ABSTRACT

Title of Dissertation:	HOUSING DEMAND AND TENURE CHOICE FOR SENIOR CITIZENS: LESSONS FROM THREE ESSAYS
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The U.S. housing market faces a huge surge brought on by the growth of the older population. Housing researchers and gerontologists are now focusing on potential challenges that older households could face over the coming decades and are attempting to estimate how such challenges will affect the housing market. This marks a critical point for assessing housing affordability, availability of accessible housing, and housing demands based on geographical locations – all of which will be of utmost importance to aging populations in the coming decades.

Although the older population is growing rapidly and is receiving considerable attention from both researchers and policymakers, there has been relatively few empirical studies about the housing behaviors of older Americans. This dissertation examines the aforementioned three challenges through empirical essays by employing micro-data (e.g., the 2004–2014 Health and Retirement Study, the 2011 American Housing Survey, and the 2013–2017 Public Use Microdata Sample).

Specifically, the first paper will examine the reasons why elderly homeowners make the downward transition from homeownership, with a particular focus on the significance of property taxes on elderly behaviors. The second paper will investigate the living conditions of existing housing for stayers – those who have remained in their place of dwelling since reaching the retirement age of 65 – and estimate how accessible their housing is to meet the daily needs for aging in place. The third paper will seek empirical determinants on residential mobility and housing choices by elderly households in the Baltimore MSA, accessing the net impact of individual and housing attributes on migration behaviors and housing consumption.

The results of these analyses show that property tax abatement programs fail to provide tax subsidies targeted to low income seniors in need. Furthermore, policy approaches to grow the accessible housing stock have proven largely unsuccessful. Finally, seniors who migrate throughout the Baltimore MSA show a strong tendency to downsize and become renters – particularly of apartments – regardless of location. This research will provide timely new evidence, which will help decision-makers better understand the burning issues that impact aging adults' housing-related behaviors in the U.S. housing market.

HOUSING DEMAND AND TENURE CHOICE FOR SENIOR CITIZENS: LESSONS FROM THREE ESSAYS

by

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Chapter 1: Introduction

The coming decades will see significant growth in the senior population, defined as those aged 65 or older. According to U.S. Census Bureau projections, the aging population will grow from 48 million in 2015 to 79 million in 2035, while the number of households headed by seniors aged 65 or older will reach nearly 50 million in 2035 (Joint Center of Housing Studies of Harvard University, 2015). Even more, the population aged 80 or older will double from 12 million in 2015 to 24 million in 2035. Overall, this substantial growth will shift the age distribution of the U.S. population and U.S. households such that one-fifth of the U.S. population and one-third of U.S. households will be comprised of seniors aged 65 or older. Undoubtedly, this age cohort has served as the largest driving force across many sectors of the housing economy in the United States, and this demographic upheaval is likely to become the most influential key factor in the short-term future of the housing market.

Housing researchers and gerontologists are now focusing on potential challenges that older households could face over the coming decades and are attempting to estimate how such challenges will affect the housing market. This work shapes a variety of policy and planning strategies aimed at addressing those concerns. A first challenge relates to the housing cost burden that older households often face in retirement. Since many will no longer have a source of income, retired homeowners are more likely than non-retired homeowners to face a housing cost burden, defined as paying more than 30 percent of income on housing costs. Even more, the share of older households carrying mortgage debt on their primary residences into retirement

jumped to 33 percent in 2013 from 22 percent in 1995 (Joint Center of Housing Studies of Harvard University, 2015). Furthermore, the Joint Center of Housing Studies of Harvard University expects that 11 million homeowners aged 65 or older will face a housing cost burden by 2035; the center predicts that the oldest homeowners with mortgage debt will face housing cost burdens as severe as those that renters face. Under these circumstances, property taxes may increase the mobility rate among retired homeowners through demand adjustments due to the fact that retired homeowners may find themselves in a precarious financial position.

A second challenge is the lack of accessible homes that allow seniors to manage functional limitations and that extend opportunities to age in place. By 2035, the number of older households with a disability will increase by 76 percent to 31.2 million; 17 million households will have at least one resident with a mobility disability, 12 million households will have at least one resident with a self-care disability, and 17 million households will have at least one resident with a household activity disability (Joint Center of Housing Studies of Harvard University, 2015). As the older population grows, it will increase demands for new constructions or modifications to housing units in order to provide basic accessibility features to cope with disabilities and health challenges. Because today's seniors have indicated a strong desire to remain in their homes as they age, rather than enter institutional long-term care, seniors' living conditions are critical to their quality of life and capacity to live independently. The home will be an increasingly important setting for the delivery of long-term care over the next two decades as the majority of seniors seek to remain in their current dwellings.

A third challenge for senior housing correlates with geographical location as seniors' social engagement with their communities and accessibility to public amenities or medical services vary based on location. Around 51 percent of seniors aged 65 or older reside in urban areas, in which more public amenities and transit services are offered. The remaining population (49 percent) of seniors aged 65 or older reside in low-density areas of metropolitan regions or in non-metro and rural areas. In these areas, seniors are more likely to face an increased risk of isolation, particularly if they neither drive nor live with someone who drives, or if they lack access to public transportation (Joint Center of Housing Studies of Harvard University, 2015). It is possible that older adults would tend to move to urban areas to have better access to public amenities and transit services, as well as to have improved social engagement. If a large enough number of older householders return to urban areas from non-metro or rural areas, it could have a significant impact on population densities in urban cities. Furthermore, the decision of whether and where to move affects housing market conditions by the magnitudes of migrant flows into and out of the market. Decisions regarding geographic location and housing consumption have large implications on the housing market.

The U.S. housing market is now facing a huge surge brought on by the growth of the older population. This marks a critical point to assess housing affordability issues, availability of accessible housing for aging in place, and housing demands based on geographical locations – all of which will be of utmost importance to aging populations in the coming decades. This dissertation seeks to fill part of the current research gap by examining the aforementioned three challenges through empirical

essays. First, this paper will examine the reasons why elderly homeowners make the downward transition from homeownership, with particular focus on the significance of property taxes on elderly behaviors. Second, this paper will investigate the living conditions of existing housing for stayers – those who have remained in their place of dwelling since reaching the retirement age of 65 – and estimate how accessible their housing is to meet the daily needs for aging in place. This will be particularly important for seniors with mobility and grasping impairments. Third, this paper will seek empirical determinants on residential mobility and housing choices by elderly households in the Baltimore Metropolitan Statistical Area (MSA), accessing the net impact of individual and housing attributes on migration behaviors and housing consumption. This research will provide timely and new evidence, which will help decision-makers better understand the burning issues that impact aging adults' housing-related behaviors in the U.S. housing market.

The reminder of this dissertation is organized as follows. Chapter 2 focuses on the theoretical framework of housing demand and tenure choice. Chapter 3 offers a summary and critique of the U.S. empirical evidence on five hypotheses concerning the determinants of tenure decision: (1) income, wealth, and employment status, (2) life-cycle factors, (3) user cost, financial constraints, and economic downturn, (4) residential mobility and location, and (5) prior tenure. These five categories acknowledge the major motivators addressed in existing literature, and they represent the critical drivers of housing tenure choice. Chapter 4 examines the significance of property taxes on elderly housing behaviors. Chapter 5 presents estimates on housing accessibility and unmet needs for aging in place. Chapter 6 sheds light on the

intersection between elderly migration and housing consumption in the Baltimore MSA. Lastly, Chapter 7 suggests the contribution of this research to academia, along with policy implications.

Chapter 2: Theoretical Background

2.1. Urban Spatial Structure

The work by Muth (1969) describes the analysis of residential land use in terms of the equilibrium of the household in urban space. Muth (1969) focuses on inquiring into the effects of (1) income, (2) housing price, and (3) transportation cost on the equilibrium location. Considering these three factors, each household determines its optimal location and amount of housing consumption for each of the house type categories (e.g., single family homes and apartments). Then, its utility maximization is determined by selecting the one which yields the greatest utility.

The increase in (1) incomes leads to an increase in housing consumption on all households. If the effects of this increased housing consumption outweigh the effects of increased transportation costs, the equilibrium distance from the Central Business District (CBD) will increase for all households. So, the demand for housing tends to increase at more distant locations from the CBD, which might transform existing cities into more sprawled cities. Therefore, higher income households are more likely to move toward the outskirts of the city. It might encourage households to become homeowners in the edges of the city. A change in (2) housing prices has a significant effect on the quantity of housing consumed and on equilibrium location. A rise in the level of housing prices decreases the equilibrium distance of the consumer from the CBD, which might contribute to form more compact cities. As all households attempt to move closer to the CBD, it might promote households to be

renters in the urban center. The demand for housing closer to the CBD rises relative to that in more distant locations, thereby housing prices increasing relatively more in the vicinity of the CBD than in the edges of the city. The effects of an increase in (3) transportation costs are similar to those of a rise in the level of housing prices. An increase in transportation costs reduces the quantity of housing consumed at the equilibrium location, thereby inducing a move toward the city center. The new equilibrium location is closer to the city center, which might promote to transform existing cities into more compact cities. Consequently, higher transportation costs might encourage households to become renters by moving into the vicinity of the CBD.

As for the decision to own versus rent housing, the monocentric city model can explain two opposing forces for households: (1) Households who have the preference for housing consumption are more likely to move to the outskirt of the city; (2) Households who have priority for the high opportunity cost of commuting cost are more likely to move toward the urban center. Depending on the effects of commuting cost and housing consumption with respect to income, households may tend to live either in the urban center, which represents a place for rental housing or in the edges of the city, which represents a place for homeownership. The relative strength of the increased income on housing consumption and on the marginal costs of transport determines an optimal household location for any given house type. In reality, the rich tend to live in owned homes in the outskirts of the city while the poor tend to live in rental housing in the urban center. Richer consumers put the higher value on increased housing consumption than on increased transportation costs, so

they are likely to live in the spacious land in the edges of the city. Conversely, poorer consumers are likely to live in the urban centers since they might put more value on increased transportation costs than increased housing consumption. Low-income households are unlikely to move the outskirts of the city, and instead, they might want to be renters in the urban center.

2.2. Utility Function and Maximization

2.2.1. Single-Period Model

Here, I attempt to deliver insights using a traditional approach involving a one-period model. Consider a two good world, *C* and *H*. The consumer wishes to maximize the utility function, which yields satisfaction from consuming a particular (*C,H*) bundle. Following the approach of Fallis (2014), the utility function is given by

$$U = U(C, H) \tag{1}$$

where dollars spent on all goods other than housing are *C* and housing consumption denoted by the square feet of floor space in a dwelling is *H*. The consumer chooses *C* and *H* to maximize utility subject to the budget constraint. If the household is likely to rent housing services, the budget constraint is given by

$$pC + pH = y + Sr \tag{2}$$

where household income is *y*; household savings is *S*, the interest (a financial asset yielding return) is *r*. If the household is likely to choose homeownership, its budget constraint is given by

$$pC + cpH + Mm = y + (S - E)r \quad (3)$$

where the down payment is *E*, the mortgage principal is *M*, the mortgage rate of interest is *m*, and the annual rate of maintenance, insurance, property taxation, and depreciation represent *c*; $M + E = pH$. In equilibrium, owners and renters should share the same indifference curve, which means that consumers must be equally well off at all locations, achieving the same utility regardless of tenure mode. If consumers enjoy the same utility regardless of whether to rent or to own, they are more likely to choose the cheaper tenure mode. However, there might be a variety of potential factors – including taxes, transaction cost, and an imperfect market – that affect the utility status in equilibrium. If disequilibrium occurs, households are likely to choose the tenure mode that yields a higher utility.

2.2.2. Multi-Period Model

In general, households tend to consume housing services by maximizing their utility function over a multi-period time frame. Today's consumption choices are the outcome of inter-temporal utility maximization; thus, households in each time period formulate consumption plans to maximize lifetime utility subject to a lifetime budget constraint. Following the approach of Ioannides and Kan (1996), I assume that time is discrete and households have infinite horizons. The utility function is given by

$$U_t = U(C_t, H_t; \theta_t) \quad (4)$$

where non-housing consumption is C_t; housing consumption is H_t; θ_t is a time varying taste shifter, which represents heterogeneity in household

socioeconomic characteristics – including the household head's age – that may change over time. To maximize expected lifetime utility, all households are set in $(C_t, H_t)_{t=0}^{\infty}$. Then, the expected lifetime utility is given by

$$\sum_{t=0}^{\infty} E_t \, \beta^t U(C_t, H_t; \theta_t) \tag{5}$$

subject to the budget constraint

$$\sum_{t=0}^{\infty} \frac{1}{(1+r_t)^t}(C_t + \pi_t H_t) = A_0 \tag{6}$$

where β^t is the rate of time preference; A_0 are initial assets; $\pi_t = R_t$ if renting in period t, and $\pi_t = r_t - a_t$, if owning in period *t*. As such, if the household is a renter in period *t*, the per period cost per unit of housing is the rental rate R_t. If the household ia an owner, this cost is the interest rate r_t minus the appreciation rate of a_t. Once θ_t – which includes the household head's age – becomes known at the beginning of period *t*, a household decides whether to adjust the path of non-housing and housing consumption.

2.3. User Cost

2.3.1. User Cost of Owner-Occupied Housing

Estimating the cost of homeownership is more problematic. The process of measuring homeownership cost applies the user cost of owner-occupied housing to incorporate current values for a mortgage payment, property taxes, depreciation, capital gain, and

so forth. Following the approach of Brueckner (2011), the user cost of owner-occupied housing is given by

$$[(1-\tau)(i+h)+d-g]v = \text{user cost of owner-occupied housing} \quad (7)$$

where *v* is the housing cost per unit of consumption; *i* is the mortgage interest rate; *h* is the property tax; *d* is the depreciation rate; and *g* is the rate of capital gain. τ is the owner occupier's income tax rate, which means that the deduction by τ can be applied on mortgage interest costs and property taxes. If the purchase price per unit of housing *v* rises, *q* will fall, and the same thing will happen if the mortgage interest rate *i* or the property tax rate h were to rise. The effect of *i* establishes the important point that the cost of a mortgage contributes to the cost of owners' occupied housing. Higher depreciation would raise the user cost, causing the quantity demanded to fall; whereas, an increase in the capital gains rate g would have the opposite effect. As such, by adopting (4), we can find the user cost under owning, and thus we will find the lower housing cost by comparing it with the rental price

2.3.2. User Cost of Rental Housing

Measures of rental cost are usually straightforward. Generally, observed rents or rent index is used to reflect the cost of rental housing. Nonetheless, following the approach of Brueckner (2011), the user cost of rental housing is given by

$$p = (i+h+d-g)v = \text{user cost of rental housing} \quad (8)$$

where *p* is the rental price that the landlords earn per unit of housing; *v* is the housing cost per unit of consumption; *i* is the mortgage interest rate; *h* is the property

tax; *d* is the depreciation rate; and *g* is the rate of capital gain. Any income-tax term is not contained in the formula.

2.4. Housing Consumption and Investment

The economic literature includes investigations into the determinants of households' housing tenure choices. Theoretical analyses present a homeownership decision, driven by the divergence between investment and consumption demand (Henderson and Ioannides, 1983), as an element of two broader motives. Assuming it is an imperfectly competitive market for housing, tenure choice has been made largely based on an underlying theory requiring the simultaneous allocation of the optimal level of housing consumption and investment motives. Households make a homeownership decision if the investment demand that reflects the portfolio motives exceeds the consumption demand that reflects the preferences for housing services. Conversely, if the consumption demand is greater than the investment demand, households are more likely to be renters.

Ioannides and Rosenthal (1994) contribute to building a behavioral model for housing tenure choice, which defines that household *i* has a consumption and investment demand expressed as $H_{Ci} = (X_i, e_{Ci})$ and $H_{Ii} = (X_i, e_{Ii})$, respectively. *X* is a vector of the explanatory variables, the union of all determinants of the elements common to both the investment and consumption demands for housing functions, and e_{Ci} and e_{Ii} are random errors. If H_{Ci} sufficiently exceeds H_{Ii}, a household may opt for rental housing. Conversely, if H_{Ii} is greater than H_{Ci}, a household is more likely to choose homeownership. Based on the magnitude of divergence between the

investment and consumption demands for housing, Ioannides and Rosenthal (1994) divide households' tenure choice into four tenures as shown in Figure 1. "Rent 1" indicates households renting without owning property, while "Rent 2" represents households renting while owning property other than their homes. "Own 1" indicates households owning their homes without owning other properties, while "Own 2" represents households owning their homes in addition to other properties.

