Estimate	SE	Std. Est.	$P(>\|z\|)$
Cycled in last week	Female	-0.163	0.246	-0.091	0.509	-0.172	0.285	-0.104	0.548
	Age	-0.037	0.012	-0.626	0.002	-0.011	0.009	-0.216	0.21
	Income								
	Income (middle)	-0.363	0.288	-0.203	0.208	0.504	0.313	0.293	0.107
	Income (high)	-0.424	0.402	-0.159	0.291	-0.123	0.578	-0.032	0.831
	Income (missing)	0.154	0.345	0.061	0.655	-0.135	0.311	-0.076	0.663
	Race/ethnicity								
	Latino	-0.254	0.341	-0.135	0.457	0.619	1.039	0.347	0.551
	Black	-0.651	0.405	-0.277	0.108	1.558	2.184	0.191	0.476
	Asian	0.293	0.561	0.07	0.602	0.73	1.054	0.35	0.488
	Other	-0.589	0.425	-0.225	0.166	0.921	1.103	0.27	0.404
	Days walked	0.098	0.05	0.291	0.052	-0.092	0.049	-0.338	0.061
	Days took transit	0.04	0.053	0.09	0.442	-0.032	0.047	-0.1	0.488
	Has car	0.217	0.268	0.119	0.418	0.34	0.314	0.201	0.279
	Has bus pass	-0.678	0.273	-0.371	0.013	-0.037	0.27	-0.023	0.891
	People who bike	0.035	0.1	0.04	0.729	0.041	0.129	0.055	0.751
	Rail within 400 m	-0.546	0.36	-0.195	0.129	-0.571	0.427	-0.198	0.181
	Transit stop density (400 m)	0.013	0.025	0.072	0.616	0.02	0.025	0.112	0.432
	Intersection density (1600 m)	1.613	0.545	0.551	0.003	0.542	0.497	0.199	0.276
	Bikeway density (400 m)	-0.153	0.425	-0.046	0.718	-0.018	0.311	-0.009	0.955
	Share highway (800 m)	-2.105	1.286	-0.24	0.102	-0.976	1.219	-0.13	0.423
	Retail (1600 m)	-3.732	2.46	-0.22	0.129	-0.401	2.396	-0.027	0.867
	Multifamily (1600 m)	-1.053	0.789	-0.203	0.182	-0.225	0.733	-0.048	0.759
	Bicycling complexity	-0.776	0.294	-0.447	0.008	0.461	0.182	0.366	0.011
	Bicycling environment	1.767	0.382	1.644	0	1.4	0.28	1.511	0
	Bicycling convenience	-0.356	0.247	-0.379	0.149	-0.276	0.227	-0.322	0.224
	Transit insecurity	-1.794	0.394	-1.467	0	-1.827	0.35	-1.549	0
	Transit complexity	0.658	0.192	0.567	0.001	-0.056	0.135	-0.055	0.678
People who bike	Immigrant enclave	-0.121	0.131	-0.057	0.356	0.135	0.154	0.064	0.378
	Has roommates	0.108	0.126	0.051	0.388	0.308	0.142	0.142	0.03
	Employed	0.185	0.143	0.085	0.194	0.426	0.141	0.198	0.003
	Cycled in last week	0.409	0.085	0.353	0	0.667	0.108	0.494	0

(Continued)

		US-born				Immigrant			
Endogenous variable	Variable	Estimate	SE	Std. Est.	$P(>\|z\|)$	Estimate	SE	Std. Est.	$P(>\|z\|)$
Days took transit	Transit insecurity	0.114	0.16	0.042	0.477	-0.068	0.238	-0.019	0.773
	Transit complexity	-0.109	0.134	-0.042	0.417	-0.167	0.176	-0.053	0.34
	Has car	-0.753	0.206	-0.186	0	-1.454	0.297	-0.28	0
	Has bus pass	0.916	0.192	0.226	0	1.551	0.309	0.317	0
Transit insecurity	Has bus pass	0.303	0.153	0.203	0.048	0.135	0.188	0.1	0.473
	Transit stop density (400 m)	0.022	0.015	0.153	0.144	0.034	0.023	0.23	0.136
	Rail within 400 m	-0.05	0.217	-0.022	0.817	0.103	0.351	0.042	0.769
	Cycled in last week	0.847	0.158	1.036	0	1.164	0.466	1.374	0.012
Bicycling environment	Rail within 400 m	-0.048	0.169	-0.019	0.775	-0.144	0.217	-0.046	0.507
	Retail (1600 m)	-0.612	1.133	-0.039	0.589	-0.375	1.188	-0.024	0.752
	Intersection density (1600 m)	0.319	0.231	0.117	0.167	-0.102	0.282	-0.035	0.718
	Bikeway density (400 m)	-0.15	0.189	-0.049	0.427	-0.301	0.182	-0.143	0.097
	Multifamily (1600 m)	-0.315	0.347	-0.065	0.364	-0.213	0.432	-0.042	0.622
	Share highway (800 m)	-0.168	0.575	-0.021	0.771	-1.381	0.631	-0.17	0.029
	Transit stop density (400 m)	-0.003	0.012	-0.018	0.796	0.03	0.013	0.16	0.02
	Cycled in last week	0.021	0.109	0.023	0.846	0.09	0.18	0.083	0.617
Bicycling convenience	Cycled in last week	0.954	0.1	0.897	0	1.051	0.129	0.899	0
Bicycling complexity	Cycled in last week	0.333	0.054	0.578	0	0.236	0.063	0.297	0
Transit complexity	Cycled in last week	0.074	0.067	0.086	0.265	0.162	0.079	0.166	0.041

