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Residential, Economic, and Transportation Mobility: The Changing Geography of Low-Income Households

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Residential, Economic, and Transportation Mobility:

The Changing Geography of Low-Income Households

A dissertation submitted in partial satisfaction

of the requirements for the degree of

Doctor of Philosophy in Urban Planning

by

Andrew Jacob Schouten

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ABSTRACT OF THE DISSERTATION

Residential, Economic, and Transportation Mobility:

The Changing Geography of Low-Income Households

by

Andrew Jacob Schouten

Doctor of Philosophy in Urban Planning

University of California, Los Angeles, 2019

Professor Evelyn A. Blumenberg, Chair

Over the past 30 years, economic distress in suburban neighborhoods has become more pronounced. This dissertation, which consists of three self-contained essays, examines how three types of mobility—residential, economic, and transportation—have contributed to the growing number of low-income households living in suburban communities.

In the first essay, I assess the degree to which residential mobility has affected the income dynamics of metropolitan areas in the U.S. I find that poorer residents suburbanized rapidly between 1999 and 2015, leaving central-city neighborhoods for outlying areas at high rates. However, during the same time period, higher-income households also made urban-to-suburban

moves in large numbers, meaning that the overall effect of population flows on suburban low-income rates was relatively modest. Results also show that low-income households that relocated from central-city neighborhoods to suburban communities were different from those that remained in urban neighborhoods. Specifically, urban-to-suburban movers were more likely to be white, had more household resources, and lived in origin neighborhoods with lower population densities and less transit supply than those that made intra-urban relocations.

The second essay addresses the influence of economic mobility on the low-income rates of both urban and suburban geographies. The results indicate that in most suburban and urban neighborhood types, more residents transitioned out of low-income status than fell below the low-income threshold. Consequently, economic mobility generally led to aggregate decreases in the percentage of low-income individuals in a given type of neighborhood. At the household level, however, income volatility was more pronounced, and families living in older, moderately dense residential neighborhoods had a relatively high likelihood of experiencing downward economic mobility.

Finally, the third essay investigates how low-income households adapt their transportation mobility to fit new residential contexts. In particular, I examine the relationship between inter-geography relocations and changes in automobile ownership. Findings demonstrate that poorer families adjusted their vehicle ownership to suit the built-environment characteristics of their destination neighborhoods. For example, carless households that made urban-to-suburban moves had a higher likelihood of acquiring a vehicle, *ceteris paribus*; by contrast, car-owning families that made suburban-to-urban moves had a relatively high probability of reducing their automobile ownership, and were more likely to become carless than households that moved within the suburbs.

The dissertation of Andrew Jacob Schouten is approved.

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Blumenberg, E., Brown, A., & **Schouten, A**. (2018). Car-deficit households: Determinants and implications for household travel. *Transportation*. DOI: 10.1007/s11116-018-9956-6

Reports

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Residential, Economic, and Transportation Mobility:

The Changing Geography of Low-Income Households

Introduction

Throughout much of the 20th century, the popular press largely portrayed suburban communities as safe, stable, and secure (Fishman, 2008; Hall & Lee, 2010; Hanlon, Vicino, & Short, 2006; Jackson, 1987). By contrast, urban areas were often viewed as repositories of vice, corruption, and blight (Zinn, 1989). To some degree, academic research and governmental analyses validated this dichotomy. Numerous studies from the 1960s to the 1980s juxtaposed the intense poverty of urban neighborhoods with the economic security of suburban areas, while public inquiry into the urban unrest of the 1960s depicted severe isolation, discrimination, and lack of economic opportunity in many inner-city communities (Jargowsky, 1997; Jencks & Peterson, 1991; National Advisory Commission on Civil Disorders, 1968; Wilson, 1987).

By the 1990s, however, researchers began to highlight changing fortunes in both cities and in suburbs. Just as the financial boom at the end of the 20th century eased concentrated poverty in America's cities, suburban communities began to struggle with growing economic insecurity (Jargowsky, 2003). The downward slide of many suburban jurisdictions continued into the 21st century, and by 2008, the poor population of suburbs surpassed that of central cities (Allard, 2017).

While the rise in suburban poverty is well documented, relatively little is known about the factors that underlie it. Many scholars contend, often implicitly, that population flows have precipitated an increase in suburban economic distress. For example, several studies note that the combined force of "push" and "pull" factors have encouraged low-income families to leave urban areas for communities on the metropolitan fringe. In particular, they demonstrate how the

decentralization of job opportunities, the dispersal of subsidized housing, and the growing diversity of suburban neighborhoods have made outlying communities more attractive to households at the lower end of the income distribution (Covington, Freeman, & Stoll, 2011; Howell & Timberlake, 2014; Hyra, 2015; Raphael & Stoll, 2010; Suro, Wilson, & Singer, 2011; Williamson, Smith, & Strambi-Kramer, 2009).

Recently, however, researchers have begun to highlight the importance of broader economic trends in the growth of suburban poverty. These scholars note that population flows alone are unlikely to fully explain the shifting spatial distribution of financial hardship. Instead, they suggest that overarching changes in the economic landscape, particularly the declining wages and job security of low-skilled workers, have harmed the life outcomes of economically vulnerable families in the suburbs (Allard, 2017; Cooke, 2010; Covington, 2015). Thus, while this line of inquiry does not deny that population migrations have contributed to growing poverty rates in suburbs, it suggests that incumbent suburban residents are getting poorer, and that this downward mobility is another important cause of suburban economic hardship.

In addition to the lack of clarity regarding the causes of growing suburban poverty, there is also a limited amount of research on how low-income suburbanites adapt to their residential context. The historic concentration of poverty in central cities means that the physical and social infrastructure of urban areas is often better equipped to meet the needs of economically vulnerable residents than that of suburban communities (Allard, 2008; Allard & Roth, 2011; Glaeser, Kahn, & Rappaport, 2008; LeRoy & Sonstelie, 1983). Therefore, as the suburban poor population grows, an increasing number of financially insecure individuals may face relatively low levels of access to necessities like transportation services and social welfare assistance. These problems are likely to be especially acute among new suburbanites—low-income residents

who have recently relocated to the suburbs from a central-city neighborhood. For these individuals, the challenges of dealing with economic insecurity may be compounded by a lack of familiarity with their new residential context. Given their potential difficulties, it is particularly important to understand how low-income urban-to-suburban movers adjust to the challenges of life outside the central city.

This dissertation aims to address these gaps in the literature by examining how three types of mobility—residential, economic, and transportation—have influenced the spatial distribution of low-income households. The analysis is comprised of three self-contained essays. The first essay is entitled "Residential Mobility and the Geography of Low-Income Households." In it, I assess the degree to which low-income households moved out of central-city areas and into suburban communities from 1999 to 2015, as well as the effect of these migrations on the low-income rates of various urban and suburban geographies. I find that since 1999, low-income residents left urban areas for outlying neighborhoods at a relatively rapid pace. At the same time, however, higher-income individuals also suburbanized, often in larger numbers than poorer households. Consequently, the impact of population migrations on suburban income composition was generally modest. Results also show that suburbanizing low-income households were different from those that remained in urban neighborhoods. Relative to families that relocated within central-city areas, urban-to-suburban movers were more likely to be white, had more household resources, and relocated from origin neighborhoods with relatively low population densities and low-levels of public transit supply.

The second essay, entitled "Economic Mobility and the Income Dynamics of Suburban and Urban Neighborhoods," investigates the role of downward mobility on the spatial distribution of economic distress. Findings suggest that in the aggregate, negative economic

mobility had a minimal impact on the income dynamics of suburban neighborhoods. Put simply, in suburban communities where low-income rates rose, these increases were generally due to a modest influx of low-income households from other geographies, and not the result of cumulative transitions into low-income status. Somewhat surprisingly, however, multivariate models indicate that at the household level, families in certain types of neighborhoods—specifically older residential communities in both urban and suburban areas—had a particularly high likelihood of falling below the low-income threshold. These findings highlight the fact that neighborhood-level trends can sometimes obscure substantial vulnerability at the household level, and demonstrate the importance of examining the implications of economic mobility from multiple perspectives.

The third essay is entitled "Residential Relocations and Vehicle Ownership among Low-Income Households." While the first two essays address the causes of neighborhood-level economic change, this analysis uses the lens of transportation mobility to examine consequences associated with these shifts. I focus on the relationship between inter-geography relocations and automobile ownership in low-income households. This focus allows me to illustrate how low-income movers adapt to the transportation landscape of their new residential contexts. Results show that households adjust their levels of vehicle ownership to suit the built-environment and transit-supply features of their destination neighborhoods. Carless urban households, for example, show a relatively high propensity to acquire an automobile in conjunction with a suburban move. Similarly, car-owning suburban households have an increased likelihood of transitioning into carlessness when relocating to an urban area. Given the substantial costs associated with vehicle ownership, these findings suggest that while suburban-to-urban moves may be an opportunity to reduce transportation costs, urban-to-suburban moves may force low-

income households to bear a substantial financial burden in order to secure adequate levels of mobility.

While the essays in this dissertation are self-contained, they do overlap in two important aspects. First, the primary data source for all three essays is the Panel Study of Income Dynamics (PSID). In many ways, the PSID serves as an ideal foundation for the analysis of residential mobility and changes in the spatial distribution of economic distress. The PSID provides a wealth of household- and individual-level data on key socioeconomic and demographic features that are central to this analysis. Furthermore, the confidential version of the PSID contains a census tract-level identifier that allows me to determine the neighborhood in which each household resides and, more importantly, identify the built-environment features of families' neighborhoods of residence. Finally, the panel nature of the PSID enables me to track households over multiple waves and assess relationships between changes in income, residential location, and vehicle ownership. All PSID data used in this analysis come from the nine survey waves from 1999 to 2015.

In addition to drawing on the PSID as a primary source of data, each of the three essays uses a refined typology developed by Voulgaris, Taylor, Blumenberg, Brown, and Ralph (2016) to identify and track households' neighborhoods of residence. This typology has important advantages over the classification schemes typically employed in the literature. First, the Voulgaris et al. typology is constructed solely using census tract-level built-environment features, road network data, and transit supply characteristics. This means that, unlike studies that rely on census-based definitions—which are constructed primarily using jurisdictional boundaries—the neighborhood types in this dissertation are far more intuitive: urban areas are heavily populated, densely developed, and have relatively robust transit options; suburban areas

have lower population densities, sprawling development, and limited public transit service. Second, the Voulgaris et al. classification system defines three types of urban neighborhoods (old urban, mixed use, and urban residential), three types of suburban neighborhoods (established suburb, patchwork, and new development), and a rural neighborhood category.[1] By contrast, most other analyses identify only two (urban and suburban) or three (urban, inner-ring suburban, outer-ring suburban) neighborhood types. This means that, relative to the existing literature, I am able to track households and identify trends at a very high level of geographic specificity.

When viewed as a whole, this dissertation addresses questions regarding both causes and consequences of the changing spatial landscape of economic hardship. Findings highlight the complexity of these issues. For example, between 1999 and 2015, large numbers of low-income households relocated from central cities to suburban neighborhoods; however, the continuing suburbanization of non-low-income residents means that the low-income rates of most neighborhood types were relatively stable during this time period. Similarly, households residing in older, moderately dense residential neighborhoods were particularly susceptible to downward financial slides; nevertheless, negative economic mobility in these neighborhoods did not cause an increase in neighborhood-level low-income rates. Finally, households often adjusted their vehicle ownership to suit the built-environment and transit-supply characteristics of their destination neighborhoods; unfortunately, it is not clear whether these adjustments were made before or after relocations, meaning the relationship between automobility and residential location decisions remains somewhat obscure.

[1] While I do not capitalize the names of the neighborhood types, I use them as proper nouns throughout the dissertation. Therefore, when I use neighborhood type names in the adjectival form (e.g. "old urban neighborhoods"), I omit hyphens.

The complexity of these findings makes it difficult to propose blanket policy recommendations to address economic distress in suburban communities. Instead, the results of this analysis are perhaps most effective in illustrating the limitations of aggregate data when evaluating changes in the spatial landscape of poverty. Between 1999 and 2015, the overall low-income rate of suburban areas was relatively stable. Nevertheless, this study finds that low-income households suburbanized rapidly, adding to the already considerable number of economically vulnerable residents living outside of the urban core. Furthermore, results show that even in areas with ostensibly stable or positive income dynamics, individual households may nevertheless be highly vulnerable to economic decline. Therefore, planners and policy makers must first examine trends and changes within their jurisdiction, identify potential problems, and seek solutions that are designed for their specific context. Given the growing alarm over increases in suburban poverty, it may be tempting propose comprehensive public action. However, this dissertation highlights the complicated forces that underlie spatial shifts in economic distress, and suggests that the solutions to these problems will be equally complex.

Essay 1: Residential Mobility and the Geography of Low-Income Households

Abstract

In contrast to the traditional image of suburban communities as stable and secure enclaves surrounding a more volatile urban core, scholars have noted considerable increases in suburban poverty over the past several decades. Using data from the Panel Study of Income Dynamics (PSID) from 1999 to 2015, this analysis seeks to better understand the growing economic distress of suburban areas in two stages: first by examining the degree to which low-income households have left central-city communities for suburban neighborhoods; and second by identifying the types of low-income households that have made urban-to-suburban moves. Results show that although low-income families rapidly suburbanized during the study period, higher-income households left central cities for outlying neighborhoods at nearly the same rate. This finding suggests that while the overall number of economically disadvantaged households in the suburbs has grown, population flows have had only a modest impact on the income composition of suburban neighborhoods. Results also highlight important differences between low-income households that suburbanized during the study period versus those that remained in urban communities. In particular, urban-to-suburban movers were more likely to be white, had more household resources, and lived in origin neighborhoods with fewer urban characteristics than families that relocated within central-city areas.

1. Introduction

Over the past 30 years, the spread of poverty and financial distress in suburban communities in the U.S. has become increasingly salient. Throughout the 1990s, as central-city areas benefitted from strong economic growth and a downturn in crime, scholars noted a

moderate rise the number of poor census tracts in suburban areas (Kingsley & Pettit, 2003; McConville & Ong, 2003). During the first decade of the 21st century, this trend intensified, with the number of people living in poverty in the suburbs increasing at double the rate of the poor population in central-city areas (Kneebone & Holmes, 2014). In fact, the suburban poor now comprise a majority of the nation's metropolitan population living below the poverty line, with approximately 56 percent of the poor in the U.S.'s 100 largest metropolitan areas residing in suburban communities (Kneebone & Holmes, 2014).

While scholars have posited a number of reasons for the increase in poverty in suburban areas, many of these causes are centered around population migration—in other words, most explanations assume that low-income individuals are leaving urban areas for suburban neighborhoods. To be sure, over the past several decades a number of factors such as federal housing policy, job decentralization, changing urban housing markets, and shifts in immigration patterns have pushed low-income residents toward the suburbs (Covington et al., 2011; Suro et al., 2011; Williamson et al., 2009). However, the urban poor are still rather limited in terms of their residential mobility (Glaeser et al., 2008; Pathak, Wyczalkowski, & Huang, 2017; Turner, 2008), and there is little empirical evidence linking low-income households with large-scale migrations from central cities to suburbs.

Using data from the Panel Study of Income Dynamics (PSID), this study addresses the relative lack of knowledge regarding the geographic mobility of low-income households, first by examining the extent to which low-income households have left urban areas for suburban communities during the past two decades, and second by investigating the factors that are associated with moves from urban to suburban areas.

Results show that from 1999 to 2015, low-income households left urban neighborhoods for suburban communities to a substantial degree, with the volume of out-movers far outpacing the number of residents moving into urban areas. Despite this flow of low-income households to outlying communities, the overall income profile of suburban neighborhoods changed only modestly: during the same time period, non-low-income households also rapidly suburbanized, meaning the proportion of low-income residents in suburban areas remained reasonably stable.

The findings from this analysis also highlight several important differences between low-income households that suburbanized during the study period versus those that relocated within urban areas. In particular, households that made moves from urban to suburban areas had different racial characteristics, differing levels of automobile access, and lived in neighborhoods that were distinct from families that moved within urban communities. These findings suggest that while low-income households suburbanized to a significant extent between 1999 and 2015, not all families were equally likely to relocate to outlying neighborhoods. Instead, key socioeconomic, demographic, and locational characteristics acted as strong predictors of which households made such moves and where these families ultimately decided to settle.

2. Background Literature

2.1. The Suburbanization of Poverty

Scholars suggest several potential reasons for the suburbanization of poverty since the 1990s. To a large degree, research has focused on the role of population flows—put simply, the migration of low-income households from central-city neighborhoods to outlying communities—as a primary source of growing suburban poverty (Covington, 2015; Holliday & Dwyer, 2009). For example, a good deal of inquiry highlights the role of housing policy as a key driver of

poverty decentralization. While public housing complexes were traditionally constructed in central cities, the growth of voucher programs, combined with the decline of project-based public housing, means that low-income households can now search for housing in a broader range of neighborhood types (Devine, Gray, Rubin, & Taghavi, 2003; Pendall, 2000). Covington et al. (2011) conclude that by 2010, nearly half of all voucher recipients in the U.S.'s largest cities lived in suburban communities. Other public programs, such as the Low-Income Housing Tax Credit (LIHTC) have also contributed to spatial changes in poverty, and in some areas these programs have had more of an effect on the relocation of low-income households than voucher programs (Freeman, 2004; Williamson et al., 2009).

At the same time as government programs have encouraged poverty decentralization, trends in urban housing markets also have hastened the moves of low-income households to outlying neighborhoods. Research suggests that central-city rents and real estate prices are increasingly unaffordable for low- and middle-class households in many cities across the country (Schuetz & Murray, 2018). Some scholars note that the lack of affordable housing has forced poorer families to secure homes in cheaper communities, particularly in so-called "inner-ring suburbs"—older suburban neighborhoods adjacent to the urban core (Lee & Leigh, 2007; Short, Hanlon, & Vicino, 2007). While many of these neighborhoods were marked by either de facto or de jure segregation during their post-war development, they now represent an affordable option for households leaving central cities, including those that are nonwhite (Hall & Lee, 2010; Hanlon et al., 2006; Howell & Timberlake, 2014; Timberlake, Howell, & Staight, 2011). The increasing diversity of these neighborhoods also means that immigrants—whose traditional neighborhood of entry was in the central city—are now more able to settle directly in suburban areas (Alba, Logan, Stults, Marzan, & Zhang, 1999; Logan, Zhang, & Alba, 2002). Given their

relatively low levels of education and their frequent employment in low-wage work, the growing number of new immigrants living in the suburbs can lead to more poverty outside of the central city (Suro et al., 2011).

In combination with housing market pressures, changes in the labor market over the past several decades have pushed poorer families away from central-city neighborhoods and toward suburban areas (Glaeser, Kahn, & Chu, 2001; Stoll, 2006). Raphael and Stoll (2010), for example, highlight the impact of job decentralization on the spatial distribution of low-income households. The authors note that while overall growth in suburban poverty was substantial between 1990 and the mid-2000s, suburban poverty rates grew fastest in metropolitan areas where employment was most decentralized—a trend they attribute to low-income workers following job opportunities in outlying communities. Similarly, Williams and Berube (2014) note that many of the fastest growing employment sectors in the U.S.—particularly retail and service—tend to be both low-skill and geographically dispersed. With suitable employment opportunities declining in some central-city areas, these jobs can act as a draw for poor workers and lead to higher poverty rates in suburban neighborhoods (Rosenbaum & Popkin, 1991).

2.2. Barriers to Low-Income Suburbanization

While several factors have pushed low-income households toward outlying areas over the past two decades, a number of barriers still exist that may prevent their widespread suburbanization. Race, for example, plays an outsized role in shaping households' residential location decisions, and the racial dynamics of suburban neighborhoods still work against a large-scale suburbanization of low-income black and Hispanic residents. Although the demographics in many suburban communities are changing rapidly, suburbs are still substantially whiter than

central-city neighborhoods (Parker et al., 2018). This means that low-income black and Hispanic families interested in making an urban-to-suburban move may face significant hurdles in doing so. Black families, for example, have a low likelihood of moving into predominantly white areas, and are quick to leave heavily white neighborhoods when they do live in them (Gramlich, Laren, & Sealand, 1992; Massey, Gross, & Shibuya, 1994; South & Crowder, 1997). Similarly, black and Hispanic families often face discrimination in their residential searches that may inhibit their relocation to suburban communities. While white households are generally shown housing options in majority white neighborhoods, black and Hispanic families often are steered away from homes in these areas, and directed toward housing in racially-mixed communities (Ross & Turner, 2005; Turner, 2008). Again, given the relatively high percentage of white residents in suburban areas, this reduces the likelihood that black and Hispanic families will ultimately settle in suburban neighborhoods, and represents a major barrier to the suburbanization of large numbers of low-income households.

In addition to race, transportation is another factor that may discourage low-income households from leaving urban areas for the suburbs. Because low-income households are less likely to own vehicles and more likely to be transit users (Giuliano, 2005; Renne & Bennett, 2014), they have a clear incentive to cluster in urban areas, particularly in neighborhoods that allow them good access to employment and amenities via public transportation (Brueckner & Rosenthal, 2009; Glaeser et al., 2008; Pathak et al., 2017). In fact, studies show that low-income, carless families often avoid making urban-to-suburban moves due to fears of being unable to reach important destinations without automobiles (Clampet-Lundquist, 2004; Rosenblatt & DeLuca, 2012). Furthermore, these households are sometimes unable to even consider searching for homes in suburban areas due to their physical inability to reach such properties (Clampet-

Lundquist, 2004). For those carless low-income individuals that do relocate to the suburbs, evidence suggests a lack of transportation access is acutely problematic. Researchers find significant levels of neighborhood dissatisfaction among carless households living in areas with poor transit service, and note that urban-to-suburban movers with no vehicle often express frustration regarding the transportation challenges in their new communities (Briggs, Popkin, & Goering, 2010; Dawkins, Jeon, & Pendall, 2015).

While a lack of automobile access can prevent urban-to-suburban moves for low-income families, a more general shortage of resources may also contribute to the inability of poor urban households to move to suburban neighborhoods. Displacement, evictions, substandard housing quality, and financial instability all disproportionately affect poorer households, and tend to result in sudden, unplanned, relatively short-distance moves (Bartlett, 1997; Rosenblatt & DeLuca, 2012). For urban households that are forced to make such moves, there is clearly little opportunity—both in terms of time and economic resources—to consider relocation to a relatively distant suburban neighborhood. Furthermore, "life-course" events (Rossi, 1955) such as marriages or the birth of a child that often precipitate household relocations tend to affect low- and non-low-income families in different ways. For example, while wealthier families can choose from a range of spatial locations when "upgrading" to larger homes, low-income households tend to have limited choices and information in their housing searches, and often settle in poorer urban neighborhoods in order to obtain homes with adequate space (Rosenblatt & DeLuca, 2012).

Against this complex background, important questions remain unanswered regarding the residential relocation patterns of low-income households. First, existing research does not fully demonstrate the degree to which low-income households have left urban areas for suburban

communities over the past two decades. While there are clearly many factors that might either encourage or discourage such moves, little is known about the actual aggregate movement of low-income families between urban and suburban areas.[2] Secondly, there is a notable lack of empirical data on households that do, in fact, move between central cities and suburbs. To date, scholars have not specifically examined the determinants of urban-to-suburban moves, meaning the characteristics correlated with these potentially complex relocations have yet to be identified. This analysis aims to address these gaps in two stages: first by examining population flows to and from urban and suburban neighborhoods; and second by using multivariate techniques to isolate the various characteristics that are associated with residential relocations between these distinct geographies.

3. Data and Methodology

3.1. Data

3.1.1. Panel Study of Income Dynamics

The Panel Study on Income Dynamics (PSID) provides the main data source for this analysis. The PSID began in 1968 as a nationally-representative longitudinal survey of the socioeconomic and demographic characteristics of just under 5,000 families. Interviews were carried out annually between 1968 and 1997 and have been conducted biannually from 1998 onward. During its 50-year history, the PSID has interviewed over 77,000 individuals, including approximately 26,000 people from roughly 9,000 families during the 2015 wave.