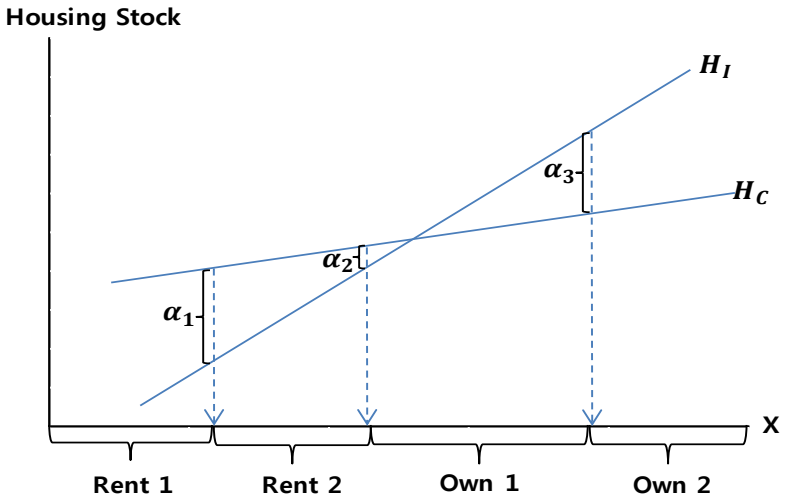

Figure 1 Housing investment and consumption

The individual components of X (the systematic determinants of H_I and H_C) do not influence housing tenure choice, but instead the divergence between H_I and H_C serves as a driver for the housing decision. In the region Rent 1, H_C is sufficiently larger than H_I; as such, households do not want to hold a property for investment. In the Rent 2 region, a household still rents H_C but also holds housing stock in its portfolio. Similarly, in the Own 1 region, a household finds owner-occupancy to be advantageous, and the household holds a housing stock. Finally, in the Own 2 region, a household opts for owner occupancy, in which the household owns additional

housing equal to the difference between H_I and H_C. In this behavior model, the difference between H_I and H_C is defined as *J*. Also, a_1, a_2, and a_3 represent the critical values for *J*, and determine the transition from Rent 1 to Rent 2, Rent 2 to Own 1, and Own 1 to Own 2. $a_1 < a_2 < a_3$ as the difference between the investment and consumption demand for housing promotes households to move successively from Rent 1 to Own 2.

2.5. Life Cycle and Non-Life Cycle Hypotheses

The most commonly used model to investigate aging households' consumption pattern is the life cycle model. Hubbard et al. (1994) and Jones (1997) suggest a standard life-cycle model for implications of tenure choice on the Life Cycle Hypothesis. It has an assumption that at each age, an elderly household is likely to maximize

$$E_t \sum_{s=t}^{T} D_s U(C_s) \,/\, (1+\delta)^{s-t} \tag{9}$$

subject to

$$W_s = W_{s-1}(1+r) + A_s + L_s + R_s - M_s - C_s \tag{10}$$

Equation (4) indicates that consumption C_s – excluding exogenous medical expenses M_s – is chosen to maximize the expected lifetime utility (where E_t is the expectations operator conditional on information available at *t*). δ is the subjective time preference rate. D_s is a state variable that is equal to 1 if the individual is alive at

s and is otherwise equal to zero, and T is the maximum number of years the consumer could possibly live. In Equation (5), W_s consists of housing and non-housing bequeathable wealth, A_s is predetermined annuity income, L_s is any exogenous labor earnings, R_s represent endogenous means-tested transfer payments, and r is a certain real after-tax return. The Life Cycle Hypothesis predicts that at some point during retirement the consumer reaches a stage where

$$C_s + M_s > rW_{s-1} + A_s + L_s + R_s \tag{11}$$

and the optimal consumption path is financed by spending W. The optimal consumption path relies on the specific form of the utility function including a taste for bequests, the degree of risk aversion to uncertain mortality, and the aforementioned components.

If households do not have a bequest motive, the consumption pattern will be constrained by the $W_T = 0$. Thus, the Life Cycle Hypothesis model predicts that if households do not have bequest motives or who have small bequest objectives, they will make a transition from homeownership when they reach the wealth consumption stage in Equation (6) (Artle and Varaiya, 1978). In the Life Cycle Hypothesis, however, consumers may liquidate housing wealth and non-housing wealth differently for optimal wealth consumption. Although the model outlined above makes no predictions about what wealth will be spent first, Hurd (1990) suggests that housing wealth may be spent last due to issues with transaction costs, precautionary savings motives, and desired bequests. Housing wealth may begin to be liquidated after most bequeathable non-housing wealth has been consumed (Levin, 1998).

Therefore, decisions to reduce housing wealth may be very different from decisions to reduce other financial wealth.

In contrast to the life cycle hypothesis model, most researchers argue that a transition from homeownership can be attributed to the fact that "noneconomic" events related with the aging process have an influential role in changing tenure. These life cycle events include various time-varying factors such as retirement, poor health, and family size. For these non-LCH households, a home equity is preserved and bequeathed as the precautionary savings unless certain wealth-impairing contingencies occur. The exit from homeownership only occurs as a result of wealth shocks that require spending a sizable portion of housing wealth to maintain the desired consumption path. Jones (1997) suggests the Non-Life Cycle Hypothesis model, in which the elderly households' tenure decision can be represented by an unobservable binary index

$$I = I(P_o/P_r, F, H, N, Z) \tag{12}$$

where the index represents the difference in utility between owning and renting, P_o is the price per unit of housing services acquired through homeownership, P_r is the price per unit of rental housing services, and P_o/P_r is expressed in units of the composite nonhousing goods. Lifetime income is proxied by bequeathable nonhousing wealth (F), housing wealth (H), and annuitized wealth (N). For simplicity, assume there are no labor earnings or transfer income, beyond what is embodied in N. Z represents household attributes that affect the utility derived from a particular tenure choice. This model predicts that the likelihood an

elderly homeowner becomes a renter is positively related to retirement, poor health, divorce, and widowhood, while the probability is negatively related to household size and the transaction costs of moving.

Chapter 3: Literature Review

3.1. Introduction

Over the past several decades, there has been consistent interest in academic research and policy debate regarding household tenure choice. This is partly because researchers have found it possible to formulate policy to promote higher levels of homeownership. Since homeownership carries substantial social benefits, higher homeownership rates benefit both the associated neighborhood and broader community, as well as the country as a whole (Yun and Evangelou, 2016). As such, policies geared toward homeownership have been part of the social fabric of the United States for decades. Despite myriad studies and debates concerning the real causes of changes in housing tenure, there is still much disagreement among researchers over the contributing factors of this phenomenon. Some researchers argue that tenure transition is mainly caused by economic factors, while others highlight the significance of noneconomic factors that greatly vary over the household life-cycle.

This article offers a summary and critique of U.S. empirical evidence on five hypotheses concerning the determinants of tenure decision: (1) income, wealth, and employment status, (2) life-cycle factors, (3) user cost, financial constraints, and economic downturn, (4) residential mobility and location, and (5) prior tenure. The aforementioned five categories include the primary motivators most commonly addressed by the literature, and thereby represent the critical drivers of tenure decision. It should also be noted that there may be a discrepancy in the factors that

drive decision-making between sequential tenure decisions that occur over the life course. Thus, it would be helpful to differentiate housing decisions by the different stages of life course in which they occurred. This study categorizes empirical evidence into three types of tenure decisions: "*Initial Tenure,"* defined as young first-time homebuyers who transition from a short renting period or from living with parents, and exit from governmental housing subsidies; "*Housing Tenure Transitions,"* which cover individuals who have rented housing for a long period or who are transitioning to a second owned home from renting; and "*Special Case of Senior Citizens,"* who are individuals aged 65 or older – including retirees – who might make the reverse transition to renting from homeownership.

Amazingly, little research has been found to produce a summary and critique of recent evidence since the work by Turner and O'Neal (1986). This article updates our current knowledge of homeownership patterns by synthesizing and critiquing the recent evidence that resulted from newer empirical studies conducted since 2000 on the determinants of tenure decisions. In cases where there is seminal evidence to support a hypothesis or there is a lack of newer literature, studies conducted prior to 2000 are examined. This study provides useful information for local and state policymakers with comprehensive use of empirical evidence, methodologies, and variables for tenure-choice research.

3.2. Five Hypotheses on the Determinants of Housing Tenure Decisions

In most literature, five major hypotheses have been offered as explanations for the real determinants of housing tenure decisions. The first hypothesis argues that the

tenure decision results from the differences in income, wealth, and employment status. The second hypothesis asserts that tenure choice is mainly caused by life-cycle factors, which have been used widely to explain time-varying influencers such as age, marriage, children, and household size over a lifetime. The third hypothesis posits that a household's tenure mode is clearly influenced by a relative user cost, which is typically calculated by the cost of owning relative to renting. In addition, financial constraints such as student loans, the availability of credit, higher down payment, and maximum loan amount can greatly influence households' tenure decisions. Furthermore, the economic downturn may have a great impact on tenure decisions. The fourth hypothesis suggests that residential mobility – by which a household is more likely to move within the next few years – has a negative effect on tenure decisions for households because high transaction overwhelm rental occupancy of a few years. Additionally, locational characteristics (i.e., urban versus suburban) serve as factors influencing determinants of tenure choice. The fifth hypothesis claims that prior tenure serves as the critical factor in the decision to purchase housing.

3.3. Empirical Evidence on the Causes of Housing Tenure Decisions

3.3.1. Income, Wealth, and Employment Status

Income - Initial Tenure

When young adults purchase a home for the first time relying on mortgage debt – the largest loan that most young adults ever undertake – the ability to manage mortgage debt might require one to have a sufficient income level unless they have significant savings (Bricker et al., 2012). For this reason, financial risks – including default and

foreclosure – happen more often for low income homebuyers. Many scholars have examined the extent to which income levels contribute to one's choice of homeownership as an initial tenure mode, controlling for the other covariates. Using the National Longitudinal Survey of Youth (NLSY) 1997 for the U.S. data and the British Household Panel Survey (BHPS) for the British data, Andrew, Haurin, and Munasib (2006) compare the transition of young adults from renting or living with parents to first-time homeownership in the United States and Britain. In both countries, increased income consistently raises the likelihood that a household will transition to homeownership, with Britain seeing a stronger correlation between income and homeownership. Lee et al. (2018) examine the role of direct parental financial assistance in their offspring's homeownership. Citing 1998-2004 Health and Retirement Study (HRS) and 1999-2015 Panel Study of Income Dynamics (PSID) data, findings reveal that inclusion of child income and wealth into the model makes the effects of parental wealth disappear. Child's income is statistically found to closely correlate with a heightened likelihood that he or she will buy a first-time home.

Some scholars focus on the housing behaviors of low-income homeowners who received community reinvestment mortgages between 1998 and 2003 through the Community Advantage Program (CAP). Using Community Advantage Panel Survey (CAPS) data from 3,743 CAP borrowers, Riley et al. (2015) examine the factors that drive mobility and housing decisions for CAP recipients. The findings reveal that, for the period between 2005 and 2012, logged income is positively associated with a transition to homeownership, if or when people move out of the

CAP home. Conversely, a higher level of logged income decreases the probability of renting during the same period. Lindblad et al. (2017) also use 1,531 samples from the CAPS to examine how psychological attitudes toward homebuying relate to first-time home purchases during the period of 2004-2014. In several specifications, higher income has consistently proven to have a positive effect on home-buying intentions.

Income - Tenure Transition

When a home-buyer has long been in the rental market or is transitioning to a second owned home from renting, he or she still faces financial risks that might stem from mortgage debt. Similar to the initial tenure decision, low-income households are more likely than higher-income households to face financial risks when they change homes. Empirical studies for examining the contribution of income levels to housing tenure transition are analogous to those employed for testing initial tenure differences in income. Gabriel and Painter (2008) employ the Census Public Use Microdata Sample (PUMS) file of the 1990 decennial census from Washington, D.C., Chicago, and Los Angeles to estimate three-level nested multinomial logit models of mobility, location, and tenure choice. The results reveal that higher levels of both permanent and transitory income positively correlated with the likelihood of achieving homeownership. Such income effects are significantly larger for black households than white or Latino households. The work by Gabriel and Painter (2003) also supports the evidence that both permanent and transitory income positively relate to the likelihood of achieving homeownership.

More recently, using the German Socio-Economic Panel (GSOEP) and the PSID, Boehm and Schlottmann (2014) investigate the likelihood and timing of

housing tenure choice dynamics in Germany and the United States between 1997 and 2007. The U.S. findings reveal that household income has a consistent and significant positive impact on the likelihood of both an initial transition to homeownership and possible transitions to a second owned home from renting during the study period. At the same time, higher household income decreases the probability of transition to renting from homeownership. Using the 1972-2003 PSID, Lee (2014) examines why renters stay in or leave certain neighborhoods – including intra-neighborhood and inter-neighborhood moves – and how these decisions are interrelated with their housing tenure transitions. The author found that higher levels of permanent and transitory income decrease one's propensity toward choosing to be renters for both intra- and inter-neighborhood moves. Nonetheless, only higher permanent income has a positive effect on achieving homeownership for both intra- and inter-neighborhood moves. Additionally, many scholars highlight the significance of household income in achieving homeownership (Goodman, 2003; Boehm and Schlottmann, 2004).

Income - Special Case of Senior Citizens

Retired seniors no longer commute to a place of employment, nor do they typically have labor income. Given that 78.7 percent of households aged 65 and older in 2016 owned their homes (Joint Center for Housing Studies, 2018), a significant increase in property taxes may cause retired homeowners living on limited incomes to make housing adjustments. Many researchers have examined the relationship between property taxes and tenure transition. Using 1969-1979 Retirement History Survey (RHS) data from 11,153 households, Seslen (2003) studied the factors that influence seniors' residential mobility, focusing on the significance of property taxation. A dual

hazard framework – which treats the failures of downsizing versus those of renting separately – showed that property taxes are somewhat important to those who consider trading down, but not to those moving out of homeownership. Sabia (2009) tests how demographic and socio-economic characteristics, housing conditions, and local policies and amenities affect the likelihood of aging in place for older homeowners. Using the 1972-1992 PSID, Cox hazard models show that increased property taxes highly correlate with a diminished propensity to age in place. For senior age groups of 50-60 (the youngest retirement-age cohort), 61-70 (the mid-senior cohort), and 71-85 (the oldest senior cohort), a 10 percent increase in property taxes is associated with a 1.4, 4.0, and 3.1 percent increase in the hazard rate of moving for each cohort, respectively. Boldt et al. (2010) investigate if property tax drives elderly homeowners out of their homes. Using 2007 data on annual changes in property tax liabilities for all homeowners in Wisconsin, the probit regression suggests that increases in property taxes have no impact on the mobility rate of homeowners ages 80 and younger. In contrast, increases in property taxes have an impact on homeowners over 80 years old, but the impact is small. Using 1999-2011 PSID, Bian (2016) studied the effect of financial leverage, measured using loan–to-value ratios on senior homeowners' decisions to downsize. Multinomial logit models testing three types of downsizing – moving into a home with fewer rooms, moving to a multi-family property from a single family property, or moving into a less expensive home – show that logged annual property taxes have only a positive effect on the likelihood that seniors will downsize when they move to multi-family housing from single family housing.

Shan's (2010) study expanded on previous studies by relying on instrumental variable approaches to address the endogeneity problem associated with property taxes. With the 1992-2004 HRS as the major data source, the author collected new state-level dataset to construct the simulated relief benefits. Then, Shan used the simulated relief benefits as a valid instrument for property taxes. The findings show that increases in property taxes play an important role in elderly homeowners' moving decisions. Furthermore, unlike in prior studies that examined a causal relationship between property taxes and the probability of moving, the work by Farnham and Sevak (2006) applied a Tiebout model to examine whether or not empty-nesters move to locations with lower property taxes and lower expenditures on public education through a life cycle. Using 1992-2000 HRS data along with a national panel of local fiscal data. they found that empty-nest movers who stay local tend to have little fiscal adjustment. In contrast, cross-state empty-nest movers are likely to experience reduced exposure to property taxes and local school spending.

Wealth - Initial Tenure

Buying a home involves both the down payment and closing costs – which usually cost several thousand dollars – and typically absorbs a substantial portion of the wealth of the home-buyer(s). Since first-home buyers are typically young adults who have been in the labor force for a comparatively short period, many researchers deal with less direct methods – such as the impact of parental wealth to progeny homeownership – to study this population**.** Boehm and Schlottmann (1999) use the 1975–1982 PSID to examine direct descendants' productivity through their education attainment and through their housing choices after they leave their parents' home.

The findings suggest that parental homeownership plays an important role in a child's/children's progress toward becoming homeowners; in cases where the parent(s) are homeowners, there is a 59.3 percent increase in the likelihood that their children achieve homeownership in their lifetime. Gyourko (2002) stresses the importance of affordability for low-wealth households, and investigates the constraints involved in the move to homeownership. The findings indicate that parental wealth serves as an important factor in one's ability to achieve homeownership, and this leads to wide aggregate racial differences in homeownership.

Aratani (2011) expands upon prior studies by examining if a positive effect of parental homeownership on offspring's homeownership is due to self-selectivity. Using 1968-1996 PSID data, findings suggest that the intergenerational effect of parental homeownership has been differentiated by race, income, and the parents' housing tenure history. Nonetheless, the offspring of socio-economically disadvantaged groups are less likely to take advantage of parental homeownership in attaining a single-family home. Lee et al. (2018) examine the role of direct parental financial assistance in their offspring's homeownership. Citing 1998-2004 HRS and 1999-2015 PSID data, the researchers confirm that the progeny of parents who have more resources are more likely to become homeowners. More specifically, offspring who receive a transfer greater than $5,000 are 15.1 percent more likely to transition to homeownership between the ages of 25 and 44. The effect of financial assistance from parents has increased since the recession of 2007-2009. Additionally, many existing studies indicate that parental wealth becomes a bigger factor as it is

increasingly difficult for aspiring homeowners to become established in the housing market (Boehm and Schlottmann, 2002; Galster et al., 2007; Lindblad et al., 2017).