Table E.6: Model 3: CFA

		US-born				Immigrant			
Latent variable	Variable	Estimate	SE	Std. Est.	$P(>\|z\|)$	Estimate	SE	Std. Est.	$P(>\|z\|)$
Bicycling complexity	Cycling hard with others	1		0.507		1		0.625	
	Cycling hard with multiple stops	0.664	0.053	0.339	0	0.664	0.053	0.416	0
	Need cycling with transit	1.531	0.168	0.765	0	1.531	0.168	0.953	0
Bicycling environment	Cycle if little crime	1		0.824		1		0.833	
	Cycle if good bike lanes	1.082	0.027	0.89	0	1.082	0.027	0.897	0
	Cycle if space for bikes on transit	1.173	0.028	0.964	0	1.173	0.028	0.969	0
	Cycle if bike parking at transit	1.145	0.028	0.941	0	1.145	0.028	0.947	0
	Take transit if space for bikes	1.139	0.028	0.936	0	1.139	0.028	0.942	0
	Take transit if bike parking	1.146	0.027	0.943	0	1.146	0.027	0.948	0
Bicycling convenience	Cycle instead of transit to save money	1		0.87		1		0.877	
	Cycle instead of transit to save time	1.049	0.035	0.906	0	1.049	0.035	0.915	0
	Cycle instead of drive	0.96	0.035	0.841	0	0.96	0.035	0.845	0
Transit insecurity	Take transit if fares affordable	1		0.691		1		0.626	
	Take transit if little crime	1.322	0.107	0.88	0	1.322	0.107	0.792	0
Transit complexity	Transit hard to take with others	1		0.768		1		0.773	
	Transit hard to take with multiple stops	1		0.768		1		0.773	

F Qualitative Interview Materials

Consent form, English (Phase 1)

Agreement to Participate in Research

Responsible Investigator: Asha W. Agrawal
Research Project Title: Barriers to Using Public Transit

1. You have been asked to participate in a research study about how immigrants get where they need to go, like to work, shopping, school, or recreation.
2. You will be asked questions about how you get to places you need to go.
3. There is no anticipated risk to you if you participate in the project.
4. There is no direct benefit to you if you participate in the project.
5. Although the results of this study may be published, no information that could identify you will be included. If you permit, the interview will be recorded and the interviewer will take notes. However, your name will not be recorded, so that what you say is completely anonymous. The research team will have a company transcribe the interview from the recording, but your name will not be anywhere in the recording.
6. There is no compensation for participating in the project.
7. Questions about this research may be addressed to Asha W. Agrawal at (408) 924-5853. Complaints about the research may be presented to Sheila Bienenfeld, Dean, College of Social Sciences, at (408) 924-5306. Questions about a research subjects' rights, or research-related injury may be presented to Pamela Stacks, Ph.D., Associate Vice President, Graduate Studies and Research, at (408) 924-2427.
8. No service of any kind, to which you are otherwise entitled, will be lost or jeopardized if you choose not to participate in the study.
9. Your consent is being given voluntarily. You may refuse to participate in the entire study or in any part of the study. You have the right to not answer questions you do not wish to answer. If you decide to participate in the study, you are free to withdraw at any time without any negative effect on your relations with San José State University or with [insert name of participating institution that helped recruit the subject].

10. At the time that you sign this consent form, you will receive a copy of it for your records, signed and dated by the investigator.

- **The signature of a subject on this document indicates agreement to participate in the study.**
- **The signature of a researcher on this document indicates agreement to include the above named subject in the research and attestation that the subject has been fully informed of his or her rights.**

Participant's signature	Date
Investigator's signature	Date

Consent form, Spanish (Phase 1)

Acuerdo para participar en la investigación

Investigadora Responsable: Asha W. Agrawal
Título del proyecto: Barreras en el uso del transporte público