[2] Cooke (2010) is a notable exception. He suggests that population flows have relatively little influence on suburban poverty rates, and that the growth of suburban poverty is instead due to declining economic conditions in many suburban communities.

In many ways, the PSID is an ideal dataset for this analysis. First—and most importantly—it allows me to determine whether or not households made a residential move between survey waves. Each survey wave contains a variable indicating if a family has moved since the previous administration of the survey, as well as an indicator of the primary reasons for a given move. Because the PSID is longitudinal, I am then able to use its household- and individual-level socioeconomic data to evaluate the pre- and post-move characteristics of households in the sample. Another important advantage of the PSID is that there is a confidential geocoded version of the survey. This geocoded version contains tract-level indicators for all households in a given survey wave. This level of geographic specificity is crucial, as a central component of this study involves identifying the types of neighborhoods that families are moving into and out of—specifically, moves from urban to suburban areas. Therefore, by using this restricted version of the PSID, I can track the geography of household moves, and identify features of both a household's origin and destination neighborhood.

3.1.2. Low-Income Households

Because I am focused on the residential mobility of low-income households, defining "low income" is clearly an important consideration. To this end, I categorize households into either low-income or non-low-income status based on guidelines from the U.S. Department of Housing and Urban Development's (HUD) Section 8 housing assistance payments program. While the federal poverty threshold may be the most common method of sorting households by income, I use the HUD measure for two primary reasons. First, the census poverty calculation does not account for geographical cost-of-living differences. This means that while two households may have the same income and similar consumption patterns, their financial burden

could be far different depending on whether they live in an area with high or low consumer prices. Ideally, any measure of financial wellbeing will consider local variations in cost of living so as to better assess a household's true level of economic security (Blank, 2008; National Research Council, 1995). Second, aside from adjustments for increasing consumer prices, the federal poverty threshold is a stagnant measure: it has been based on the same factor—a basic household food budget—since its development in the early 1960s. As a result, the measure does not capture changes in the fundamental needs of households—changes that are generally associated with rising standards of living, and that are incorporated into the relative estimate used by HUD (Blank, 2008).

3.1.3. Neighborhood Types

In addition to identifying low-income households, I also classify the types of communities that low-income households are moving out of and moving into. To do so, I categorize neighborhoods according to a typology developed by Voulgaris, Taylor, Blumenberg, Brown, and Ralph (2016). This typology is based on a comprehensive suite of built-environment and transportation-related characteristics drawn from the U.S. Census and the Environmental Protection Agency's (EPA) Smart Location Database (Environmental Protection Agency, 2014). Using these variables in combination with factor analysis and cluster analysis, the authors divide each of the roughly 73,000 census tracts in the U.S. into one of seven neighborhood types: rural, new development, patchwork, established suburb, urban residential, mixed use, and old urban. Three of these neighborhood types can be classified as suburban areas (new development, patchwork, established suburb) and three of them can be classified as urban areas (urban

residential, mixed use, and old urban). A brief overview of each of the neighborhood types is shown below in Table 1-1.

Table 1-1: Neighborhood Types

	Description	Mean housing density[1]	Mean job accessibility[2]	Transit supply index[3]	% of tracts (all US[4])	% of tracts (PSID sample[4])
Old Urban	High-density, transit-rich areas, generally in central cities	27.5	533	4.2	5.4	3.5
Mixed Use	Urban commercial/industrial districts	5.2	181	1.1	7.0	5.8
Urban Residential	Residential neighborhoods, generally in central-cities	5.9	147	0.8	16.7	15.6
Established Suburb	Older, mostly residential suburban neighborhoods	4.1	186	0.6	17.1	18.0
Patchwork	Mixture of residential and commercial land uses in suburban areas	1.7	94	0.1	17.6	18.0
New Development	Mostly new, low-density suburban neighborhoods, generally in outlying portions of metropolitan areas	1.4	68	0.0	24.2	27.4
Rural	Non-urban and non-suburban development	0.1	14	0.0	12.0	11.8

Adapted from Blumenberg et al. (2015); U.S. Environmental Protection Agency (2014)
[1]Housing units per acre
[2]Jobs within a 45-minute drive (in thousands)
[3]Composite index of transit supply; see Blumenberg et al. (2015) for details
[4]MSAs only

There are two primary advantages to using such a refined neighborhood typology for this analysis. First, the seven-category typology allows for a far more nuanced understanding of household relocation patterns than other analyses that examine the suburbanization of poverty. For the most part, previous analyses have divided neighborhoods into either two categories (central city and suburbs) or three categories (central city, inner suburbs, outer suburbs). While this is an intuitive and convenient categorization, it ignores a good deal of variation within these various geographies. A more refined classification system allows for a better understanding of the origins and destinations of households making moves between urban and suburban areas.

Second, the classification scheme used in this analysis categorizes neighborhoods by a far more diverse and complete set of variables than prior studies. Researchers have typically categorized neighborhoods either by jurisdictional boundaries, or by the time period in which the majority of a neighborhood was developed (Howell & Timberlake, 2014; Kingsley & Pettit, 2003; Kneebone & Holmes, 2014; Yang & Jargowsky, 2006). Unfortunately, these methodologies have some important shortcomings. In particular, jurisdictional classifications are often poor proxies for a neighborhood's relative level of "urbanness," (see Cooke, 2010, for a discussion), while neighborhoods developed during the same time period can vary dramatically on a number of key features, such as their population and employment density or their access to public transportation. Not only does the multivariate system used in the present study permit the classification of neighborhoods across a range of built-environment dimensions, but it also allows for the inclusion of characteristics such as job access and transit supply in the analysis—variables that are rarely, if ever included in studies of urban-suburban population dynamics.

Despite its advantages, there are some shortcomings of this typology that merit recognition. First, several of the variables from the dataset used to develop the neighborhood

types are only available for 2010. This means that while neighborhoods may gradually change in character over the study period, I am only able to categorize an area at one point in time. While this is undoubtedly a limitation, neighborhood built-environment and transportation characteristics tend to change rather slowly, particularly in neighborhoods that are already heavily developed. For example, the correlation between population density in 2000 and 2015 is 0.85 or above for all neighborhood types. Similarly, the correlation between the percent of the population commuting by transit in 2000 and 2015 is above 0.8 for all neighborhood categories except for new development and rural areas. These correlations suggest that while most neighborhood types are rather stable, transitions from relatively undeveloped areas, specifically rural neighborhoods, into new development communities may be an area of minor concern.

Furthermore, although there is clearly strong a connection between neighborhood type and location, the classification of census tracts does not specifically consider a neighborhood's spatial location. One must therefore exercise caution when drawing connections between a given neighborhood type and its position within an urban agglomeration. For example, old urban neighborhoods are often adjacent to mixed use and urban residential neighborhoods, and all three of these urban neighborhood types tend to lie in the heart of metropolitan areas. Similarly, new development neighborhoods are frequently spatially distant from urban neighborhood types, and commonly abut rural census tracts. Thus, it is possible to generalize about where each of these neighborhoods is located within an urban region, and which neighborhood types are likely to be adjacent and which are likely to be physically separated. However, it is important to remember that these are generalizations: absent the type of spatially-specific data included in some other analyses (Cooke, 2010; Lee & Leigh, 2007), it is not possible to draw definitive conclusions regarding the actual location of the various neighborhood types.

3.2. Methodology

In order to paint a clearer picture of residential relocation patterns among low-income households, the first part of this analysis examines aggregate population changes for the seven neighborhood types during each wave of the PSID. I use the geocoded PSID data to track households that move from one neighborhood type to another, obtaining a raw count of how many individuals are leaving and entering a given geography during each administration of the survey. I then use these counts to calculate the percentage change in both low- and non-low-income population due to residential relocations for each neighborhood category throughout the duration of the study period. Finally, I again use data on inflows and outflows to calculate changes in the proportion of low-income residents for each neighborhood type, allowing me to isolate the effect of residential relocations on the overall income composition of neighborhoods.

In addition to evaluating the population dynamics associated with household relocations, I also develop a modelling strategy to examine relationships between household-level characteristics and the types of neighborhoods that families move out of and into. The literature on residential relocation highlights a number of features that are reliable predictors of household moves (Clark, 2013; Clark & Davies Withers, 2007; Diaz-Serrano & Stoyanova, 2010; Dieleman, 2001). The majority of these characteristics are so-called "life-course" factors (Rossi, 1955)—substantial life changes such as marriage, divorce, the birth of a child, the death of a household member, retirement, job loss, or a job change—that might precipitate the need for a change of residence.

Traditionally, researchers have used these life-course variables to identify families with an increased propensity to move *relative to non-moving households*. By contrast, because I am

interested in the geographic origins and destinations of *only* moving households, I am able to utilize PSID data that directly captures a household's motivation(s) for a move. Respondents, for example, state whether their household move was occasioned by a job-related event, a need for more housing, a search for less or cheaper housing, or a desire for a better neighborhood. Because these motivations are comprehensive and parsimonious, I include them as independent variables in lieu of the discrete life-course variables discussed above.

I also include several other independent variables that scholars show to be associated with residential moves such as income, education level, race, home ownership, region within the U.S. (Northeast, Midwest, South, or West), and the population of the metropolitan area in which a household resides.[3] Furthermore, I incorporate a categorical variable measuring household car ownership. I define households as being either "fully equipped" (i.e., having at least one vehicle per household adult), "car deficit" (i.e., having fewer vehicles than household adults), or carless. While car ownership is typically not considered a determinant of household moves, I include it here because, as I note previously, past research suggests vehicle access affects the residential location decisions of low-income households (Clampet-Lundquist, 2004; Glaeser et al., 2008; Rosenblatt & DeLuca, 2012).

Finally, to isolate associations between the aforementioned independent variables and a household's destination neighborhood, I specify six separate discrete-time logistic regression models (Allison, 1982). The discrete-time model form is a standard statistical approach for assessing the relationship between moves and their determinants (Clark & Davies Withers, 1999; Clark & Huang, 2003; Clark & Ledwith, 2006; Davies Withers, 1998; Dewilde, 2008). Three of

[3]I examine only households that live within a Metropolitan Statistical Area (MSA). Additionally, because the determinants of local moves differ significantly from long-distance moves, I restrict the sample to households that moved within the same MSA between a given survey wave (time *t*) and a subsequent survey wave (time *t +2*).

these models examine the likelihood of a low-income household making an urban-to-suburban move, and contain only movers who lived in urban neighborhood types (old urban, mixed use, urban residential) at time *t*. These models estimate the likelihood that a given low-income urban household relocated to 1) an established suburb neighborhood; 2) a patchwork neighborhood; or 3) a new development neighborhood, relative to making an intra-urban move. The three remaining models are identical in form to the first three models, but evaluate only non-low-income households, providing a background against which the determinants of low-income households' moves can be interpreted. Table 1-2 provides descriptive statistics for the variables included in each of the models, divided into low- and non-low-income groups.

Table 1-2: Descriptive Statistics for Urban Households that Moved between PSID Survey Waves

	Low-income urban movers (all)	Low-income movers (urban-to suburban movers only)	Non-low-income urban movers (all)	Non-low-income movers (urban-to suburban movers only)
% suburban move	33.3	100	41.2	100
% renter	92.0	88.6	78.6	75.7
MSA population (in millions)	2.9	2.5	3.6	2.99
% in Northeast region	17.5	10.8	22.2	12.2
% university graduate	13.9	15.6	49.1	43.3
% non-Hispanic white	43.1	50.0	71.7	70.2
Income (in 2015 dollars)	29,797	30,020	91,738	81,514
% fully equipped	50.4	56.3	75.3	80.6
Reason for move (%)				
Job	3.3	2.6	7.8	7.7
Bigger/better home	23.8	22.5	26.4	23.8
Smaller/cheaper home	12.9	9.3	7.7	7.3
Settle down	13.9	17.7	28.9	32.5
Find better neighborhood	9.3	10.6	5.7	4.8
Involuntary	17.4	17.5	9.6	8.1
Mixed	19.2	19.9	13.9	15.8
Moved from (%)				
Old urban	9.2	5.2	12.1	7.6
Mixed use	24.1	26.9	32.0	33.7
Urban residential	66.7	67.9	55.9	58.6
N	2,101	700	1,285	550

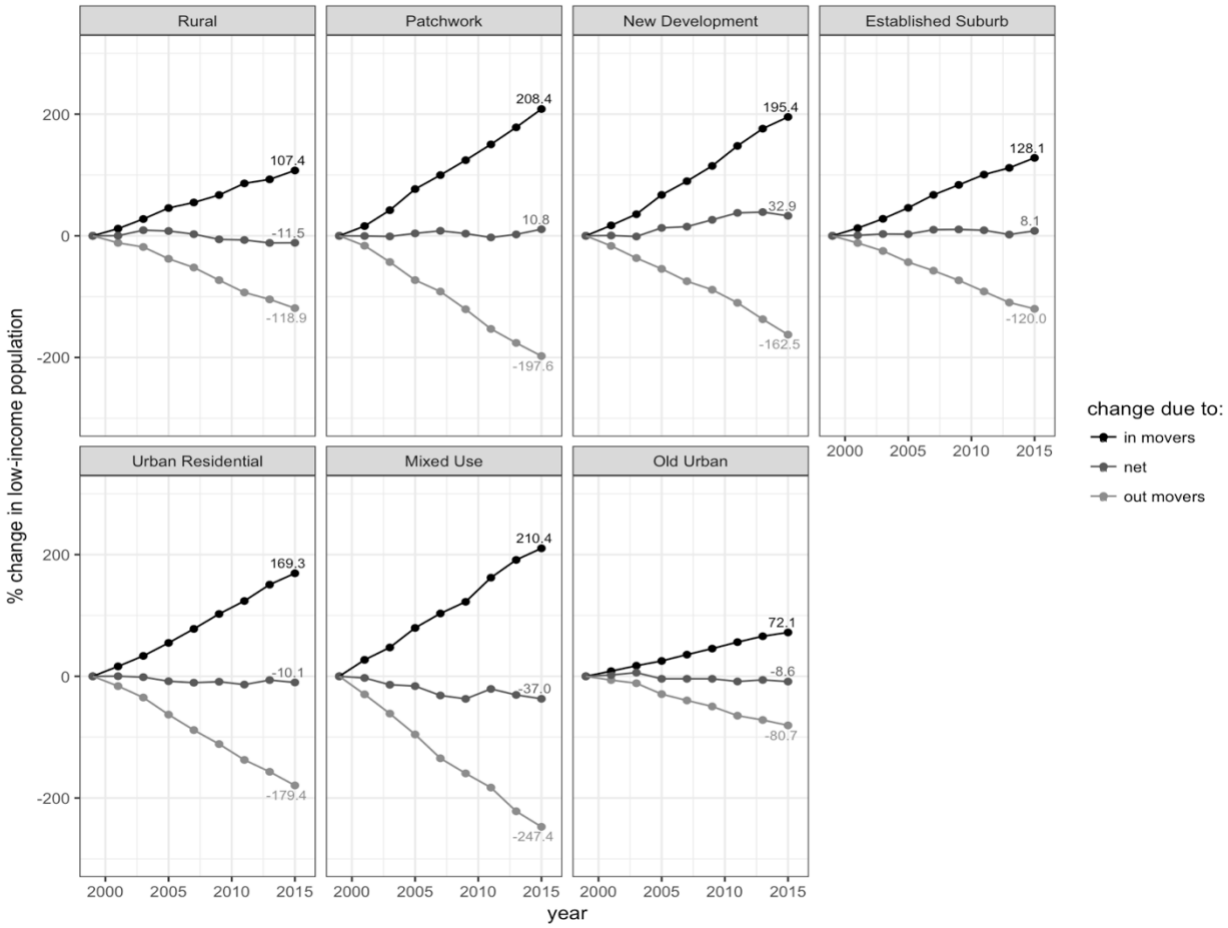
Source: Panel Study of Income Dynamics, 1999-2015

4. Results and Discussion

4.1. Population Flows

Figure 1-1 shows the percentage change in low-income population for each of the seven neighborhood types between 1999 and 2015. The top line in each graph represents increases in low-income population due solely to individuals moving into a given neighborhood type from a different geography; the bottom line shows decreases in low-income population due to households moving out of a neighborhood type; the center line denotes the aggregate change in low-income population resulting from all residential relocations.

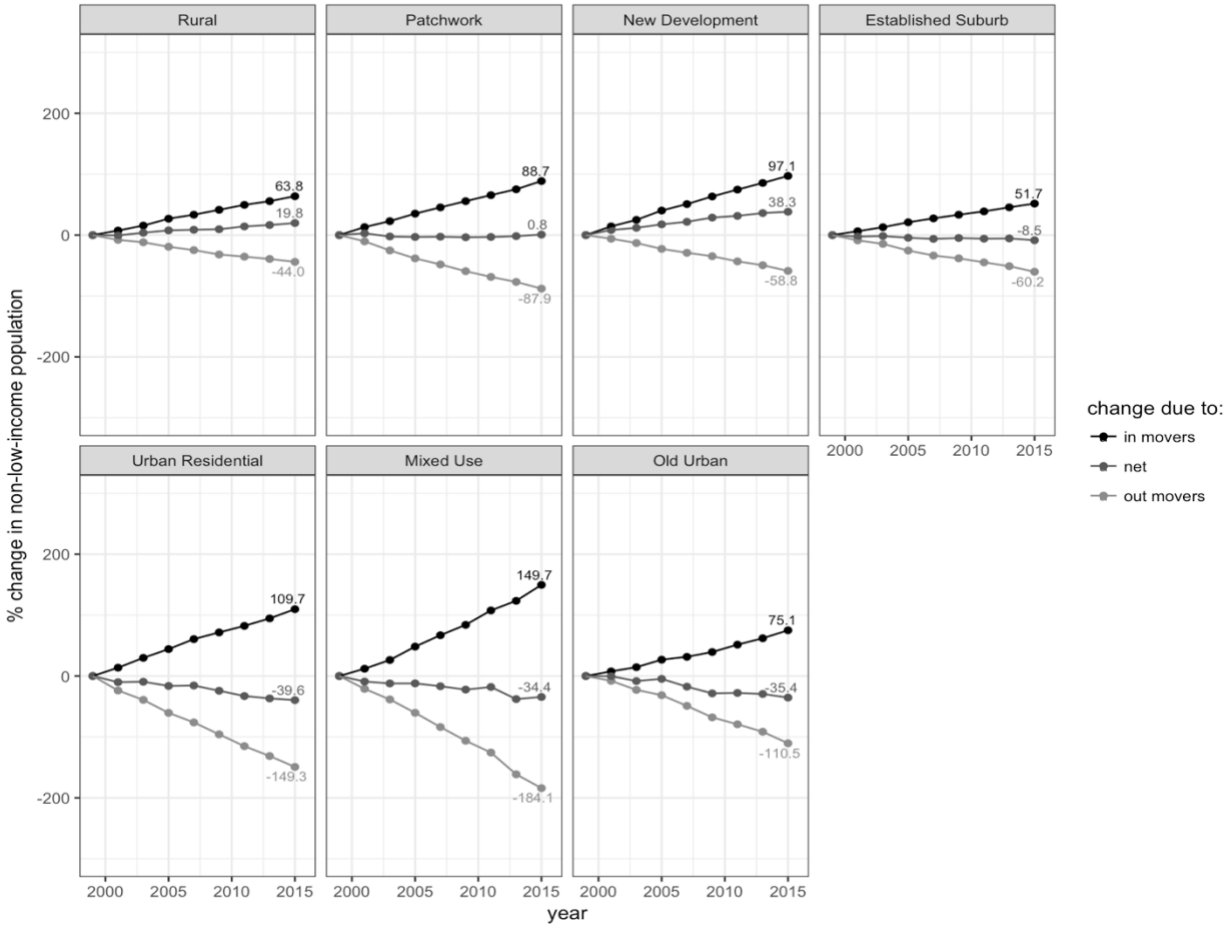
Figure 1-1: Low-Income Population Flows by Neighborhood Type, 1999-2015



Source: Panel Study of Income Dynamics, 1999-2015

For low-income households, there is a moderate but clear trend toward suburbanization. Since 1999, each of the three urban neighborhood types experienced a drop in its low-income population, with decreases in mixed use neighborhoods being particularly large (37 percent). The low-income population of suburban neighborhoods, on the other hand, grew between 1999 and 2015. Low-income population growth in new development neighborhoods was especially robust, increasing by almost 33 percent, while the population growth of low-income residents was much more modest in patchwork neighborhoods (10.8 percent) and established suburban neighborhoods (8.1 percent). Finally, rural neighborhoods experienced a moderate net decrease in their low-income population, with the proportion of low-income residents dropping by 11.5 percent relative to 1999.

Figure 1-2: Non-Low-Income Population Flows by Neighborhood Type, 1999-2015



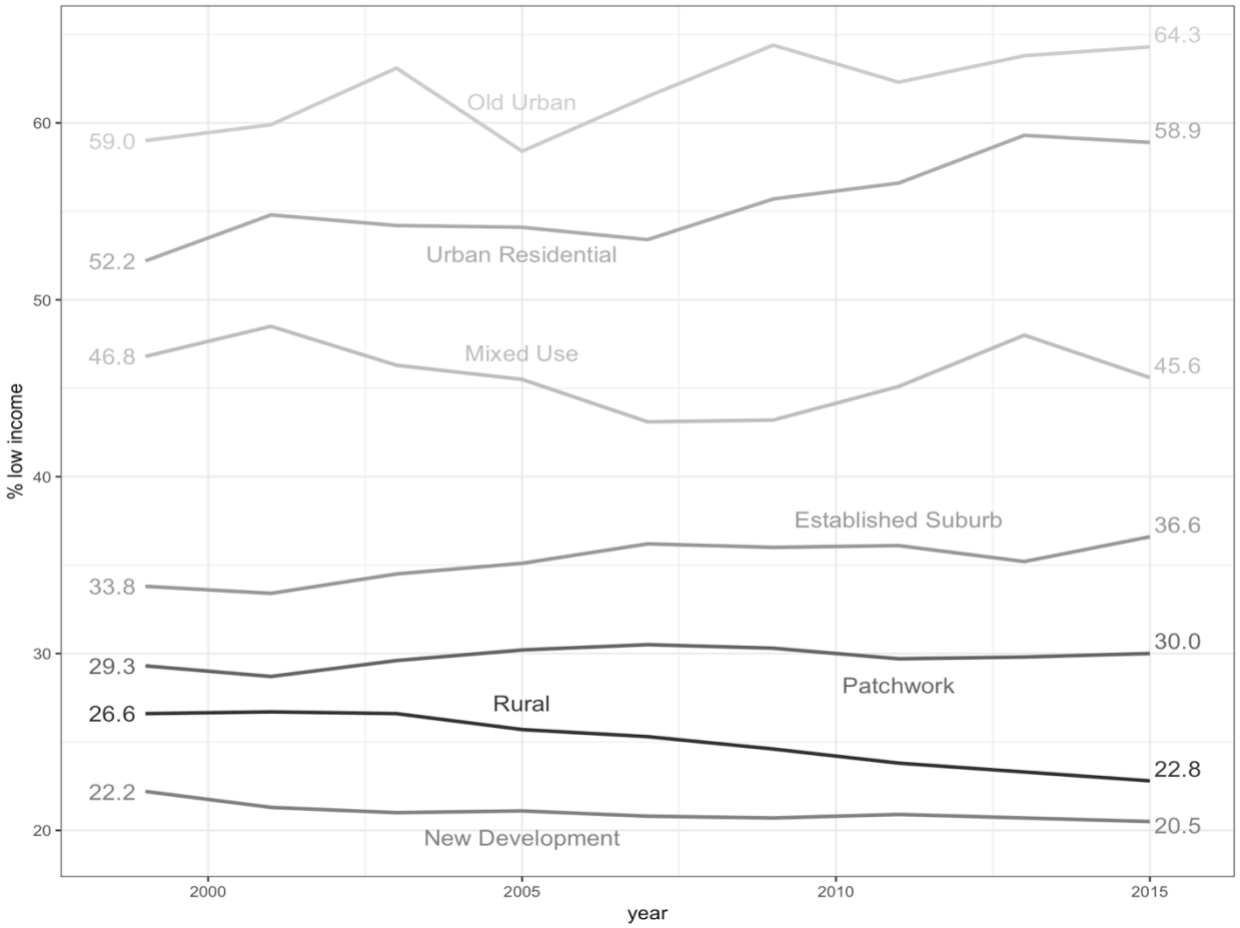
Source: Panel Study of Income Dynamics, 1999-2015

Figure 1-2 provides data on population flows of non-low-income households. These families, like their low-income counterparts, moved in large numbers to new development neighborhoods: since 1999, the non-low-income population of new development areas grew by over 38 percent. Unlike low-income families, however, non-low-income households did not appear to be drawn to other suburban neighborhood types: the non-low-income population in patchwork areas grew by only 0.8 percent during the study period, while the proportion of non-low-income residents in established suburb communities dropped by 8.5 percent. In urban neighborhoods, the population flows of non-low-income households, while similar to the trends of low-income families, were somewhat more pronounced. In fact, all of the urban neighborhood

types experienced non-low-income population drops of over 30 percent. Finally, the non-low-income population of rural neighborhoods grew substantially, increasing by 18 percent since 1999.