Wealth - Tenure Transition

Regarding households who have been in the rental market for several years to accumulate the financial wealth necessary to purchase a home, household wealth still might play a significant role in the transition to homeownership. In a similar way to the initial tenure decision process, financial wealth can help resolve several expenditures including transaction costs. Many researchers have investigated the extent to which wealth levels contribute to tenure changes by employing wealth measures or proxies for wealth. Relying on three separate cross-sectional household surveys performed by the Federal Reserve Board (FRB), Gyourko et al. (1999) examine the critical determinants of the racial disparities in U.S. homeownership. Wealth constraint variables – which are created as proxies for wealth – indicate that racial differences in homeownership among households possessing sufficient wealth to meet standard mortgage underwriting criteria do not exist. In the case of wealth-constrained households, however, substantial racial disparities exist. Constrained whites show much higher homeownership rates than equivalent minority households. By employing the PUMS file from the 1990 decennial census, Gabriel and Painter (2003) explore the residential location and tenure choice decisions of African American households in the Los Angeles area. Using dividend income as a proxy for wealth, the findings demonstrate that both white and black households that have a higher dividend income are more likely to be homeowners. Dawkins (2005) employs the 1978–1997 PSID, investigating the contribution of residential location toward the

black-white gap in first-time transitions to homeownership. By using a wealth variable such as the total value of non-housing assets – including rent, interest, dividends, trust funds, and royalties1 – the results show that whites are more likely to own housing if they have more non-housing wealth, while blacks tend to choose rental housing. Boehm and Schlottmann (2014) suggest that the highest two quintiles of household savings have a significant positive impact on the likelihood of achieving homeownership in the initial transition to homeownership, but they do not have a positive effect for a transition to a second owned home from renting. Nonetheless, the lowest two quintiles of a given sample's real wealth distribution consistently show the positive effect for both transitions to the first and second owned home.

Wealth - Special Case of Senior Citizens

Retired seniors relying on fixed income often face financial difficulty in covering housing costs, daily expenditures, and supportive services. Accrued wealth can serve as an important financial source to sufficiently bolster fixed retirement incomes as households age. Many analysts have examined how wealth level affects the likelihood of one's exit from homeownership. Jones (1997) utilizes the 1983–1986 Federal Reserve Survey of Consumer Finance (SCF) to test all bequeathable wealth by splitting it into housing and non-housing components. The findings indicate that non-housing bequeathable wealth has a negative effect on leaving homeownership. Using the 1968-1989 PSID, VanderHart (1998) examines the likelihood that old households will leave homeownership to become renters or choose to downsize to a low-equity

[1] Dividend income, royalties, rent, and interest may be forms of income. Nonetheless, Dawkins (2005) employed the total value of those sources for a time varying measure of non-housing wealth.

home. The findings consistently indicate that high-level assets reduce the utility derived from other tenure options; as such, household residents become less likely to leave homeownership. Additionally, using the 1968-2005 PSID, Painter and Lee (2009) measure financial wealth as the sum of shares of stock in a publicly held corporation, mutual funds or investment trusts, checking and savings accounts, and so forth. Using this definition, they show that greater financial wealth reduces the likelihood of transitioning away from homeownership. Another work by Lee and Painter (2014) examines how the proximity of children influences housing tenure transitions of older households. According to the 1968–2007 PSID, findings consistently suggest that household residents with higher levels of housing wealth are less likely to leave homeownership. More recently, Bian (2016) shows that having more assets has a negative effect solely on moving to less expensive housing rather than on moving to housing with fewer rooms or transitioning to multi-family housing from single-family housing.

Employment Status - Tenure Transition

Income uncertainty arising from unexpected income variability and the likelihood of future unemployment is one of the most relevant factors in tenure decisions. Most studies focus primarily on households who have been in the labor force rather than first-time home buyers or retiree households. Robst et al. (1999) investigate several measures of income uncertainty by using 1983-1987 PSID data to show that income uncertainty reduces the likelihood of homeownership by 0.4 to 1.1 percent in response to a 10 percent increase in average uncertainty. Using the April 1996 Survey of Income and Program Participation (SIPP) – which followed a panel of 17

households for 48 months between April 1996 and March 2000 – Shore and Sinai (2010) show that the household tends to stay in the current home and reduce the consumption of other goods due to high transaction costs if only one spouse is unemployed. If both spouses are concurrently unemployed, the household is more likely to pay the transaction costs and reduce its housing consumption. Nonetheless, if a couple shares the same occupation in the same industry, spouses may invest more in housing than couples who do not share an occupation despite the higher household labor income risk. The findings reveal that same-occupation couples invest at least 2.1 percent more in owner-occupied housing than couples who do not share the same occupation. Riley et al. (2015) suggest that becoming employed increases the likelihood of moving to remain owners by nearly two times and of moving to become renters by nearly three times. Becoming unemployed is positively associated with the likelihood of a move to own or rent, but it is not statistically significant; in turn, a one percent increase in the unemployment rate nearly doubles the probability of moving, regardless of subsequent tenure choice. Additionally, the works by Lee (2014) and Lindblad et al. (2017) present the negative effect of income uncertainty on homeownership.

Limitations

Several studies from the 2000s and 2010s employ deficient methods regarding income and wealth measures. Several measures of permanent income are preferable to current income measures as predictors of tenure choice. Some supporters of this position suggest that permanent income potentially reflects the concept of a future income over the life cycle. Goodman and Kawai (1982) greatly contribute to

developing the method by which permanent income serves as the predicted value of a regression of household income on a set of demographic and human capital characteristics. For example, Dawkins (2005) obtains predicted permanent income value from an equation where current income is regressed on factors including race, age, sex, education, non-housing wealth, occupation, and region. Additionally, residual of current family income and expected income are defined as transitory income. Using this method, many studies (Painter, 2000; Goodman, 2002, 2003; Gabriel and Painter 2008; Lee 2014) include the variable for permanent income; however, many studies do not employ permanent income as a proxy of income. Instead, those studies use information such as annual median income, annual average income, and five-year average income after moving (Painter and Lee, 2009; Boehm and Schlottmann, 2014; Riley et al., 2015; Lindblad et al., 2017).

Specific measures of a household's wealth are rarely available. Gabriel and Painter (2003) use dividend income as a proxy for wealth to investigate the differences in homeownership. Dawkins (2005) calculates a wealth variable as the total value of non-housing assets including rent, interest, dividends, trust funds, and royalties. Painter and Lee (2009) measure the financial wealth as the sum of shares of stock in a publicly held corporation, mutual funds or investment trusts, checking and savings accounts, etc. Furthermore, Jones (1997) argues that consumers may liquidate housing wealth and non-housing wealth differently for optimal wealth consumption, thereby testing all bequeathable wealth by splitting wealth into housing and non-housing components. Most studies have used mixed types of wealth measures or proxies without the separation of housing and non-housing wealth.

Methodologically, the econometric models are subject to some criticisms. Many researchers (John 1997; Gabriel and Painter, 2008; Lee 2014) rely on the cross-sectional logit regression, which estimates the model using a sample of all households. Painter (2000) argues that this approach models cumulative homeownership attainment, and thus homeownership is considered a long-term decision based on future needs as well as present needs. Nevertheless, there has always been a distance between the time at which individuals are observed and the time at which a housing decision was made. This model actually demonstrates the profile of all individuals because cross-sectional data does not reflect past choices among homeowners. Moreover, Painter (2000) points out that, particularly for householders who are 45 years of age or older, cumulative homeownership attainment may reflect the lagged effects of past choices. Another method for modeling tenure choice has been to estimate the model using a sample of recent movers (Gabriel and Painter, 2003). This approach has the advantage of not being influenced by the lagged effect of tenure-choice models among all households. Painter (2000) argues that the decisions of recent movers are more likely to reflect equilibrium conditions in the housing market. Nevertheless, cross-sectional models do not account for the ownership decision, but instead only describe the profile of a household at the time of the survey. There exists a gap between the time of the survey and the time of tenure transition. This time gap yields inaccurate information which can lead to biased results.

Summary

To conclude, most researchers suggest that income, wealth, and employment factors play significant roles in determining initial tenure, tenure transition, and seniors' housing modes. As for a household's income, there is a clear correlation between high income and homeownership, particularly for the transition of young adults from renting (or leaving from parents or government subsidy) to homeownership. Nonetheless, there is still mixed evidence regarding the association of senior housing with property taxes and the likelihood of transitioning away from homeownership. One possible explanation can be the fact that many studies ignore the heterogeneous nature of housing, especially with regards to local- and state-level property tax relief and limit programs. Given that property tax assistance programs can have a significant effect on seniors' housing behaviors, failing to address unobservable heterogeneity of housing might produce biased estimates. Many studies have employed fixed-effect models to account for heterogeneity existing between different times and locations. Nonetheless, year- and state-level fixed effect estimations may still reveal challenges in removing heterogeneity between local level-based households.

Regarding differences in wealth levels, the overall relationship aligns with my expectations. Most studies reveal that wealth-related variables play a significantly positive role in the likelihood of homeownership. In particular, there are consistent findings regarding seniors' housing behaviors; this proves that affluent seniors are unlikely to leave their homeownership. Mixed results regarding initial tenure and tenure transition may derive from the different measures of a household's wealth. With regard to employment status and income uncertainty, there are also mixed

results. One possible explanation for the mixed results is the challenge of distinguishing the effect of unemployment from the effect of lower income. Since one's employment status highly correlates with labor income, the integrated effect of unemployment and low income may yield biased outcomes. In general, one could not become unemployed without losing income**.**

Future research is needed to provide a better understanding of the extent to which low-income households face challenges in achieving homeownership for the first time and sustaining homeownership over time. Most notably, prior studies that estimate the effect of financial factors on tenure decisions largely ignore the possible endogeneity problem. For example, income tax rates, educational attainment, and other family members' income sources play important roles in determining the amount of real household income. Two-stage least squares regression analysis can be considered to control endogeneity with an instrumental variable. Likewise, failure to account for the heterogeneous nature of housing may result in inappropriate inferences. In cases where there is heterogeneity that cannot be explained, one analytical approach is to employ a random-effect model. Future studies are required to account for the heterogeneity issue by imposing appropriate statistical specifications.

Table 1 Summary of the studies on income, wealth, and employment status

Author(s)	Income, wealth, and employment status	Types	Study area	Data	Relationship with the hypothesis
Andrew et. al (2006)	Income	Initial Tenure	The US nation	1997 NLSY	(+)
Lee et al. (2018)			The US nation	1998-2004 HRS/1999-2015 PSID	(+)
Riley et. al (2015)			The US nation	2004-2014 CAPS	(+)
Lindblad et. al (2017)			The US nation	2004-2014 CAPS	(+)
Gabriel & Painter (2008)		Tenure Transition	Washington, D.C., Chicago, Los Angeles	1990 PUMS file	(+)
Gabriel & Painter (2003)			The US nation	1990 PUMS file	(+)
Boehm & Schlottmann (2014)			The US nation	1997-2007 PSID	(+)
Lee (2014)			The US nation	1972-2003 PSID	(+)
Seslen (2003)		Senior Citizens (Property tax)	The US nation	1969-1979 RHS	Mixed
Sabia (2009)			The US nation	1972-1992 PSID	(+)
Boldt et al. (2010)			Wisconsin	2007 income tax returns filed annually by all residents in Wisconsin	Mixed
Bian (2016)			The US nation	1999-2011 PSID	Mixed
Shan (2010)			The US nation	1992-2004 HRS	(+)
Farnham & Sevak (2006)			The US nation	1992-2000 HRS	Mixed
Boehm & Schlottmann (1999)	Wealth	Initial Tenure (Parental wealth)	The US nation	1975-1982 PSID	(+)
Aratani (2011)			The US nation	1968-1996 PSID	Mixed
Lee et al. (2018)			The US nation	1998-2004 HRS/1999-2015 PSID	(+)
Galster et al. (2007)			The US nation	The PSID cohort of children born from 1968 and 1974	(+)
Lindblad et al. (2017)			The US nation	2004-2014 CAPS	(+)
Gyourko et al. (1999)		Tenure Transition	The US nation	**Surveys performed by** the FRB	(+)
Gabriel & Painter (2003)			The US nation	1990 PUMS file	(+)
Dawkins (2005)			The US nation	1978-1997 PSID	Mixed
Boehm & Schlottmann (2014)			The US nation	1997-2007 PSID	Mixed
Jones (1997)		Senior Citizens	The US nation	**1983–1986 SCF**	(+)
VanderHart (1998)			The US nation	**1968-1989 PSID**	(+)
Painter & Lee (2009)			The US nation	1968-2005 PSID	(+)
Lee & Painter (2014)			The US nation	1968-2007 PSID	(+)
Bian (2016)			The US nation	1999-2011 PSID	(+)
Robst et al. (1999)	Employment Status/Income uncertainty	Tenure Transition	The US nation	1983-1987 PSID	(+)
Shore and Sinai (2010)			The US nation	1996-2000 SIPP	Mixed
Riley et al. (2015)			The US nation	2004-2014 CAPS	Mixed
Lee (2014)			The US nation	1972-2003 PSID	(+)
Lindblad et al. (2017)			The US nation	2004-2014 CAPS	(+)

3.3.2. Life-Cycle Factors

Initial Tenure

There is a great deal of literature that examines the contribution of lifetime variables (i.e., age, marital status, education attainment, and family size or the number of children) toward housing-tenure choice. In regard to the age of the household head, Gabriel and Painter (2003) examine the transition of first-time homeownership between white and black populations, and show that the increase in age plays positive roles in white-black homeownership decisions. Boehm and Schlottmann (2014) suggest that younger households faced a less likely transition to initial ownership from renting during the period of 1997-2007. More recently, Lindblad et al. (2017) show that first-time home purchases are positively associated with an increase in age. Nonetheless, Riley et al. (2015) show that increasing age yields a negative effect on homeownership.

Regarding marital status, many scholars consistently show that a household's married or partnered status relates to the likelihood of moving and achieving homeownership for younger households, including low-income households who move out of the CAP residence (Boehm and Schlottmann, 2014; Riley et al., 2015; Lindblad et al., 2017). Conversely, many argue that the likelihood of homeownership declines with a transition to single status (Gabriel and Painter, 2003; Boehm and Schlottmann, 2004). Additionally, Riley et al. (2015) and Lindblad et al. (2017) argue that female headship increases the likelihood of first-time home purchases relative to male headship.

The scholars also show education attainment increases the likelihood of achieving initial homeownership from renting. Gabriel and Painter (2003) suggest that higher degrees of education play positive roles in first-time homeownership decisions for both white and black populations. Boehm and Schlottmann (2004) also support the argument that first-time homeownership rises with higher levels of education. Riley et al. (2015) and Lindblad et al. (2017) prove that first-time home purchases are positively associated with having a bachelor's degree or more for low-income households who move out of the CAP residence.

As for the family size or the number of children, Boehm and Schlottmann (2004) argue that the likelihood of first-time homeownership declines with an increase in family size. Riley et al. (2015) also show that a greater number of children yield a negative effect on homeownership. In contrast, Boehm and Schlottmann (2014) and Lindblad et al. (2017) suggest that household size (or households with three or more children) is positively associated with first-time home purchases.

Tenure Transition

Preferences for tenure vary between families across different life-cycle stages. Many researchers have employed longitudinal analysis to relate changing housing tenure to various lifetime events occurring over the household's life cycle. Regarding the age of a household head, many scholars have produced mixed findings. The results by Gabriel and Painter (2008) vary significantly across locations and among racially stratified samples. In Los Angeles, as age increases, homeownership becomes increasingly likely across all racial and ethnic groups. The age of a household head, however, inversely correlates with homeownership attainment among all groups in

Chicago and among blacks in Washington, D.C. Lee (2014) shows that the rise of age consistently yields positive effects on achieving homeownership when people pursue intra-neighborhood moves. Conversely, household age negatively correlates with becoming a homeowner when the household faces inter-neighborhood moves. Boehm and Schlottmann (2014) suggest that older households consistently increase the likelihood of achieving a second owned home.

In relation with marital status, Gabriel and Painter (2008) show that married status consistently yields positive effects on homeownership attainment across all observed locations (Los Angeles, Chicago, Washington, D.C.) and among all racial and ethnic groups, with the sole exception being white households in Chicago. Lee (2014) also shows that married status consistently yields positive effects on achieving homeownership when people pursue intra-neighborhood moves. Likewise, Boehm and Schlottmann (2014) also argue that single status negatively correlates with the likelihood of achieving a second owned home. Some researchers also examine the difference in homeownership attainment between male- and female-headship. Boehm and Schlottmann (2004) use 1984–1992 PSID data to examine the determinants of the transition of second-, and third-time homeownership from renting. At second and third homeownership, the probability of homeownership decreases for single male-headed households. Lee (2014) also shows that female headship yields positive effects on achieving homeownership when a household pursues an intra-neighborhood move.

Analysts have revealed mixed results regarding education attainment, Gabriel and Painter (2008) suggest that higher educational attainment (college degree or

better) increases the likelihood of achieving homeownership in Los Angeles, Chicago, and Washington, D.C. Lee (2014) shows that higher education attainment consistently yields positive effects on achieving homeownership when people pursue intra-neighborhood moves. In contrast, higher education attainment negatively correlates with becoming a homeowner when households face inter-neighborhood moves. Boehm and Schlottmann (2014) also suggest that education attainment negatively correlates with the likelihood of achieving a second owned home.

As for family size or the number of children, Lee (2014) shows that a higher number of children per household consistently yields positive effects on achieving homeownership when pursuing intra-neighborhood moves. Boehm and Schlottmann (2014) also suggest that household size increases the likelihood of achieving a second owned home. In contrast, the higher the number of children there is for a given household, the lower the likelihood there is that the household will achieve homeownership (Gabriel and Painter, 2008).