1. Se le ha pedido participar en una investigación para entender como los inmigrantes logran llegar a su destino, como al trabajo, de compras, al escuela o a lugares de recreación.
2. Se le harán preguntas sobre cómo llega a los lugares que necesita ir.
3. No hay ningún riesgo previsto para usted si participa en el proyecto.
4. No hay ningún beneficio directamente relacionado a su participación en el proyecto.
5. Aunque los resultados de esta investigación puedan ser publicados, ningún tipo de información que lo pueda identificar será utilizada. Si usted esta de acuerdo, la entrevista será grabada y la persona entrevistándolo/la tomará notas pero su nombre no será grabado. De esta manera, lo que usted diga permanecerá completamente anónimo. El equipo de investigación le pedirá a una compañía que transcriba la grabación de la entrevista, pero su nombre tampoco se encontrará en ninguna parte de la transcripción.
6. No habrá ninguna compensación por su participación en el proyecto.
7. Preguntas sobre esta investigación pueden dirigirse a Asha W. Agrawal, usando el número (408) 924-5853. Quejas acerca de la investigación pueden ser presentadas a Sheila Bienenfeld, Decana del Colegio de Ciencias Sociales, usando el número (408) 924-5306. Preguntas relacionadas a los derechos de los participantes o lesiones relacionadas a la investigación pueden ser dirigidas a Pamela Stacks, Doctorado, Vicepresidenta Asociada en los Estudios Graduados e Investigaciónes, al número (408) 924-2427.
8. Ningún servicio de cualquier tipo, del cual usted ya tiene derecho está en riesgo o peligro de perderse si no desea participar en la investigación.
9. Su consentimiento es completamente voluntario. Usted puede negarse a participar en toda la investigación o en cualquier parte de la investigación. Usted tiene el derecho de no contestar las preguntas que no desee contestar. Si usted decide participar en esta investigación, usted tiene derecho de retirarse en cualquier momento sin ningún efecto negativo a sus relaciones con la Universidad Estatal de San José [o la organización del cual la/lo reclutamos].
10. Al firmar esta forma de consentimiento, usted recibirá una fotocopia de este documento con la fecha y la firma de la investigadora.

- **La firma del participante en este documento indica su acuerdo para participar en la investigación.**
- **La firma del investigador en este documento indica el acuerdo de incluir al participante previamente nombrado en esta investigación y la certificación de que el participante ha sido plenamente informado de sus derechos.**

Firma del Participante	Fecha
Firma del Investigador	Fecha

Consent form, English (Phase 2)

Introduction and Informed Consent

Hello, my name is _____. I am a [graduate] student from the University of California, Berkeley. I am working on a research project in which I want to understand how people get where they need to go, like to work, shopping, school, or recreation. Your answers will help us give recommendations to local government and planners on how to improve transportation for people like you.

I expect the interview to take about an hour. I will ask you questions about transportation—how you get around town to where you need to go. I want to find out about what you like or find easy about getting around, and what you find difficult or would like to see improved.

I have some questions I want to ask you, but this is an open discussion. If there is a topic you'd like to discuss that we haven't talked about, please let us know. I want to hear any thoughts you have about your transportation experience that you think would be helpful to me. Also, there are no right or wrong answers to any of the questions I will ask.

I would like to record the interview and take notes as we talk to make sure I've clearly understood what we talked about today. However, I won't write down your name anywhere, so that what you say is anonymous. I will have a company transcribe [and translate *if it's being done in Spanish*] the interview, but your name will not be anywhere in the recording. No one else will be able to have access to what we talk about today. **Is it OK to record?**

Your participation is voluntary. You have the right to not answer any questions you do not wish to answer. The results of this study may be published and shared with transportation planners and agencies, but I won't write anything that might allow someone to identify you. We may include some of your quotes if they help us tell the story, and I would like to share with you what we'll write if you'd like to read it. **Would you like to make up a name that we would use in the report if we present something that you have said?**

As a token of appreciation for speaking with me today, I have a gift card to give to you at the end of our interview. **Do you have any questions or concerns about participating in this study?** [*Wait for response. If no questions/concerns, then continue.*]

Consent form, Spanish (Phase 2)

Introducción y consentimiento informado

Hola, mi nombre es _____. Estamos investigando para un proyecto de la Universidad de California, Berkeley como la gente llega a donde tiene que ir, como cuando va al trabajo, de compras, a la escuela o a lugares de recreación. Sus respuestas ayudarán a que hagamos recomendaciones al gobierno local y planeadores para sugerir como pueden mejorar el transporte para personas como usted.

La entrevista va a durar alrededor de una hora. Le voy a preguntar sobre formas de transportación—cómo viaja para llegar a donde necesita llegar. Queremos saber que le gusta o que se le hace fácil de viajar, y que se le hace difícil o que quiere ver mejorar.

Tenemos algunas preguntas que le quisiéramos preguntar, pero esta es una discusión abierta. Si hay un tema que usted quiere discutir del cual no hemos hablado, por favor díganos. Queremos saber que de sus experiencias de transportación que usted piense que me ayudaría a mi saber. Además, no hay respuestas correctas ni incorrectas para cualquier pregunta.

Quisiéramos grabar la entrevista y tomar notas mientras hablamos para asegurarnos que he entendido claramente de lo que vamos a hablar. No vamos a escribir su nombre en ningún lado, entonces todo lo que dirá va a ser confidencial. Vamos a tener a algiuen que traduzca la entrevista, pero su nombre no va a estar en ninguna grabación. **¿Está bien si grabamos?**

Su participación es voluntaria. Usted tiene el derecho de no responder a cualquier pregunta que no desea responder. Los resultados de este estudio serán publicados y compartidos con planeadores y agencias de transportación, pero no vamos a escribir ninguna cosa que pueda identificarlo/a. Podríamos escribir algunos de sus dichos si nos ayudan compartir nuestra historia, y me gustaría compartir lo que vamos a escribir si lo quiera leer. **¿Le gustaría inventar un nombre lo cual usaríamos en el reporte si presentamos algo que haya dicho?**

Como muestra de agradecimiento, tengo una tarjeta de regalo de $20 para darle al fin de la entrevista. **¿Tiene alguna pregunta o preocupación acerca de su participación en esta investigación?**
[Espera respuesta. Si no hay preguntas o preocupaciones, continuar.]