Figure 1-3 shows how residential relocations affected the percentage of low-income residents in the seven neighborhood types between 1999 and 2015. The values on the far left of the figure represent the percentage of the population in each of the neighborhood categories that was low income in 1999. Subsequent changes in the proportion of low-income residents in a given neighborhood reflect net population changes *due only to movers*.

Figure 1-3: Change in Percent Low Income due to Movers by Neighborhood Type, 1999-2015



Source: Panel Study of Income Dynamics, 1999-2015

It is clear from Figure 1-3 that in urban neighborhoods—particularly in urban residential and old urban neighborhoods—net population flows were responsible for notable increases in the proportion of low-income residents since 1999: nine percent in old urban neighborhoods (from 59 percent to 64.3 percent) and almost 13 percent in urban residential neighborhoods (from 52.2 percent to 58.9 percent). In suburban neighborhoods, by contrast, the influence of residential migrations had more modest impacts on the concentration of low-income residents. The proportion of low-income residents grew by 8.3 percent in established suburb neighborhoods (from 33.8 percent to 36.6 percent) and by 2.4 percent in patchwork neighborhoods (from 29.3 percent to 30 percent). Perhaps most notably, residential relocations led to a decrease in the proportion of low-income residents living in new development neighborhoods, with rates dropping by 7.7 percent (from 22.2 percent to 20.5 percent) during the study period. Lastly, rural neighborhoods had the most significant decrease in their proportion of low-income residents, while mixed use neighborhoods experienced substantial volatility during the study period.

Viewed in aggregate, the trends illustrated in Figures 1-1 through 1-3 show that low-income households have undoubtedly suburbanized. Figure 1-1 demonstrates that while each of the urban neighborhood types experienced a decline in its low-income population since 1999, the percentage of low-income residents in all of the suburban neighborhoods grew between 1999 and 2015. Figure 1-2, however, shows that the flow of low-income households out of urban neighborhoods and into suburban communities is not unique: non-low-income households suburbanized as well, in some cases at a faster rate than their low-income counterparts. Two trends highlighted by Figure 1-3 demonstrate this particularly well. First, while the low-income population of old urban and urban residential neighborhoods dropped dramatically between 1999 and 2015, the *proportion* of low-income residents in these neighborhoods rose considerably. This

finding suggests that although low-income households left such neighborhoods to a substantial degree, higher-income families abandoned them even more rapidly. Second, despite a considerable influx of low-income households into new development communities since 1999, the overall percentage of low-income residents in these neighborhoods declined. This again demonstrates that flows of low-income residents out of urban neighborhoods and into suburban areas, while significant, generally have been met by even larger flows of non-low-income households in the same direction.

4.2. Determinants of Residential Location Change

Table 1-3 provides the results of the six discrete-time logistic regressions. Each model represents the likelihood of a given household moving from an urban neighborhood to a specific suburban neighborhood type. Urban residents are defined as those living in old urban, mixed use, and urban residential areas at time *t*.

Table 1-3: Likelihood of Making an Urban-to-Suburban Move, Various Geographies

	Low income	Non-low income	Low income	Non-low income	Low income	Non-low income
Likelihood of making a(n) _____ move (versus making an intra-urban move)	**Urban to established suburb**		**Urban to patchwork**		**Urban to new development**	
Renter	-0.119	-0.123	-0.272	0.324	0.063	-0.288
	(0.278)	(0.253)	(0.274)	(0.258)	(0.320)	(0.207)
CBSA population (ln)	0.107	-0.007	-0.200**	-0.251**	-0.035	-0.198*
	(0.066)	(0.101)	(0.065)	(0.090)	(0.073)	(0.084)
Region (Northeast)						
Midwest	0.070	0.399	0.713*	0.267	1.117*	1.975***
	(0.202)	(0.293)	(0.335)	(0.393)	(0.544)	(0.569)
South	-0.410*	-0.815**	1.124***	0.713*	2.120***	2.515***
	(0.205)	(0.299)	(0.324)	(0.344)	(0.529)	(0.544)
West	-1.033***	-0.760*	0.664	0.005	1.682**	1.924***

	(0.295)	(0.338)	(0.357)	(0.378)	(0.543)	(0.555)
Education (No high school diploma)						
High school graduate	-0.233	-0.393	-0.099	-0.401	-0.070	-0.097
	(0.152)	(0.387)	(0.173)	(0.356)	(0.204)	(0.346)
Some college	-0.350*	-0.385	-0.216	-0.132	0.115	0.238
	(0.173)	(0.388)	(0.192)	(0.355)	(0.209)	(0.346)
College graduate	-0.663*	-0.646	-0.022	-0.203	-0.598*	0.119
	(0.272)	(0.406)	(0.240)	(0.359)	(0.284)	(0.350)
Job change (*t*, *t* + *2*)	0.071	0.102	0.194	-0.002	0.236	-0.034
	(0.126)	(0.199)	(0.137)	(0.195)	(0.152)	(0.172)
Race/ethnicity (Non-Hispanic white)						
Black	0.171	0.391	-0.493**	-0.421	-0.918***	-0.331
	(0.191)	(0.237)	(0.178)	(0.227)	(0.195)	(0.207)
Hispanic	-1.284	0.494	-0.109	-14.268	-1.211	0.240
	(0.765)	(0.863)	(0.473)	(545.718)	(0.771)	(0.695)
Asian	1.086	0.301	0.588	-0.058	0.537	-0.288
	(0.583)	(0.728)	(0.577)	(0.818)	(0.594)	(0.737)
Other	-0.128	-0.409	-1.624**	0.157	-0.677	-0.429
	(0.428)	(0.617)	(0.619)	(0.506)	(0.444)	(0.525)
Income (ln)	0.119	0.096	-0.025	-0.165	0.055	-0.180
	(0.063)	(0.210)	(0.055)	(0.214)	(0.077)	(0.185)
Car ownership (Fully equipped)						
Carless	0.011	-0.980*	-0.319	-0.489	-0.875***	-1.029*
	(0.149)	(0.420)	(0.171)	(0.419)	(0.197)	(0.503)
Car deficit	-0.259	-0.183	-0.079	-0.182	-0.570**	-0.144
	(0.195)	(0.252)	(0.188)	(0.250)	(0.212)	(0.225)
Reason for move (Job related)						
Find bigger/better home	0.316	-0.066	-0.521	0.151	-0.117	0.406
	(0.461)	(0.475)	(0.328)	(0.498)	(0.390)	(0.410)
Find smaller/cheaper home	0.274	0.081	-0.249	0.490	0.117	-0.608
	(0.490)	(0.524)	(0.353)	(0.547)	(0.414)	(0.545)
To settle down	0.387	0.772	-0.432	0.663	0.470	0.995*
	(0.473)	(0.462)	(0.341)	(0.488)	(0.390)	(0.408)
To find better neighborhood	0.855	-0.458	0.138	0.368	0.388	-0.500
	(0.478)	(0.597)	(0.357)	(0.559)	(0.427)	(0.567)
Involuntary move	0.666	-0.450	-0.419	0.307	-0.107	0.123
	(0.466)	(0.535)	(0.345)	(0.526)	(0.414)	(0.454)

Mixed reasons	0.515	0.202	-0.265	0.326	0.257	0.360
	(0.463)	(0.508)	(0.336)	(0.530)	(0.398)	(0.455)
Origin neighborhood type (Old urban)						
Urban residential	0.436	-0.481	2.080***	0.547	1.508**	0.350
	(0.230)	(0.320)	(0.595)	(0.485)	(0.525)	(0.457)
Mixed-use	0.290	-0.433	1.947**	0.708	1.337*	0.172
	(0.266)	(0.356)	(0.608)	(0.499)	(0.544)	(0.472)
Year (1999)						
2001	0.025	-0.285	-0.102	-0.191	-0.354	-1.087**
	(0.316)	(0.438)	(0.331)	(0.418)	(0.399)	(0.363)
2003	0.231	0.149	-0.072	-0.275	0.108	-0.438
	(0.307)	(0.460)	(0.337)	(0.465)	(0.378)	(0.364)
2005	0.278	0.121	-0.142	-0.087	0.331	-1.024**
	(0.292)	(0.446)	(0.325)	(0.419)	(0.356)	(0.378)
2007	0.106	-0.259	0.114	-0.571	0.005	-0.797*
	(0.300)	(0.446)	(0.314)	(0.432)	(0.360)	(0.349)
2009	-0.100	-0.550	0.104	-0.758	-0.013	-1.071**
	(0.303)	(0.446)	(0.320)	(0.429)	(0.367)	(0.355)
2011	-0.223	0.188	0.248	-0.414	0.323	-0.541
	(0.312)	(0.416)	(0.314)	(0.419)	(0.355)	(0.352)
2013	-0.097	-0.298	0.143	-0.787	-0.003	-0.940**
	(0.303)	(0.431)	(0.310)	(0.430)	(0.360)	(0.347)
Constant	-4.662***	-1.336	-0.395	3.266	-4.350**	2.159
	(1.333)	(2.757)	(1.335)	(2.644)	(1.591)	(2.384)
Observations	1,861	811	1,811	813	1,760	893
Log Likelihood	-830.002	-346.499	-726.739	-357.097	-602.380	-433.550
Akaike Inf. Crit.	1,724.003	756.998	1,517.478	778.194	1,268.760	931.100
Pseudo R^2	0.09	0.09	0.09	0.08	0.12	0.15

*p < 0.05 **p < 0.01 ***p<0.001

Note: Person level variables (education, job change, and race/ethnicity) are for the household head. All variables are measured at time *t* unless otherwise noted. Standard errors are in parentheses and are clustered at the household level.

For urban movers, several variables serve as predictors of relocation to a given suburban neighborhood type. The population of a household's MSA, for example, is correlated with the likelihood of making an urban-to-suburban move for all income levels, as is the region in which

a family resides. Education shows some associations with the geography of household relocations, with better educated low- and non-low-income households being less likely to move to established suburb neighborhoods than to make an intra-urban relocation. Year variables, while generally uncorrelated with the geography of a move, suggest that non-low-income urban households are becoming less likely to make moves to new development neighborhoods as time passes.

Race—specifically, being in a family with a black household head—is also key predictor of residential location decisions. While the likelihood of moving between urban neighborhoods and established suburb communities does not differ between low-income black and white households, low-income black families have a substantially lower probability of moving to patchwork and new development neighborhoods. This finding suggests that low-income black families are more likely to make intra-urban moves than to relocate to low-density, outlying suburban neighborhoods. In contrast to the strong connection between race and the settlement patterns of low-income households, the impact of race on the residential location decisions of non-low-income households is far more muted. In fact, the settlement patterns of higher-income black families show no statistically significant differences from white families.

In addition to race, vehicle ownership is also a noteworthy determinant of urban-to-suburban moves. Perhaps not surprisingly, for low-income households, a lack of vehicle access is associated with a decreased likelihood of moving from urban areas to the most sprawling and car-centric suburban neighborhood type. Specifically, both carless and car-deficit low-income households have a higher probability of making an intra-urban move than of moving to a new development neighborhood. For non-low-income households, the relationship is somewhat different: only carlessness is predictive of relocation geography. Non-low-income households

without an automobile have a lower likelihood of making both an urban-to-new development move and an urban-to-established suburb move relative to relocating within an urban area. Having a car deficit, by contrast, shows no association with non-low-income households' destination neighborhoods.

In terms of movers' origin neighborhoods, the results suggest that low-income urban movers are more likely to suburbanize—particularly to sprawling, outlying areas—if they already live in a community that is somewhat suburban in character. Relative to movers from densely-populated, heavily-developed old urban neighborhoods, households in urban residential areas are significantly more likely to make a move to a patchwork or new development neighborhood than to relocate within an urban neighborhood. For those living in mixed use communities, the pattern is similar. The relationship between origin and destination neighborhood for non-low-income households, however, is far different, with the residential relocations of these families being less geographically constrained. Simply put, there is no association between the origin and destination neighborhoods among higher-income households, and these households have the same likelihood of moving to any of the suburban neighborhood types—even those that may be spatially distant—as of making an intra-urban move.

Finally, and somewhat surprisingly, the variables that address households' motivations for moving are almost wholly unassociated with the neighborhood to which they relocate. For low-income families, the reasons behind a move show no statistical association with their ultimate neighborhood of residence. This is generally true for non-low-income households as well, with one exception: relative to households that move for a job change, families hoping to "settle down" are more likely to relocate to new development communities than to stay in an urban neighborhood.

4.3. Discussion

These results underscore several notable trends regarding the residential mobility of low-income households. One of the most salient of these factors is the role that neighborhood of origin plays in a household's post-move destination. For the last several decades, both national and local policy makers have pursued a strategy of poverty decentralization, aiming to alleviate the acute concentrations of poverty that characterized many urban neighborhoods during the latter half of the 20th century (Covington et al., 2011; Williamson et al., 2009). To this end, research shows that voucher programs and the Low-Income Housing Tax Credit influence the spatial distribution of low-income households.

Although this analysis does not specifically evaluate such programs, it does shed light on how policies that aim to influence households' settlement patterns might function. Unlike higher-income families, who may not hesitate to move between dense old urban neighborhoods and sprawling new development communities, low-income households make relatively modest relocations in terms of residential geography. Specifically, low-income movers who change neighborhood types are far more likely to settle in areas that are physically similar (and likely spatially proximate) to their community of origin. The results show that low-income households living in old urban neighborhoods rarely relocate to outlying neighborhoods, and urban movers are most likely to suburbanize if their community of origin is modestly suburban in character. This suggests that the relocation patterns of low-income households are largely incremental, and that dramatic locational shifts are relatively rare. Planners and officials would thus do well to consider these tendencies, and maintain realistic expectations for any policies aimed at deconcentrating economic or social distress.

The role of car ownership in the relocation decisions of low-income households is also noteworthy. Qualitative research highlights the fact that automobile access affects both the neighborhoods where families search for housing and the areas in which they eventually settle (Clampet-Lundquist, 2004; Rosenblatt & DeLuca, 2012). The results of this analysis provide some quantitative evidence to support both of these notions. Relative to households with one vehicle per adult, urban households with limited vehicle access are significantly less likely to move to new development communities than to relocate within an urban area. Because new development communities are particularly car-centric, these findings suggest that transportation concerns may be at play when low-income carless and car-deficit households avoid settling in these areas. Similarly, new development communities also tend to be spatially removed from urban neighborhoods. This means that the paucity of moves between urban areas and new development neighborhoods may be due to physical distance. It is also important to note that while non-low-income households with limited vehicle access show some parallels with low-income families in their relocation patterns, the dynamics that underlie these trends are almost certainly very different. Non-low-income households with limited vehicle ownership are far more likely to have *chosen* to restrict their household automobile fleet compared to those with low-incomes (Brown, 2017), and studies demonstrate that poorer households without vehicles eagerly acquire them as soon as they are able (Blumenberg & Pierce, 2012; Goodman-Bacon & McGranahan, 2008). Therefore, while wealthier households may avoid car-centric neighborhoods due to a preference for a relatively car-free lifestyle, low-income households are far more likely to eschew these areas due to a limited level of mobility stemming from financial constraints.

Race, like automobile ownership, is also a key determinant of low-income households' residential relocation patterns. Relative to their white counterparts, low-income black movers are more likely to relocate within urban neighborhoods than to move into suburban communities. For non-low-income black families, however, this trend is notably absent: non-low-income black families are equally as likely as whites to move into each of the suburban neighborhood types.

In light of past research, these results—particularly with regard to low-income black families—are not surprising: a large body of literature shows that, on average, black and white families face very different circumstances and as a result make dramatically different residential location decisions (Gramlich et al., 1992; Massey et al., 1994; South & Crowder, 1997). These analyses, however, tend to focus on how the racial characteristics of origin and destination neighborhoods influence household settlement patterns. This study, by contrast, examines how the physical and spatial features of neighborhoods affect where a household decides to relocate. Because the neighborhood types used in this analysis were developed without regard to demographic characteristics, results can serve as additional evidence of the role of race in residential relocation patterns: not only is race a primary determinant of the demographic makeup of a family's destination neighborhood, but it is also strongly associated with the physical environment in which low-income households ultimately reside.

For non-low-income households, the dynamics are somewhat different. Higher-income black families are equally likely to move to suburban neighborhoods as their white counterparts. Although there may be numerous reasons for the distinct relocation patterns of low- and non-low-income black households, these differences potentially stem from the complex relationship between economic resources, racial discrimination, and residential mobility. While higher-income black households may still suffer from substantial levels discrimination in their search

for housing, their economic resources might nevertheless allow them to select into suburban neighborhoods that fulfill specific demographic and built-environment preferences. By contrast, low-income black families—particularly those using Section 8 vouchers—face far more limitations in their residential location choices, and research shows that these households often have considerable difficulty securing housing in suburban neighborhoods (Gill, 2012). Given their limited economic means, poorer black households likely have few suitable housing options in patchwork and new development neighborhoods—options that may be further constrained by discriminatory practices—making intra-urban moves more attractive than urban-to-suburban relocations.

Finally, this study highlights the association—or more specifically, the lack of association—between the factors that underlie household relocations and the types of neighborhoods into which families actually settle. Since the 1950s, the so-called "life course" theory (Rossi, 1955) has dominated researchers' understanding of the motivations for household moves, with a range of studies confirming the importance of these life course variables as determinants of household relocations (Clark, 2013; Clark & Davies Withers, 1999, 2007; Diaz-Serrano & Stoyanova, 2010; Dieleman, 2001). However, while there is strong evidence to suggest that life stages predict if and when a household moves, it seems that these characteristics have little relationship with *where* low-income families relocate. Moves motivated by a desire for a larger or smaller home—variables that serve as proxies for increasing and decreasing family size, respectively—are not related to relocations between urban and suburban neighborhoods, nor are moves made toward the goal of "settling down." Other, non-life course motivations such as a desire for a better neighborhood or moves for mixed or involuntary reasons, are also unrelated to urban-to-suburban transitions. Even for non-low-income

households, who presumably have a wider variety of relocation options, the motivation behind a move shows very little association with its geography. While there may be numerous factors that contribute to the disconnect between why and where low-income (and non-low-income) families move—for example, the decentralization of employment, the rise in automobility, or the overall suburbanization of the population—the lack of association between the motivations and the geography of low-income households' moves is nevertheless rather unexpected.

5. Conclusion

Numerous studies highlight a socioeconomic shift in many metropolitan areas over the past two decades, with increasing numbers of low-income residents now living outside of the central city. This analysis sheds light on two aspects of this trend: first, it assesses the degree to which intra-metropolitan residential relocations have affected the low-income rates of suburban communities; second, it identifies the characteristics of low-income households that are most likely to leave urban areas for suburban neighborhoods. Results show that while low-income households exited urban neighborhoods for suburban communities during the study period, higher-income families also rapidly suburbanized. These trends mean that residential relocations had only a modest impact on the income composition of suburban neighborhoods. Furthermore, findings from the multivariate models show that low-income households that suburbanized had different characteristics than those that remained in urban neighborhoods. Urban-to-suburban movers were more likely to be white, own automobiles, and live in origin neighborhoods with suburban characteristics than families that made intra-urban moves.

These findings have important implications for policy. First, despite the relatively modest influence of household relocations on low-income rates, it is clear that residential mobility has

led to substantial growth in the low-income population of suburban neighborhoods. This means that even in the context of stable neighborhood-level income dynamics, a large number of economically vulnerable households have left central cities for outlying areas. Of course, new arrivals to the suburbs will face an array of challenges with regard to their economic wellbeing, their social networks, and their ability to reach destinations. Unfortunately, research shows that, relative to central cities, suburban areas are often ill-equipped to provide social services and assistance to struggling residents, and that new suburbanites frequently tend to have difficulty in adapting to their post-move communities (Allard, 2008; Allard & Roth, 2011; Dawkins et al., 2015; Rosenblatt & DeLuca, 2012). Consequently, planners and policy makers in areas that have experienced rapid population growth must be prepared to expand their social welfare infrastructure and address the needs of new arrivals, even if the percentage of low-income residents in their growing jurisdictions has remained relatively stable.

Second, while a good deal of scholarly work has drawn attention to the influx of wealth and capital into the urban core in recent years (Hyra, 2012, 2015), the findings of this analysis suggest that the revitalization of inner-city neighborhoods is by no means a universal phenomenon. Instead, the aggregate outflow of both low- and non-low-income residents from urban geographies indicates that a number of central-city communities continue to suffer from a significant degree of economic instability. In particular, non-movers who remain in these communities may be highly restricted in their ability to choose residential locations, and potentially face considerable financial uncertainty. Planners and public officials must therefore work to understand the characteristics of incumbent residents who continue to reside in urban areas and develop policies and programs to address their needs.

There are, of course, important limitations to this research. Despite the advantages of the refined neighborhood typology used in this analysis, several of the variables from the dataset used to develop the neighborhood types are only available for 2010. This means that while neighborhoods may gradually change in character over the study period, I am only able to categorize an area at one point in time. Similarly, although there is clearly a strong connection between neighborhood type and spatial location, the classification system used in this study does not specifically evaluate this relationship. One must thus exercise caution when drawing connections between a given neighborhood type and its positioning within an urban agglomeration. Finally, this analysis focuses solely on the relationship between intra-metropolitan migrations and changing low-income rates; I do not address how other factors—notably relocations to and from other metropolitan areas and household transitions into and out of low-income status—affect the income compositions of various geographies. Therefore, results must be interpreted within this limited context, and do not represent a comprehensive portrait of spatial changes in income during the study period.

Despite these shortcomings, the results from this analysis address an important gap in the literature by highlighting the degree to which low-income households are leaving urban neighborhoods for suburban communities, and by identifying the characteristics of households that are most likely to suburbanize. With these findings as context, planners and policy makers can have a better understanding of the causes that underlie socioeconomic trends in their jurisdictions, and make informed choices about how to best deal with the challenges they face as a result of these changes.

Essay 2: Economic Mobility and the Income Dynamics of Suburban and Urban Neighborhoods

Abstract

Poverty rates in many suburban areas have increased substantially since the 1990s. Researchers often attribute this to population migrations, suggesting that both an influx of lower-income households and an exodus of higher-income families has led to growing financial distress in some suburban communities. Recently, however, scholars have recognized that economic mobility—in particular, the downward trajectory of incumbent suburbanites—may play an equally, if not more important role in declining income levels in suburban areas. In this analysis, I use data from the Panel Study of Income Dynamics to better understand the relationship between economic mobility and the financial wellbeing of suburbanites. I find that during the study period (1999 to 2015), negative economic mobility had only a very minimal impact on the percentage of low-income residents living in suburban neighborhoods. In fact, in suburban geographies where the low-income rate rose, these increases were not due to downward economic mobility, but rather to a modest net influx of poorer residents. Despite the minimal impact of economic mobility on aggregate low-income rates, I do find strong associations between residential location and economic outcomes at the household level. Specifically, while households living in both newly developed suburban neighborhoods and densely populated urban communities were financially stable, on average, those residing in older, medium-density residential neighborhoods were susceptible to economic decline. Overall, findings highlight the complex relationship between economic mobility and residential geography, and illustrate how positive aggregate trends can obscure financial vulnerability at the disaggregate level.