Special Case of Senior Citizens

Most studies of the elderly population's housing decisions include predictors for "health and disability" and "retirement status." Megbolugbe et al. (1997) argue that the probability of owning a home generally decreases at retirement for female-headed elderly households, but not for male-headed elderly households. VanderHart (1998) shows that physical limitation raises the utility derived from renting or living dependently, which indicates that disability may have adverse effects on the utility that a household derives from homeownership. Furthermore, retirement status influences a household's desire to liquidate their home equity. Sabia (2008) argues

that the presence of physical or nervous conditions that impede work significantly increase the probability to leave homeownership, with the strongest predictor being a consistent physical limitation. Painter and Lee (2009) include binary variables for a household head's disability at the time of the interview in the model or within the past two years. The findings show that retired households and those with disabilities are more likely to be renters or to downsize. Similarly, Shan (2010) suggests that recent retirement and hospitalization consistently increase the likelihood that the elderly make decisions to move from homeownership.

Lee and Painter (2014) expand their previous study (Painter and Lee, 2009) by examining the intersection between the health status of older households, proximity of children to their parents, and a household's decision to make housing tenure transitions. In particular, they test the hypothesis that a child's recent moves may mitigate the likelihood that a parent with poor health status becomes a renter if children could provide immediate health care. Using 1968-2007 PSID data, Cox proportional specifications reveal that disability and retirement increase the likelihood of renting. Furthermore, the authors added interaction terms between elderly health deterioration and children's recent moves to examine how their interaction contributes to the housing tenure transition of older households. The findings reveal that the presence of adult children could help their elderly parents with health deterioration stay home by providing immediate health care services and reducing their institutionalization. Nonetheless, if older households who have experienced disability within the past two years live in proximity to their adult children – either if they have moved in with them or have moved closer to them – the adult

child's/children's mobility does not seem to have a positive effect on mitigating the likelihood that older homeowners with deteriorating health make a transition to become renters. Bian (2016) also suggests that retirees are more likely to downsize to all types of downsizing (e.g., moving into a home with fewer rooms, moving to a multi-family property from a single family property, or moving into a less expensive home). However, Megbolugbe et al. (1999) assert that the coefficient on retirement within the past three years does not greatly influence the homeownership decision. Painter and Lee (2009) also argue that recent retirement does not change the likelihood of becoming a renter.

Limitations

One limitation of life-cycle variables is that the age of the household head may correlate with a proxy of wealth, and thus make age a proxy for wealth. As a result, the model that includes both an age measure and a wealth measure suggests that the age of the household head may be insignificant when household wealth is effectively measured. Furthermore, a more appropriate model for reflecting the impact of life-cycle factors (i.e., time-varying variables) would be the duration model, which utilizes panel data. With the emergence of datasets not previously available to tenure-choice researchers, duration modeling strategies have become more common. A tendency has developed to consider previous cross-sectional analysis, but this presents challenges in explaining the relationship between the event of changing residence and other events over the life cycle. Several studies (Archer et al., 2010; Boehm and Schlottmann, 2014; Dawkins, 2005; Painter and Lee, 2009; Riley et al., 2015) rely on panel data using a duration model to examine the contribution of

lifetime variables toward housing-tenure choice. Nonetheless, plenty of studies still rely on cross-sectional data, which means that they do not reflect the significant effects of life-cycle factors on tenure choice over one's lifetime.

Despite the wide use of a duration model, this model presents well-recognized challenges of right- and left-censoring when it is used to estimate hazard functions. The first episode – defined as a whole sequence of events that a certain household faces during the study period – notes that the beginning and ending times for episodes are unknown (left- and right-censored). The second episode indicates that the beginning and ending times for episodes were observed during the study period (uncensored). The other episodes are either right- or left-censored. The hazards model was fitted only to the uncensored and right-censored observations (Archer et al., 2010). Left-censored observations cannot be used adequately because one cannot properly deal with the difference between the beginning of the observation period and the beginning of the risk period (Boehm and Schlottmann, 2014). Thus, it is quite important for duration models to use samples that are still intact in the last observation time. Moreover, a duration model causes some difficulty in understanding the interaction with additional crucial decisions. This may prove important when we need to investigate a bundle of housing tenure choices under the assumption that three choices (e.g., residential mobility, location choice, and tenure choice) are associated with stages of the household housing process.

Summary

By changing the preference for consumption versus investment over the life cycle – in a way demonstrated by Ioannides and Rosenthal's (1994) behavioral model – one

may demonstrate the importance of life-cycle status on decisions to move to homeownership. Longitudinal analysis would provide the ability to develop measures that capture the long-term nature of tenure choice; it allows us to demonstrate that the event of moving from a rental dwelling to ownership exists as part of a whole sequence of events. By employing the empirical strategy, the findings suggest that life-course events clearly play a major role in tenure decisions over all the stages of a lifetime. In particular, marital status and higher levels of education for an initial tenure decision consistently increase the probability of moving to homeownership. In contrast, age itself does not seem to be critical in determining tenure mode for households. This makes sense because the rise of age may correlate with a proxy of wealth. Furthermore, large family size and/or number of children do not align with my expectations. One possible explanation is that low-income households who have many family members still seek to live in rental housing or governmental subsidized housing. As for the elderly's housing decision, predictors for "health and disability" and "retirement status" might serve as more significant characteristics for tenure transition. Older households prefer to stay in their own home as they get older, which is referred to as "aging in place." Nevertheless, lower health and poor financial status make a move more likely because individuals face many difficulties in maintaining their own homes.

Future research is required to provide evidence on the effect of retirement on tenure transition over the long-term period. The effect of retirement on tenure transition has been considered for a short-term period. If observed over a longer time period, the effect of retirement might significantly increase the likelihood of a

person's decision to liquidate his or her home equity, leading him or her to become a renter or to downsize. Methodologically, very few studies adopt the competing risk framework. In general, a household who makes a tenure decision is exposed to choose one of two or three housing options. For example, renting and downsizing are considered competing risks when a senior homeowner is likely to consume their home equity. By focusing only on the probability of subjects who actually developed the event of interest, the competing risk framework produces the unbiased estimates on the probability that the event of interest happens. The competing risk framework can be a useful option for reflecting the effect of life-cycle factors in the presence of competing risks.

Table 2 Summary of the studies on life-cycle factors

Author(s)	Life-cycle factors	Types	Study area	Data	Relationship with the hypothesis
Gabriel & Painter (2003)	Age	Initial Tenure	The US nation	1990 PUMS	(+)
Boehm & Schlottmann (2014)			The US nation	1997-2007 PSID	(+)
Riley et al. (2015)			The US nation	2004-2014 CAPS	(–)
Lindblad et al. (2017)			The US nation	2004-2014 CAPS	(+)
Gabriel & Painter (2008)		Tenure Transition	Washington, DC, Chicago, Los Angeles	1990 PUMS	Mixed
Lee (2014)			The US nation	1972-2003 PSID	Mixed
Boehm & Schlottmann (2014)			The US nation	1997-2007 PSID	(+)
Gabriel & Painter (2003)	Marital status	Initial Tenure	The US nation	1990 PUMS	(+)
Boehm & Schlottmann (2004)			The US nation	1984-1992 PSID	(+)
Boehm & Schlottmann (2014)			The US nation	1997-2007 PSID	(+)
Riley et al. (2015)			The US nation	2004-2014 CAPS	(+)
Lindblad et al. (2017)			The US nation	2004-2014 CAPS	(+)
Gabriel & Painter (2008)		Tenure Transition	Washington, DC, Chicago, Los Angeles	1990 PUMS	(+)
Lee (2014)			The US nation	1972-2003 PSID	(+)
Boehm & Schlottmann (2014)			The US nation	1997-2007 PSID	(+)
Gabriel & Painter (2003)	Education attainment	Initial Tenure	The US nation	1990 PUMS	(+)
Boehm & Schlottmann (2004)			The US nation	1984-1992 PSID	(+)
Riley et al. (2015)			The US nation	2004-2014 CAPS	(+)
Lindblad et al. (2017)			The US nation	2004-2014 CAPS	(+)
Gabriel & Painter (2008)		Tenure Transition	Washington, DC, Chicago, Los Angeles	1990 PUMS file	(+)
Lee (2014)			The US nation	1972-2003 PSID	Mixed
Boehm & Schlottmann (2014)			The US nation	1997-2007 PSID	(–)
Boehm & Schlottmann (2004)	Family size/ the number of children	Initial Tenure	The US nation	1984-1992 PSID	(–)
Boehm & Schlottmann (2014)			The US nation	1997-2007 PSID	(+)
Riley et al. (2015)			The US nation	2004-2014 CAPS	(–)
Lindblad et al. (2017)			The US nation	2004-2014 CAPS	(+)
Gabriel & Painter (2008)		Tenure Transition	Washington, DC, Chicago, Los Angeles	1990 PUMS	(–)
Lee (2014)			The US nation	1972-2003 PSID	(+)
Boehm & Schlottmann (2014)			The US nation	1997-2007 PSID	(+)
Sabia (2008)	Disability/ retirement	Senior Citizens	The US nation	1972–1992 PSID	(+)
Painter & Lee (2009)			The US nation	1968-2005 PSID	Mixed
Shan (2010)			The US nation	1992-2004 HRS	(+)
Bian (2016)			The US nation	1999-2011 PSID	(+)
Lee & Painter (2014)			The US nation	1968-2007 PSID	(+)

3.3.3. User Cost, Financial Constraints, and Economic Downturn

User Cost - Tenure Transition

A relative user cost – defined as an owner-to-renter price ratio – has a negative effect on the probability of purchasing a home; this means that households are more likely to choose the cheaper tenure mode if both types provide the same utility[2]. The first way to calculate the opportunity cost of owner occupancy is to employ hedonic price regression. Initially, Goodman and Kawai (1982) greatly contributed to developing this strategy, studying housing demand by investigating income and price variables. The results show that a higher housing price leads to a lower demand market. The other studies consistently show that an owner-to-renter price ratio, acquired from the estimation of hedonic price regression, has a negative effect on home purchase decision (Goodman 2003).

Another way to obtain the opportunity cost of ownership is to apply a user cost formula of owner-occupied housing. Robst et al. (1999) include owner user cost and renter user cost in the model, which examines the impact of income uncertainty on housing tenure choice. The results indicate that an owner user cost has a highly negative effect on homeownership. Conversely, a renter user cost has a positive effect on the likelihood of homeownership, even though it is not significant statistically. Bourassa and Yin (2006) compare the homeownership rates of young households in the United States and Australia. The study includes a relative cost ratio as the proxy of ownership and rental price over several models. The majority of models reveal the

[2] In terms of spatial equilibrium in a city, owners and renters should share the same indifference curve, which means that consumers must be equally well off at all locations, achieving the same utility regardless of a tenure mode. If consumers enjoy the same utility regardless of whether to rent or to own, they are likely to choose the cheaper tenure mode.

negative effect of a relative cost ratio on the likelihood of homeownership. Boehm and Schlottmann (2014) also note the variable denoting the cost of owning relative to renting by state or major metropolitan areas in the United States. The findings reveal that higher ownership costs decrease the likelihood of transition from renting to first ownership, along with a move to second ownership. Nonetheless, those coefficients are still negative on transition from ownership to renting and from first ownership to second ownership.

User Cost - Special Case of Senior Citizens

Most previous studies that focus on the elderly's housing decision do not include a relative user cost variable acquired from constructing user costs or using a standard hedonic price equation. Nevertheless, Wasi and White (2005) and Sabia (2008) assert that increases in property taxes and annual utility costs (e.g. higher heating and electricity costs) are correlated with a diminished propensity to age in place

Financial Constraints - Initial Tenure

Student loan debt has been recognized as a major barrier for homeownership for young adults by an array of academic researchers and policymakers. Many researchers have attempted to isolate the effect of student loans by controlling for a set of observable student characteristics. Using the NLSY 1997 with approximately 9,000 youths who were born between 1980 and 1984, Letkiewicz and Heckman (2018) focus on the role of student loan debt as it impacts homeownership among young adults. The findings reveal that there is no clear discrepancy in homeownership between debtors and non-debtors after controlling for a number of factors.

Nonetheless, paying off loans increases the likelihood of owning a home. Likewise, Houle and Berger (2019) employ data from the NLSY 1997, examining the associations of student loan debt with homeownership. Despite findings that there is a negative association between debts and homeownership, the correlation between debtor and non-debtor and homeownership is very modest. Furthermore, the authors find no evidence of an association between debt amount and homeownership among debtors.

Other recent studies rely on instrumental variable estimation to examine the effect of student loans on the decision to become a homeowner. Robb et al. (2019) use the Baccalaureate and Beyond 2008:2012 (B&B) panel dataset with a representative sample of four-year U.S. college graduates surveyed by the U.S. Department of Education. Unlike prior studies that used cumulative loan balances, this study investigates the impacts through the separation of federal and private student loans. By instrumenting student loans using in-state tuition rates, the results suggest that a $1,000 increase in private loans causes a 5 percent decrease in the likelihood of purchasing a home. Conversely, a $1,000 increase in federal loans has no significant impact on homeownership. Mezza et al. (2020) rely on the merging of multi-datasets from the National Student Clearinghouse (NSC), the Department of Education (DE), and the College Board (CB), instrumenting for the amount of individual student debt using changes to the in-state tuition rate at public four-year colleges. The authors found that a $1,000 increase in student loan debt decreases the likelihood of buying a home by about 1.8 percent for households in their mid-20s,

which is equivalent to an average delay of about four months in attaining homeownership.

Financial Constraints - Tenure Transition

There have been numerous examples in literature that offer interesting evidence on financial constraints. Generally, lender-borrowing constraints account for a decrease in the likelihood of homeownership. In contrast, low down payment loans, low transaction costs, and the tax treatment of homeownership raise the likelihood of achieving homeownership. First, many analysts have discussed how the size of a down payment could affect access to homeownership. The work by Gyourko (2002) reviews the constraints involved in the transition from renting to owning. The study partially agrees that very low down payment loans contribute to increasing affordable homeownership. The study by Fuster and Zafar (2016), using the monthly Federal Reserve Bank of New York Survey of Consumer Expectations in August 2015, also suggests that the size of the down payment is an important determinant on homeownership decisions. The reduced ability to obtain low down payment loans would reduce homeownership especially among younger and more constrained households.

Likewise, recent researchers have examined the association of homeownership with credit quality, which affects the ability of households to obtain a mortgage. Using 1979 NLSY data, Barakova et al. (2014) examine the impact of constraints on the probability of homeownership during the housing market boom between 2003 and 2007. The findings show that the wealth-related constraint has a negative impact on homeownership status while the marginal impact of borrowing

constraints associated with income and credit quality declined during the study period. Acolin et al. (2019) review findings in the literature regarding the role of credit constraints in lowering access to homeownership, with the highlight of the tightening of mortgage credit after the U.S. Great Recession. The authors found that tight credit – which affects the ability for households to obtain a mortgage and become homeowners – largely accounts for the decline of homeownership after 2004, rather than to changes in the demand for homeownership. As drivers of continued tight credit conditions, they point out representations and warrant risk, along with the liability for triple damages under the False Claims Act and the high and uncertain costs of servicing delinquent loans.

Additionally, many researchers have examined a variety of housing-related factors determined by the mortgage market condition. Boehm and Schlottmann (2014) investigated the likelihood and timing of housing tenure choice in Germany and the United States. The findings from the GSOEP and the PSID reveal that housing and mortgage market conditions, along with the tax treatment of owned homes across the two nations, cause observed differentials in tenure transitions. More recently, Halket and Vasudev (2014) also argue that financial constraints, housing illiquidities, and housing price risk can contribute to delayed homeownership over the life cycle. Moreover, borrowing constraints in the mortgage market, risk house values, and transaction costs equally increase the likelihood of becoming renters.

Economic Downturn - Initial Tenure

Recent literature discusses how the recession has impacted attitudes toward first-time homeownership. The hypothesis is that the economic downturn decreases the

likelihood of becoming a homeowner or leaving one's parents to establish an independent household. Lee and Painter (2013) focus on how the economic downturn has affected the formation of potential households over the several decades. Using the 1968-2009 PSID, the findings suggest that a recession decreases the probability that a young adult leaves one's parents to become an independent homeowner or renter. The likelihood falls by 1 to 11 percent depending on age and employment. Lindblad et al. (2017) use the same respondents to reveal that the attitudes toward homebuying shifted due to the financial crisis. Dummy variables denoting the years of 2005–2014 show that coefficients of 2009, 2010, 2011, and 2012 have negative effects on home purchase decisions. Additionally, the authors add two dummy variables denoting the period of 2004–2007 versus that of 2008–2014 to see the difference between pre- and post-recession housing decisions. As expected, first-time homebuyers are less likely to purchase homes during the post-recession period.