Interview topic guide, English (Phase 1)

Basic Information to be recorded by interviewer

Name of Interviewer(s):
Interviewee number:
Location of Interview:
Date and Time:
Language of Interview:
Gender:
Estimated age:
Other Information:

Topic Guide Questions

Throughout the interview, the interviewer should be aware of when the interviewees mentions a barrier to or attitude toward transportation, and adapt the interview questions to follow that lead. Prompts and probes are not meant to be exhaustively covered during the interview or read verbatim, but are ways to help the respondent think about some of the topics we're interested in.

Main interview (45 min)

1. Could you tell me about all the places you have gone or will go today, including here [*to the interview site*]? I'd like to know how you got to or will get to each place, and your experience on each part of your trip.
***Prompts and probes*:**

- If respondent mentions transit, ask about access and egress at same level of detail as other components of the trip
- Why did the respondent take a particular mode? If multiple modes taken throughout the day, what caused the respondent to switch modes?
- If someone was traveling with the respondent, did that play a role in the mode he or she selected?

2. Are there other ways you get around but didn't happen to do so today?
***Prompts and probes*:**

- You talked about using [*list modes*] as ways you get around. How did you make your choice?
- Are there advantages or disadvantages for you to using a particular way [*car, transit, biking, walking, etc.*] to get around?

3. Can you think back to a recent time you took transit somewhere? Where did you go and what was the experience like?
***Prompts and probes*:**

- Where were you traveling between?
- How many places did you have to get to on that day?
- How did you get from your starting point to the bus or train stop? Tell me about that part of the trip.
- How did you get to your final destination once you got off the bus or train? Tell me about that part of the trip.
- Were there particular moments on that trip that stick out in your mind?
- How did you find the trip? That is, was it easy to make, or did you have any problems?
- If the last transit trip was by bus, ask the respondent to compare that trip with the most recent one on BART, light rail, or Caltrain. And vice versa for rail.

3a. **If the interviewee mentions biking to transit**: Why did you to ride your bike to the bus or train stop?
***Prompts and probes*:**

- Why didn't you bike all the way to your destination?
- How was your experience taking your bike with you on the bus or train?
- Are there some things that would make it easier for you to take your bike on the train?

4. Have you ridden your bicycle for any [other] trips within the last year?
If yes: Could you tell me about the last time you biked?
If no: Why not? What prevents you from bicycling?

Prompts and probes for "yes"

- *If the last trip was for* ***recreation****, ask about another trip for work, school, shopping, or visiting. If respondent didn't bike for any of these, explore why not.*
- How did you find the trip (easy, challenging)?
- Were there particular moments on that trip that stick out in your mind?
- What types of trips do you bike for?
- How often do you bike?
- Why do you bike rather than find another way to get places?
- Are there some ways you might ride your bike for more trips? Could you tell me about them? [*Or, is there anything that prevents you from riding for certain trips?*]
- Do you know other people who bike? What have they told you about their experiences?

Prompts and probes for "no" 5.

- Can you imagine a specific trip or situation where it would be feasible for you to ride your bike somewhere? Could you tell me about that? [*Or, why wouldn't it be feasible?*]
- Do you know other people who bike? What have they told you about their experiences? [*Or, what have they told you about why they do not bike?*]

How does getting around in the Bay Area compare with other places you've lived?
Prompts and probes**:**

- If needed, prompt for: information available from transportation operators, frequency and availability of transit service, cost, different transportation services, bike- and pedestrian-friendly design, driver licensing

Final questions (5-10 min)

6. Is there something we didn't talk about today that you think is important about your transportation needs?
7. What could **transportation planners** do to better address your needs and the needs of other immigrants like you?
8. If we wanted to distribute a short survey to ask immigrants who take transit or ride their bikes about how they get around, where would you suggest we go to find people to talk to?

Other demographic information

Now I have just a few final questions about yourself before we finish up.

9. How long have you been in the US?
10. What is your native country?
11. What neighborhood do you live in now? And what is the nearest intersection to your home?
Thank you for taking the time to answer our questions. Do you know other people [not affiliated with this organization *if recruited through social service organization*] who might be willing to be interviewed? [*Give participant business cards or contact information from research team to distribute to his or her contacts. Hand out incentive.*]

Interview topic guide, Spanish (Phase 1)

Información básica

Nombre de entrevistador:
Número de entrevistado:
Lugar de entrevista:
Fecha y hora:
Idioma de entrevista:
Sexo/género:
Edad estimada:
Otra información:

Preguntas para la entrevista

Entrevista principal (45 min)

1. Me puede hablar sobre todos los lugares a los que ha ido hoy y los que tiene que ir, incluyendo a este lugar [*para esta entrevista*]? Me gustaría saber como llegó o como planea llegar a cada lugar y su experiencia en cada parte de su viaje.
***Prompts and probes*:**

- Si el/la participante menciona su uso de transito, pregunta sobre su acceso y salidas al mismo nivel de detalle que los otros componentes del viaje.
- ¿Porque usó ese modo de transporte en particular? Si hubieron varios modos de transporte usados durante el día, ¿cual fue la razón o razones por estos cambios?
- Si alguien viajaba con la persona, ¿Tuvo algo que ver la persona con la que viajaba con el modo de transporte que decidio tomar?