1. Introduction

In the U.S., the notion of suburban communities as mostly white, wealthy, staid, and stable has long held sway (Hall & Lee, 2010; Kneebone & Berube, 2013; Kruse & Sugrue, 2006; Teaford, 2008). Over the past several decades, however, the demographic and socioeconomic landscape of many suburban areas has changed dramatically. Not only are suburbs far more racially and ethnically diverse than in years past (Frey, 2003, 2011; Hall & Lee, 2010), but suburban communities also are increasingly likely to experience the kind of acute economic distress that has typically been associated only with neighborhoods in the urban core. Since 1990, for example, the number of poor people living in suburban census tracts has increased three times faster than in central-city areas (Allard, 2017). Similarly, by 2014 the number of suburban residents living in high poverty neighborhoods—those where over 20 percent of residents are at or below the poverty line—reached almost 25 million, more than triple 1990 levels and almost equal to the high-poverty urban population (Allard, 2017).

Scholars suggest a number of causes for the spread of poverty in the suburbs over the past 30 years. By and large, most of these explanations focus on population migrations—the flow of both low- and non-low-income households from one geography to another—as the root cause of increasing suburban economic distress. For example, several studies detail how housing policy, labor market dynamics, immigration patterns, and gentrification have simultaneously pushed low-income households out of poor central-city neighborhoods and pulled them toward communities on the metropolitan fringe (Covington et al., 2011; Ding, Hwang, & Divringi, 2016; Raphael & Stoll, 2010; Suro et al., 2011). Others note that higher-income families are leaving certain types of suburban communities—particularly older, more densely populated suburbs—for

newer developments with larger lot sizes and newer homes (Short et al., 2007). Recently, however, a growing body of literature stresses the notion that population flows, while important, cannot solely account for the rise in poverty outside central cities over the past 30 years (Allard, 2017; Cooke, 2010; Covington, 2015). Instead, these analyses indicate that shrinking economic opportunity—particularly for low-skill workers—has made once-stable communities far more volatile, precipitating a downward socioeconomic slide for incumbent suburban residents.

Despite recognition that growing financial insecurity has hastened the spread of suburban poverty, little is known about how economic mobility affects the income composition of the residents living in various geographies. In other words, it is still unclear if and to what degree the deteriorating economic security of incumbent suburbanites has contributed to growth in the number of financially precarious households in the suburbs. This study aims to address this gap in the literature. With geocoded data from the Panel Study of Income Dynamics (PSID) as my main data source, I use a refined classification system to categorize household residential location (Voulgaris et al., 2016). Then, using the Department of Housing and Urban Development's low-income threshold, I track transitions of PSID households into and out of low-income status between 1999 and 2015. Finally, I employ two types of analyses to evaluate the relationship between the financial stability of individual households and the cumulative economic health of the various geographies: a decomposition analysis, which assesses the relative influence of economic mobility on the aggregate low-income rates of several different suburban and urban neighborhood types; and a multivariate analysis, which evaluates how residential geography affects the economic mobility of individual households.

Results show that during the study period, downward economic mobility did not cause substantial increases in the low-income rates of suburban neighborhoods. In fact, in communities

where the percentage of low-income inhabitants increased—generally older, moderately dense suburban neighborhoods—this increase was solely driven by a modest net influx of poorer residents from other geographies. However, despite the limited effect of downward economic mobility on aggregate low-income rates, residential geography did show associations with household economic outcomes at the disaggregate level. In particular, households living in older, medium-density residential neighborhoods—both in urban and suburban areas—had a higher likelihood of falling below the low-income threshold than households in sprawling suburban communities and those in densely populated central-city neighborhoods. Overall, findings illustrate the complex relationship between economic mobility and residential location, and highlight the importance of examining both aggregate and disaggregate trends when assessing neighborhood financial stability.

2. Background Literature

Researchers have proposed a number of potential reasons for the suburbanization of poverty since the 1990s. Most often, these explanations center on population flows—specifically, the movement of low-income households out of poor central-city neighborhoods and into surrounding suburban communities. In particular, a number of studies highlight the role of federal housing policy, with its long-standing focus on deconcentration and decentralization, as an important driver in the suburbanization of poverty (Devine et al., 2003; Hartung & Henig, 1997; McClure, 2006). Covington, Freeman, and Stoll (2011), for example, find high rates of suburbanization among housing choice voucher recipients, with participants in these programs being almost equally likely to live in a suburban neighborhood as in an urban one. Other public programs, such as the Low-Income Housing Tax Credit (LIHTC), have also contributed to

spatial changes in poverty, and in some areas have had more of an effect on the relocation of low-income households than voucher programs (Freeman, 2004; Williamson et al., 2009).

In a similar vein, studies show that spatial changes in the labor market may be encouraging the suburbanization of low-income households. Raphael and Stoll (2010), for example, find high levels of suburban poverty in metropolitan areas with decentralized labor markets, suggesting low-income households have followed employment opportunities to outlying areas. Immigration patterns also have shifted since the 1990s, with an increasing number of new arrivals to the U.S. eschewing traditional central-city ethnic enclaves in favor of settling directly in suburban communities (Alba et al., 1999; Farrell, 2016; Wilson and Svajlenka, 2014). Since new arrivals to the U.S. tend to have lower levels of education and are more likely to engage in low-wage work, the growing number of new immigrants living in suburban communities can lead to higher poverty rates outside of central-city areas (Suro, Wilson, & Singer, 2011).

Short, Hanlon, and Vicino (2007) also stress the importance of population flows in shaping the socioeconomic landscape of urban areas. In particular, they highlight how a neighborhood's built-environment features—specifically, the age and quality of its housing stock—can affect residential settlement patterns. Echoing classic theories of urban ecology (Burgess, 1925), the authors suggest that as time has passed, homes in so-called "inner-ring" suburban communities have become increasingly incompatible with the consumption patterns of middle- and upper-middle-class households. They contend that wealthier families are therefore prone to leaving older suburban neighborhoods in search of more satisfactory homes in other parts of the metropolitan area. While Short et al. (2007) do not empirically quantify the effect of such migrations on suburban poverty rates, their research provides a theoretical argument for

how population flows have reshaped the landscape of metropolitan poverty. Specifically, the authors give context to the numerous studies that show sharp growth in economic hardship in older suburban communities across the U.S., and demonstrate how an outflow of non-low-income residents can precipitate a shift in neighborhood income dynamics (Cooke & Denton, 2015; Hanlon, 2008; Hanlon & Vicino, 2007; Jargowsky, 2003; Kingsley & Pettit, 2003; Lee & Leigh, 2007).

A complementary body of research examines growing poverty in inner-ring suburbs through the lens of gentrification and urban redevelopment. Like Short et al. (2007), these studies stress the importance of population migrations—particularly the changing residential location choices of wealthy households—in affecting the spatial distribution of economic distress. However, instead of highlighting the outflow of rich households from older suburban communities, this line of inquiry focuses on the influx of affluent inhabitants into central cities. Numerous observers have detailed a back-to-the city movement in which both well-to-do residents and investment capital flow into previously struggling urban core areas (Birch, 2009; Hyra, 2012, 2015; Sturtevant & Jung, 2011). Not surprisingly, these forces place economic pressures on low-income residents. Research finds, for example, that gentrification can substantially reduce the supply of affordable housing in a community (Chizeck, 2017). Other studies note that rising rents may compel poorer families to leave their central-city homes for cheaper areas, often in neighborhoods further from the urban core (Ding et al., 2016; Guerrieri, Hartley, & Hurst, 2010; Hyra & Rugh, 2016; Newman & Wyly, 2006; Schuetz & Murray, 2018). While there is little direct evidence linking gentrification with the changing spatial distribution of poverty, these analyses are nevertheless instructive. By demonstrating how rising affluence in central cities can push low-income residents toward adjacent suburban neighborhoods, they

establish a conceptual link between increasing affluence in central cities and rising economic distress in suburban neighborhoods, and provide additional context for how population flows might reshape the socioeconomic landscape of metropolitan regions.

As the literature demonstrates, numerous studies attribute the growth of suburban poverty to population migrations. While the authors point to an array of underlying mechanisms, all of these analyses share an implicit understanding that residential mobility has precipitated changes in the spatial distribution of poverty. Recently, however, a growing body of literature has taken a somewhat different view. These studies hold that socioeconomic declines in many suburban communities are not solely the result of population flows, but are also due to worsening opportunities for incumbent residents (Allard, 2017; Cooke, 2010; Covington, 2015). Simply put, they contend that while population migration may play a role in growing suburban distress, poverty in outlying communities is also increasing because the long-term residents of these areas are getting poorer.

While direct empirical support for this phenomenon is rare, a number of analyses provide circumstantial evidence of how downward mobility has affected suburban communities. In particular, these studies note that sweeping changes in the labor market have reduced employment opportunities for low-skill, low-education workers in communities across the U.S. (Autor, 2011; Case & Deaton, 2015; Cooke & Denton, 2015; Cortes, 2015; Kneebone & Berube, 2013; Shulman, 2011). To be sure, residents of heavily segregated urban neighborhoods have long suffered from a lack of access to stable, middle-wage employment opportunities (Massey & Denton, 1993; Wilson, 1987). However, recent trends mean that households in a range of geographies—including traditionally stable suburban neighborhoods—have become increasingly

economically vulnerable, and workers in these communities can no longer depend on steady employment to insulate themselves from a negative economic slide (Allard, 2017).

Additional research shows that the Great Recession had a particularly damaging impact on the economic security of suburban families. Between 2008 and 2010, foreclosure rates spiked and employment opportunities shrank in many areas on the urban periphery (Anacker, 2015; Kneebone, 2013). In fact, as Garr (2011) points out, the economic downturn of the late 2000s was the first recession to be more acutely felt in suburbs than in cities. Scholars also note that as economic distress in outlying areas has become more intense, the social services in these communities are, relative to their urban counterparts, often poorly equipped to provide assistance. Not surprisingly, findings indicate that this lack of a well-developed support structure can exacerbate the instability of low-income suburban households and may lead to higher levels of downward mobility (Allard, 2008; Allard & Roth, 2011; Garr, 2011). Regardless of the specific causes, these studies agree that the rising economic distress of suburban areas cannot be adequately explained by solely focusing on population migrations from one geography to another. Instead, they stress that the financial trajectory of incumbent suburban households is a key component of the aggregate growth in poverty outside of the urban core.

Despite growing recognition that negative economic mobility has contributed to financial distress in many suburban communities, the relationship between household-level economic instability and aggregate-level changes remains largely unexplored. For example, little is known about the degree to which upward and downward mobility—as opposed to moves into and out of particular geographies—contributes to changes in neighborhood economic composition. Similarly, scholars have a limited understanding of the types of suburban or urban areas where households are most apt to move up or down the economic ladder. This study aims to address

this gap in the literature in two parts. The first part of the study is aggregate in scope. In it, I use a decomposition analysis to measure the influence of household economic mobility on the low-income rates in suburban and urban geographies. In the second part of the study, I focus on disaggregate-level associations. Specifically, I use a multivariate analysis to examine the relationship between a family's neighborhood of residence and the likelihood that it will transition into or out of low-income status during a given period of time.

3. Data

3.1. Panel Study of Income Dynamics

The PSID serves as the primary source of data for this analysis. Since 1968, the PSID has surveyed a nationally representative panel of households, gathering data on a range of socioeconomic, demographic, and geographic characteristics. The first wave of the survey included roughly 5,000 families, and between 1968 and 1997 interviews were conducted yearly. Since then, the PSID has been administered biannually, with the 2015 wave including data from almost 26,000 individuals in approximately 9,000 households.

Because this study aims to understand the relationship between economic outcomes and residential context, it is necessary to obtain both a family's income level and its geographic location at multiple points in time. In terms of income, the panel nature of the PSID makes this rather straightforward: each household's income is available at regular two-year intervals as long as it remains active in the panel. With regard to geographic location, the publicly-available PSID contains only state-level data, precluding any assessment of neighborhood-level features. Fortunately, the PSID provides researchers with access to a confidential version of the survey that specifies household location to the census tract. Using these restricted data, I am able to

append tract-level characteristics from external sources and create a profile of the types of neighborhoods in which survey respondents reside.

3.2. Identifying Neighborhood Types

The relationship between a neighborhood's physical context and the economic outcomes of its residents lies at the heart of this analysis. Therefore, the way in which I define and classify neighborhoods is crucially important. To this end, I use a unique neighborhood typology developed by Voulgaris et al. (2016). Using built-environment data from the U.S. Environmental Protection Agency's Smart Location Database (Environmental Protection Agency, 2014) and the 2010 census, this classification system employs a combination of factor and cluster analysis to group census tracts into one of seven neighborhood types—rural, patchwork, new development, established suburb, urban residential, mixed use, and old urban—based on built-environment characteristics. Below, Table 2-1 provides a brief overview of the characteristics of each neighborhood type.

Table 2-1: Neighborhood Types

	Description	Mean housing density[1]	Mean job accessibility[2]	Transit supply index[3]	% of tracts (all US[4])	% of tracts (PSID sample[4])
Old Urban	High-density, transit-rich areas, generally in central cities	27.5	533	4.2	5.4	3.5
Mixed Use	Urban commercial/industrial districts	5.2	181	1.1	7.0	5.8
Urban Residential	Residential neighborhoods, generally in central-cities	5.9	147	0.8	16.7	15.6
Established Suburb	Older, mostly residential suburban neighborhoods	4.1	186	0.6	17.1	18.0
Patchwork	Mixture of residential and commercial land uses in suburban areas	1.7	94	0.1	17.6	18.0
New Development	Mostly new, low-density suburban neighborhoods, generally in outlying portions of metropolitan areas	1.4	68	0.0	24.2	27.4
Rural	Non-urban and non-suburban development	0.1	14	0.0	12.0	11.8

Adapted from Blumenberg et al. (2015); U.S. Environmental Protection Agency (2014)
[1]Housing units per acre
[2]Jobs within a 45-minute drive (in thousands)
[3]Composite index of transit supply; see Blumenberg et al. (2015) for details
[4]MSAs only

As the data from Table 2-1 suggest, the seven specific neighborhood types also can be categorized into more general "urban" and "suburban" groupings. For example, old urban, mixed use, and urban residential neighborhoods have moderate to high densities, relatively high levels of job access and public transportation service, and typically represent the urban core of a given metropolitan area. I thus identify these neighborhood types as being "urban." By contrast, established suburb, patchwork, and new development neighborhoods all have moderate to low population densities, contain minimal public transit service, and are commonly located in outlying areas. Therefore, I define these three categories as being "suburban." Finally, rural neighborhoods are sparsely populated, have low levels of job access and almost no public transit supply, and thus closely correspond to traditional definitions of rural areas.

Although this type of classification system has not been widely used in the literature, it has notable advantages over more common conceptualizations of urban and suburban space. For example, census definitions of principal city and suburb—perhaps the most convenient and frequently used classification method—rely largely on jurisdictional boundaries and do not consider characteristics such as population density, land-use development, housing stock, and geographical contiguity. Therefore, principal cities with small geographical footprints—such as Hartford, CT, Boston, MA, or San Francisco, CA—may encompass only a small proportion of an MSA's census tracts that feature urban characteristics (i.e. high population densities, mixed land uses, and high percentages of multi-family housing). Conversely, principal cities with generous boundaries—for example, Jacksonville, FL, Oklahoma City, OK, or Nashville, TN—tend to include numerous census tracts with typically suburban features (i.e. sprawling, single-use land development, and an abundance of single-family homes on large plots of land) (Cooke & Marchant, 2006). The classification system used in this analysis, by contrast, is wholly derived

from tract-level built-environment and transit system characteristics. Because neighborhoods are classified strictly on the basis of their physical features, they correspond much more closely to intuitive notions of "urban" and "suburban" than do census definitions.

The seven-group classification scheme used in this analysis also has advantages over other, more refined methodologies, such as those that identify three neighborhood types (urban, inner-ring suburbs, and outer-ring suburbs). While three-category typologies generally consider built-environment features in their classification procedures, the range of variables they consider tends to be rather limited (Hanlon, 2009; Hanlon & Vicino, 2007; Lee & Leigh, 2005). Generally speaking, these schemes rely on some combination of population density and the time period during which the bulk of local buildings was constructed. The methodology used here employs a much more comprehensive suite of variables to classify neighborhoods. This is important because many of these variables—such as job access and public transit supply—may have key associations with quality-of-life outcomes. Furthermore, a three-category grouping can potentially obscure considerable variation among neighborhoods within the same classification. A more refined typology, by contrast, can identify differences within the broader urban and suburban groups, allowing for a better assessment of the relationship between neighborhood type and household-level outcomes.

3.3. Identifying Low-Income Households

Because transitions into and out of low-income status serve as the primary outcome of this study, determining the appropriate threshold at which a family should be considered "low income" is also important. While most analyses use the federal poverty line to evaluate both individual- and neighborhood-level distress, I define low-income households using the

Department of Housing and Urban Development's (HUD) Section 8 housing assistance payment guidelines.

The main advantage of using the HUD measure lies in its sensitivity to differences in local and regional costs of living. Families living in metropolitan areas with high rents and consumer prices face a far greater expenditure burden than those residing in more affordable areas. Unlike the federal poverty threshold, which is uniform across the U.S., HUD's income thresholds recognize this important difference, and identify low-income households as those earning less than 80 percent of the local median income.

HUD's measure is also beneficial in that it is far more sensitive to the increasing costs associated with a modernizing society. Since its inception in the 1960s, the federal poverty level has been based on a single measure: the cost of a basic food budget. As time has passed, however, households' fundamental needs have grown, with costly items such as mobile phones and internet access now a virtual necessity for participating in modern society. Therefore, a dynamic measure such as HUD's—one that incorporates the costs associated with rising standards of living—is better able to capture the true financial security of households across the income spectrum.

4. Decomposition analysis

4.1. Methodology

A given neighborhood type can experience aggregate decline in two primary ways: first, through residential mobility, in which the net in-migration of low-income individuals exceeds the net in-migration of non-low-income residents; and second, through economic mobility, in which total transitions into low-income status outstrip total transitions out of low-income status.

The purpose of the decomposition analysis is to understand the degree to which the latter—economic mobility—affects the aggregate economic health of various metropolitan geographies.

In practice, of course, these two forces often act simultaneously, making it difficult to pinpoint the degree to which an individual factor is driving economic change in a certain community. Fortunately, the panel structure of the PSID allows me to track both the residential location and the income levels of individual households over multiple time periods. This means that when aggregated to the neighborhood level, I can decompose changes in the percentage of low-income residents into a residential mobility component and an economic mobility component. Using a methodology similar to Cooke (2010) and Quillian (1999), I calculate the aggregate change in the low-income population (P^{low}) of a given neighborhood type between a PSID wave at time *t* and the subsequent wave two years later at time *t + 2*:

Equation 2-1

$$change\ in\ low\ income\ population = \left(P_{t+2}^{low} - P_{t}^{low}\right) - \left(P_{t+2}^{non} - P_{t}^{non}\right)$$

Simply put, I subtract the change in the non-low-income population (P^{non}) from that of the low-income population for each contiguous set of PSID waves. Equation 2-2 decomposes the first term of Equation 2-1, breaking down the change in the low-income population into transitions from non-low income into low income ($Trans^{non,low}$), transitions from low income into non-low income ($Trans^{low,non}$), low income moves into a given neighborhood (In^{low}), and low-income moves out of a given neighborhood (Out^{low}):

Equation 2-2

$$\left(P_{t+2}^{low} - P_{t}^{low}\right) = \left(Trans_{t,t+2}^{non,low} - Trans_{t,t+2}^{low,non}\right) + \left(In_{t,t+2}^{low} - Out_{t,t+2}^{low}\right)$$

Equation 2-3 shows a similar decomposition for the non-low-income population:

Equation 2-3

$$(P_{t+2}^{non} - P_t^{non}) = \left(Trans_{t,t+2}^{low,non} - Trans_{t,t+2}^{non,low}\right) + \left(In_{t,t+2}^{non} - Out_{t,t+2}^{non}\right)$$

Substituting Equations 2-2 and 2-3 into Equation 2-1 yields:

Equation 2-4

$$net\ change = \left(2Trans_{t,t+2}^{non,low} - 2Trans_{t,t+2}^{low,non}\right) + \left(In_{t,t+2}^{low} - Out_{t,t+2}^{low}\right) - \left(In_{t,t+2}^{non} - Out_{t,t+2}^{non}\right)$$

In order to calculate a total percentage change in low-income population between two PSID waves, I then divide each term by the number of person-years (*PY*) for times *t* and *t + 2*. I define a person-year as any observation that includes both income and locational data for a given individual in consecutive PSID waves:

Equation 2-5

$$\%\ net\ change = \frac{(2Trans_{t,t+2}^{non,low})}{PY_{t,t+2}} - \frac{(2Trans_{t,t+2}^{low,non})}{PY_{t,t+2}} + \frac{\left(In_{t,t+2}^{low} - Out_{t,t+2}^{low}\right)}{PY_{t,t+2}} - \frac{\left(In_{t,t+2}^{non} - Out_{t,t+2}^{non}\right)}{PY_{t,t+2}}$$

The values derived from Equations 2-4 and 2-5 thus represent the net (or percentage) change in the low-income population for a given neighborhood type. More importantly, this equation also allows me to identify the relative contribution of both economic mobility and residential mobility on neighborhood-level trends. Specifically, the sum of the first and second terms yields the net (percentage) change in low-income residents due to transitions among the incumbent population; the sum of the third and fourth terms produces the net (percentage) change in low-income residents due to population flows.

4.2. Results and Discussion

Table 2-2 contains the results of the decomposition analysis. The left-most numeric column illustrates how the economic mobility of incumbent residents influenced the proportion of low-income inhabitants in each neighborhood type from 1999 to 2015. The center column shows the how population flows affected the proportion of low-income residents in each neighborhood type during the study period. Finally, the right-hand column shows the total percentage change in the proportion of low-income residents in the seven neighborhood categories between 1999 and 2015, as well as the totals for all urban and suburban neighborhoods.

Table 2-2: Decomposition Analysis

	Percentage change in the proportion of low-income residents due to:		
Neighborhood type	**Net transitions into low-income status**	**Net inmoves of low-income residents**	**Total**
Old Urban	-7.1	+9.0	+1.9
Mixed Use	-0.4	-2.7	-3.1
Urban Residential	-14.8	+12.8	-2.0
Established Suburb	-0.7	+8.3	+7.6
Patchwork	-7.2	+2.4	-4.8
New Development	+1.4	-7.7	-6.4
Rural	+10.7	-14.3	-3.4
All urban neighborhoods	-10.7	+9.1	-1.6
All suburban neighborhoods	-1.5	-0.3	-1.8

In urban neighborhoods, economic mobility was responsible for declines in the proportion of residents that are below the low-income threshold. This trend is most salient in urban residential communities, where the proportion of low-income inhabitants dropped by nearly 15 percent due to net transitions out of low-income status. Similarly, in old urban neighborhoods more residents rose above the low-income threshold than dropped below it, leading to a 7.1 proportionate decline in low-income residents. In mixed use communities, there was also a tendency toward transitions out of low-income status, but only to a very modest extent: the proportion of low-income households in mixed use neighborhoods dropped by less than one percent during the study period.

Trends in suburban communities were mixed. Transitions out of low-income status were relatively common in patchwork neighborhoods, leading to a 7.2 percent decline in low-income residents. In both established suburb and new development areas, economic mobility had a very small impact on the proportion of low-income residents. For established suburbs, economic transitions caused a 0.7 percent decrease in the low-income rate; in the mostly sprawling new development neighborhoods, by contrast, downward mobility was more predominant, and raised the proportion of low-income residents by a modest 1.4 percent. Finally, the influence of

downward economic mobility was strongest in rural neighborhoods. In these areas, transitions above the low-income threshold had a prominent impact on population dynamics, increasing the low-income rate by 10.7 percent.