Economic Downturn - Tenure Transition

Some researchers have investigated estimations on the transition to homeownership before, during, and after the Great Recession. Acolin et al. (2016) explore the impact of borrowing constraints on homeownership after the Great Recession. By using the 2010–2013 SCF, the findings reveal that tightened borrowing constraints decreased the likelihood of becoming a homeowner in the aftermath of the Great Recession. With regards to being subject to one of three borrowing constraints (wealth, income, or credit), the estimated decline in the probability of being a homeowner was 26 percent in 2001 and 23 percent in 2004–2007. Following the Great Recession, being financially constrained caused a 30 percent decrease in the likelihood of owning,

according to 2010-2013 data. Using the SCF for 2010 and 2013, Acolin et al. (2016) also examined the impact of borrowing constraints on homeownership before, during, and after the Great Recession. By comparing the estimates with those obtained using their previous study (Acolin et al., 2015), they found that tightened borrowing constraints had a significant negative effect on the likelihood of achieving homeownership over all the periods of 2001, 2004–2007, and 2010–2013. In particular, the effect is most substantial in the aftermath of the Great Recession. Nonetheless, the work by Drew and Herbert (2013) does not align with our expectation. The study relies on data from Fannie Mae's National Housing Survey (NHS), and investigates the determinant of homeownership in the post-recession period. The findings indicate that recent housing price declines and loan delinquency rates appear not to affect individuals' tenure preferences. Instead, individual characteristics are the strongest drivers of post-recession demand for homeownership.

Limitation

Rather than apply a user cost of owner-occupied housing or produce an estimate using a standard hedonic price equation, many studies still use inaccurate methods for employing proxies for housing price. Painter and Lee (2009) use the average housing price measured in logs. Carter (2011) employs the housing price index at the metropolitan level, which represents the cost of homeownership in the household's region. Many scholars argue that measuring homeownership costs should allow one to apply a user cost of owner-occupied housing. This incorporates current values for the opportunity cost of invested equity, mortgage interest costs, depreciation,

maintenance or operations, property taxes, and expected appreciation (Andrew et al., 2006).

As an alternative, both prices are estimated using a standard hedonic price equation. Many studies consistently show that an owner-to-renter price ratio, acquired from the estimation of hedonic price regression, has a negative effect on home purchase decisions (Goodman, 2002, 2003; Robst et al., 1999). Measures of rental cost generally follow observed rents or rent index used to reflect the cost of rental housing. Otherwise, the median of a rental cost in a study area is used as a proxy. More importantly, past studies ignore the effect of property tax assistance programs on tenure decisions. All 50 states and Washington, D.C. have some type of property tax assistance programs, which have a great impact on determining user cost for homeowners. In instances where one state has more than one type of assistance programs, higher assistant benefits create lower property tax payments, and thus consequently produce a lower user cost for homeowners. Factoring in relief benefits to calculate a user cost produces a more accurate cost of homeownership especially for low-income, elderly, or disabled households.

Summary

To conclude, scholars consistently present a relative user cost, in the context of an owner-to-renter price ratio, which serves as a negative predictor of the probability of homeownership. As mentioned above (see footnote 2), comparing user cost under owning and renting, consumers will choose the lower housing cost under the assumption that both provide the same utility in the spatial equilibrium. Financial constraints account for the decrease in the likelihood of ownership, and thus explain

the delay on transitions into homeownership. Recent studies dealing with the endogeneity of student loan debt using in-state tuition rates have consistently found that student loan debt lowers the likelihood of buying a home. In addition, low down payment loans, credit quality, low transaction costs, and the tax treatment of homeownership may have positive effects on increasing the likelihood of homeownership. Finally, the likelihood of purchasing a home significantly fell during and after the Great Recession for both initial tenure and tenure transition. Nonetheless, mixed evidence regarding the post-recession period highlights the significance of personal characteristics on housing behaviors.

Table 3 Summary of the studies on user cost, financial constraints, and economic downturn

Author(s)	User cost, Financial constraints, Economic downturn	Types	Study Area	Data	Relationship with the hypothesis
Goodman (2003)	User cost	Tenure Transition	The US nation	1981-1993 AHS	(+)
Bourassa & Yin (2006)			The US nation	1989 AHS	(+)
Boehm & Schlottmann (2014)			The US nation	1997-2007 PSID	(+)
Wasi & White (2005)		Senior Citizens	The US nation	1970-2000 IPUMS	(+)
Sabia (2008)			The US nation	1972-2992 PSID	(+)
Letkiewicz & Heckman (2018)	Financial constraints	Initial Tenure (Student debt)	The US nation	1997 NLSY	(–)
Houle & Berger (2019)			The US nation	1997 NLSY	(–)
Robb et al. (2019)			The US nation	2008-2012 B&B	(+)
Mezza et al. (2020)			The US nation	Multi-datasets including NCS, DE, and CB	(+)
Fuster & Zafar (2016)		Tenure Transition (Down payment, credit quality, mortgage market condition)	New York	2015 FRB of New York Survey of Consumer Expectations	(+)
Barakova et al. (2014)			The US nation	1997 NLSY	Mixed
Acolin et al. (2019)			The US nation	Existing literature	(+)
Boehm & Schlottmann (2014)			The US nation	1997-2007 PSID	(+)
Halket and Vasudev (2014)					(+)
Lee & Painter (2013)	Economic downturn	Initial Tenure	The US nation	1968-2009 PSID	(+)
Lindblad et al. (2017)			The US nation	2004-2014 CAPS	(+)
Acolin et al. (2016)		Tenure Transition	The US nation	2010-2013 SCF	(+)
Drew & Herbert (2013)			The US nation	2010-2011 NHS	(–)

3.3.4. Residential Mobility and Location

Residential Mobility - Tenure Transition

Expected residential mobility negatively correlates with the likelihood of purchasing a home because high transaction costs drive rational households to delay purchasing a home if they expect to move in the near future. Most studies examine separate models investigating demographic and socio-economic determinants on residential mobility and housing tenure choice. Only a few studies have sought evidence in the joint modeling of tenure choice-mobility relationships. Kan (2000) uses the joint model of expected mobility and tenure choice by controlling for simultaneous bias. The results from the 1970–1992 PSID data reveal that the effect of expected mobility on becoming a homeowner is negative in large magnitude, which discourages households to choose homeownership. Using the 1992 Survey of the Married Military Officers and Enlisted Personnel, Haurin and Gill (2002) test the hypothesis that an increase in the expected length of stay in a dwelling raises the likelihood that a household will choose to own a home rather than rent. They found that expected length of stay in a dwelling is an important determinant to the ownership decision. As the expected length of stay increases from one to 10 years, the impact on the user cost of housing is the same as a decrease in the nominal mortgage interest rate from 21.3 percent to 5.3 percent. Also, the same impact occurs when the income tax rate increases from 0 to 53 percent. Using the Los Angeles Family and Neighborhood Study (LAFANS), a longitudinal study of families in Los Angeles County completed in January 2002, Clark and Ledwith (2006) examine actual and planned mobility via two separate analyses. A separate analysis examines expected mobility through the

role of neighborhood characteristics in planned mobility. The findings suggest that tenure plays an important role in the probability of future mobility. This is somewhat intuitive as owners are less likely to plan to move than renters.

Residential Mobility - Special Case of Senior Citizens

Regarding mobility patterns for the elderly, residential moves might not be as strong a determinant compared with young people's tenure choices; this is because an older household's migration tends not to occur when they remain at their current residence. Joint Center of Housing Studies of Harvard University (2014) argue that the residential mobility rate drops sharply after the age of 50 – particularly when households retire – and continues to decline as households reach their 60s and older; there is, however, a small uptick around age 85. Very few studies survey the probability of the elderly's tenure choice based on residential mobility.

Location - Initial Tenure

Locational characteristics serve as factors influencing determinants of tenure choice. In general, no explicit rationale has been presented for including specific variables. Existing studies have employed various location characteristics such as urban versus rural, large or small city by population, and distance of residence from the central city as a proxy of the predictor. Dawkins (2005) examines the contribution of residential location toward the black-white gap in first-time homeownership transition. The study includes locational variables about the neighborhood, central city, and region differentials. The empirical evidence suggests that first-time homebuyers are likely to move into homeownership sooner when they search for housing outside the central

city. Both white and black rental tenure durations are delayed by residence in the central city. This evidence coincides with the initial work by Ioannides and Rosenthal (1994). They argue that proximity to densely populated urban areas is highly associated with a diminished propensity to investment demand. Conversely, the other suburbs – except for the suburbs of one of the ten largest MSAs – are related with a decreased propensity to consumption demand. In contrast, Raymond et al. (2018) examined whether Millennial (those born between the early-1980s and the mid-1990s) first-time homebuyers – mortgaged from 2000 to 2016 in the 50 largest U.S. cities – prefer to purchase homes near city centers. The results suggest that Millennials do not move to the suburbs at the same rate as Generation X (those born between the mid-1960s and the early-1980s) when they purchase homes; instead, Millennials are 21 percent more likely to buy homes near city centers than Generation X.

Location - Tenure Transition

Some analysts focus on investigating the racial differences in homeownership. Deng et al. (2003) employ the 1985 Metropolitan Area sample of the American Housing Survey (AHS) for Philadelphia, examining whether existing racial differences in residential location decrease the homeownership rate among African Americans in major U.S. metropolitan areas. The empirical evidence suggests that African-American residential location outcomes are not associated with the lower homeownership rate among African Americans, which is even lower than the expected racial differences in homeownership. A dummy variable denoting if a household resides in the central city suggests that households are less likely to be

homeowners in the central city. Gabriel and Painter (2003) base their observations on Public Use Micro-data Areas (PUMA) in their study of Los Angeles neighborhood characteristics, suggesting that both white and black households are less likely to be homeowners in neighborhoods that have higher levels of immigrant populations in South Central LA, while there is a less depressive effect in San Bernardino County. Additionally, white movers are reluctant to become homeowners in neighborhoods with higher levels of black populations in non-central areas of LA and San Bernardino County. In contrast, larger Asian populations increase the probability that both white and black households will achieve homeownership in South Central LA and San Bernardino County. Similarly, higher levels of black populations raise the likelihood of transitioning to homeownership only among black movers in South Central LA and the LA suburbs.

Location - Special Case of Senior Citizens

Very few studies investigate the link between elderly tenure choice and location characteristics while a great deal of existing literature studies the probability of predictors on the location decision. Numerous studies show that the elderly stay at the current residences; however, they may move back to a high level of rural amenity and towns in areas of high landscape quality (Domazlicky, 2002). Only Painter and Lee (2009) and Lee and Painter (2014) examine the determinant on housing tenure choice of older households and test the importance of the geographic location of households by including binary variables for a residential location in the city and regional areas. The results reveal that there are no systematic differences across regions; however, living in a large metropolitan area increases the likelihood of a transition from

homeownership. The study mentions that this may be due to higher volatility in housing prices.

Limitations

Regarding expected mobility, data reliability might be suspect since the respondent's ability or willingness to participate has a major impact on the quality of data collected by phone calls or email surveys. Methodologically, many scholars have attempted to link tenure choice with additional decisions, including residential mobility (Kan, 2000; Painter et al., 2001) or location choice (Deng et al., 2003; Gyourko et al., 1999). To account for this joint nature of the decisions concerning mobility, tenure choice, and location choice, several researchers have frequently used the Multinomial Logit Model (MLM) (Gabriel and Painter, 2003; Skaburskis, 1999; Lee, 2014). It is assumed that a household considers residential mobility or location choice and tenure choice as a simultaneous choice for MLM. Nevertheless, the MLM strategy has one critical limitation. A commonly known problem with MLM is the potential violation of the independence of the irrelevant alternative (IIA) assumption. The typical solution to this problem is to use the Nested (Multinomial) Logit Model (NMLM) model (Deng et al., 1999; Gabriel and Painter, 2008), which represents the alternatives as a hierarchy of choices.

The NMLM allows households to choose the range of different alternatives for a hierarchy of choices across tenure types. Unless the tenure choice model accounts for these differences, the estimated tenure choice parameters might be biased since the model reflects the value of other choice alternatives that offer the highest proportion across tenure options, rather than the attributes of the tenure

options themselves. Nevertheless, the NMLM is subject to some criticisms. The NMLM requires us to investigate the interactions between mobility, tenure choice, and location choice. The strategy highlights the interaction between tiers rather than the impact of diverse demographic and socio-economic characteristics on tenure choice. As such, it might be difficult to find the concrete determinants on tenure changes. The duration model must be a more useful strategy to relate the event of changing housing tenure to time-varying influencers occurring over a lifetime. Furthermore, by mainly relying on cross-sectional analysis, the model does not relate the event of changing residence to continuous events over the household life cycle.

Summary

To summarize, expected residential mobility has a negative impact on homeownership decisions but it might not be an important determinant for older households. High transaction costs up to a maximum 10 percent of housing value make ownership more expensive than a rental for occupancy of just a few years. As for the location characteristics, many studies provide various results with no explicit definition. Most studies have been conducted with location variables at large geographic levels, and thus they provide only rough evidence for the housing market. Furthermore, location variables serve primarily as proxies for excluded variables such as price, appreciation, discrimination, and housing stock characteristics (Turner and O'Neal, 1986). Generally, urban centers are positively related to homeowner dissatisfaction, and thus cause consumers to become more likely to be renters, particularly in big cities. Conversely, consumers tend to enjoy spacious land as homeowners in the edges of the city or suburbs. This is consistent with initial findings

by Muth (1969). That said, Millennials' housing and location choices do not align with such evidence. It is likely that Millennials are responding to expanded choices of locations with their preferred amenities in cities. Furthermore, the literature argues that racial differences in residential location do not correlate with lower rates of homeownership for African Americans. Nonetheless, whites are unlikely to move in neighborhoods with a large black population whereas blacks prefer to be homeowners in such neighborhoods.

3.3.5. Prior Tenure

Tenure Transition

Prior tenure is considered by some researchers as a determinant of individual household decisions to either purchase a home or to become a renter. Upon moving, prior owners are less likely to move than prior renters and they have a lower likelihood of returning to renter status. Ioannides and Kan (1996) indicate that, in general, the likelihood of moving is lower for previous homeowners. One possible explanation for this difference in residential mobility may be found in the fact that buying a home involves long-term financial and non-financial commitments. However, if moving is chosen by a homeowner, it is more likely for households to become homeowners again. Kan (2000) indicates that previous homeownership plays a positive role in the following homeownership decision. Also, previous homeowners are less likely to move in time or in the future.

Other recent studies provide mixed results. Boehm and Schlottmann (2014) suggest that prior homeownership is positively associated with the likelihood of transitioning back to the second owned home from a renting status. But, prior homeownership

negatively relates to other housing behaviors including from renting to first owned home; from first owned home to renting; and from first owned home to a second owned home. The study by Lee (2014) also suggests that households who were ever homeowners are more likely than those who have always been renters to be either homeowners or renters when they make intra- and inter-neighborhood moves.

Special Case of Senior Citizens

Only a few studies test the likelihood of the elderly's tenure choice on the prior tenure. Jones (1997) takes into account the number of years the elderly homeowners have resided in their current home, rather than their prior tenure. As expected, the results indicate that households that have resided in their current home are less likely to become renters. Painter and Lee (2009) show that elderly household heads who rented a home – but had once owned before age 50 – are more likely to be homeowners than elderly homeowner heads who rented a home, but had always rented before age 50.

Limitation

The variable of prior tenure is subject to several criticisms. One disadvantage of this variable is that prior tenure may act as a proxy for wealth, which may be highly correlated across the two variables. Another criticism is that cross-sectional analysis typically employs a sample of recent movers, which may be biased due to the fact that there are no controls for the prior tenure. Renters are overrepresented in a sample of recent movers (Painter et al., 2001). As such, a key drawback of models using a sample of recent movers is sample selection bias. As an alternative, a Heckman-style

correction by Heckman (1977) has been suggested (Painter, 2000; Painter et al., 2001), to properly account for the likelihood that someone is a mover. Painter (2000) employs a Heckman-style correction in which a two-step selection model is conducted. Working from a latent variable that measures the propensity to own among mover households in the sample, the observable tenure choice indicator is regressed on a vector of demographic, socio-economic, and other variables affecting the housing tenure decision.

Summary

To conclude, only a few available studies offer information on the impact of prior tenure on tenure choice. Overall studies show that previous homeowners are less likely to move than prior renters. Previous homeowners have a lower likelihood of returning to renter status. One possible explanation for this difference in the likelihood of homeownership may be found in the fact that overcoming the hurdle of accumulating a down payment reduces the likelihood of returning to a renter status. Nonetheless, there is still mixed evidence regarding the effect of prior homeownership if or when a household transitions back to second homeownership from renting, or experiences residential moves across different locations or time periods. Given that the tenure decision is a complex social phenomenon, there may exist many unobservable causes of tenure decisions along with invisible discriminatory treatment against blacks.

Table 4 Summary of the studies on residential mobility and location

Author(s)	Residential mobility and location	Type	Study Area	Data	Relationship with the hypothesis
Kan (2000)	Residential mobility	Tenure Transition	The US nation	1970-1992 PSID	(+)
Haurin & Gill (2002)			The US nation	1992 Survey of the Married Military Officers and Enlisted Personnel	(+)
Clark & Ledwith (2006)			Los Angeles	2002 LAFANS	(+)
Dawkins (2005)	Location (Urban verses Suburban)	Initial Tenure	The US nation	1978-1997 PSID	(+)
Raymond et al. (2018)			Fifty largest US cities	2001-2016 FRB of New York's Consumer Credit Panel.	(–)
Deng et al. (2003)		Tenure Transition	Philadelphia MSA	1985 AHS	(+)
Gabriel & Painter (2003)			The US nation	1990 PUMS	Mixed
Painter & Lee (2009)		Senior Citizens	The US nation	1968-2005 PSID	Mixed
Lee & Painter (2014)			The US nation	1968-2007 PSID	Mixed

Table 5 Summary of the studies on prior tenure

Author(s)	Prior tenure	Type	Study Area	Major Data	Relationship with the hypothesis
Kan (2000)	Prior homeownership	Tenure Transition	The US nation	1970-1992 PSID	(+)
Boehm & Schlottmann (2014)			The US nation	1997-2007 PSID	Mixed
Lee (2014)			The US nation	1972-2003 PSID	Mixed
Painter & Lee (2009)		Senior Citizens	The US nation	1968-2005 PSID	(+)

3.4. Conclusion

Since the 19th century, the movement to promote homeownership – considered a fundamental part of the American Dream – has perhaps been one of the longest-standing domestic policies. For many years in the United States, policymakers have made extensive efforts to encourage the American people to own homes. Such efforts to encourage citizens to buy their own homes have included government-funded activities and subsidized programs, cooperation with nongovernmental organizations, and technical advancements in the home-building industry, which have made it dramatically easier for renters to transition to homeownership. Policy approaches to increase U.S. national homeownership rates remain in progress still.