2. Hay otras maneras en las que usted viaja pero que no escogió viajar de esa manera hoy?
***Prompts and probes*:**

- Habló usted sobre su uso de (lista de los medios de transporte) para llegar a sus destinos. *Como fue que hizo estas preferencias?*
- Hay ventajas o desventajas para usted al usar un tipo de transporte en vez de otro? *(Por ejemplo, carro, transporte público, caminar, etc.)*

3. Puede recordar algún día en el que uso el tránsito para llegar a algún lugar? A donde fue y como fue su experiencia?
***Prompts and probes*:**

- ¿A qué lugar viajaba en este transcurso?
- ¿A cuantos lugares tenía que llegar en ese dia?

- ¿Cómo llegó de donde comenzó su viaje al autobús o a la parada del tren?
- ¿Cómo fue que llegó a su último destino cuando se bajó del tren o autobús? Cuénteme más sobre esa parte de su viaje.
- ¿Hay momentos de ese viaje que le resaltan más que otros?
- ¿Como le pareció ese viaje? Se le hizo facil o se enfrentó con algunos problemas?
- ¿Puede comparar este viaje con algún viaje que ha tomado usando el BART, tren ligero o Caltrain?

3a. **If the interviewee mentions biking to transit**: ¿Porque escogió andar en bicicleta para llegar a la parada de autobus o tren?
***Prompts and probes*:**

- ¿Porque no usó su bicicleta para llegar hasta su última parada?
- ¿Cómo fue su experiencia al llevar su bicicleta en el tren o autobús consigo?
- ¿Que sugerencias tiene para que se le haga más facil llevar su bicicleta en el tren?

4. ¿En el último año, ha andado en bicicleta para hacer otros viajes?
Si la respuest fue sí: ¿Me puede decir más sobre la última vez que andaba en bicicleta?
Si la respuesta fue no: ¿Qué lo impide usar su bicicleta?

Prompts and probes for "yes"

- *Si el último viaje fue por razones de recreación, como su experiencia al ir al trabajo, la escuela, de compras o al hacer una visita. Si el participante no anduvo en bicicleta para ninguna de esas razones, por que no?*
- ¿Como le pareció el viaje (fácil, difícil)?
- ¿Hay momentos de ese viaje que le resaltan más?
- ¿Para qué tipos de viajes escoge andar en bicicleta?
- ¿Qué tan seguido anda en bicicleta?
- ¿Porqué escoge andar en bicicleta en vez de encontrar otra manera de llegar a esos lugares?
- ¿Me puede decir si hay algunos métodos en los que puede andar más en su bicicleta durante ciertos viajes? [¿O hay algo que la/lo previene andar en bicicleta en algunos viajes?]
- ¿Conoce a otras personas que usan su bicicleta? ¿Que le han contado sobre sus experiencias?

Prompts and probes for "no"

- ¿Se puede imaginar algún viaje o alguna situación en donde sería posible que usted usará su bicicleta? ¿Me puede contar más sobre eso? [¿O que es lo no lo haría posible?]
- ¿Conoce a otras personas que anden en bicicleta? ¿Qué le han contado sobre sus experiencias? [O que le dicen ellos que son sus razones para no andar en bicicleta?]

5. ¿Cómo se compara la manera en la que viaja aqui en la área de la bahía con otros lugares en los que ha vivido?

***Prompts and probes*:**

- Información sobre operadores de transporte público, la frecuencia y disponibilidad del servicio de transito, el costo, diferentes opciones a servicios de transporte, el planeamiento de las calles para ciclistas y peatones, licencias de conducir.

Preguntas finales (5-10 min)

6. ¿Hay algo que no hablamos pero que desea compartir sobre sus necesidades de transporte?
7. ¿Cuáles sugerencias les daría a **planificadores de transporte** para mejor responder a sus necesidades y las necesidades de otros inmigrantes como usted?

8. Si queremos distribuir un cuestionario corto para preguntarle a otros inmigrantes que usan el transporte público o sus bicicletas sus experiencias al tomar estos viajes, ¿en dónde nos sugiriera que deberíamos ir para poder encontrar y hablar con estas personas?

Otra información demográfica

Me gustaría hacerle algunas preguntas básicas sobre usted antes de terminar
9. ¿Cuánto tiempo ha vivido en los EE.UU.?
10. ¿Cuál es su país de origen?
11. ¿En qué área/barrio/comunidad vive ahora? ¿Y cuál es la intersección más cercana a su hogar?
Gracias por tomar su tiempo para contestar estas preguntas. ¿Conoce a otras personas [que no tengan conexión con esta organización] quienes podrían estar dispuestos para ser entrevistados?