The results of the decomposition analysis are notable for two primary reasons. First, they suggest that during the study period, the downward mobility of incumbent suburbanites did not cause substantial increases in neighborhood-level distress. For the most part, net transitions had a positive effect on the income characteristics of suburban communities; in the only suburban neighborhood type where the impact of economic mobility was negative—new development neighborhoods—the magnitude of this negative effect was minimal, and was far smaller than the positive influence of non-low-income in-movers. To some degree, these findings contrast with those of Cooke (2010), who uses similar data and methods to track trends in suburban poverty during the 1990s and early 2000s. He notes that to the extent poverty rates in suburban areas changed during his study period, shifts were the result of net transitions into poverty among local households. The findings of this study, however, indicate the opposite. In areas where economic distress increased—specifically, established suburb communities—growth in neighborhood-level financial hardship was entirely the result of population flows; in areas where downward mobility did in fact contribute to growing hardship, the level of neighborhood decline was modest, and the magnitude of this effect was wholly obscured by aggregate inflows of higher-income residents.

Second, the findings of the decomposition analysis highlight the disparate fortunes of various suburban communities. While the total proportion of low-income residents decreased in patchwork and new development neighborhoods, the percentage of economically vulnerable inhabitants rose moderately in established suburb areas. These results echo the conclusions of several other studies on suburban poverty, many of which juxtapose the relatively positive

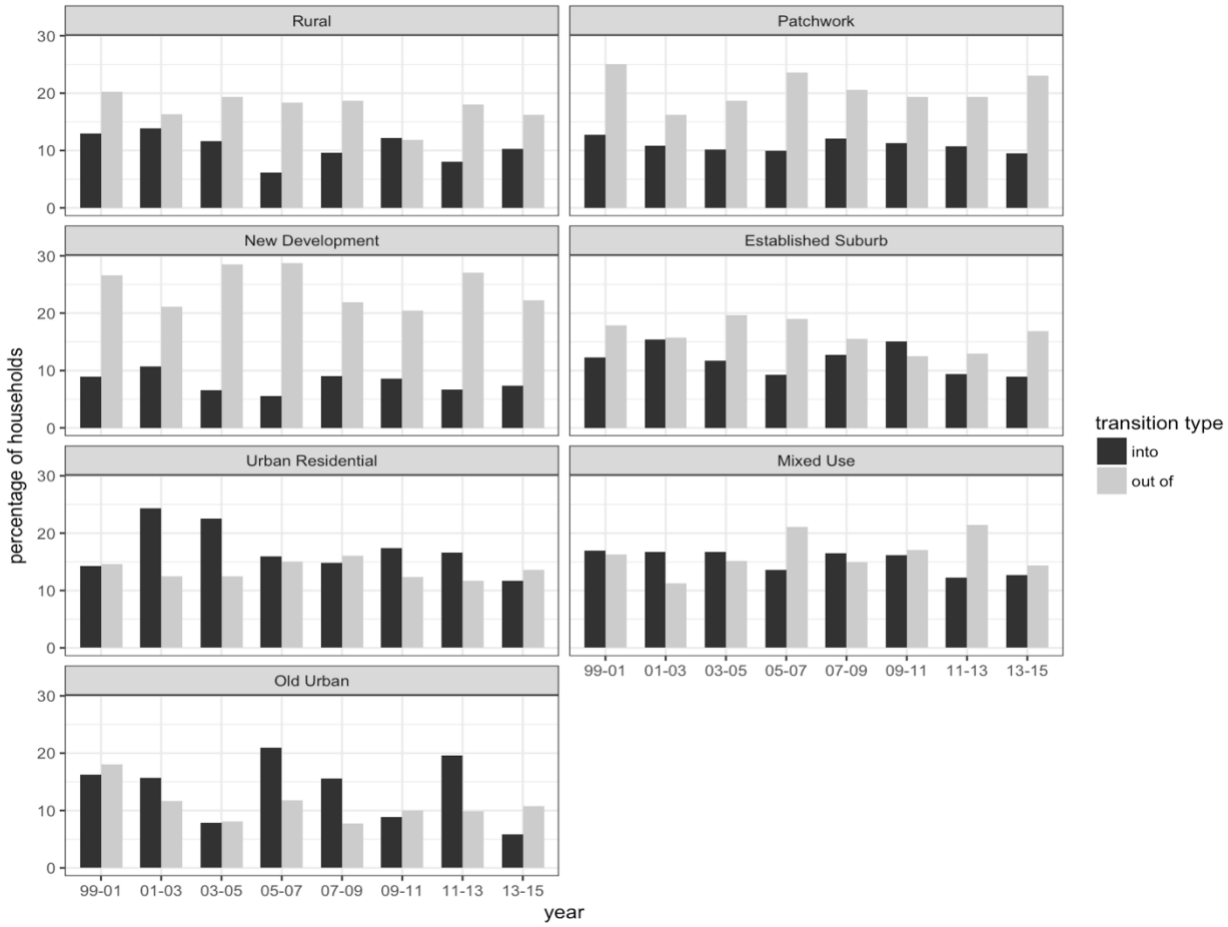
economic performance of newer, sprawling suburbs in outlying areas with the struggles of older, denser communities adjacent to central-city neighborhoods (Cooke & Denton, 2015; Hanlon, 2008; Hanlon & Vicino, 2007; Jargowsky, 2003; Kingsley & Pettit, 2003; Lee & Leigh, 2007). In particular, this analysis provides support for Short, Hanlon, and Vicino's (2007) contention that inner-ring decline is propelled at least in part by an incompatibility between the housing stock of older suburban communities and the consumption patterns of middle- and upper-middle class households. Trends from this study suggest that higher-income residents are leaving established suburb communities—areas that are older, relatively densely populated, and share a number of physical characteristics with inner-ring suburbs—and possibly settling in new development neighborhoods that might offer newer homes, increased space, and more modern amenities.

Despite these insights, the decomposition analysis has some important shortcomings. Most notably, this approach only shows how transitions into and out of low-income status affect the overall proportion of low-income residents in a particular neighborhood type. It does not, unfortunately, provide any insight into the relationship between a household's neighborhood of residence and its economic wellbeing. For example, between 1999 and 2015, the percentage of low-income residents in urban residential neighborhoods declined substantially. While this speaks to the aggregate income dynamics of these communities, one cannot conclude that, at a disaggregate level, poorer households in urban residential neighborhoods were particularly likely to rise above the low-income threshold. This is due to a simple arithmetic fact: while neighborhoods with a high proportion of low-income households have many potential individuals who can transition out of low-income status, they have relatively few who can transition into this classification; similarly, neighborhoods with a low proportion of low-income

households have relatively few people who can transition out of low-income status and many who can transition into this designation. Therefore, although low-income rates in urban residential neighborhoods declined due to residents transitioning out of poverty, this *does not* mean that a given urban residential household has a high likelihood of rising above the low-income threshold.

A comparison of Table 2-2 and Figure 2-1 demonstrates this issue. For each neighborhood type, Figure 2-1 shows both the percentage of all low-income households that rose above the low-income threshold each year, as well as the percentage of non-low-income households that fell below the threshold from year-to-year. Even a cursory appraisal of Table 2-2 and Figure 2-1 highlights substantial differences between aggregate-level changes in low-income rates and the percentage of households that transition into and out of low-income status. For example, Table 2-2 shows that in urban residential neighborhoods, net transitions out of low-income status precipitated a large drop in the total proportion of low-income residents. Figure 2-1, however, indicates that in a given year, low-income urban residential households had a relatively low likelihood of rising above the low-income threshold and a high likelihood of dropping below it. An examination of new development neighborhoods reveals a similarly contradictory pattern. Table 2-2 shows that net transitions led to a small overall increase in the percentage of low-income residents in new development neighborhoods between 1999 and 2015. Nevertheless, Figure 2-1 indicates that in the disaggregate, individual households fared quite well: between each survey wave, a relatively low percentage of households dropped below the low-income threshold while a comparatively high percentage rose above it.

Figure 2-1: Percentage of Households Transitioning into and out of Low-Income Status, by Neighborhood Type, 1999-2015



Source: Panel Study of Income Dynamics, 1999-2015

5. Multivariate analysis

5.1. Methodology

To shed additional light on the aggregate decomposition analysis, I employ a modeling framework that isolates the association between neighborhood type and household-level transitions into and out of low-income status. Discrete-time logistic regression (Allison, 1982), a common technique for analyzing event histories, allows me to estimate the likelihood that a given household will rise above or fall below the low-income threshold during each survey wave, while controlling for a range of confounding variables.

I specify two models: a low-income model that includes all low-income households that did not change neighborhood types between time *t* and time *t + 2* (to evaluate the likelihood of transitioning out of low-income status); and a non-low-income model that includes all non-low-income households that did not change neighborhood types between time *t* and time *t + 2* (to evaluate the likelihood of transitioning into low-income status). Using the broader literature on individual- and household-level economic outcomes, I identify several control variables that are typically associated with either upward or downward mobility (Hout, 2012; Judge, Cable, Boudreau, & Bretz, 1995; Ludwig et al., 2012; Ng, Eby, Sorensen, & Feldman, 2005). These variables include geographic characteristics (MSA population, MSA region), neighborhood-level features (percent non-Hispanic white, poverty rate), and household-level features (age, household structure, race/ethnicity, education, income, employment status, vehicle ownership[4]). Most importantly, I also include a variable indicating the type of neighborhood in which each household resides. The coefficient produced on this "neighborhood type" variable demonstrates the association between a family's neighborhood context and the likelihood that it will rise above or fall below the low-income threshold. Put simply, interpreting the neighborhood type coefficient allows me to identify the geographies in which households are most likely to experience either positive or negative economic mobility.

Below, Tables 2-3 and 2-4 provide descriptive statistics for independent variables included in the discrete-time logistic regression models by neighborhood type. Table 2-3 includes only low-income households; Table 2-4 includes only non-low-income households. All data are measured at time *t*, unless otherwise noted.

[4] With regard to vehicle ownership, I divide households into three categories: "fully equipped" (those with at least one vehicle for every adult), "car deficit" (those with fewer vehicles than adults), and "carless" (those without a vehicle).

Table 2-3: Descriptive Statistics, Low-income Households

	Old Urban	Mixed Use	Urban Residential	Established Suburb	Patchwork	New Development	Rural
% renter	72.1	64.5	64.2	35.1	47.7	36.3	28.9
CBSA population (millions)	9.7	1.9	2.6	4.0	2.6	2.4	1.4
% NH white (tract)	24.5	57.1	40.5	52.5	70.6	70.1	80.7
% poverty (tract)	27.0	23.6	24.8	15.6	13.8	10.2	11.4
% in Northeast region	70.8	15.6	18.8	25.1	24.2	6.7	32.7
Family size change (*t, t +2*)	+ 0.012	+ 0.049	+ 0.032	- 0.004	+ 0.003	+ 0.012	+ 0.033
Age	52.3	53.3	49.5	57.8	54.7	54.2	56.5
% college graduate	16.6	15.3	13.9	14.2	18.6	17.9	8.8
% non-Hispanic white	35.8	64.0	48.8	63.1	76.2	75.6	82.9
Income ($)	22,588	22,189	22,597	24,404	23,393	25,633	23,634
% employed	47.0	49.9	54.9	41.8	47.7	52.6	44.3
% employed (*t + 2*)	44.1	47.4	54.5	40.0	46.4	50.1	41.8
% unemployed (*t, t +2*)	10.0	4.7	12.8	10.2	7.8	8.9	8.1
% fully equipped	24.4	53.7	55.1	55.0	66.8	69.9	69.6
N	628	675	3,109	2,441	1,853	2,089	1,231

Note: Person-level variables (age, % college graduate, % non-Hispanic white, % employed, and % unemployed) are for the household head. All variables are measured at time *t* unless otherwise noted.
Source: Panel Study of Income Dynamics, 1999-2015

Table 2-4: Descriptive Statistics, Non-Low-Income Households

	Old Urban	Mixed Use	Urban Residential	Established Suburb	Patchwork	New Development	Rural
% renter	64.0	34.4	29.7	10.3	13.0	8.1	6.7
CBSA population (millions)	10.5	2.8	2.8	4.3	3.0	2.5	1.6
% NH white (tract)	44.9	67.3	56.8	72.9	75.9	75.3	86.3
% poverty (tract)	19.6	14.8	17.6	8.4	9.5	7.1	8.3
% in Northeast region	81.1	14.8	18.8	40.5	23.2	8.4	39.3
Family size change (*t*, *t +2*)	+ 0.013	+ 0.026	- 0.019	- 0.036	- 0.005	- 0.005	- 0.044
Age	44.8	47.7	48.3	53.1	51.6	50.0	51.7
% college graduate	50.0	47.8	45.7	45.4	46.5	48.6	36.0
% non-Hispanic white	63.0	81.7	72.0	83.5	84.4	87.4	92.3
Income ($)	92,232	109,357	90,402	113,857	115,267	110,451	113,282
% employed	84.7	79.6	84.0	78.5	78.7	80.2	78.9
% employed (*t + 2*)	81.3	75.0	79.9	74.3	74.9	76.5	75.0
% unemployed (*t*, *t +2*)	6.0	6.4	7.1	5.9	5.7	5.7	6.2
% fully equipped	36.4	76.5	81.0	81.4	82.0	86.7	86.7
N	372	716	2,190	3,320	3,155	6,407	2,503

Note: Person-level variables (age, % college graduate, % non-Hispanic white, % employed, and % unemployed) are for the household head. All variables are measured at time *t* unless otherwise noted.
Source: Panel Study of Income Dynamics, 1999-2015

While Tables 2-3 and 2-4 highlight numerous differences among households living in various neighborhood types, the data regarding two factors are particularly noteworthy. First, the tables highlight crucial geographical differences in household incomes. On average, households living in suburban neighborhoods have higher incomes than their urban counterparts at time *t*. This, of course, has potentially important implications for transitions into and out of low-income status. Specifically, the higher average starting incomes of suburban families may make them less susceptible to transitions into low-income status (for non-low-income households), and more likely to rise above the low-income threshold (for low-income households) than somewhat less affluent urban families.

Second—and perhaps most notably—a comparison of the sample sizes in Tables 2-3 and 2-4 illustrates why changes in neighborhood-level low-income rates (Table 2-2) may seem inconsistent with household-level transitions into and out of low income status (Figure 2-1). Urban neighborhoods clearly have a far higher proportion of low-income households than suburban communities. As I discuss above, this means that a large percentage of families in urban neighborhoods have the opportunity to transition out of low-income status, while relatively few can transition in. Conversely, only a small percentage of families in suburban neighborhoods are able to rise above the low-income threshold, while a large proportion may drop below it. Thus, the descriptive statistics suggest that the decomposition analysis may paint an incomplete picture of economic mobility, and illustrate why disaggregated multivariate models can shed additional light on the relationship between residential location and household-level economic outcomes.

5.2. Results and Discussion

Table 2-5 contains the results of the discrete-time logistic regressions. Model 1 (the "low-income model") includes only low-income families at time *t* and estimates the likelihood of rising above the low-income threshold at time *t + 2*. Model 2 (the "non-low-income model") consists of only non-low-income families at time *t* and estimates the likelihood of dropping below the low-income threshold at time *t + 2*.[5]

Table 2-5: Likelihood of Transitioning out of or into Low-Income Status

	Model 1	Model 2
	Low-income households	**Non-low-income households**
	Transitioned out of low-income status	Transitioned into low-income status
Renter	-0.545***	0.509***
	(0.060)	(0.066)
CBSA population (ln)	-0.003	0.151***
	(0.024)	(0.024)
Tract % non-Hispanic white (ln)	0.109***	-0.091*
	(0.032)	(0.035)
Tract % in poverty (ln)	-0.247***	0.044
	(0.048)	(0.048)
Region (Northeast)		
Midwest	-0.031	0.019
	(0.087)	(0.087)
South	0.116	-0.047
	(0.087)	(0.085)
West	0.068	0.076
	(0.096)	(0.095)

[5] To test the robustness of these models, I also run pooled Ordinary Least Squares (OLS) regressions using a household's change in income between time *t* and *t + 2* as the dependent variable. Results are shown in Table A-1 in the Appendices. For the low-income model, I include all households; for the non-low-income model, I limit the sample to households with incomes between $1 and $50,000 above the low-income threshold in order to capture only families with a reasonably high risk of transitioning into low-income status. Models are estimated with robust standard errors clustered by household. While p-values are generally somewhat larger than those presented in Table 2-5, the magnitude and direction of coefficients of the OLS models are very similar to those of the discrete-time logistic regressions discussed below.

Family size change (*t*, *t* + *2*)	-0.186***	0.074*
	(0.034)	(0.037)
Age	-0.010***	-0.004
	(0.002)	(0.002)
Education (No high school diploma)		
High school graduate	0.196**	-0.227**
	(0.075)	(0.083)
Some college	0.445***	-0.322***
	(0.079)	(0.086)
College graduate	0.914***	-0.777***
	(0.090)	(0.092)
Race/ethnicity (Non-Hispanic white)		
Black	-0.182**	0.292***
	(0.070)	(0.073)
Hispanic	-0.316	0.136
	(0.181)	(0.210)
Asian	-0.214	0.062
	(0.223)	(0.248)
Other	-0.006	0.282*
	(0.133)	(0.144)
Income (ln)	0.334***	-1.754***
	(0.044)	(0.076)
Employed	0.287***	-0.359***
	(0.078)	(0.080)
Employed (*t* + *2*)	0.665***	-0.916***
	(0.081)	(0.076)
Unemployed (*t*, *t* + *2*)	-0.507***	0.927***
	(0.089)	(0.079)
Car ownership (Fully equipped)		
Carless	-0.667***	0.915***
	(0.089)	(0.113)
Car deficit	0.118	0.182**
	(0.063)	(0.067)
Neighborhood type (New development)		
Rural	-0.169	0.256**
	(0.099)	(0.092)
Patchwork	0.032	0.116

	(0.084)	(0.082)
Established suburb	-0.010	0.174*
	(0.088)	(0.085)
Old urban	0.078	-0.548**
	(0.166)	(0.198)
Urban residential	-0.036	0.287**
	(0.088)	(0.090)
Mixed-use	0.210	0.183
	(0.125)	(0.133)
Year (1999)		
2001	-0.381***	0.430***
	(0.113)	(0.102)
2003	-0.292**	0.291**
	(0.108)	(0.108)
2005	-0.157	0.086
	(0.105)	(0.112)
2007	-0.157	0.299**
	(0.108)	(0.105)
2009	-0.357**	0.410***
	(0.109)	(0.104)
2011	-0.161	0.127
	(0.106)	(0.109)
2013	-0.057	0.141
	(0.106)	(0.111)
Constant	-4.318***	16.417***
	(0.645)	(0.931)
Observations	12,026	18,663
Log Likelihood	-4,898.605	-5,147.779
Akaike Inf. Crit.	9,869.210	10,367.560
Pseudo R^2	0.145	0.202

*p < 0.05 **p < 0.01 ***p<0.001

Note: Person level variables (age, education, race/ethnicity, employment, and unemployment) are for the household head. All variables are measured at time *t* unless otherwise noted. Standard errors are in parentheses and are clustered at the household level.

The models show that numerous characteristics are associated with both transitions into and transitions out of low-income status. First, among low-income households, variables generally conform to expectations. For example, high levels of educational attainment, higher incomes at time *t*, and being employed at both time *t* and *t + 2* show strong associations with transitioning from low- to non-low-income status. Conversely, being a renter, living in a census tract with high levels of poverty, and having a period of unemployment between survey waves are all factors associated with a lower likelihood of rising above the low-income threshold. Coefficients on the year variables tend to follow broad economic trends, with the economic downturn of the early 2000s reflected in the lower likelihood of transitioning out of low-income status prior to the 2001 and 2003 waves, and the effects of the Great Recession inhibiting moves out of low-income status before the 2009 wave.

Racial characteristics are also associated with a household's propensity to transition out of low-income status. Families living in neighborhoods that have higher percentages of non-Hispanic white households are more likely to climb above the low-income threshold, while black families are less likely than their white counterparts to change from low- to non-low-income. In terms of family structure, both a growing family and an older household head show negative associations with transitions out of low-income status. Households with fewer resources are also less likely to rise above the low-income threshold. In particular, carless households are more likely to stay below the low-income threshold than those with at least one car per driver, highlighting the close connection between vehicle access and positive economic outcomes (Baum, 2009; King, Smart, & Manville, 2019; Raphael & Rice, 2002; Sandoval, Cervero, & Landis, 2011). Finally, neighborhood type—the primary variable of interest—shows no association with transitions out of low-income status: relative to families living in new

development communities, low-income households have a statistically equal likelihood of rising above the low-income threshold regardless of the type of neighborhood in which they reside.

In the non-low-income model, independent variables also tend to conform to expectations, and often mirror the findings of the low-income analysis. More education, higher incomes at time *t*, and being employed at the beginning and end of a survey interval are all associated with a decreased likelihood of dropping below the low-income threshold. By contrast, households that do not own their home and those in which a household head experienced a period of unemployment have a higher propensity to transition into low-income status. Macroeconomic trends—particularly the economic downturns in the early 2000s and during the Great Recession—also are associated with a higher likelihood of becoming low income, with the 2001, 2003, 2007, and 2009 survey waves showing a positive correlation with low-income transitions.

Similar to the low-income model, the race and ethnicity variables also are related to the likelihood of a non-low-income household transitioning into low-income status. Households living in neighborhoods with a higher percentage of minorities as well as households where the head is black are particularly prone to falling below the low-income threshold. Access to automobiles shows strong associations with household economic health, reflecting the findings of previous research (Baum, 2009; King et al., 2019; Raphael & Rice, 2002; Sandoval, Cervero, & Landis, 2011). Specifically, families where vehicle availability is limited—both those that are carless and those that have a car-deficit—are more likely to become low-income than households with at least one vehicle per adult. Additionally, variables related to family size and metropolitan area population show positive associations with transitioning into low-income status.

Finally, in contrast to the low-income analysis, the neighborhood type variable shows statistically significant correlations with financial stability among non-low-income households. Generally speaking, the base category—new development neighborhoods—is associated with positive economic outcomes. While families living in patchwork and mixed use areas have statistically similar outcomes relative to families living in new development communities, those living in rural, established suburb, and urban residential neighborhoods are significantly more likely to transition into low-income status. The only neighborhood type with better outcomes than new development communities is the old urban category, in which non-low-income households are substantially less likely to become low income, *ceteris paribus*.

When viewed in concert with the findings of the decomposition analysis, the model results highlight the complex interaction between household-level economic mobility and neighborhood-level economic distress. On one hand, aggregate transitions into and out of low-income status (see Table 2-2 above) suggest a degree of economic stability—or even economic vitality—among incumbent residents of certain neighborhood types. For example, the decomposition analysis indicates that downward mobility in established suburb areas has not contributed to increases in the proportion of low-income residents over the past two decades. In urban residential neighborhoods, the pattern appears even more positive: net transitions above the low-income threshold are actually reducing the proportion of low-income residents in these areas. However, non-low-income households in both of these neighborhood types have a relatively high likelihood of falling into low-income status. In other words, even though downward mobility is not driving dramatic growth in the percentage of low-income residents in established suburb and urban residential communities, households in these neighborhoods still suffer from a great deal of economic instability.

To a large extent, this apparent incongruity is likely a function of a given area's original proportion of low-income residents. As I mention above, even if a small percentage of residents in an economically distressed neighborhood rise above the low-income threshold, this represents a substantial overall number of residents transitioning out of low-income status. Conversely, even if a large percentage of residents in these neighborhoods fall below the low-income threshold, this effect will still be small in terms of raw numbers, and may be overwhelmed by the volume of individuals transitioning into low-income status. Therefore, somewhat counterintuitively, aggregate-level trends do not necessarily reflect the vulnerability of individuals and households. This explains the somewhat surprising findings regarding urban residential and established suburb neighborhoods—both areas with relatively high percentages of low-income inhabitants. While downward mobility in these areas has not caused an increase in the total proportion of low-income residents, local households are nevertheless very economically vulnerable, and have a comparatively high likelihood of falling into low-income status.