This review clearly reveals that income, a relative user cost, life-cycle factors (e.g., identifying with a minority group), and expected mobility (e.g., transaction cost) – all of which are critical to low-income and minority households – are key drivers in determining homeownership. Nonetheless, we know relatively little about the experiences of these households as renters or homeowners. Even though a few surveys – the CAPS and Moving to Opportunity for Fair Housing (MTO), in particular – track a sample of low-income homeowners who received government subsidies over several years, the most important area for policy efforts is still the collection of information about the challenges low-income and minority households face and the financial resources to which they have access. Policymakers need this information to consider if sufficient resources and effective mechanisms are in place to support affordable homeownership for these households. It is possible that such information would allow policymakers to identify the type of support necessary to

ensure that low-income and minority households are able to achieve and sustain homeownership over time, and thus enjoy the many financial and social benefits of homeownership.

Chapter 4: Property Taxes and Elderly Housing

4.1. Introduction

The U.S. senior population – defined as those aged 65 or older – will grow from 48 million in 2015 to 79 million in 2035, and the number of households headed by seniors will grow to nearly 50 million in the same time frame (Joint Center of Housing Studies of Harvard University, 2014). Overall, this substantial growth will shift the age distribution of the U.S. population and U.S. households such that one-fifth of the U.S. population and one-third of U.S. households will be comprised of seniors aged 65 or older by 2035. Undoubtedly, this age cohort has served as the largest driving force across many sectors of the housing economy in the United States, and this demographic change is likely to become the most influential key factor shaping the future of the housing market.

Through the years, anecdotal evidence has suggested that seniors move less frequently than younger households and prefer to remain in their homes as long as they can afford to do so; however, a significant increase in property taxes may cause retired homeowners living on fixed incomes – such as social security, pension benefits, or savings – to make housing adjustments. Property taxes rose significantly in the early 2000s due to soaring housing prices, and in many cases, this added financial burden may affect retired homeowners' tenure decisions due to liquidity constraints. Figure 2 illustrates how housing values and property taxes fluctuated during the period of 2005-2014. The recession that began in 2007 led to a

significant decrease in housing values between 2008 and 2013. During the same period, housing values dropped by nearly 23 percent, while property taxes held steady for units with a mortgage, and increased by nearly 12 percent for units without a mortgage. Because housing values fell during the financial crisis, one might expect that property taxes fell commensurately, but they did not. The fiscal report released by the Tax Foundation (2010) presents two possible explanations for this: (1) Unlike state sales and income tax rates – for which changes require state legislature action – it is comparatively easy for localities to raise the property tax rate and thereby compensate for the declining value of property; (2) Lagged or incorrect assessments are two of the reasons that property tax revenues continue to increase. Many homeowners undoubtedly paid property taxes on an assessed value that was higher than their property's true value. Even more, the gap between housing values and property taxes had increased over the period of 2008-2013. Although retired homeowners are typically considered "housing rich but income poor," increasing property taxes may have been significantly burdensome to those facing decreasing housing values during the recession and even afterward.

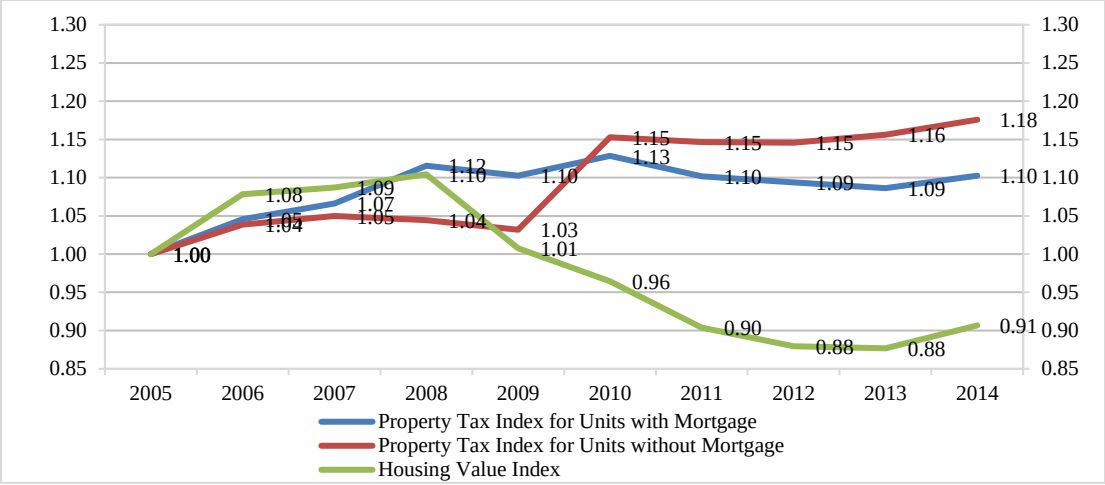

Figure 2 Property taxes and housing values in the United States, 2005-2014.
Source: Author's calculation from 2005-2014 American Community Survey 1-year estimates. (Indexes have been established by dividing the values of 2007-2014 with the value of 2005; All dollar amounts are in 2005 dollars)

Figure 3 depicts the share of senior homeowners who face a housing cost burden defined as paying 30-50 percent (moderately burdened) or over 50 percent (severely burdened) of income on housing. According to 2014 data, homeowners with mortgage debts are much more likely to face a housing cost burden than homeowners without mortgage debts. In particular, 34 percent of the U.S. population aged 80 and older are severely cost burdened, while 25 percent of the same age bracket are moderately cost burdened. Younger seniors aged 65 to 79 similarly have experienced moderate housing cost burdens, but only 20 percent of the same age group are considered severely cost burdened. As such, carrying mortgage debts into retirement significantly increases the likelihood of having a housing cost burden as severe as renters have; this, in turn, drives retiree homeowners to liquidate their home equity. Furthermore, the Harvard University Joint Center of Housing Studies (2015) expects that 11 million homeowners aged 65 or older will face a housing cost burden by 2035. The Center also predicts that

homeowners aged 80 and older with mortgage debts will face housing cost burdens as severe as those that renters face.

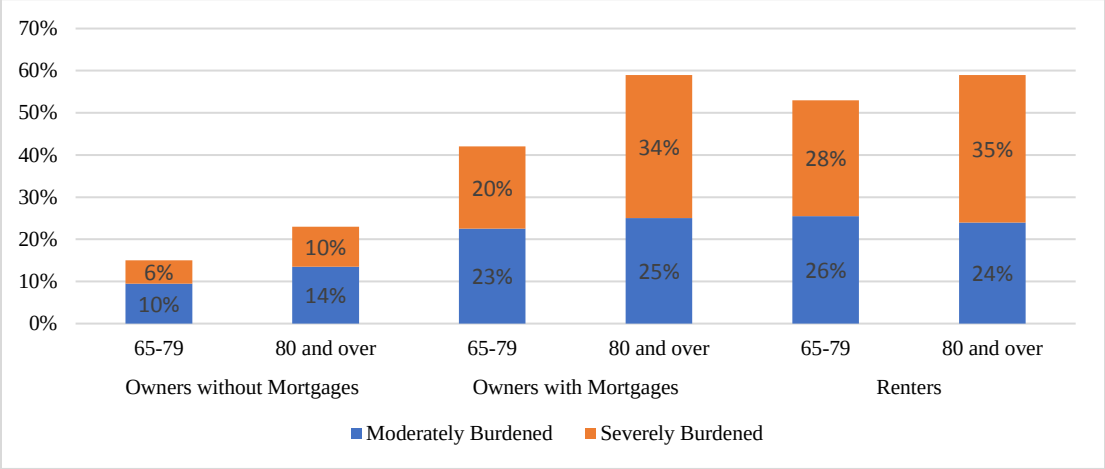

Figure 3 Share of housing cost burdened households by age group
Source: JCHS tabulations of US Census Bureau, 2014 American Community Survey 1-year estimates

Both during the recession and following the economic recovery, rising property taxes may have been – and may remain – one of the most critical issues to senior homeowners who withstood the plunge in housing values. Moreover, economic pressures are compounded by the increasing number of seniors carrying mortgage debt into retirement. Many states have enacted policies designed to relieve property taxes paid by those facing high property tax bills relative to their income. Property tax abatement programs for liquidity-constrained homeowners could help prevent unwanted moves and enhance welfare particularly for low-income retirees. Property tax abatement programs would benefit retirees by lowering the costs of homeownership and by sparing them the possible hardship of moving. Increasing property taxes could also raise mobility rates for senior homeowners through housing adjustments. Retirees may decide to adjust their housing consumption by either relocating to areas with lower property taxes or by making the transition to renter

status. Given that more than 50 percent of property tax revenues is allocated to public school expenditures, Sabia (2009) argues that it is expected that retirees would prefer communities with low property taxes since they do not benefit from many local public goods financed through property taxes (e.g., schooling services for children).

This article attempts to shed light on the reasons why senior homeowners liquidate their housing wealth by ending homeownership or downsizing to less expensive homes. This article focuses largely on the significance of property taxes and housing values on senior homeowner behavior under the presence and absence of mortgage debts. Furthermore, this article examines how property tax abatement programs influence seniors' tenure transition. Finally, we conduct simulations to provide estimates of the degree to which seminal variables (e.g., property tax rate, housing value, and loan-to-value ratio) increase the likelihood of dissaving housing wealth under different economic conditions (e.g., before, during, and after the Great Recession). This study provides estimates of the elasticity of residential mobility and housing consumption for senior homeowners with respect to property taxes, which offers insights into fiscal policies that state and local governments may wish to consider to retain and attract senior homeowners in their jurisdictions.

4.2. Literature Review

Over the past few decades, several scholars have relied on micro-level datasets such as the Retirement History Survey (RHS), the Health and Retirement Study (HRS), and the Panel Study of Income Dynamics (PSID). Many of these studies employ duration modeling strategies for reflecting the impact of life-cycle factors (i.e., time-

varying variables) on housing behaviors, with a focus on property taxes. Other studies have used the instrumental variable analysis to address the endogeneity problem. Still others utilize probit regression to conduct the cross-sectional analysis between two time periods.

Seslen (2003) provides insights into the factors that influence senior mobility, focusing on seniors' response to property taxation. Using data on 11,153 households from the 1969-1979 RHS, Seslen compares results from three different single risk duration models and a semiparametric dual risk model. Single risk models that define ending homeownership and trading down as a failure reveal that increased age, being married, and female headship have positive effects on the duration of homeownership. In contrast, being newly widowed, being out of the labor force, and having a larger number of children contribute to a higher likelihood of moving. A dual hazard framework – which treats the failures of partial versus complete equity reduction as distinct from one another – determined that property taxes are important to those contemplating trading down, but not to those moving out of their homes. Nevertheless, the hazard of trading down is so small that relief is likely to end up in the pockets of those who never would have moved. Seslen concludes that tax abatement programs provide a pure transfer to the wealthiest seniors without achieving the goal of protecting those in need. Farnham and Sevak (2006) test a life cycle Tiebout model by using the HRS for four two-year periods between 1992 and 2000 along with a national panel of local fiscal data. They explore whether or not empty-nesters move to locations with lower property taxes and lower expenditures on public education rather than examine a causal relationship between property taxes and

the likelihood of moving. With regards to the fiscal adjustment associated with moves by empty-nest households, findings suggest that cross-state empty-nest movers tend to move to areas that have lower property taxes and lower public school expenditures. In contrast, local empty-nest movers tend to have little fiscal adjustment.

Sabia (2009) examines the effects of demographic and socio-economic characteristics, housing conditions, and local policies and amenities on aging in place for older homeowners. Using the 1972-1992 PSID, Cox hazard models reveal that increased property taxes are associated with a diminished propensity to age in place. A 10 percent increase in property taxes correlated with a 1.4 percent increase in the hazard rate of moving for the younger retired cohort aged 50 to 60, a 4.0 percent increase in the hazard rate for the mid-senior cohort aged 61 to 70, and a 3.1 percent increase in the hazard rate for the oldest senior cohort aged 71 to 85. Shan (2010) examines the links between property tax levels and senior mobility rates. Using the 1992-2004 HRS, this study relies on instrumental variable approaches to address the endogeneity of property taxes. By using the variation in state-provided property tax relief programs, the author collected new state-level datasets and calculated simulated relief benefits, which are used as a valid instrument for property taxes. The findings reveal that property taxes play an important role in senior homeowners' moving decisions. A $100 increase in annual property taxes carries a 0.73 percent average point increase in the two-year mobility rate for homeowners over the age of 50. Boldt et al. (2010) investigate if property tax drives senior homeowners out of their homes. Using information from 2007 income tax returns filed annually by all residents in Wisconsin, the probit regression suggests that increases in property taxes have no

impact on the mobility rate of homeowners aged 80 and younger, while a significant rise in property taxes has a positive but small impact on those over 80 years old. Only one person in 600 Wisconsin homeowners over the age of 80 moved due to the above-average property taxes in 2005.

Despite a wide array of studies and debates concerning the contributing factors of seniors' tenure transition, there is still disagreement among researchers over the significance of property taxes affecting seniors' housing behaviors. Some argue that rising property taxes have a significant impact on residential mobility and housing consumption for seniors, while others assert that seniors' housing behaviors would not be affected by those factors. By employing more recent datasets, this study investigates how property taxes and housing values – under the presence and absence of mortgage debts – relate to residential mobility and housing adjustments for senior homeowners. This study addresses four primary research questions about housing behaviors related to the links between property taxes, housing values, and mortgage debts for seniors.

4.3. Research Questions

(1) Why do senior homeowners liquidate their housing wealth by ending homeownership or downsizing to less expensive homes, with a focus on property taxes, housing values, and the presence of mortgage debts?

To address this question, we use the 2004-2014 HRS to estimate how property taxes, housing values, and the presence of mortgage debts affect senior housing behavior. We expect that senior homeowners will move and liquidate their housing

wealth if or when they face rising property taxes and decreasing housing values under the presence of mortgage debts. These estimations provide a detailed look at the significance of various covariates on senior housing behavior.

(2) Are the effects of property taxes and housing values on seniors' housing behaviors different under the presence or absence of mortgage debts?

Additionally, we investigate the ways in which the effects of property taxes and housing values are different between two sub-samples with and without mortgage debts. We expect that rising property taxes and decreasing housing values have larger impacts for the sub-sample with mortgage debts. These examinations allow us to see if the presence of mortgage debts has an effect on housing adjustments that might be influenced by property taxes and housing values.

(3) What are the effects of tax abatement programs interacted by property taxes?

We use the HRS restricted geographic identifiers, which allows us to combine HRS data with secondary data at the state level. To examine how the number of tax abatement programs available in a given state influences senior homeowner behaviors, we added categorical variables denoting the number of existing limit and relief programs in a given state. Furthermore, we examine how interactions of property taxes and abatement programs affect senior's housing behaviors. We hypothesize that the increase in the number of abatement programs available in a given state positively relates to the likelihood of maintaining homeownership for low income households. These analyses allow us to examine whether or not the generosity

or tightness of abatement programs available in a given state encourages seniors in need of tax benefits to continue being homeowners.

(4) Which variables (e.g., property tax rate, housing value, and loan-to-value ratio) increase the likelihood of dissaving housing wealth before, during, and after the Great Recession?

To provide estimates of the magnitude of several housing related variables (e.g., property tax rate, housing value, and loan to value ratio) on increasing the probability of dissaving housing wealth, we perform simulations to provide a detailed look at seniors' housing behaviors before, during, and after the economic downturn. We expect that senior homeowners may react to financial damages more sensitively during the recession. By using the cross-sectional analyses, our findings can be used to explain the extent to which each of the three variables stratified by quintile are thresholds at which seniors choose to consume their housing wealth through renting and downsizing based, in part, on economic conditions

4.4. Data

4.4.1. Health and Retirement Study Panel Data

The HRS provides biannual panel data for the U.S. senior population. This study uses the six waves of survey data from 2004 through 2014. For most years, the HRS offers excellent housing status information, including tenure, housing value, and mortgage-related questions. In addition, the HRS offers various demographic and socio-economic variables, and thus provides sufficient data for our analyses. Our 11-year

study period is consistent with previous work (Andrew et al., 2006; Boehm and Schlottmann, 2011, 2014). The HRS does not provide information about the household head; however, it identifies financial respondents by posing questions about housing, income, and assets. This study assumes that a financial respondent represents a household head since we focus on the significance of property taxes on housing behaviors. In addition to the public HRS data, we obtained restricted access to household-level geographical identifiers. These identifiers allow us to identify the residential location for each household. The identifier is crucial, because it links households to several variables that capture state characteristics. In addition, it allows us to control for unobserved *heterogeneity* with fixed effects. Due to the ambiguity associated with mobility for people living in mobile homes, mobile home residents were excluded from the analyses discussed in this paper. Households living on farms and ranches are excluded from the studied sample as well, because these properties may be treated as agricultural rather than residential for property tax purposes.