Interview topic guide, English (Phase 2)

Throughout the interview, the interviewer should be aware of when the interviewees mentions an attitude toward transportation or their neighborhood, and adapt the interview questions to follow that lead. Prompts and probes are not meant to be exhaustively covered during the interview or read verbatim, but are ways to help the respondent think about some of the topics we're interested in. Questions about bicycling should be prioritized. Interviewees may answer questions in the course of answering others, so be aware to avoid repeating questions.

Topic Guide Questions

Neighborhood environment

1. Tell me about the neighborhood where you live. [*Ask for respondent's neighborhood if you don't know it.*]
Prompts and probes:

- What are some things you do around your neighborhood?
- What do you notice about your neighborhood? (Things to probe if nothing comes to mind: streets, types of buildings and services, traffic, people who live there, visitors)
- How easy or difficult is it to get around your neighborhood?
- How do you get around your neighborhood? What do you notice when you walk? Wait for the bus? Bike? Drive?
- How do other people get around in your neighborhood? What do you notice about people who are walking? Waiting for the bus? Biking? Driving?

2. What do you like about where you live? What do you dislike?
3. What are some things you notice about your neighborhood compared to others you go to or know about?
Prompts: streets, types of buildings and services, traffic, people who live there, visitors
4. What things did you consider important when you decided to move into your current neighborhood?
Prompts and probes:

- Possible factors: Family, friends, community; transportation access; safety; cost

Travel Behavior

5. Could you tell me about all the places you went yesterday? Start from the first time you left home. I'd like to know how you got to each place, and your experience on each part of your trip.
Prompts and probes:

- What are some reasons you took a particular way to get somewhere? What caused you to take a different mode of transportation somewhere else [*If multiple modes taken throughout the day*]?
- Was anyone traveling with you? How did that affect the way you got somewhere?
- What did you notice when you were traveling other places?
- Were there any portions of the trip that were difficult? How were they difficult?
- Were there any portions of the trip that were easy? How were they easy?

6. Are there other ways you normally get around but didn't happen to do so yesterday? [*If yes*:] Tell me more about the last time you got around that way.
Prompts and probes:

- What made you choose that mode of transportation?
- What advantages or disadvantages are there for you to using a particular way [*car, transit, biking, walking, etc.*] to get around?

6a. [*If a mode of transportation was left out:*] I noticed you didn't mention [XX] as a way you normally get around. What are some reasons you don't normally use that mode of transportation?
7. Can you think back to a recent time you took the bus somewhere? Where did you go and what was the experience like?
Prompts and probes:

- What are some of the reasons you decided to take the bus instead of another mode of transportation?
- How many places did you have to get to on that day? What types of places were they?
- How did you get from your starting point to the bus stop? Tell me about that part of the trip.
- How did you get to your final destination once you got off the bus? Tell me about that part of the trip.
- Were there particular moments on that trip that stick out in your mind?
- How did you find the trip? That is, was it easy to make, or did you feel particularly good or bad?
- What do others you know who ride the bus tell you about their experience?
- What do you notice as you travel through different neighborhoods in the city?

8. Can you think back to a recent time you took BART somewhere? Where did you go and what was the experience like?
Prompts and probes:

- What are some of the reasons you decided to take BART instead of another mode of transportation?
- How many places did you have to get to on that day? What types of places were they?
- How did you get from your starting point to the BART station? Tell me about that part of the trip.
- How did you get to your final destination once you got off BART? Tell me about that part of the trip.
- Were there particular moments on that trip that stick out in your mind?
- How did you find the trip? That is, was it easy or difficult to make?
- What do others you know who ride BART tell you about their experience?
- How is getting around on BART different from taking the bus for you?

7a/8a. **If the interviewee mentions biking to transit**: How did you decide to ride your bike to the bus or train stop?
Prompts and probes:

- Why didn't you bike all the way to your destination?
- How was your experience taking your bike with you on the bus or train?
- What would make it easier for you to take your bike on the bus or train?

9. Tell me about the last time you biked somewhere.
Prompts and probes:

- If the last trip was for fun/recreation, ask about the last time he/she took a trip to get to work, school, or some other place. If he/she didn't take a trip for those reasons, ask what might cause them to do so.
- Where did you go?
- How did you find the trip?
- Were there particular moments on that trip that stick out in your mind?
- What types of trips do you bike for?
- How often do you bike?
- How do you make the choice to bike rather than find another way to get places?
- What might cause you to ride your bike for more trips? Could you tell me about those reasons?

10. Do you know other people who bike? Who are they? (Or, who are the kind of people who bike?) How does this affect how often you bike? What experiences have you had where you convinced other people to bike somewhere?
11. What are some of the reasons you decide NOT to bike some place?
12. What are some of the things you notice about biking in your neighborhood compared to others?
13. How often do you have the option to drive?

- *If never*: How would having the option to drive change how you usually get around?
- *If sometimes/always*: Do you have your own car or do you share one with others? [*If he/she shares:*] How do you negotiate for when you get access to the car? How do you decide whether to drive somewhere or get somewhere another way? Do you use formal car-sharing options, like City CarShare or ZipCar? Why/why not?