Against this background, it is crucial to understand why, despite their apparent cumulative stability, households living in urban residential and established suburb communities are particularly susceptible to downward economic mobility. To a large degree, these findings echo previous research on the suburbanization of poverty. Several analyses, for example, have illustrated the growth of economic distress in areas adjacent to the urban core, particularly in older, moderately dense, inner-ring suburban neighborhoods (Cooke & Denton, 2015; Hanlon, 2008; Hanlon & Vicino, 2007; Jargowsky, 2003; Kingsley & Pettit, 2003; Lee & Leigh, 2007). These areas have been especially hard hit by economic trends that have reduced job opportunities for low-skill workers, depressed wages, and encouraged job growth in areas at the metropolitan

fringe (Cooke, 2010; Leigh and Lee, 2007; Short, Hanlon, & Vicino, 2007). While established suburb neighborhoods most closely align with traditional definitions of inner-ring suburbs, urban residential neighborhoods—with their aging housing stock, moderate densities, and residential character—also have a good deal in common with typical inner-ring suburban communities. Consequently, it is perhaps not surprising that households in these two neighborhood types are the most vulnerable to economic decline.

It is also important to understand why economically vulnerable households in old urban neighborhoods have a substantially *lower* propensity of falling below the low-income threshold relative to other neighborhood types. Perhaps the most likely explanation stems from growing investment in central-city neighborhoods over the past several decades. Many inner-city communities have experienced an influx of development and job growth since the 1990s (Birch, 2009; Hyra, 2012, 2015; Sturtevant & Jung, 2011). This trend may be responsible for providing more economic opportunity to lower-middle income workers in these areas, and preventing these households from sliding into low-income status. Of course, it is also crucial to recognize that in many cases, housing costs and commodity prices in these areas have risen far faster than in surrounding communities, placing intense economic pressure on lower-income families (Ding et al., 2016; Guerrieri, Hartley, & Hurst, 2010; Hyra & Rugh, 2016; Newman & Wyly, 2006; Schuetz & Murray, 2018). Therefore, even though households in old urban neighborhoods have a relatively low likelihood of falling into low-income status, they may be suffering from economic insecurity at levels similar to, or perhaps even greater than, families in other neighborhood types.

6. Conclusion

As the spatial distribution of poverty has shifted over the past two decades, scholars have sought to identify the roots of growing economic distress in suburban communities. Several studies suggest that an array of forces have pushed low-income households out of central cities and pulled them toward outlying neighborhoods. By contrast, others point to the financial instability of incumbent suburbanites, and argue that downward mobility is the primary cause of increasing suburban poverty. This analysis addresses the uncertainty surrounding this issue, primarily by examining the relationship between neighborhood-level low-income rates and household-level economic mobility.

Findings show that from 1999 to 2015, economic mobility generally had a *positive* effect on the aggregate low-income rates of various neighborhood types. Only one suburban geography—new development neighborhoods—experienced more net transitions into low-income status than out of low-income status. In these areas, however, downward mobility had only a small impact on low-income rates, and this effect was minimal compared to the net influx of non-low-income residents. Similarly, in the only suburban geography that experienced a downward economic trend—established suburb neighborhoods—declines were wholly caused by a net influx of low-income residents, and not the result of net transitions of longer-term residents below the low-income threshold. Finally, the impact of economic mobility in urban areas was universally positive: net transitions out of low-income status reduced the total percentage of low-income residents in each of the urban neighborhood types.

The positive aggregate effect of economic mobility, however, obscures a relatively high degree of instability among households in certain geographies. Specifically, families living in established suburb and urban residential areas were more likely to fall below the low-income

threshold than households in other types of neighborhoods. This is potentially a reflection of the negative economic trends that have affected older, moderately dense residential areas over the past several decades. By contrast, households in old urban communities enjoyed a relatively high degree of economic stability during the study period, and were less likely to fall into low-income status than their counterparts in other areas. This may again be a reflection of broader trends, with economic development and employment growth in the urban core buoying the financial prospects of central-city residents.

The findings of this analysis highlight the importance of evaluating economic distress from multiple perspectives. In particular, results demonstrate that even in areas that appear to be "stable," individuals and households may experience a substantial degree of economic insecurity. This is especially important to remember in suburban areas, where social welfare infrastructure tends to be less well-developed than in central cities. Allard and Roth (2010), for example, illustrate how, despite growing demand for social services outside of central city neighborhoods, many suburban providers lack both the personnel and the funding to deal with their growing caseloads. Therefore, suburban jurisdictions—even those experiencing relatively positive aggregate economic trends—must work to develop networks that not only promote upward mobility, but also protect local residents from a downward financial slide.

Essay 3: Residential Relocations and Vehicle Ownership among Low-Income Households

Abstract

Densely developed urban areas generally offer good access to destinations by public transportation, bicycle, or on foot, attenuating automobile dependence to some degree. In sprawling suburban communities, by contrast, transit service tends to be sparse and infrequent, destinations are spatially distant, and owning a vehicle is a virtual necessity. While a robust body of literature has investigated the relationship between automobile ownership and residence in both urban and suburban neighborhoods, little is known about how household relocations—specifically, moves between urban and suburban geographies—affect the likelihood of owning a vehicle. Using the Panel Study of Income Dynamics and a refined neighborhood typology, I examine the relationship between inter-geography moves and transitions into and out of carlessness among low-income households. Results suggest that urban-to-suburban movers, relative to households that move within urban neighborhoods, have an increased likelihood of becoming car owners. By contrast, households moving in the "opposite" direction—from suburban to urban neighborhoods—show an increased propensity to transition into carlessness. These findings demonstrate how low-income families adjust their vehicle ownership in conjunction with changes in residential context, and indicate that these households align their level of car access to suit the built environment of their post-move neighborhood.

1. Introduction

The travel behavior literature has long recognized both a theoretical and empirical relationship between a neighborhood's built environment and the transportation choices of its residents (Boarnet & Crane, 2001; Cao, Mokhtarian, & Handy, 2009; Ewing & Cervero, 2001,

2010; Handy, Cao, & Mokhtarian, 2006; Stevens, 2017). Central-city communities, for example, tend to offer mixed-use land development and relatively good public transit access, making non-automotive modes of transportation a viable option for some residents. Suburban neighborhoods, by contrast, are more likely to be sprawling and diffusely developed, meaning that public transit is often ineffective, and private vehicles are the dominant mode of transportation (Ewing & Hamidi, 2014; Ewing, Pendall, & Chen, 2003; Hamidi, Ewing, Preuss, & Dodds, 2015).

Given the close relationship between neighborhood characteristics and automobile use, one might expect vehicle ownership to be an important determinant of household residential location decisions. In other words, from a theoretical perspective, households without vehicle access should presumably gravitate toward central-city neighborhoods, while car-owning households may prefer to live in suburban communities where they are able to consume more housing (Alonso, 1964; LeRoy & Sonstelie, 1983; Mills, 1972; Muth, 1969). Empirically, studies suggest that this pattern is generally true: several analyses show that carless low-income households are particularly likely to cluster in dense urban neighborhoods with relatively robust supplies of public transit (Glaeser et al., 2008; Heilmann, 2018; Pathak et al., 2017).

In recent years, however, scholars have noted a considerable increase in the number of low-income households living in suburban areas. Suburban poverty has risen dramatically since 1990, with the suburban poor population overtaking the urban poor population by 2010 (Allard, 2017). To some degree, research suggests that population flows are responsible for this trend. These analyses indicate that the migration of low-income households out of central cities and into suburban communities has contributed to the shifting spatial distribution of economic distress. For example, studies highlight how numerous factors, including federal housing policy, immigration trends, and changes in the labor market, have precipitated urban-to-suburban moves

among low-income families, and encouraged the decentralization of poverty in areas throughout the U.S. (Covington, 2015; Covington et al., 2011; Freeman, 2004; Raphael & Stoll, 2010; Suro et al., 2011).

Against this background of suburbanizing poverty, it is crucial to remember the close connection between a household's residential location and its transportation options. Traditionally, poor carless families have clustered in central-city neighborhoods at least partly because of the relative transit richness of these areas (Glaeser et al., 2008; LeRoy & Sonstelie, 1983). However, as moves away from central cities into suburbs become more common, households likely find their post-move neighborhood to be far less accommodating of carlessness than their original community. For scholars and planners, it is important to know how low-income households, when faced with a new and challenging transportation landscape, adapt to their surroundings. One might expect, for example, that carless urban households have a high likelihood of becoming car-owning in conjunction with moves to suburban communities. Similarly, relocations in the opposite direction—from suburban locations to urban centers—might also be associated with changes in car ownership: low-income households may decide to reduce their vehicle fleet (and thus their transportation expenditures) in combination with their relocation to a more transit-rich neighborhood.[6]

Although a large body of literature has investigated the relationship between neighborhood built-environment characteristics and travel behavior, the connection between residential *relocations*—household moves—and changes in vehicle ownership remains relatively

[6] While I focus on the likelihood of households first making a relocation and then adjusting their vehicle ownership to suit a new residential location, it is, of course, possible for this chronology to function in the reverse order: households may first transition into car ownership or carlessness and then relocate to a new neighborhood. Unfortunately, the data used in this analysis do not allow to precisely determine the sequencing of these events. This is undoubtedly a limitation of the analysis, and I address this issue in more detail in the Data and Methodology section below.

unexplored. This study aims to address this gap in the literature. The main dataset for the analysis is the Panel Study of Income Dynamics (PSID) which, combined with a unique neighborhood typology, allows me to track both car ownership and geographic location among low-income households from 1999 to 2015. Then, using a series of discrete-time logistic regressions, I estimate the likelihood that households making a move from one neighborhood type to another will transition into or out of carlessness.

Results suggest a strong relationship between household moves and changes in vehicle ownership. All else equal, when urban, carless, low-income households move to suburban neighborhoods, they have an increased likelihood of becoming car owning. Conversely, when car-owning households from the suburbs relocate to central-city neighborhoods, they show a relatively high propensity to transition into carlessness. Moves within a given geography—from one type of urban or suburban neighborhood to another—are also associated with vehicle ownership changes. When urban car owners move to other urban neighborhoods that are denser and more transit rich, they show an increased likelihood of becoming carless. The pattern for suburban car owners is similarly intuitive: moves to more sprawling neighborhoods with less transit supply are associated with a decreased likelihood of transitioning into carlessness. This analysis adds depth to the travel behavior-built environment literature by demonstrating that residential relocations may spur adjustments in vehicle ownership—adjustments in which low-income households align their level of automobility with the physical characteristics of their destination neighborhood.

2. Automobile Ownership, Residential Location, and Low-Income Households

Americans' dependence on the private automobile is well documented. For over a century, public policies at the local, state, and national levels have supported and subsidized car dependence through a mix of regulation, taxation, and infrastructure development (Baum-Snow, 2007; Kawabata, 2009; Kawabata & Shen, 2006; Manville, 2017; Manville, Beata, & Shoup, 2013; Su & Desalvo, 2008). As a result, the convenience and utility of the automobile is almost unrivaled as a mode of transportation, and car ownership is a virtual necessity for most households in the U.S. (King et al., 2019). Ninety-three percent of households have at least one vehicle, and roughly 82 percent of all trips in the U.S. are made by private automobile (Ruggles et al., 2018; U.S. Department of Transportation, 2017).

One of the clearest indicators of the importance of automobile access in the U.S. is the high car ownership rates of poor households (Pucher & Renne, 2003). Despite their modest financial means, low-income households often dedicate a large portion of their limited economic resources toward the purchase of an automobile. Studies show, for example, extremely strong correlations between higher incomes and vehicle acquisition rates among poorer households (Blumenberg & Pierce, 2012; Chu, 2002). At the low end of the income distribution, additional capital tends to be quickly dedicated to obtaining a car. By contrast, in middle- and high-income households where the demand for automobility is often saturated, additional income is only very weakly associated with increased vehicle ownership. Analyses of Earned Income Tax Credit payments echo the importance of vehicle access to low-income households. Researchers find that one of the most frequent uses of these lump-sum tax rebates—which, depending upon the number of children in a household, can be in excess of $5,000—is for the purchase of an

automobile (Adams, Einav, & Levin, 2009; Goodman-Bacon & McGranahan, 2008; Mendenhall et al., 2012).

Numerous studies suggest that this eagerness to purchase an automobile, despite the substantial burden it represents, is actually a sensible investment for many low-income families. Accessibility to important destinations via private vehicle in the U.S. is almost universally better than when using transit, even in urban areas with dense development and relatively robust public transportation service (Blumenberg & Ong, 2001; Grengs, 2001; Kawabata, 2003, 2009; Kawabata & Shen, 2006, 2007; Rogalsky, 2010; Shen, 2001). Not surprisingly then, having reliable vehicle access is generally associated with improved wellbeing and positive life outcomes. For example, a large body of literature highlights a causal relationship between vehicle ownership and an increased likelihood of employment among low-skill and low-education workers (Blumenberg & Pierce, 2014; Cervero, Sandoval, & Landis, 2002; Gurley & Bruce, 2005; Lucas & Nicholson, 2003). Similarly, there is also a strong connection between having a car and increased hours worked, higher wages, transitions off of welfare, and lower stress levels (Baum, 2009; King et al., 2019; Raphael & Rice, 2002; Sandoval et al., 2011).

Despite the ubiquity of the automobile, certain aspects of one's physical surroundings may reduce vehicle dependence and promote travel by alternative modes. Over the past several decades, hundreds of studies have examined the relationship between the built environment and travel behavior (Ewing & Cervero, 2010; Stevens, 2017). While findings are somewhat mixed overall, there is a general consensus that, even when controlling for residential self-selection, contextual characteristics such as high densities, mixed land uses, and transit accessibility can have a modest positive effect on the amount individuals travel by alternative modes. Scholars also generally find a reduction not only in vehicle miles traveled among people living and/or

working in densely developed urban areas, but also in the number of vehicles that they own (Bhat & Guo, 2007; Cao, Mokhtarian, & Handy, 2007; Chen, Gong, & Paaswell, 2008).

Taken together, these studies suggest that although car-centrism may be the norm in most communities throughout the U.S., vehicle use and automobile dependence may be less intense in specific built-environment contexts. This means that under certain conditions and in particular communities, carless households and other individuals with limited vehicle access will be at less of a disadvantage in reaching destinations than they might otherwise be. Therefore, those who prefer limited levels of auto ownership and, perhaps more frequently, those who struggle to afford vehicle ownership, might be expected to cluster in neighborhoods that support non-car travel.

A number of empirical analyses do, in fact, support this assumption (Brueckner & Rosenthal, 2009; Heilmann, 2018; Pathak et al., 2017; Varady & Walker, 2007). LeRoy and Sonstelie (1983) examine how automobile access influences the spatial distribution of households. They note that as long as owning an automobile is a financial burden for a significant proportion of the population, poor households will gravitate toward transit-rich central cities. Vehicle owners, by contrast, are able to capitalize on their high travel speeds and settle in suburban areas where they can consume more housing. While the authors suggest that this dynamic may shift over time as auto ownership among the poor becomes more widespread, Glaeser et al. (2008) contend that this pattern persists; low-income households continue to gravitate toward central-city neighborhoods due to their dependence on public transit.

Other evidence indicates, however, that this traditional spatial distribution of low-income households may be shifting. Several studies show substantial increases in suburban poverty since the turn of the century (Garr, 2011; Jargowsky, 2014; Jargowsky, Rog, & Henderson, 2014;

Kneebone, 2014; Kneebone & Berube, 2013). Allard (2017), for example, finds that the number of poor living in suburban areas surpassed the urban poor population by 2010, and that since 1990, the poor population in suburban neighborhoods has expanded roughly three-times faster than in urban communities. Scholars note that to some degree, the growth in suburban poverty is due to macroeconomic trends that have disrupted labor markets, putting downward pressure on the incomes of many low-skill suburban workers (Case & Deaton, 2015; Cooke, 2010; Covington, 2015; Shulman, 2011). Research also shows that population flows have played an important role in spatial shifts in poverty. Specifically, a number of factors, including federal housing policy, changing immigration patterns, rising housing prices, and the decentralization of job opportunities have provided and incentive for low-income households to move away from central-city areas and into suburban neighborhoods[7] (Covington et al., 2011; Farrell, 2016; Freeman, 2004; Raphael & Stoll, 2010; Suro et al., 2011; Williamson et al., 2009).

Regardless of its causes, the growth of suburban poverty means that, compared to decades ago, a far higher number of financially insecure households now live in neighborhoods that are extremely car-centric. While this undoubtedly puts intense economic pressure on low-income households to purchase, own, and maintain automobiles (Fletcher, Garasky, & Nielsen, 2005), little is known about how economically vulnerable families have adjusted and adapted to

[7] In the first two essays of this dissertation, I examine the degree to which these potential causes—population flows and downward economic mobility—contributed to changes in suburban low-income rates between 1999 and 2015. In Essay 1, I focus on population migrations. I find that the in-migration of low-income individuals led to a modest increase in the low-income rates of older, medium-density suburban neighborhoods. In other suburban neighborhoods, net in-moves by non-low-income individuals outnumbered those by lower-income residents, and low-income rates in these geographies declined during the study period. In Essay 2, I assess the role of economic mobility on changes in suburban low-income rates. I find that, contrary to existing research, the impact of downward mobility among incumbent residents was limited in suburban areas. In fact, in most suburban geographies, economic mobility led to reductions in the low-income rate; in the only suburban neighborhood type in which downward mobility caused an increase in the proportion of low-income residents, the magnitude of this increase was small, and a strong influx of higher-income residents meant that overall low-income rates in these areas actually decreased.

this new reality. In particular, these households may make tradeoffs between their residential location and their vehicle ownership level in order to maximize their destination accessibility and minimize their transportation expenditures. Poor suburbanites, for example, may view a move to a walkable, transit-rich central-city neighborhood as a way to reduce the financial burden associated with vehicle ownership, prompting them to trim their vehicle fleet in conjunction with a suburban-to-urban relocation. Conversely, low-income households making an urban-to-suburban move might find carlessness untenable in their new car-centric neighborhood, forcing them to dedicate scarce economic resources toward the purchase of a vehicle.[8]

Despite clear shifts in the spatial distribution of low-income households, few scholars have examined the relationship between residential relocations and changes in vehicle ownership among low-income households. While several analyses assess associations between the built environment and vehicle ownership, these studies tend to rely on cross-sectional data, meaning that they are generally unable to capture how movers anticipate or respond to their new physical context. As a result, it is unclear how residential relocations—specifically those between central-city and suburban neighborhoods—affect a household's level of car ownership. This study aims to address this gap in the literature, first by tracking household moves within and between urban and suburban neighborhoods, and second by examining how these moves affect the likelihood that a family will transition into or out of carlessness.

[8] Of course, it is also possible that carlessness might wholly prevent low-income households from making an urban-to-suburban move. As studies show, households that lack vehicle access often do not consider suburban neighborhoods as a residential option (Clampet-Lundquist, 2004; Rosenblatt & DeLuca, 2012).

3. Data and Methodology

3.1. Data

3.1.1. Panel Study of Income Dynamics

The main dataset for this analysis comes from the Panel Study of Income Dynamics (PSID). Since 1968, the PSID has followed a representative sample of households from across the U.S., collecting data on an extremely wide range of socioeconomic and demographic characteristics. The first wave of the survey included roughly 5,000 households and 18,000 individuals. From 1968 until 1997, the PSID was conducted annually; since 1998, the survey has been administered biannually, and now includes over 26,000 people from approximately 9,000 families. This analysis contains data from nine survey waves, spanning the time period from 1999 to 2015.

The PSID's publicly-available files contain income and vehicle ownership data, allowing me to track both shifts in a household's finances and changes in its vehicle fleet throughout the course of the survey period. Since the focus of this analysis is the relationship between vehicle ownership and the geography of residential relocations, it is also imperative to have data on household moves. While the publicly-available dataset includes a variable that indicates whether or not a household moved between survey administrations, it does not provide detailed geospatial data on household location. I therefore use the confidential version of the PSID, which identifies household location at the census-tract level.

3.1.2. Neighborhood Types

With a household's census tract serving as a proxy for its neighborhood, I then define the "type" of neighborhood in which each family resides. In order to do this, I use a unique

neighborhood typology developed by Voulgaris et al. (2016). This categorization scheme, using data from the census, the U.S. Environmental Protection Agency's Smart Location Database, and a combination of factor and cluster analysis, classifies neighborhoods based on a wide range of built-environment and transportation-related characteristics. The typology includes seven neighborhood types, three of which can be classified as urban (old urban, mixed use, and urban residential), and three of which can be defined as suburban (established suburb, patchwork, and new development). Table 3-1 includes a description of each of the neighborhood types and an overview of their features.

Table 3-1: Neighborhood Types

	Description	Mean housing density[1]	Mean job accessibility[2]	Transit supply index[3]	% of tracts (all US[4])	% of tracts (PSID sample[4])
Old Urban	High-density, transit-rich areas, generally in central cities	27.5	533	4.2	5.4	3.5
Mixed Use	Urban commercial/industrial districts	5.2	181	1.1	7.0	5.8
Urban Residential	Residential neighborhoods, generally in central-cities	5.9	147	0.8	16.7	15.6
Established Suburb	Older, mostly residential suburban neighborhoods	4.1	186	0.6	17.1	18.0
Patchwork	Mixture of residential and commercial land uses in suburban areas	1.7	94	0.1	17.6	18.0
New Development	Mostly new, low-density suburban neighborhoods, generally in outlying portions of metropolitan areas	1.4	68	0.0	24.2	27.4
Rural	Non-urban and non-suburban development	0.1	14	0.0	12.0	11.8

Adapted from Blumenberg et al. (2015); U.S. Environmental Protection Agency (2014)
[1]Housing units per acre
[2]Jobs within a 45-minute drive (in thousands)
[3]Composite index of transit supply; see Blumenberg et al. (2015) for details
[4]MSAs only

While this neighborhood typology has the disadvantage of being rather computationally complex, it has important advantages over traditional census-based classification systems. First, studies often classify communities using a typical urban-suburban dichotomy, grouping all neighborhoods into one of these two very broad categories. This approach, of course, obscures a great deal of diversity within both urban and suburban areas. Central business districts, for example, are very different from residential areas in the central city; similarly, old suburban neighborhoods are undoubtedly distinct from newly developed communities on the metropolitan fringe. The Voulgaris et al. (2016) typology allows me to identify intra-geography differences with much greater specificity, and examine how location changes both between and within urban and suburban neighborhoods influence vehicle ownership.

Another shortcoming of census-based definitions of central city and suburb is that they are constructed largely using jurisdictional boundaries. Consequently, geographically large central cities may include areas that are suburban or even rural in character, while smaller central cities may be surrounded by suburban communities that are notably urban in many of their built-environment characteristics (Cooke & Marchant, 2006). By contrast, the neighborhood typology I use in this analysis has the advantage of being based exclusively on built-environment and transportation-related characteristics. This means that a neighborhood's type will generally adhere very closely to intuitive notions of "urban" and "suburban." Areas categorized as urban are densely populated and relatively rich in public transit supply, while suburban communities are sprawling and car centric.

3.1.3. Low-income Households

In order to identify households in which vehicle ownership might be a considerable financial burden, I use the low-income thresholds developed by the Department of Housing and Urban Development (HUD). HUD uses median area incomes, usually based at the county level, to determine eligibility for Section 8 housing vouchers. They define "low-income" as households with yearly incomes at or below 80 percent of the area median. While most analyses use the federal poverty threshold as their primary indicator of economic distress, the HUD measure is a more appropriate metric in the context of this study for two primary reasons. First, the poverty line is a measure of extreme deprivation. Therefore, only examining the behavior of households below this threshold will cause me to exclude numerous families that, while not technically "poor," may face significant financial challenges in buying and maintaining an automobile. Second, since the HUD measure is based on county data, it is able to capture the dramatic variations in costs-of-living at the local level far better than the federal poverty line. This approach allows me to more directly compare households that may have very different incomes but face similar challenges in acquiring and retaining a vehicle.

3.2. Methodology

The primary goal of this analysis is to identify associations between changing residential locations and transitions into and out of carlessness among low-income households. This means that for families with automobiles, I must estimate the likelihood that a they will become carless in conjunction with a move to a new neighborhood type, relative to those that stay within the same community; for carless families, I must similarly estimate their propensity to become car owners upon a move to a new geography, relative to households that remain in the same

neighborhood type. In order to do this, I specify a set of four discrete-time logistic regression models (Allison, 1982). Discrete-time regressions are a commonly-used modeling approach in studies that use panel data in order to identify and measure the determinants of household relocations (Clark & Davies Withers, 1999; Clark & Huang, 2003; Clark & Ledwith, 2006; Davies Withers, 1998; Dewilde, 2008).