4.4.2. Property Tax Abatement Program Data

All 50 states and Washington, D.C. offer some type of property tax relief for senior homeowners. This study categorizes those programs into five types of benefits: (1) *Homestead Exemption* programs allow eligible taxpayers to receive an exemption from a certain amount based on the assessed value of their homes. (2) *Homestead Credit* programs allow taxpayers eligible for the benefit to receive a refundable credit. (3) *Circuit breaker* programs, named for the electrical devices that shut down electric power to avoid circuit overload, allow homeowners to avoid excessive tax burdens by shutting off property taxes once they exceed a certain share of household income. (4)

Property Tax Deferral programs allow qualifying homeowners to postpone payment of part or all of the property taxes on their homes until the homeowners sell their homes. (5) *Tax Freezes* freeze a property tax rate once the homeowner reaches a certain age required in a given state. (6) *Property Tax Limit* programs restrict property taxation by placing limits on rates, limits on levies, or limits on growth using assessed values.

To consider the significance of state-level property tax abatement programs, this research relies on information collected by the Lincoln Institute of Land Policy. The Lincoln Institute database provides detailed information about property tax features – tax relief programs, tax limits, tax rates, and more – for all 50 states and Washington, D.C. The categorical variable denoting the number of existing relief programs is defined as the number of relief programs a given state has. For example, if a given state has no relief programs, the categorical variable assigned is "0." Conversely, states that utilize all five relief programs are given a "5." At the same time, if a given state has no limit programs, the categorical variable assigned is "0." States that utilize all three limit programs are given a "3." In 2014, nine states had all three limits on rates, levies, and accessed values and four states with no tax limit programs. In the same year, only one state utilized five property tax relief programs, and six states utilized only one program. Our categorical variable (e.g., 0-3 for limit, and 0-5 for relief) conveys the generosity or tightness of tax abatement programs available in a given state.

In addition to limit and relief program data, we obtain information on state characteristics from a variety of sources. Public welfare and health and hospital

expenditures per capita – derived from the Urban Institute-Brookings Institution Tax Policy Center – represent how generous seniors benefit from public welfare and medical amenities in a given state. The Tax Foundation provides the state-specific local tax burden rate, which represents the ratio of the total amount paid in state and local taxes to the total state income.

Table 6 Variable description

Variable	Definitions	Source
Demographic Characteristics		
age 55-64	1 = 55-64 age of the household head; 0 = otherwise	HRS public
age 65-74	1 = 65-74 age of the household head; 0 = otherwise	HRS public
age 75-84	1 = 75-84 age of the household head; 0 = otherwise	HRS public
age 85	1 = over 85 age of the household head; 0 = otherwise	HRS public
male	1 = household head is male; 0 = otherwise	HRS public
female	1 = household head is female; 0 = otherwise	HRS public
white	1 = household head is White; 0 = otherwise	HRS public
black	1 = household head is Black; 0 = otherwise	HRS public
others	1 = household head is other than White and Black; 0 = otherwise	HRS public
high school	1 = household head is a high school graduate; 0 = otherwise	HRS public
college	1 = household head is a college graduate; 0 = otherwise	HRS public
bachelor	1 = household head has a bachelor's degree or over; 0 = otherwise	HRS public
divorced	1 = household head is divorced; 0 = otherwise	HRS public
widowed	1 = household head is widowed; 0 = otherwise	HRS public
widowed in the past 2 years	1 = household head was widowed in the past 2 years; 0 = otherwise	HRS public
retired	1 = household head is retired; 0 = otherwise	HRS public
retired in the past 2 years	1 = household head was retired in the past 2 years; 0 = otherwise	HRS public
hospitalized in the past 2 years	1 = household head was hospitalized in the past 2 years; 0 = otherwise	HRS public
the number of children	The number of children aged 18 or below	HRS public
Financial Characteristics		
property taxes	natural log of self-reported property tax paid last year	HRS public
property tax rate	the ratio of property taxes to housing value	Author' calculation
household income	natural log of annual household income	RAND HRS
housing value	natural log of housing value (excluding mortgage debts)	RAND HRS
non-housing asset ***a***	natural log of non-housing asset value	RAND HRS
non-housing financial wealth ***b***	natural log of non-housing financial wealth value	RAND HRS
mortgage	1 = households have carried mortgage debts; 0 = otherwise	HRS public
County Characteristics		
largest counties	1 = counties in metro areas of 1 million population or more; 0 = otherwise	HRS restricted
large counties	1 = counties in metro areas of fewer than 1 million; 0 = otherwise	HRS restricted
medium counties	1 = counties in non-metro of 20,000 or more; 0 = otherwise	HRS restricted
small counties	1 = counties in non-metro or rural of fewer than 20,000; 0 = otherwise	HRS restricted
State Characteristics		
property tax limit ***c***	the number of property tax limit programs available in given state	Lincoln Inst.
property tax relief program ***d***	the number of property tax relief programs available in given state	Lincoln Inst.
public welfare expenditure	natural log of state and local general expenditures, per capita	Urban Inst.
health and hospital expenditure	natural log of state and local general expenditures, per capita	Urban Inst.
local tax burden rate ***e***	state-specific local tax burden rate	Tax Foundation
Region Dummies		
new_england	1 = New England (CT, ME, MA, NH, RI, VT); 0 = otherwise	HRS restricted
pacific	1 = Pacific (CA, WA, OR, AK, HI); 0 = otherwise	HRS restricted
mountain	1 = Mountain (MT, ID, WY, NV, UT, CO, AZ, NM); 0 = otherwise	HRS restricted
south_atlantic	1 = South-Atlantic (DE, FL, GA, MD, NC, SC, VA, DC, WV); 0 = otherwise	HRS restricted
westsouth_central	1 = West South Central (TX, OK, AR, LA); 0 = otherwise	HRS restricted
westnorth_central	1 = West North Central (ND, SD, NE, KS, MN, IA, MO); 0 = otherwise	HRS restricted

eastnorth_central	1 = East North Central (MI, WI, IL, IN, OH); 0 = otherwise	HRS restricted
eastsouth_central	1 = East South Central (KY, TN, MS, AL); 0 = otherwise	HRS restricted
middle_atlantic	1 = Middle Atlantic (NY, NJ, PA); 0 = otherwise	HRS restricted
Year Dummies		
2004	1 = *t* is 2004; 0 = otherwise	HRS public
2006	1 = *t* is 2006; 0 = otherwise	HRS public
2008	1 = *t* is 2008; 0 = otherwise	HRS public
2010	1 = *t* is 2010; 0 = otherwise	HRS public
2012	1 = *t* is 2012; 0 = otherwise	HRS public

a – stocks, mutual funds, investment trusts, checking, savings, money market accounts, government saving bonds, other bonds, and all other savings
b – net value of non-housing wealth, calculated by subtracting nonmortgage debts from the sum of stocks, mutual funds, investment trusts, checking, savings, money market accounts, saving bonds, and other bonds/savings
c – the number of limit programs available with tax limits on rates, levies, or growth using assessed values
d – the number of relief programs available with homestead exemption, homestead credit, circuit breaker, tax deferral, and tax freeze programs
e – a state's local tax burden is the total amount that the state's residents pay in state and local taxes, even if some of those payments go to out-of-state jurisdictions. The local tax burden rate is expressed as a proportion of local tax burden to total state income.

4.5. Methodology

We conduct survival analysis, which considers the time a specific event takes place as a dependent variable. This study first employs a Cox proportional hazard model (Cox, 1972) to examine the determinant of residential mobility, differentiating moves that terminate residential spells under the presence of mortgage debts from those that terminate without any mortgage debts. Furthermore, this study adopts the competing risk framework (Fine and Gray, 1999). The competing-risks regression provides a useful alternative to the Cox regression model in the presence of one or more competing failure risks.

We consider ending homeownership and trading down as two distinct behaviors of liquidating housing wealth. Therefore, renting and downsizing are considered competing risks when retirees are likely to consume their home equity; this is because each of those risks precludes action against the other. Fine and Gray's (1999) approach specifies multiple failure types using a model for the hazard sub-distribution associated with a given event type. In our model, we define residential spells that terminate with one of two events: (1) a residential spell that ends with a move to make a transition to rental status, and (2) a residential spell that ends with a move to downsize to less expensive homeownership. Fine and Gray (1999) define the sub-distribution hazard function for risk type 1 as below:

$$h_1(t) = \lim_{\delta \to 0} \frac{\Pr\left(t < T \leq t + \ \delta \ and \ event\ 1\right) \mid T > t > or\ (T\ \leq t \leq and\ not\ event\ 1)}{\delta} \tag{13}$$

Fine and Gray's (1999) approach to analyze competing risk data is to employ the Cumulative Incidence Function (CIF), which estimates the marginal probability for each competing risk. With the CIF, the marginal probability for each competing risk is derived from the cause-specific hazard. $\mathrm{CIF}_1(t)$ is expressed as below:

$$\mathrm{CIF}_1(t) = 1 - exp\{-H_1(t)\} \tag{14}$$

where $H_1(t) = \int_0^t h_1(t)dt$ is the cumulative sub-hazard. The CIF-based proportional hazard model is similar to the Cox regression model since the baseline sub-hazard is left unspecified. In addition, the effects of the covariates x are assumed to be proportional as below:

$$h_1(t|x) = h_{1,0}(t)\exp(x\beta) \tag{15}$$

The exponentiated coefficients represent sub-hazard ratios, which can be interpreted in the same way that odds-ratios are reported in standard logistic regression analysis. The estimated sub-hazard ratios can be interpreted in the same way that hazard ratios are interpreted in Cox regression. An estimated sub-hazard ratio greater than 1 is associated with higher incidence of a given type of failure. Conversely, an estimated sub-hazard ratio less than 1 suggests a smaller risk. For instance, the sub-hazard ratio of 2 means that the incidence rate of a given event in one treatment group is twice the rate in the control group. Conversely, a hazard ratio of 0.5 means that the sub-hazard ratio in the treatment group is one half of that in the control group.

4.6. Results

4.6.1. Descriptive Statistics

Table 7 presents the summary statistics for the independent variables used in the regression. The fourth and fifth columns of Table 7 depict statistics for senior households who ended homeownership and traded down to less expensive homeownership. This data shows that, overall, seniors aged 75 or older are more likely to become renters than they are to downsize. Conversely, younger seniors aged 55 to 74 are most likely to downsize to less expensive owned housing. Female headship increases the likelihood of making the transition to renting status, and black households are less likely to consume housing wealth, if or when they move. Seniors who have become divorced or widowed tend to adjust their housing consumption through transitions to renting. Seniors who became widowed recently are more likely to become renters than to downsize. Recent retirement or hospitalization both increase the propensity for homeowners to adjust their housing consumption by becoming renters or by downsizing to less expensive owned housing. The increase in the number of children has a positive effect on liquidating housing equity, which increases the propensity toward downsizing.

Property taxes increase the probability that one may transition to renter status or downsize their home. Conversely, property tax rates decrease the likelihood of liquidating housing wealth. Low income seniors are more likely to rent, while affluent seniors are instead more willing to downsize to less expensive homeownership. Similarly, low housing values encourage homeowners to consume their housing wealth through renting, despite the fact that seniors who downsize often live in

relatively expensive homes. Reliance on mortgage debts increases the likelihood that a senior household will liquidate their housing wealth through renting or downsizing. Seniors are more likely to become renters in the largest metropolitan area counties, whereas seniors in large, medium, and rural counties are more likely to downsize. For state characteristics, greater availability of property tax abatement programs increases the likelihood that seniors will dissave their housing wealth by renting or downsizing. More expenditures per capita in public welfare and medical amenities increase the likelihood that seniors will end their homeownership; in contrast, only medical welfare stability increases the likelihood that seniors will downsize, if or when they move. Regarding a link between local tax burdens and housing adjustments, low local tax rates encourage seniors to maintain homeownership by downsizing to less expensive homes.

Table 7 Summary statistics stratified by sub-samples

	Full sample		Sub-sample who experience residential mobility		Sub-sample who transition from ownership to renters		Sub-sample who downsize to less expensive housing	
Demographic Characteristic	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
age 55-64	0.317	0.465	0.352	0.478	0.205	0.405	0.354	0.479
age 65-74	0.401	0.491	0.357	0.479	0.254	0.436	0.433	0.497
age 75-84	0.225	0.417	0.232	0.422	0.366	0.483	0.192	0.394
age 85	0.051	0.221	0.059	0.236	0.176	0.381	0.021	0.143
male	0.537	0.499	0.564	0.496	0.463	0.500	0.558	0.498
female	0.463	0.499	0.436	0.496	0.537	0.500	0.442	0.498
white	0.918	0.274	0.947	0.225	0.946	0.226	0.946	0.227
black	0.059	0.235	0.031	0.173	0.039	0.194	0.029	0.169
others	0.023	0.151	0.023	0.149	0.015	0.120	0.025	0.156
high school	0.447	0.497	0.382	0.486	0.429	0.496	0.392	0.489
college	0.228	0.420	0.255	0.436	0.229	0.421	0.296	0.457
bachelor	0.325	0.468	0.364	0.481	0.341	0.475	0.313	0.464
divorced	0.078	0.267	0.092	0.289	0.117	0.322	0.075	0.264
widowed	0.250	0.433	0.233	0.423	0.400	0.491	0.192	0.394
widowed in past 2 years	0.020	0.139	0.033	0.179	0.078	0.269	0.008	0.091
retired	0.651	0.477	0.641	0.480	0.741	0.440	0.638	0.482
retired in past 2 years	0.021	0.143	0.052	0.223	0.044	0.205	0.033	0.180
hospitalized in past 2 years	0.141	0.348	0.205	0.401	0.249	0.433	0.242	0.429
the number of children	2.962	1.888	2.943	1.866	2.777	1.720	3.064	1.875
Financial Characteristic								
property taxes	7.544	0.783	7.611	0.798	7.614	0.785	7.727	0.816
property tax rate	1.327	3.697	1.226	1.088	1.308	1.064	1.033	0.831
household income	10.754	0.911	10.875	0.887	10.536	0.833	11.023	0.891
housing value	12.184	0.745	12.256	0.710	12.172	0.743	12.551	0.652
non-housing asset	12.076	1.668	12.259	1.593	11.669	1.904	12.481	1.427

non-housing financial wealth	11.133	1.886	11.348	1.742	11.085	1.932	11.480	1.674
mortgage	0.254	0.435	0.343	0.475	0.283	0.452	0.379	0.486
County Characteristic								
largest counties	0.521	0.499	0.531	0.499	0.556	0.498	0.483	0.501
large counties	0.312	0.464	0.314	0.464	0.312	0.465	0.367	0.483
medium counties	0.080	0.271	0.081	0.273	0.078	0.269	0.083	0.277
small counties	0.084	0.277	0.072	0.258	0.049	0.216	0.067	0.250
State Characteristic								
property tax limit	1.974	0.760	2.034	0.755	2.039	0.679	2.017	0.803
property tax relief program	2.914	0.981	2.934	0.950	2.956	0.933	2.946	0.990
public welfare expenditure	7.135	0.262	7.094	0.270	7.153	0.270	7.116	0.262
health and hospital expenditure	6.403	0.349	6.399	0.340	6.409	0.374	6.463	0.327
local tax burden rate	10.035	1.223	9.880	1.201	10.045	1.169	9.999	1.224
Region Dummies								
new_england	0.050	0.217	0.043	0.203	0.088	0.284	0.021	0.143
pacific	0.145	0.352	0.163	0.369	0.215	0.412	0.183	0.388
mountain	0.053	0.224	0.082	0.274	0.054	0.226	0.092	0.289
south_atlantic	0.216	0.411	0.193	0.395	0.127	0.334	0.179	0.384
westsouth_central	0.056	0.230	0.086	0.281	0.078	0.269	0.058	0.235
westnorth_central	0.106	0.308	0.117	0.322	0.151	0.359	0.104	0.306
eastnorth_central	0.200	0.400	0.167	0.373	0.151	0.359	0.196	0.398
eastsouth_central	0.045	0.207	0.045	0.208	0.029	0.169	0.067	0.250
middle_atlantic	0.127	0.333	0.100	0.300	0.102	0.304	0.100	0.301
Year Dummies								
2004	0.253	0.435	0.327	0.469	0.249	0.433	0.225	0.418
2006	0.223	0.416	0.230	0.421	0.200	0.401	0.263	0.441
2008	0.198	0.398	0.184	0.388	0.239	0.428	0.233	0.424
2010	0.172	0.376	0.136	0.343	0.146	0.354	0.167	0.373
2012	0.154	0.361	0.123	0.328	0.166	0.373	0.113	0.317
Number of observations		15,259		880		205		240

4.6.2. Property Taxes and Housing Values

In using the Cox hazard framework to track senior population mobility for the full samples, this study found that, overall, marital status has a significant effect on residential mobility. In particular, widowhood in the past two years significantly increases the probability of moving. Similarly, retirement in the past two years has a significantly positive effect on moving. Furthermore, households who faced hospitalization in the past two years are much more likely to experience residential mobility. More importantly, rising property taxes and the presence of mortgage debts significantly increase the propensity to move. Higher housing value decreases the likelihood of moving, but the coefficient is not statistically significant. Contrary to expectations, the property tax rate itself does not significantly impact the likelihood

of moving. Additionally, tax abatement programs do not have a significant impact on the likelihood of moving. Senior households are more likely to live in states that devote higher expenditures per capita on medical amenities. In contrast, seniors are reluctant to move to places with higher local taxes.