14. How does getting around in your neighborhood compare with other places you've lived?
Prompts and probes:

- Where else have you lived?
- What makes it different?
- Can you think of an instance where getting around in the Bay Area would be easier than other places you lived? Harder?
- How would you compare the bus or train to other places you've lived?
- How would you compare biking to other places you've lived?

Planning and policy

15. How do you think the cost of traveling affects the way you choose to get around? Or, what trade-offs do you make when considering your transportation needs?
16. How do you think your experiences getting around compare to other people you know? Let's start with family, friends, and neighbors. What about your bosses, supervisors, or teachers? [*This question should be personalized to the interviewee's personal situation. We are asking about class differences in travel behavior.*]
17. What could transportation planners do to better address your needs and the needs of other people like you? Or, what would you do if you were in charge of transportation?
18. Is there something we didn't talk about today that you think is important about your transportation needs?
Thank you for taking the time to answer our questions. Do you know other people who might be willing to be interviewed? [*Give the participant business cards from the research team to distribute to his or her contacts. Hand out incentive.*]

Interview topic guide, Spanish (Phase 2)

Throughout the interview, the interviewer should be aware of when the interviewees mentions an attitude toward transportation or their neighborhood, and adapt the interview questions to follow that lead. Prompts and probes are not meant to be exhaustively covered during the interview or read verbatim, but are ways to help the respondent think about some of the topics we're interested in. Questions about bicycling should be prioritized. Interviewees may answer questions in the course of answering others, so be aware to avoid repeating questions.

Preguntas

Barrio y medio ambiente

1. ¿Me puede platicar del vecindario en donde vive? [*Pregúntele lo cuál es si no lo sabe*]
Pruebas:

- ¿Qué son algunas de las cosas que hace en su vecindario?
- ¿Qué cosas nota en su vecindario? (como las calles, los tipos de edificios y servicios, el tráfico, la gente que vive allí o la gente que visita)
- ¿Qué fácil o difícil se le hace para viajar en su vecindario?
- ¿Cómo viaja por su vecindario? ¿Que nota cuando camina? ¿Cuando espera el autobús? ¿Cuando utiliza su bicicleta? ¿Cuando maneja?
- ¿Cómo viaja la gente en su vecindario? Que nota cuando otra gente camina? ¿Cuando espera el autobús? ¿Cuando utiliza su bicicleta? ¿Cuando maneja?

2. ¿Qué le gusta de su vecindario? ¿Qué no le gusta?
3. ¿Qué son algunas cosas que usted nota de su vecindario comparado a otros vecindarios que visita o que conoce?
Pruebas: Como las calles, los tipos de edificios y servicios, el tráfico, la gente que vive allí o la gente que visita
4. ¿Qué cosas reconoció como importantes cuando decidió mudarse a su vecindario?
Pruebas: Factores posibles: su familia, amig@s, la comunidad, el acceso de transportación, la seguridad, el costo

Manera de viajar

5. ¿Me puede platicar de todos los lugares donde fue ayer? Puede comenzar desde el momento cuando salió de la casa. Quisiera saber como llegó a cada lugar y su experiencia en cada parte de su viaje.
Pruebas:

- ¿Cuáles son algunas de las razones por las cual usted usted llegó a algún lugar de una forma en particular? *[Si tomó varias formas durante el día:]* ¿Qué causó que usted tomó una forma de transportación distinta para llegar a algún otro lugar?
- ¿Alguna persona viajó con usted? *[De ser así:]* ¿Cómo afectó la forma en que llegó a algún lugar?
- ¿Qué notó cuando estaba viajando a otros lugares?
- ¿Fue alguna parte de su viaje difícil? ¿Cómo fueron difícil?
- ¿Fue alguna parte de su viaje fácil? ¿Como fueron fácil?

6. ¿Hay otras formas en las que normalmente viaja pero ayer no viajó así? *[De ser así:]* ¿Me puede platicar más de la última vez en la cual viajó así?
Pruebas:

- ¿Como hizo su decisión?
- ¿Qué ventajas o desventajas existen para usted cuando viaja de una forma particular? [*e.g. carro, transporte publico, bicicleta, caminando*]

6a. [*Si no mencionó una forma de transporte:*] Noto que no mencionó [*XX*] como una forma en la cual usted normalmente viaja. ¿Cuáles son las razones por la cual usted no usa esa forma de transportación?
7. Puede pensar en un momento reciente en el cual usted viajó a algún lugar en el autobús? ¿A dónde fue y cómo fue su experiencia?
Pruebas:

- ¿Cuáles son algunas razones por las que usted decidió tomar el autobús en lugar de otra forma de transportación?
- ¿A cuántos lugares tuvo que ir ese día? ¿A qué tipos de lugares fue?
- ¿Cómo llegó del punto de partida a la parada del autobús? ¿Me puede platicar de esa parte de su viaje?
- ¿Cómo llegó a su último destino cuando se bajo del autobús? ¿Me puede platicar de esa parte de su viaje?
- ¿Hubieron algunos momentos en ese viaje que se quedaron en su mente?
- ¿Cómo se le hizo el viaje? Quiero decir, ¿fue fácil de hacer o se sintió particularmente bien o mal?
- ¿Qué experiencias le platican personas que conoce que viajan por autobús?
- ¿Qué cosas nota cuando viaja por diferentes vecindarios en la ciudad?