Each of the four models includes households with different residential location-vehicle ownership combinations at time *t*: Model 1 is comprised of suburban car-owning households; Model 2 contains suburban carless households; Model 3 is made up of urban car-owning households; and Model 4 includes urban carless households. For Models 1 and 3 (i.e., those that include only car owners), the dependent variable is the likelihood that a household transitioned into carlessness between time *t* and *t +2*; for Models 2 and 4 (i.e., those that include only carless households), the dependent variable is the likelihood that a household transitioned into car ownership between time *t* and *t +2*. The independent variable of interest is a dummy variable indicating whether or not a household made an inter-geography move (i.e., from an urban to a suburban neighborhood or from a suburban to an urban neighborhood). Finally, I draw from the broader residential relocation literature in order to identify potentially confounding factors (Clark, 2013; Clark & Davies Withers, 1999; Dawkins, 2006). Specifically, I focus solely on households that made moves within the same Metropolitan Statistical Area (MSA), and I include control variables related to income, employment, race, and family structure.[9]

While this approach allows for new insight into the relationship between residential location choices and vehicle ownership, there are some notable limitations. The most prominent

[9] As a robustness check, I also run pooled Ordinary Least Squares regressions to test the relationship between residential relocations and changes in the vehicle-to-adult ratio of low-income households. The results of this analysis are included in Appendix A-2. Findings are similar to those presented in Table 3-3 of the Results and Discussion section.

of these is an inability to untangle the chronology of changes in household vehicle fleet and relocations to a new geography. To be sure, knowing whether transitions into car ownership or carlessness happen in anticipation of or in reaction to a move would provide valuable insight into both how automobility shapes relocation choices and how relocation choices affect automobility. Unfortunately, the data do not allow for this type of analysis. Another limitation of this methodology stems from a lack of information regarding household members' employment locations. Workplace built-environment characteristics, like residential built-environment features, can play an important role in influencing both travel behavior and vehicle ownership decisions (Boarnet, 2011; Chatman, 2003; Maat & Timmermans, 2009). However, because the PSID does not include workplace geographic identifiers, I am unable to assess how changes in employment location might affect transitions into or out of carlessness.

Table 3-2 provides the descriptive statistics for households included in the sample. Perhaps not surprisingly, the data show clear differences between car-owning and carless households, particularly in terms of economic characteristics. For example, the heads of car-owning households are far more likely to be employed than those in carless households, regardless of whether they live in suburban or urban communities. Similarly, incomes—both at time *t* and time *t + 2*—are substantially higher for households that own at least one vehicle relative to their carless counterparts. In terms of race, there are notable differences related both to car ownership and residential location: heads of car-owning households are much more likely to be white than carless household heads; however, within both the car-owning and carless group, suburban household heads have a higher likelihood of being white than the heads of urban households.

Table 3-2: Descriptive Statistics

	Suburban car-owning movers	Suburban carless movers	Urban car-owning movers	Urban carless movers
% Head employed time t	72.2	42.2	73.2	47.0
% Head employed time t + 2	73.2	42.8	72.1	45.1
% Non-Hispanic white	69.2	47.7	53.9	33.8
% Non-Hispanic black	22.3	44.9	35.3	61.0
Family size change (t, t + 2)	0.00	+ 0.07	+ 0.05	+ 0.08
Income time t ($)	25,256	14,077	24,952	15,330
Income time t + 2 ($)	34,927	18,050	33,033	19,319
Vehicles per adult	0.96		0.92	
% made urban move	23.8	34.4	60.7	68.7
% made suburban move	76.2	65.7	39.3	31.2
% of urban movers that became carless	18.9		15.2	
% of suburban movers that became carless	11.6		15.1	
% of urban movers that became car owning		29.3		24.2
% of suburban movers that became car owning		28.8		29.5
N	2,117	1,005	1,630	1,165

Source: Panel Study of Income Dynamics, 1999-2015

With regard to residential relocations, intra-geography moves are clearly more common than moves between urban and suburban areas, echoing previous findings on the relative frequency of short-distance moves (Clark, 2013). Regardless of car ownership, over 60 percent of movers stay within their original geography. Nevertheless, it appears that vehicle ownership at time *t* does play a role in residential relocation decisions. For the most part, families whose vehicle ownership is "mismatched" with residential location—i.e. suburban households that do not own vehicles and urban households that do own vehicles—are the most likely to change residential geographies. Among suburbanites, only 23.8 percent of car owners make an urban move; conversely, over 34 percent of carless households relocate to urban communities. For urban households, the pattern is similar: car owners move to suburban areas relatively frequently, with 39.3 percent of all moves ending in the suburbs; by contrast, 31.2 percent of moves by carless households involve a relocation to a suburban community.

Finally, Table 3-2 addresses the central research question of this analysis: Are moves to a different geography correlated with an increased likelihood of becoming car owning or carless?

The descriptive statistics suggest that there is, in fact, a relationship between inter-geography moves and car ownership changes. For example, while only 11.6 percent of intra-suburban movers become carless, almost 19 percent of suburban-to-urban movers transition into carlessness. These figures highlight a propensity among low-income households to reduce vehicle ownership in coordination with a relocation to less automobile-centric neighborhoods. Carless urban-to-suburban movers also appear to make adaptations in conjunction with their relocation: whereas 24.2 percent of intra-urban carless movers become car owning during a given survey wave, 29.5 percent of carless urban-to-suburban movers become vehicle owners. Once again, this finding appears to indicate a response to a new built environment, with households being more likely to acquire a vehicle in conjunction with a move to a more car-centric community.

4. Results and Discussion

Table 3-3 shows the results of the car ownership models. Models 1 and 3 are "carless household" models, and focus on transitions from carlessness to car ownership between survey waves. Model 1 includes only suburban households at time *t*, while Model 3 contains only urban households at time *t*. Models 2 and 4 are "car-owning household" models, and evaluate the probability of the opposite phenomenon: transitioning from car owning at time *t* to carlessness at time *t +2*. Model 2 includes only suburban households at time *t*, and Model 4 focuses on households living in urban neighborhoods at time *t*.

Table 3-3: Low-Income Households, Residential Relocations, and Changes in Car Ownership

	Model 1	Model 2	Model 3	Model 4
	Suburban car owners	**Suburban carless**	**Urban car owners**	**Urban carless**
	Likelihood of becoming carless	Likelihood of becoming car owning	Likelihood of becoming carless	Likelihood of becoming car owning
CBSA population (ln)	0.001	-0.055	0.031	-0.213***
	(0.061)	(0.070)	(0.072)	(0.069)
Region (Northeast)				
Midwest	-0.078	0.977***	-0.404	0.841***
	(0.290)	(0.318)	(0.294)	(0.255)
South	-0.121	0.987***	-0.495*	0.855***
	(0.283)	(0.312)	(0.284)	(0.249)
West	-0.311	1.308***	-0.382	0.917***
	(0.322)	(0.391)	(0.326)	(0.316)
Employed	-0.354**	0.444***	-0.113	-0.009
	(0.162)	(0.169)	(0.174)	(0.161)
Employed (*t* + *2*)	-0.726***	0.454***	-1.113***	0.641***
	(0.159)	(0.170)	(0.169)	(0.164)
Race/ethnicity (Non-Hispanic white)				
Black	0.407**	0.163	0.997***	0.162
	(0.162)	(0.202)	(0.214)	(0.233)
Hispanic	-0.089	0.251	0.744	1.000
	(0.642)	(0.593)	(0.597)	(0.695)
Asian	0.096	-0.460	0.748	0.900
	(0.863)	(0.843)	(0.636)	(0.965)
Other	0.888***	-0.549	0.223	0.388

	(0.342)	(0.631)	(0.513)	(0.504)
Family size change (*t*, *t* + *2*)	-0.215***	0.414***	-0.283***	0.275***
	(0.063)	(0.079)	(0.072)	(0.066)
Income (ln)	-0.134**	0.019	-0.130*	0.095*
	(0.054)	(0.045)	(0.076)	(0.054)
Income (ln) (*t* + *2)*	-0.270***	0.320***	-0.262***	0.315***
	(0.053)	(0.078)	(0.064)	(0.080)
Vehicles per adult	-0.682***		-0.195	
	(0.202)		(0.213)	
Suburban-to-urban move	0.530***	-0.073		
	(0.149)	(0.161)		
Urban-to-suburban move			0.025	0.302**
			(0.156)	(0.151)
Year (1999)				
2001	-0.157	0.028	-0.596	0.263
	(0.331)	(0.402)	(0.416)	(0.363)
2003	0.059	-0.261	-0.189	0.112
	(0.311)	(0.387)	(0.369)	(0.364)
2005	-0.104	-0.125	-0.102	0.251
	(0.316)	(0.375)	(0.356)	(0.352)
2007	-0.295	-0.137	0.267	0.013
	(0.314)	(0.360)	(0.346)	(0.363)
2009	-0.070	-0.255	-0.227	0.365
	(0.305)	(0.366)	(0.360)	(0.340)
2011	-0.217	-0.451	0.271	-0.065
	(0.302)	(0.360)	(0.347)	(0.350)

2013	-0.428	-0.110	0.006	0.124
	(0.315)	(0.355)	(0.355)	(0.339)
Constant	3.282***	-4.606***	2.319*	-3.302**
	(1.207)	(1.356)	(1.341)	(1.315)
Observations	2,117	1,005	1,630	1,165
Log Likelihood	-734.397	-534.568	-590.872	-602.936
Akaike Inf. Crit.	1,514.794	1,113.136	1,227.744	1,249.872
Pseudo R^2	0.116	0.116	0.146	0.097

*p < 0.05 **p < 0.01 ***p<0.001

Note: Person level variables (employment and race/ethnicity) are for the household head. All variables are measured at time *t* unless otherwise noted. Standard errors are in parentheses and are clustered at the household level.

4.1. Carless Household Models

For households that are carless at time *t*, the predictors of transitioning into car ownership are very similar regardless of whether they reside in urban or suburban neighborhoods. In general, these variables conform to expectations. For example, among urban carless households, the likelihood of transitioning into car ownership decreases as core-based statistical area (CBSA) population rises. This finding possibly reflects the fact that large metropolitan areas tend to have relatively robust transit supply (U.S. Department of Transportation, 2018), limiting the urgency with which families acquire automobiles. Similarly, the region variables also highlight the relative importance of vehicle ownership in different parts of the U.S. Compared to carless households in the Northeast, those living in the Midwest, South, and West are more likely to obtain access to a vehicle. This result is potentially a reflection of older, denser, more compact development in the eastern portion of the U.S., which—even when controlling for a household's home neighborhood—makes non-automobile travel in the Northeast somewhat less burdensome than in other parts of the country.

Measures of household characteristics also perform as expected. Growth in household size is associated with becoming car owning among both urban and suburban families, most likely reflecting increased travel complexity due to the birth of a child (McCarthy, Delbosc, Currie, & Molloy, 2017) or the addition of a vehicle-owning adult to the household. Similarly, higher incomes, particularly at time $t + 2$, show correlations with higher levels of car ownership. This result echoes the findings of numerous studies that suggest carless low-income households, despite their financial vulnerability, often eagerly dedicate additional income to the purchase of a vehicle (Blumenberg & Pierce, 2012; Chu, 2002). For these households, the increased mobility

and accessibility afforded by an automobile clearly outweighs the financial burden inherent in vehicle ownership.

Like the strong relationship between income and vehicle ownership, the positive association between employment and transitions out of carlessness is also intuitive. The models show that when the household head is employed—particularly at time *t + 2*—families are far more likely to obtain a vehicle than those where the head is not in the workforce. Again, this relationship echoes the findings of several studies that suggest a strong link between employment and car ownership (Baum, 2009; Blumenberg & Pierce, 2014; Lucas & Nicholson, 2003; Sandoval et al., 2011). To be sure, the causality of this relationship is notoriously knotty—just as having a job can aid a person in purchasing a car, having a car can aid a person in finding work. While this analysis does not examine this particular causal question, it does reaffirm the close link between employment and vehicle ownership and highlights the importance of this relationship for those living in both urban and suburban communities.

The primary variable of interest—the geography of a household relocation—has the expected relationship with car ownership outcomes: urban carless families that make a suburban move are more likely to obtain a vehicle than those that make an intra-urban move; by contrast, suburban carless households that make an urban move do not show an increased propensity to acquire an automobile. These results, while echoing findings that show higher levels of car ownership among suburban families (Cao et al., 2007; Chen et al., 2008), also highlight the fact that household moves can be a mediating factor in auto ownership decisions. Unfortunately, it is not possible to determine the chronology of the car ownership-residential relocation relationship; households may acquire a vehicle in anticipation of their suburban relocation, or they might purchase an automobile in response to the transportation demands of their destination

neighborhood. While this is undoubtedly a considerable limitation, results nevertheless emphasize a close connection between residential relocations and adjustments in automobility: for urban, low-income, carless households, transitions into vehicle ownership clearly occur in conjunction with moves to a more car-centric environment.

4.2. Car-Owning Household Models

Like the carless household models, the majority of statistically-significant variables in the car-owning household models conform to expectations. Once again, the employment status of the household head is a strong predictor of a transition from car owning to carlessness: those in the workforce, particularly at time $t + 2$, are far less likely to give up their vehicles than household heads who are not employed. Increases in family size are also associated with relatively high levels of vehicle ownership, as growing households are less likely to become carless than households that lose members. Changes in income follow a comparable pattern: households whose incomes grew between survey waves were less likely to become carless than households whose incomes fell during this time period. This finding, mirroring that of the carless household models, once again reflects the tension between the importance of automobile access for personal mobility and the high financial burden that vehicle ownership places on low-income households.

While the carless and car-owning models share several key similarities, there are also some important differences in the model outcomes. For example, race is a statistically-significant predictor of car ownership changes only in the car-owning household models. These models show that, all else equal, black-headed households living in both urban and suburban areas are more likely to transition into carlessness than comparable households with a white head.

Although the reasons for this are not clear, studies have detailed how black car owners suffer disproportionate exposure to a number of financial hardships associated with vehicle ownership such as high insurance rates, frequent citation by law enforcement, and predatory lending practices—all of which may make possession of an automobile untenable (Lundman & Kaufman, 2003; Ong & Stoll, 2007; Sweeting, 2015). In addition to race, the importance of a household's baseline level of car ownership—measured by its vehicles-to-adults ratio—is also a key difference between the carless and car-owning models. This variable, omitted from the carless household model due to their lack of auto ownership, is a strong predictor of transitions into carlessness, as expected. Simply put, households with fewer cars per adult are more likely to become carless than those with more vehicles per adult.

In terms of the relationship between the geography of a move and vehicle ownership changes—the key variable of interest in this analysis—the findings conform to expectations. Not surprisingly, households making an urban-to-suburban move show no increase in their likelihood of becoming carless relative to intra-urban movers. This unwillingness of urban-to-suburban movers to forego automobility is almost certainly a reflection of the need for households to have vehicle access in car-centric sprawling suburban communities (Cao et al., 2007; Chen et al., 2008; King et al., 2019).

Automobile-owning households that leave the suburbs for urban neighborhoods, however, show a high propensity to transition into carlessness. Relative to households that make a move within the suburbs, suburban-to-urban movers are roughly 70 percent more likely to become carless. This result is somewhat expected in light of previous research. For example, several analyses highlight the relatively low vehicle ownership rates of households living in central-city neighborhoods (Boarnet & Crane, 2001; Cao et al., 2007; Chen et al., 2008).

Furthermore, given the high costs associated with automobile ownership (Fletcher et al., 2005; King et al., 2019), transitioning into carlessness may represent an expedient financial decision for low-income suburban-to-urban movers. Specifically, the increased transit supply of a household's post-move urban neighborhood might mean that they are willing to sacrifice the mobility benefits of a private vehicle for the cost savings of carlessness. Again, the data do not allow me to determine whether transitions into carlessness happen before or after suburban-to-urban moves, and thus the chronology of car acquisitions and residential relocations remains unclear. However, this study demonstrates that residential relocations can act as a mechanism for vehicle ownership adjustments, and indicates that changes in automobility occur in conjunction with changes in one's built environment context.

4.3. Neighborhood Decomposition Analysis

While the above analysis provides a general understanding of how residential relocations affect car ownership, focusing on broad geographic categories such as "suburban" and "urban" may obscure important differences within these groups. For example, a large body of literature has highlighted a vast degree of diversity within suburbs themselves, often dividing suburban communities into multiple groups based on their era of development, residential density, and proximity to the urban center (Hanlon, 2008, 2009; Lee & Leigh, 2007; Short et al., 2007). This means that the propensity of urban-to-suburban movers to obtain a vehicle may differ greatly depending on whether they relocate to a relatively dense, older community adjacent to the central city or a sprawling, newly-developed community on the fringe of the metropolitan area. Likewise, there are large differences within urban areas themselves, ranging from central business districts with extremely high activity densities and mixed land uses to moderately dense

residential areas. Clearly, for suburban-to-urban movers the likelihood of becoming carless might differ greatly depending on the type of urban neighborhood in which they settle.

In order to address this issue, I decompose the models from Table 3-3 by movers' origin and destination pairs. Specifically, I use the neighborhood classification system discussed above to examine changes in vehicle ownership when moving from a given origin neighborhood to a given destination neighborhood. The advantage of these models lies in their ability to highlight how car ownership might change differently for a household that makes a "small" move from an urban residential area to an older suburban community versus a household that makes a "large" move from an intensely urban area to a sprawling suburb.[10]

Table 3-4 shows the results of the decomposed regressions for low-income car-owning households at time *t*. In the interest of simplicity, I do not include other control variables in the table; however, they generally function similarly to the control variables described in Table 3-3.[11] For households making suburban-to-urban moves, the pattern is clear: those moving from new development neighborhoods—the most sprawling and car-centric of the neighborhood types—to an urban residential area are far more likely to become carless than those who move within a new development community.[12] For financially insecure households, this relationship makes intuitive sense: although urban residential communities are not the most transit-rich neighborhood type, they do offer far more transit service than new development areas. Therefore, these neighborhoods may serve as a reasonable residential option for households that can no

[10] Because of the relatively small number of households in old urban and mixed use neighborhoods, I combine these neighborhood types into a single group.
[11] Complete results are included in Tables A-3 and A-4 in the Appendices.
[12] It is important to note that the coefficient for the old urban/mixed use neighborhood type, while not statistically significant, is actually larger than that of urban residential areas. This result suggests that movers from new development neighborhoods to urban/mixed used areas might follow a similar pattern of transitioning into carlessness. The lack of statistical significance potentially stems from small sample size, as new development neighborhoods are often spatially distant from old urban/mixed use areas making these moves both difficult and unattractive for low-income households.

longer afford an automobile. To a certain degree, this finding provides additional support for studies that suggest that the poor cluster in central-city neighborhoods primarily for their transportation advantages (Glaeser et al., 2008; Pathak et al., 2017). In short, because carlessness is often untenable in new development neighborhoods, families without the means to purchase and maintain vehicles may choose (or be forced) to relocate to urban residential areas.

Table 3-4: Low-Income Car-Owning Households, Likelihood of Becoming Carless

Neighborhood type (*t*)	**Old urban/mixed use**	**Urban residential**	**Established suburb**	**Patchwork suburb**	**New development**
Neighborhood type (*t* + *2*)					
New development	NS	NS	NS	- *	
Patchwork suburb	NS	NS	- *		NS
Established suburb	NS	NS		NS	NS
Urban residential	NS		NS	NS	+ ***
Old urban/Mixed use		+ *	NS	NS	NS
Observations	453	1177	649	719	749
Pseudo R^2	0.201	0.160	0.141	0.164	0.191

$^{*}p < 0.05$ $^{**}p < 0.01$ $^{***}p<0.001$

Note: The base neighborhood type category is a household's neighborhood type at time *t*.

Table 3-5: Low-Income Carless Households, Likelihood of Becoming Car Owning

Neighborhood type (*t*)	**Old urban/mixed use**	**Urban residential**	**Established suburb**	**Patchwork suburb**	**New development**
Neighborhood type (*t* + *2*)					
New development	NS	+ **	NS	NS	
Patchwork suburb	NS	NS	NS		NS
Established suburb	NS	NS		NS	NS
Urban residential	NS		NS	NS	NS
Old urban/Mixed use		NS	NS	NS	- *
Observations	382	783	484	314	207
Pseudo R^2	0.145	0.106	0.135	0.178	0.176

$^{*}p < 0.05$ $^{**}p < 0.01$ $^{***}p<0.001$

Note: The base neighborhood type category is a household's neighborhood type at time *t*.

Aside from new development to urban residential relocations, no other suburban-to-urban moves have a statistically-significant relationship with transitions into carlessness, nor do any urban-to-suburban relocations. Somewhat surprisingly, the only additional cases in which this relationship is salient occur with intra-suburban and intra-urban moves. For example, households moving from established suburb areas to patchwork neighborhoods are less likely to become carless than those moving within established suburb communities. Similarly, families relocating from patchwork neighborhoods to new development districts also have a reduced likelihood of transitioning into carlessness relative to intra-patchwork movers. These results show that suburban car-owning households who move to areas that are *even more* car-dependent are loath to lose vehicle access. This attachment to automobile ownership among suburban movers seems reasonable: given their incumbent suburban status, these households are fully aware of the importance of a vehicle when living in a car-centric environment (Baum, 2009; Grengs, 2001; Lucas & Nicholson, 2003; Rogalsky, 2010; Sandoval et al., 2011), and are thus keen on maintaining car ownership when moving to a less dense, less transit-rich community.

Changes in car ownership also occur among households moving within urban areas. In this case, however, the trend is the opposite to the one observed in intra-suburban moves: rather than maintaining vehicle access when moving to a more car-centric environment, intra-urban movers are more likely to forego automobile ownership when relocating to denser, more transit-rich community. Specifically, relative to households that move within urban residential neighborhoods, those that relocate to old urban or mixed use areas have a high propensity of transitioning into carlessness. While all of these neighborhood types fall into the "urban" category, they are clearly very different in terms of their built-environment characteristics. Old urban and mixed use areas are the most transit-rich neighborhoods, and perhaps the only

communities in which destination accessibility by public transit is even remotely competitive with the automobile (Kawabata, 2003; Kawabata & Shen, 2007). Furthermore, although car ownership is more strongly associated with economic benefits than public transportation access (Ong & Houston, 2002; Sanchez, 1999), the high levels of access to job opportunities from old urban and mixed use neighborhoods likely maximizes transit's positive role in employment outcomes. In light of these potential benefits, it is not surprising that low-income households that relocate to these neighborhoods—even from other urban communities—might shed the financial burden of vehicle ownership and rely more heavily on non-automotive means of transportation.

Finally, among low-income carless households, intra-geography moves show no associations with changes in car ownership. As Table 3-5 illustrates, non-car owners that relocate within urban or suburban areas do not have an increased or decreased likelihood of obtaining a vehicle. Moves *between* specific urban and suburban neighborhood pairs (i.e., inter-geography moves), however, are correlated with transitions into car ownership, and provide a bit more nuanced picture of the analysis presented above in Table 3-3. For example, households moving from urban residential neighborhoods to new development areas show a relatively high likelihood of becoming car owning. Given the intense automobile dependence of households living in sprawling, transit-poor neighborhoods (King et al., 2019), the car acquisition of movers to new development communities is hardly surprising. Likewise, the relationship between car ownership and moves between new development and old urban/mixed use neighborhoods is similarly intuitive: carless households making these relocations are less likely to acquire a vehicle than those moving within new development communities. This finding likely reflects the fact that recent movers to densely developed neighborhoods are less likely to see a need to shoulder the financial burden of car ownership, and echoes much of the travel behavior literature

that suggests somewhat lower levels of car use in the most densely developed urban communities (Ewing & Cervero, 2010, 2017; Hamidi et al., 2015).

5. Conclusion

Over the past several decades, a large body of literature has examined the relationship between the built environment and vehicle ownership (Boarnet & Crane, 2001; Cao et al., 2009; Ewing & Cervero, 2001, 2010; Handy et al., 2006; Stevens, 2017). Few studies, however, have investigated how residential relocations are associated with changes in household automobility. The above analysis addresses this issue by identifying correlations between inter-geography moves and transitions into and out of carlessness.

Results show that low-income households moving from urban neighborhoods to suburban communities are more likely to become car owning than intra-urban movers. These findings clearly reflect the car-centrism of many suburban areas, and highlight how low-income families often dedicate scarce financial resources in order to obtain a level of automobility that suits their residential location. Suburban-to-urban moves also are associated with changes in vehicle ownership. Households making these moves have a high propensity to transition into carlessness, suggesting that to some degree, they are trading the convenience of automobility for the cost savings of public transit dependence. Finally, intra-area moves are also associated with changes in car ownership. Specifically, urban households that move to denser, more transit-rich urban neighborhoods are highly likely to become carless; similarly, suburban households relocating to areas that are "more suburban"—that is, less densely populated and with less transit supply—have a higher propensity to become car owning than those who stay within their original neighborhood.

These results contribute to a deeper understanding of the interaction between residential relocations and vehicle ownership. One might assume that household automobility is somewhat independent of changes in neighborhood context. Carless urbanites, for example, may avoid suburban neighborhoods completely, or select destination neighborhoods with at least enough transit supply to allow them to remain carless. Similarly, one might expect suburban-to-urban movers to be dependent upon the ease and efficiency of automobile travel, and thus unwilling to lose vehicle access despite the urban-ness of their post-move neighborhood. Results, however, demonstrate that influence of this sort of "inertia" is limited, and households often make adjustments in their vehicle ownership—perhaps willingly or perhaps by necessity—in conjunction with moves to a new built-environment context.

The findings from this analysis have some important implications for policy. Given the cost of vehicle ownership (Fletcher et al., 2005; King et al., 2019), the fact that low-income suburban-to-urban movers have a high propensity to become carless is not surprising. Densely-populated neighborhoods with good transit supply clearly give poorer families the opportunity to maintain some level of mobility without the financial burden of vehicle ownership. However, the neighborhood type that is almost undoubtedly the most accommodating to carless households—old urban neighborhoods—makes up less than six percent of MSA census tracts nationwide. Consequently, many of the low-income households that wish to relocate to a transit-rich neighborhood and become carless in the process likely have little opportunity to do so, either because they do not exist (Levine, 2006), or because they have been priced out of these areas by higher-income households (Ding et al., 2016; Guerrieri et al., 2010; Hyra & Rugh, 2016; Newman & Wyly, 2006; Schuetz & Murray, 2018). Policies that add affordable housing to

neighborhoods with high transit supply or programs that improve transit in areas with modestly-priced housing may help alleviate incongruent levels of supply and demand.

Similarly, the propensity of urban-to-suburban movers to transition into car ownership reinforces the absolute necessity of vehicle access in suburban communities. To be sure, many politicians, planners, and environmental advocates may be loath to encourage increased automobile dependence. However, as jobs continue to decentralize (Raphael & Stoll, 2010) and the suburban poor population continues to grow (Allard, 2017; Kneebone, 2014; Kneebone & Berube, 2013), access to automobility will become increasingly important for low-income households. Programs to subsidize vehicle ownership for financially unstable families, while likely unpopular, will not only help to ease the substantial burden associated with having a car, but also potentially improve the economic outcomes and overall wellbeing of low-income families (Blumenberg, 2004; Lucas & Nicholson, 2003).

Summary

The spatial distribution of poverty in metropolitan areas in the U.S. has changed considerably over the past 30 years. Throughout much of the 20th century, acute economic distress tended to be clustered in central-city neighborhoods, while suburban communities generally had higher household incomes and lower rates of poverty (Jargowsky, 1997, 2003; Jencks & Peterson, 1991). Since the 1990s, however, the number of low-income people living in suburbs has grown apace, and the suburban poor population now outnumbers that of central cities (Allard, 2017; Kneebone & Berube, 2013). To date, a large body of literature has examined these spatial shifts in poverty and contributed to a deeper understanding of the changing economic landscape of metropolitan America. However, because most of this research is based on aggregate and cross-sectional data, the role of household-level factors in the changing income dynamics of cities and suburbs in the U.S. has remained somewhat unclear.

This dissertation addresses this gap in the literature. Using data from the Panel Study of Income Dynamics (PSID) and a refined neighborhood typology, I track individuals and households across time and space to understand associations between disaggregate-level characteristics and aggregate-level trends in economic hardship. In order to explore these connections, I identify three types of household mobility: residential mobility, economic mobility, and transportation mobility. Then, in three independent essays, I examine how these various types of mobility have changed at the household level, and how household-level changes have contributed to aggregate socioeconomic shifts in urban and suburban geographies.

At the disaggregate level, results show noteworthy patterns among low-income households across all three dimensions of mobility. With regard to residential mobility, Essay 1 illustrates the rapid rate at which low-income residents moved out of urban neighborhoods and

into suburban communities between 1999 and 2015. All three suburban neighborhood types included in the analysis experienced a net inflow of low-income people during the study period, with white, car-owning residents of urban residential neighborhoods being the most likely to make an urban-to-suburban move. Essay 2 highlights economic mobility by tracking the relationship between residential location and transitions into and out of low-income status. Findings show considerable differences in income volatility at the household level: while those living in areas with strong urban characteristics (old urban and mixed use neighborhoods) and strong suburban characteristics (new development and patchwork neighborhoods) were relatively stable financially, households residing in older, moderately dense residential areas (established suburb and urban residential neighborhoods) exhibited a high degree of economic vulnerability. Finally, Essay 3 addresses transportation mobility among low-income households. Results show that poorer families often altered their transportation mobility in order to suit their residential location, with those moving from urban-to-suburban neighborhoods showing a relatively high propensity to obtain a household vehicle, while those relocating from suburban-to-urban communities were particularly likely to transition into carlessness.

The findings of the three essays highlight the fluid nature of residential, economic, and transportation mobility among low-income households. However, results also show that this volatility at the household-level is often obscured when viewed in aggregate. For example, while low-income households suburbanized rapidly between 1999 and 2015, the flow of non-low-income residents into suburban communities was also rather robust during the same time period. This means that the urban-to-suburban migration of poorer families had, at most, only a modest effect on the low-income rates of suburban neighborhoods. Likewise, despite the high propensity of households in established suburb and urban residential neighborhoods to transition into low-

income status, the cumulative effect of economic mobility in these areas was actually positive. Finally, while moves into and out of certain geographies were associated with changes in car ownership, other factors—particularly income and employment—were also strong predictors of household automobile ownership. This finding demonstrates that the link between residential location and transportation mobility rests within a broader context, one in which macroeconomic trends shape vehicle ownership decisions through their effect on family finances and employment outcomes.

Given the complex relationship between disaggregate and aggregate outcomes, it is crucial for planners and policy makers to carefully assess the size and scope of economic hardship in their jurisdictions. Data at the city and MSA level are widely available and often easily interpretable, meaning positive trends on cumulative metrics such as median household income and poverty rate may play an outsized role in shaping perceptions of community wellbeing. However, the results of this dissertation demonstrate that even in areas that appear to be economically vibrant, systematic vulnerability may still exist at the household and neighborhood level. Public officials must therefore examine how trends in residential, economic, and transportation mobility are reshaping the socioeconomic landscape of their jurisdictions, and target aid toward the people and places in their communities that are most in need.

Appendices

Table A-1: Change in Household Income between Survey Waves (Pooled OLS, 1999-2015)

	Household income change (*t*, *t* + *2*)	
	Low-income households	**Non-low-income households**
Renter	-3,448.907***	-3,626.011***
	(518.224)	(942.852)
CBSA population (ln)	456.764*	-1,031.354**
	(209.960)	(333.937)
Tract % non-Hispanic white (ln)	178.030	-227.873
	(188.870)	(508.987)
Tract % in poverty (ln)	-2,322.156***	-772.514
	(414.554)	(947.501)
Region (Northeast)		
Midwest	-44.403	808.574
	(846.684)	(1,592.806)
South	85.639	-822.546
	(756.876)	(1,497.354)
West	378.815	-2,538.661
	(900.895)	(1,724.190)
Family size change (*t*, *t* + *2*)	1,503.877***	1,263.073
	(284.264)	(1,517.027)
Age	-96.632***	-189.984***
	(15.013)	(42.426)
Education (No high school diploma)		
High school graduate	164.734	-440.182
	(411.908)	(1,185.339)

Some college	953.425	204.536
	(511.886)	(1,325.579)
College graduate	8,144.788***	4,312.134**
	(1,259.762)	(1,381.088)
Race/ethnicity (Non-Hispanic white)		
Black	-1,427.823**	-2,560.848**
	(548.900)	(865.265)
Hispanic	-1,855.987	2,944.570
	(1,345.186)	(2,262.177)
Asian	249.092	6,132.586
	(3,227.503)	(3,181.761)
Other	-1,470.776	-1,544.050
	(834.865)	(2,147.604)
Employed	-397.271	1,738.681
	(554.374)	(2,771.788)
Employed (*t* + *2*)	5,021.783***	9,633.917***
	(574.635)	(2,795.478)
Unemployed (*t*, *t* + *2*)	-4,751.819***	-11,403.260***
	(494.290)	(1,641.936)
Car ownership (Fully equipped)		
Carless	-599.042	-4,629.820
	(450.437)	(3,298.373)
Car deficit	2,154.595**	1,081.210
	(674.974)	(1,340.671)
Neighborhood type (New development)		
Rural	-1,437.974	-1,222.273
	(922.924)	(1,199.020)
Patchwork	-1,106.883	1,775.351
	(889.537)	(1,199.926)

Established suburb	-705.653	-1560.125
	(1,016.043)	(1,112.309)
Old urban	-14.331	6,546.131*
	(1,177.961)	(3,166.590)
Urban residential	-589.041	-1,712.297
	(837.188)	(1,179.741)
Mixed-use	516.115	457.874
	(1,043.725)	(1,809.608)
Year (1999)		
2001	-1,720.394	-12,328.480***
	(1,071.066)	(3,495.466)
2003	-937.188	-3,933.166
	(1,068.515)	(4,471.015)
2005	-1,434.365	-6,755.952
	(1,046.774)	(3,946.172)
2007	188.213	-7,289.634**
	(1,132.588)	(2,423.637)
2009	-3,459.077***	-15,385.950***
	(994.552)	(4,346.924)
2011	-1,277.076	-4,001.088
	(989.370)	(2,580.018)
2013	-1,038.020	-6,210.974*
	(996.289)	(2,791.938)
Constant	12,187.650**	26,202.930***
	(3,998.311)	(7,586.854)
Observations	12,026	13,340
R^2	0.069	0.072
Adjusted R^2	0.066	0.047

*p < 0.05 **p < 0.01 ***p<0.001

Note: Person level variables (age, education, race/ethnicity, employment, and unemployment) are for the household head. All variables are measured at time *t* unless otherwise noted. Standard errors, in parentheses, are robust and clustered by household.

Table A-2: Change in Household Vehicles per Adult between Survey Waves (Pooled OLS, 1999-2015)

	Change in household vehicles per adult (*t*, *t* + *2*)			
	Model 1	Model 2	Model 3	Model 4
	Suburban car owners	**Suburban carless**	**Urban car owners**	**Urban carless**
	(1)	(2)	(3)	(4)
CBSA population (ln)	-0.010	-0.017	-0.003	-0.034***
	(0.010)	(0.013)	(0.011)	(0.012)
Region (Northeast)				
Midwest	-0.010	0.153***	0.132***	0.124***
	(0.047)	(0.041)	(0.044)	(0.036)
South	0.032	0.137***	0.124***	0.105***
	(0.047)	(0.039)	(0.041)	(0.033)
West	0.085	0.192***	0.107**	0.141***
	(0.055)	(0.059)	(0.044)	(0.054)
Employed	0.047	0.079**	0.046	0.0004
	(0.031)	(0.032)	(0.032)	(0.027)
Employed (*t* + *2*)	0.137***	0.103***	0.172***	0.145***
	(0.032)	(0.032)	(0.032)	(0.029)
Race/ethnicity (Non-Hispanic white)				
Black	-0.064**	0.029	-0.095***	0.015
	(0.026)	(0.035)	(0.027)	(0.038)
Hispanic	-0.064	0.089	0.021	0.050
	(0.078)	(0.119)	(0.084)	(0.140)

Asian	-0.142**	-0.135	-0.067	0.092
	(0.069)	(0.142)	(0.086)	(0.128)
Other	-0.108*	-0.137**	-0.115**	0.035
	(0.060)	(0.055)	(0.053)	(0.099)
Family size change (*t*, *t* + *2*)	-0.031**	0.031***	-0.019	0.021**
	(0.013)	(0.011)	(0.012)	(0.010)
Income (ln)	-0.017	0.002	-0.0004	0.010*
	(0.030)	(0.006)	(0.021)	(0.006)
Income (ln) (t + 2)	0.046***	0.024***	0.044***	0.022***
	(0.015)	(0.005)	(0.013)	(0.004)
Vehicles per adult	-0.568***		-0.590***	
	(0.050)		(0.046)	
Urban move	-0.112***	-0.026		
	(0.025)	(0.027)		
Suburban move			-0.011	0.044
			(0.023)	(0.027)
Year (1999)				
2001	0.007	-0.007	-0.012	0.027
	(0.051)	(0.073)	(0.052)	(0.065)
2003	-0.037	-0.002	-0.046	-0.028
	(0.054)	(0.069)	(0.051)	(0.060)
2005	0.024	-0.018	0.015	0.002
	(0.054)	(0.069)	(0.053)	(0.059)
2007	0.037	-0.005	-0.044	0.015
	(0.050)	(0.068)	(0.053)	(0.060)
2009	-0.035	-0.050	0.007	0.038

	(0.048)	(0.062)	(0.054)	(0.058)
2011	-0.019	-0.064	-0.083	-0.006
	(0.047)	(0.061)	(0.053)	(0.061)
2013	0.010	-0.0002	-0.045	-0.009
	(0.046)	(0.064)	(0.052)	(0.057)
Constant	0.189	0.051	-0.151	0.228
	(0.297)	(0.204)	(0.261)	(0.203)
Observations	2,117	1,005	1,630	1,165
R^2	0.230	0.088	0.249	0.074
Adjusted R^2	0.222	0.069	0.238	0.057

$^{*}p < 0.05$ $^{**}p < 0.01$ $^{***}p<0.001$

Note: Person level variables (employment and race/ethnicity) are for the household head. All variables are measured at time *t* unless otherwise noted. Standard errors, in parentheses, are robust and clustered by household.

Table A-3: Low-Income Car-Owning Households, Likelihood of Becoming Carless (Full Model Output)

	Likelihood of becoming carless (*t, t + 2*)				
Neighborhood at time t	**Old urban/Mixed use**	**Urban residential**	**Established suburb**	**Patchwork**	**New development**
CBSA population (ln)	-0.046	0.023	0.187	-0.206**	0.104
	(0.147)	(0.087)	(0.131)	(0.103)	(0.118)
Region (Northeast)					
Midwest	0.508	-0.798**	0.792	-0.643	-0.246
	(0.625)	(0.355)	(0.540)	(0.447)	(0.803)
South	-0.123	-0.660*	1.510***	-0.624	-1.123
	(0.617)	(0.343)	(0.554)	(0.442)	(0.783)
West	0.639	-0.899**	0.768	-1.118**	-0.699
	(0.683)	(0.395)	(0.678)	(0.510)	(0.804)
Employed	-0.432	0.030	-0.195	-0.322	-0.698**
	(0.365)	(0.209)	(0.285)	(0.295)	(0.305)
Employed (*t + 2*)	-0.665*	-1.304***	-0.602**	-0.766***	-0.978***
	(0.377)	(0.203)	(0.275)	(0.293)	(0.295)
Race/ethnicity (Non-Hispanic white)					
Black	1.251***	0.867***	0.481	0.021	0.730**
	(0.430)	(0.259)	(0.331)	(0.299)	(0.309)
Hispanic	1.154	0.450	-0.019	0.147	-14.275
	(1.342)	(0.701)	(0.873)	(1.201)	(686.021)
Asian	-0.045	0.986	-12.708	1.244	-13.117
	(1.551)	(0.759)	(638.781)	(1.137)	(1,190.940)
Other	-13.965	0.420	1.325**	1.551***	-0.488
	(769.574)	(0.540)	(0.607)	(0.588)	(0.810)

Family size change (*t*, *t* + *2*)	-0.093	-0.363***	-0.172*	-0.287**	-0.317**
	(0.148)	(0.087)	(0.101)	(0.124)	(0.128)
Income (ln)	-0.183	-0.123	-0.096	-0.288***	-0.050
	(0.247)	(0.080)	(0.102)	(0.105)	(0.093)
Income (ln) (*t* + *2*)	-0.455***	-0.214***	-0.198**	-0.233*	-0.324***
	(0.170)	(0.070)	(0.080)	(0.129)	(0.093)
Vehicles per adult	-0.709	-0.007	-0.293	-1.548***	-0.421
	(0.482)	(0.253)	(0.338)	(0.423)	(0.333)
Neighborhood at *t* + *2* (base: neighborhood at time t)					
New development	0.441	-0.192	-0.107	-0.738*	
	(0.558)	(0.306)	(0.443)	(0.400)	
Patchwork	0.074	-0.322	-0.977*		0.579
	(0.517)	(0.295)	(0.584)		(0.376)
Established suburb	0.712	0.092		0.442	0.145
	(0.460)	(0.261)		(0.398)	(0.558)
Urban residential	-0.186		0.376	0.395	1.064***
	(0.417)		(0.284)	(0.324)	(0.335)
Old urban/Mixed use		0.508*	-0.158	0.709	-0.182
		(0.279)	(0.446)	(0.461)	(0.663)
Year (1999)					
2001	-0.087	-0.687	-0.308	-0.823	0.497
	(0.974)	(0.494)	(0.532)	(0.707)	(0.627)
2003	-0.400	-0.155	-0.186	0.600	-0.311
	(1.023)	(0.420)	(0.497)	(0.586)	(0.711)
2005	0.728	-0.376	-0.652	0.403	0.138
	(0.880)	(0.420)	(0.515)	(0.607)	(0.629)

2007	1.005	0.028	-0.756	-0.103	-0.308
	(0.870)	(0.406)	(0.496)	(0.622)	(0.629)
2009	0.508	-0.402	-0.281	0.311	-0.529
	(0.923)	(0.417)	(0.468)	(0.595)	(0.652)
2011	1.023	0.031	-0.803	0.254	-0.183
	(0.891)	(0.403)	(0.499)	(0.590)	(0.592)
2013	1.264	-0.362	-0.922*	0.113	-0.614
	(0.882)	(0.416)	(0.526)	(0.606)	(0.626)
Constant	4.697	2.303	-1.770	8.454***	1.967
	(3.235)	(1.569)	(2.397)	(2.188)	(2.431)
Observations	453	1,177	649	719	749
Log Likelihood	-147.542	-424.149	-243.467	-239.007	-207.851
Akaike Inf. Crit.	349.083	902.299	540.934	532.013	469.702
Pseudo R^2	0.201	0.160	0.141	0.164	0.191

*p < 0.05 **p < 0.01 ***p<0.001

Note: Person level variables (employment and race/ethnicity) are for the household head. All variables are measured at time *t* unless otherwise noted. The base neighborhood type category is a household's neighborhood type at time *t*. Standard errors are in parentheses and are clustered at the household level.

Table A-4: Low-Income Carless Households, Likelihood of Becoming Car-Owning (Full Model Output)

	Likelihood of becoming car-owning (*t*, *t* + *2*)				
Neighborhood at time t	**Old urban/Mixed use**	**Urban residential**	**Established suburb**	**Patchwork**	**New development**
CBSA population (ln)	-0.386***	-0.047	-0.338**	0.086	0.060
	(0.136)	(0.088)	(0.139)	(0.117)	(0.156)
Region (Northeast)					
Midwest	1.067**	0.448	1.165***	0.879	0.773
	(0.495)	(0.315)	(0.437)	(0.625)	(1.042)

South	1.166**	0.431	0.963**	0.769	0.750
	(0.490)	(0.308)	(0.462)	(0.605)	(0.917)
West	1.355**	0.442	1.529**	1.505**	0.956
	(0.578)	(0.420)	(0.654)	(0.755)	(0.979)
Employed	0.119	-0.034	0.625**	0.240	0.242
	(0.317)	(0.192)	(0.253)	(0.329)	(0.407)
Employed (*t + 2*)	0.713**	0.614***	0.523**	0.618*	0.340
	(0.329)	(0.197)	(0.253)	(0.334)	(0.413)
Race/ethnicity (Non-Hispanic white)					
Black	0.545	-0.266	0.133	-0.069	0.673*
	(0.441)	(0.295)	(0.411)	(0.350)	(0.398)
Hispanic	2.039*	0.263	0.445	-0.697	1.043
	(1.060)	(1.025)	(1.026)	(0.952)	(1.618)
Asian	-11.449	0.963	-13.374	-0.248	-0.164
	(622.540)	(1.145)	(535.412)	(1.534)	(1.339)
Other	0.201	0.033	-1.625	-0.101	-0.495
	(1.269)	(0.582)	(1.235)	(1.192)	(1.221)
Family size change (*t, t + 2*)	0.398***	0.236***	0.409***	0.416***	0.402**
	(0.147)	(0.076)	(0.114)	(0.155)	(0.196)
Income (ln)	0.042	0.110*	-0.052	0.090	0.028
	(0.108)	(0.063)	(0.063)	(0.083)	(0.128)
Income (ln) (*t + 2*)	0.189	0.423***	0.217**	0.494***	0.551**
	(0.131)	(0.109)	(0.095)	(0.167)	(0.217)
Neighborhood at *t + 2* (base: neighborhood at time t)					
New development	0.456	0.697*	0.196	0.284	
	(0.667)	(0.362)	(0.750)	(0.425)	

Patchwork	-0.232	0.007	0.077		0.201
	(0.530)	(0.299)	(0.522)		(0.471)
Established suburb	0.204	0.055		-0.856	0.090
	(0.405)	(0.232)		(0.565)	(0.620)
Urban residential	-0.407		-0.118	-0.089	0.652
	(0.347)		(0.267)	(0.349)	(0.490)
Old urban/Mixed use		-0.394	0.170	-0.799	-1.519*
		(0.291)	(0.396)	(0.551)	(0.861)
Year (1999)					
2001	-0.010	0.511	-1.161*	0.688	0.578
	(0.631)	(0.471)	(0.675)	(0.792)	(0.861)
2003	-0.253	0.346	-0.932	-0.111	0.472
	(0.654)	(0.469)	(0.570)	(0.821)	(0.878)
2005	-0.447	0.550	-0.770	0.518	-0.521
	(0.665)	(0.451)	(0.578)	(0.772)	(0.870)
2007	-0.384	0.340	-0.773	0.181	0.032
	(0.655)	(0.469)	(0.558)	(0.741)	(0.782)
2009	-0.050	0.641	-0.972*	0.139	-0.155
	(0.600)	(0.443)	(0.582)	(0.745)	(0.780)
2011	-0.444	0.259	-0.972*	-0.652	0.035
	(0.605)	(0.455)	(0.551)	(0.763)	(0.753)
2013	-0.117	0.303	-0.645	0.066	0.191
	(0.596)	(0.442)	(0.556)	(0.744)	(0.699)
Constant	0.351	-6.203***	1.451	-8.887***	-8.789***
	(2.399)	(1.702)	(2.355)	(2.515)	(3.196)
Observations	382	783	484	314	207

Log Likelihood	-171.370	-414.101	-237.592	-162.813	-108.024
Akaike Inf. Crit.	394.740	880.201	527.184	377.627	268.048
Pseudo R^2	0.145	0.106	0.135	0.178	0.176

$^{*}p < 0.05$ $^{**}p < 0.01$ $^{***}p<0.001$

Note: Person level variables (employment and race/ethnicity) are for the household head. All variables are measured at time *t* unless otherwise noted. The base neighborhood type category is a household's neighborhood type at time *t*. Standard errors are in parentheses and are clustered at the household level.

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