8. ¿Puede pensar en un tiempo reciente en el que tomo el BART a algún lugar? ¿A donde fue y como fue su experiencia?
Pruebas:

- ¿Cuáles son las razones por las cual decidió tomar el BART en vez de otra forma de transportación?
- ¿A cuántos lugares tuvo que llegar ese día? ¿Qué tipos de lugares fueron?
- ¿Cómo llegó del punto de partida a la estación del BART? ¿Me puede platicar de esa parte de su viaje?
- ¿Cómo llegó a su ultimo destino cuando se bajo del BART? ¿Me puede platicar de esa parte de su viaje?
- ¿Hubieron algunos momentos en ese viaje que se quedaron en su mente?
- ¿Como se le hizo el viaje? Quiero decir, ¿fue fácil o difícil de hacer?
- ¿Qué experiencias le platican otras personas que conoce que viajan por BART?
- ¿Cómo se le hace diferente para usted transportar por BART o por autobús?

7a/8a. [*Si el entrevistado menciona que anda por bici al transporte público:*] ¿Cómo decidió irse en su bicicleta a la parada del autobús o BART?
Pruebas:

- ¿Por qué no se fue en su bicicleta hasta el fin de su destino?
- ¿Cómo fue su experiencia llevándose su bicicleta en el autobús o tren?
- ¿Qué haría más fácil para que usted lleve su bici en el autobús o el tren?

9. ¿Me puede platicar de la última vez que se llevo su bicicleta a algún lugar?
Pruebas:

- Si el último viaje fue para divertirse o el recreo, pregúntele de la última vez que anduvo por bici para llegar al trabajo, a la escuela, o a cualquier otro lugar. Si no anduvo por bici por causa de esas razones, pregúntele de qué le motivaría para hacerlo.
- ¿A dónde fue?
- ¿Cómo se le hizo el viaje?
- ¿Hay momentos particulares de ese viaje que se le quedaron en la mente?
- ¿Para qué tipo de viajes utiliza su bicicleta?
- ¿Con qué frecuencia utiliza su bicicleta?

- ¿Cómo hace la decisión de utilizar su bicicleta en vez de otra forma de transportación?
- ¿Por cuáles razones utilizaría mas su bicicleta? ¿Me platica de esas razones?

10. ¿Conoce a otras personas que utilizan su bicicleta? ¿Quiénes son (*O*, qué tipos de personas son)? ¿Esto afecta con que frecuencia usted utiliza su bicicleta? ¿Qué experiencias ha tenido en las cuales ha convencido a otras personas a utilizar su bicicleta?
11. ¿Cuáles son algunas de las razones por las cual usted decide no utilizar su bicicleta?
12. ¿Qué son algunas de las cosas que usted nota de andar en bicicleta en su vecindario comparado a otros vecindarios?
13. ¿Con qué frecuencia tiene la opción de manejar?

- *De ser nunca*: ¿Si tuviera la opción de manejar, como cambiaría la forma en la cual usted viaja?
- *De ser algunas vezes/siempre*: ¿Tiene su propio carro o comparte con otros?
  - *Si lo comparte*: ¿Cómo negocia quién utiliza el carro? ¿Cómo decide si va a manejar o a llegar a su destino de otra forma? ¿Utiliza maneras formales de compartir un carro, como City CarShare o ZipCar? ¿Por qué o por qué no?

14. ¿Cómo se compara viajar en su vecindario a otros lugares dónde ha vivido?
Pruebas:

- ¿En qué otros lugares ha vivido?
- ¿Cómo era diferente allí?
- ¿Puede pensar en un instante en la que viajar en la Área de la Bahía sería mas fácil que otros lugares donde ha vivido? ¿Más difícil?
- ¿Cómo compararía el autobús o el tren aquí que en otros lugares donde ha vivido?
- ¿Cómo compararía utilizar su bicicleta a otros lugares donde ha vivido?

La planificación y la póliza

15. ¿Cómo piensa que el precio de viajar afecta la forma en la cual usted viaja? ¿Cuáles sacrificios hace cuando considera sus necesidades de transportación?
16. ¿Cómo cree que sus experiencias viajando se comparan a otras personas que conoce? Puede empezar con su familia, amigos y vecinos. ¿Y qué tal sus managers, supervisores, o maestros? [*Esta pregunta debe ser personalizado a la situación personal del entrevistado. Preguntamos de las diferencias de las maneras de viajar entre personas de clases socio-económicas distintas.*]
17. ¿Qué podría hacer la gente que planea formas de transportación para trabajar con sus necesidades y las necesidades de otras personas como usted? ¿Qué haría usted si estuviera en cargo de transportación?
18. ¿Hay algo de lo que no hablamos hoy que usted cree que es importante para sus necesidades de transportación?

19. Gracias por su tiempo compartiendo su historia. ¿Conoce a otras personas que quisieran ser entrevistadas? [*Dele al participante unas tarjetas de visita del equipo de la investigación, para que pueda darles a sus contactes. Dele la tarjeta de regalo.*]