In competing risk regression models that track the senior population's transition from homeownership, it becomes apparent that age deeply correlates with housing consumption. Older homeowners are more likely to become renters as they age. In particular, seniors aged 85 or older are most likely to end homeownership if or when they move. In contrast, senior homeowners are less likely to downsize as they age. Senior households' consumption patterns – ending homeownership and trading down – demonstrate that different patterns emerge as older populations age. Female headship increases the probability that a senior will transition to renting or downsizing, but those coefficients are not statistically significant. Senior homeowners with a bachelor's degree or more are significantly more likely to become renters if or when they move. In contrast, higher educational attainment decreases the likelihood that seniors will downsize to less expensive housing. Life-cycle factors – marital status, disability, retirement, hospitalization, and the number of children – significantly affect senior household decisions regarding housing consumption for the rest of their lives. Divorce and widowhood significantly increase the likelihood that one will transition to renting from homeownership, but these factors decrease the probability of downsizing. As expected, recent retirement and hospitalization lead homeowners to consume housing wealth through renting or downsizing.

Property taxes have an expected effect. Rising property taxes increase the probability that seniors will become renters or downsize, but the coefficient is statistically significant only for transitions to renting. Nonetheless, tax rates do not have an effect on the behaviors of dissaving housing wealth. High income seniors are less likely to consume their housing wealth through renting, but are more likely to downsize to cheaper homes. Similarly, higher housing values decrease the likelihood of leaving homeownership but increase the probability of downsizing. As expected, reliance on mortgage debts increase the likelihood that senior homeowners will consume their housing wealth through both renting and downsizing. Furthermore, seniors tend to downsize in places that provide generous benefits by way of available tax abatement programs, but the coefficient is not statistically significant. Finally, seniors are likely to become renters in places that provide better public welfare benefits, and they tend to downsize in places that provide more medical amenities.

Table 8 Competing risk regression on the probability of renting and downsizing for the full sample

	Cox proportional hazard		Competing risk hazard			
	Mobility		Renting		Downsizing	
Variables	Hazard Ratio	Robust S.E.	Sub-Hazard Ratio	Robust S.E.	Sub-Hazard Ratio	Robust S.E.
Demographic Characteristic						
age 55-64	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
age 65-74	+0.853	0.077	1.343	0.320	0.934	0.155
age 75-84	1.010	0.115	***3.690	0.868	0.792	0.177
age 85	1.127	0.196	***7.681	2.315	*0.294	0.149
male	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
female	0.901	0.071	1.003	0.170	1.027	0.162
white	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
black	**0.553	0.120	0.665	0.314	0.681	0.266
others	0.843	0.210	0.458	0.334	0.732	0.370
high school	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
college	1.146	0.105	1.150	0.234	1.029	0.176
bachelor	1.028	0.095	*1.627	0.317	**0.547	0.104
divorced	*1.363	0.179	**2.104	0.602	0.975	0.260
widowed	+1.200	0.122	*1.621	0.357	0.970	0.197
widowed in the past 2 years	***1.902	0.375	***5.120	1.444	+0.293	0.218
retired	**1.260	0.110	1.255	0.239	1.276	0.208
retired in the past 2 years	***2.482	0.413	***4.215	1.669	1.220	0.517
hospitalized in the past 2 years	***1.589	0.136	***1.872	0.306	***1.982	0.304
the number of children	1.008	0.020	0.962	0.042	1.026	0.039
Financial Characteristic						
property taxes	**1.267	0.108	**2.295	0.680	1.043	0.154
property tax rate	0.972	0.037	0.733	0.165	0.991	0.022
household income	1.087	0.056	0.962	0.090	+1.196	0.126
housing value	0.912	0.084	*0.537	0.163	***2.098	0.258
non-housing asset	0.999	0.041	*0.812	0.082	0.945	0.066
non-housing financial wealth	1.038	0.034	1.115	0.094	1.051	0.059
mortgage	***1.498	0.126	**1.607	0.297	*1.435	0.232
County Characteristics						
largest counties	1.059	0.155	1.346	0.490	0.844	0.254
large counties	1.143	0.168	1.247	0.449	1.463	0.440
medium counties	1.196	0.216	1.452	0.632	1.613	0.603
small counties	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
State Characteristics						
property tax limit	0.993	0.073	1.147	0.236	0.911	0.129
property tax relief program	1.057	0.057	0.940	0.116	1.096	0.099
public welfare expenditure	1.077	0.265	2.297	1.369	0.856	0.397
health and hospital expenditure	*1.372	0.199	0.981	0.357	***2.350	0.608
local tax burden rate	0.983	0.054	0.892	0.107	1.161	0.142
Region Dummies		Yes		Yes		Yes
Year Dummies		Yes		Yes		Yes
Number of observations		15,259		15,259		15,259
Number of failures		880		205		240
Number of competing		-		240		205

LR chi2/Wald chi2	195.14	833.34	875.47
Log pseudolikelihood	-6,592.00	-1,466.86	-1,864.53

$^{+}p \leq 0.10$. $^{*}p \leq 0.05$. $^{**}p \leq 0.01$. $^{***}p \leq 0.001$

4.6.3. Mortgage Debts

In using the Cox hazard framework for seniors' residential mobility for two sub-samples with or without mortgage debts, we found that when or if senior homeowners carry mortgage debts, rising property taxes no longer seem to be important factors in the decision to move. Conversely, this study found that rising property taxes are important for moving when or if senior homeowners do not carry mortgage debts. Furthermore, higher housing value does not have an effect on seniors' housing behaviors under the presence or absence of mortgage debts.

The competing risk regression for housing adjustments of sub-samples with mortgage debts reveals that rising property taxes do not have a significant impact on housing consumption when or if seniors carry mortgage debts. In contrast, rising property taxes have a significantly positive effect on the decision to liquidate housing wealth through renting in cases where seniors own their homes without any mortgage debts. Nonetheless, higher housing values decrease the likelihood of ending homeownership but increase the probability of downsizing regardless of the presence of mortgage debts. Seniors are likely to downsize in states that provide generous benefits from available tax abatement programs, when or if seniors do not carry mortgage debts, but those coefficients are not statistically significant. For other state characteristics, the findings are mixed and modest, except for the coefficient denoting health and hospital expenditures per capita; in states that provide more medical amenities, seniors are likely to downsize.

Table 9 Competing risk regression on the probability of renting and downsizing for homeowners with a mortgage

	Cox proportional hazard		Competing risk hazard			
	Mobility		Renting		Downsizing	
Variables	Hazard Ratio	Robust S.E.	Sub-Hazard Ratio	Robust S.E.	Sub-Hazard Ratio	Robust S.E.
Financial Characteristic						
property taxes	1.303	0.258	2.303	1.256	1.039	0.374
property tax rate	0.933	0.134	0.817	0.265	0.841	0.311
household income	1.098	0.098	1.193	0.325	1.043	0.133
housing value	0.830	0.177	0.554	0.335	*1.972	0.679
non-housing asset	0.991	0.062	+0.732	0.127	0.999	0.101
non-housing financial wealth	1.003	0.049	1.083	0.152	0.983	0.085
mortgage	-	-	-	-	-	-
State Characteristics						
property tax limit	0.918	0.119	1.447	0.612	*0.603	0.138
property tax relief program	1.024	0.093	0.956	0.277	0.910	0.123
public welfare expenditure	1.260	0.472	3.195	2.851	0.892	0.626
health and hospital expenditure	*1.710	0.420	1.731	1.362	*2.506	1.046
local tax burden rate	1.112	0.102	1.124	0.249	1.151	0.235
Region Dummies		Yes		Yes		Yes
Year Dummies		Yes		Yes		Yes
Number of observations		3,871		3,871		3,871
Number of failures		303		58		91
Number of competing		-		91		58
LR chi2/Wald chi2		82.65		6,781.83		5,310.71
Log pseudolikelihood		-1,855.74		-318.94		-587.93

$^{+}p \leq 0.10$. $^{*}p \leq 0.05$. $^{**}p \leq 0.01$. $^{***}p \leq 0.001$

* All other variables were controlled.

Table 10 Competing risk regression for the probability of renting and downsizing for homeowners without a mortgage

	Cox proportional hazard		Competing risk hazard			
	Mobility		Renting		Downsizing	
Variables	Hazard Ratio	Robust S.E.	Sub-Hazard Ratio	Robust S.E.	Sub-Hazard Ratio	Robust S.E.
Financial Characteristic						
property taxes	*1.282	0.127	*2.175	0.746	1.088	0.217
property tax rate	0.979	0.034	0.747	0.191	0.998	0.021
household income	1.070	0.070	0.866	0.085	*1.360	0.199
housing value	0.958	0.100	0.583	0.201	***2.114	0.319
non-housing asset	0.998	0.055	0.824	0.108	0.898	0.091
non-housing financial wealth	1.065	0.047	1.156	0.129	1.116	0.086
mortgage	-	-	-	-	-	-
State Characteristics						
property tax limit	1.058	0.097	1.105	0.260	1.312	0.248
property tax relief program	1.081	0.072	0.940	0.133	1.224	0.160
public welfare expenditure	1.044	0.336	1.806	1.225	0.943	0.617
health and hospital expenditure	1.151	0.208	0.793	0.320	+1.691	0.519
local tax burden rate	0.909	0.063	0.818	0.116	1.181	0.174

Region Dummies	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes
Number of observations	11,381	11,381	11,381
Number of failures	577	147	149
Number of competing	-	149	147
LR chi2/Wald chi2	127.31	586.92	593.75
Log pseudolikelihood	-4,180.67	-1,012.65	-1,102.09

$^{+}p \leq 0.10$. $^{*}p \leq 0.05$. $^{**}p \leq 0.01$. $^{***}p \leq 0.001$

* All other variables were controlled.

4.6.4. Property Tax Abatement Programs

Since we found little evidence on how tax abatement programs affect housing adjustments (Table 8), we attempted to examine the interactions through two seminal covariates: tax rates and tax amounts interacted with limit and relief programs. Using two variables of tax rates and amounts might allow us to examine if low income households benefit from these subsidies. In general, low income households might be vulnerable to paying taxes that have outpaced the ratio of tax amounts to housing values. Conversely, affluent households might be less sensitive to a short-time rise in taxes; instead, such households might simply maintain concern about tax rates. We run models by excluding the related variables (i.e., tax rate, tax amount, limit, and relief programs) instead of integrating interactions into the full model (Table 8) in efforts to avoid the multi-collinearity issue.

This study found that seniors are likely to move and become renters in places that offer generous benefits from tax abatement programs when they face higher property taxes. Nonetheless, the combination of limit and relief programs associated with higher property taxes has a positive effect on decreasing the likelihood of seniors' mobility and tenure changes. Conversely, we found that the tax rate itself does not show a significant and consistent effect on moving and ending homeownership when it is interacted with tax abatement programs. Nonetheless, the tax rate is deeply associated with housing liquidation through trading down. Seniors are likely to downsize in places that provide more benefits from tax abatement programs when they face higher property tax rates; those coefficients are consistent and statistically significant.

Table 11 Competing risk regression on interactions of property taxes and abatement programs for the full sample

	Cox proportional hazard		Competing risk hazard			
	Mobility		Renting		Downsizing	
Variables	Hazard Ratio	Robust S.E.	Sub-Hazard Ratio	Robust S.E.	Sub-Hazard Ratio	Robust S.E.
Interactions						
property tax amounts * tax limit	*1.055	0.026	**1.214	0.078	0.986	0.043
property tax amounts * tax relief	**1.058	0.019	*1.125	0.059	**0.737	0.082
property tax amounts * tax limit * tax relief	**0.979	0.008	*0.950	0.019	0.987	0.016
property tax rates * tax limit	0.991	0.042	0.989	0.080	*1.120	0.054
property tax rates * tax relief	0.947	0.039	0.855	0.096	1.058	0.042
property tax rates * tax limit * tax relief	+1.026	0.015	1.045	0.033	+1.078	0.044
Region Dummies		Yes		Yes		Yes
Year Dummies		Yes		Yes		Yes
Number of observations		15,259		15,259		15,259
Number of failures		880		205		240
Number of competing		-		240		205
LR chi2/Wald chi2		196.37		482.57		387.34
Log pseudolikelihood		-6591.39		-1532.39		-1962.81

$^{+}p \leq 0.10$. $*p \leq 0.05$. $**p \leq 0.01$. $***p \leq 0.001$

* All other variables were controlled.

4.7. Simulations

We conducted four simulations to estimate cross-sectional effects of seminal variables on housing behaviors before, during, and after the Great Recession, controlling for all other variables, as noted in Table 12-15. The data are simulated using binary and multinomial logit models. First, to test the effects of changes in financial characteristics in the past two years on the likelihood of moving, we used the binary logit model, employing dummy variables denoting + or – in financial characteristics in the past two years, and including all variable controls. Second, to provide estimates of the degree to which major variables (property tax, housing value, and mortgage) increase the likelihood of dissaving housing wealth, we employed the multinomial logit (MNL) model, and replaced those three variables with stratified ones, respectively. In the MNL model, we used the stayer group as a reference. These results are shown in Table 7-10.

4.7.1. Residential Mobility

We examined how the lagged financial status affected senior housing behaviors before, during, and after the economic downturn. Dummy variables representing the increase or decrease in financial characteristics in the past two years demonstrate that a recent increase in property taxes increased the probability of moving during and after the recession, but it had a modest effect before the recession. These findings suggest that an increase in property taxes has little effect on senior migration in a booming economy. Nonetheless, a decrease in income had a positive effect on the propensity to move before the recession. The most critical factor in seniors'

propensity to move was the decline in housing value before and after the recession. During the recession, the decline in housing value moderately increased the likelihood of moving. Counter to expectations, non-housing assets and wealth were shown not to have a strong influence the likelihood of moving.

4.7.2. Housing Adjustments

We conducted simulations to determine the percentage of property tax rates – stratified by a quintile (Q1-Q5) – that would force seniors to liquidate their housing wealth. Overall, rising property tax rates significantly increase the likelihood of renting, but such a rise provides mixed results on downsizing. When senior homeowners reached the rates of Q3-4 (0.85–1.68%) before the recession, the probability of making a transition from homeownership to renters rose significantly. During the recession, seniors were more likely to make a transition to renters at the lowest rate of Q1 (0-0.56%). Nonetheless, the rate at which the senior become renters will increase to Q5 (1.68% and over) after the recession. The increase in property tax rates drove seniors to downsize to cheaper homeownership before and during the recession, but it does not seem to have a critical effect on downsizing in the current period following the recession.

We also studied how the effect of housing value – stratified by a quintile – works in the model. The results show that, during the three different periods, higher housing values consistently decreased the likelihood that seniors will dissave their housing wealth by renting; those coefficients proved statistically significant before the recession. Conversely, higher housing values tend to increase the probability of

downsizing to less expensive homes before, during, and after the recession. In particular, those coefficients are statistically significant for the period of 2012-2014.

Finally, we investigated the extent to which a loan-to-housing-value (LTV) ratio affects the likelihood of consuming housing wealth. We could not use variables stratified by a quintile because inputting "0" in the LTV ratio to note homeowners who do not have any mortgage loans would not permit us to divide our data by a quintile. Overall, a higher ratio of LTV causes one to leave homeownership to become renters or to downsize to less expensive housing. In particular, the LTV ratio of Q3 (51-75%) had a significant impact on seniors' decision to be renters before the recession. The ratio, however, increases to Q4 (75% and over) during and after the recession. Similarly, the LTV ratio of Q4 (75% and over) has a positively greater effect on downsizing before and after the recession even though those coefficients are not statistically significant.

Table 12 Binary logistic regression on the probability of mobility by lagged financial characteristics

Wave	2004-2006		2008-2010		2012-2014	
Residential mobility (reference: stayer)	Coef.	Robust S.E.	Coef.	Robust S.E.	Coef.	Robust S.E.
+ in property tax in past 2 years	0.014	0.132	**0.530	0.174	*0.525	0.099
– in income in past 2 years	*0.307	0.132	0.207	0.176	0.187	0.100
– in housing value in past 2 years	***1.317	0.139	*0.409	0.190	***1.296	0.102
– in non-housing asset in past 2 years	0.107	0.159	-0.260	0.207	-0.310	0.123
– in non-housing wealth in past 2 years	**-0.466	0.160	-0.022	0.206	-0.142	0.123
Number of observations	3,867		3,017		2,349	
Number of failures	288		162		108	
Pseudo R2	0.099		0.093		0.104	
Log pseudolikelihood	-885.24		-540.15		-368.63	

$^{+}p \leq 0.10$. $*p \leq 0.05$. $**p \leq 0.01$. $***p \leq 0.001$

* All other variables were controlled.

Table 13 MNL regression on the probability of renting and downsizing by property tax rates

Wave	2004-2006		2008-2010		2012-2014	
Renting (reference: stayer)	Coef.	Robust S.E.	Coef.	Robust S.E.	Coef.	Robust S.E.
property tax rate Q1 (0%-0.56%)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
property tax rate Q2 (0.56%-0.85%)	0.573	0.613	*1.314	0.578	0.369	0.827
property tax rate Q3 (0.85%-1.17%)	*1.242	0.637	0.766	0.724	1.120	0.733
property tax rate Q4 (1.17%-1.68%)	**1.796	0.642	1.179	0.872	1.022	0.826
property tax rate Q5 (1.68% and over)	1.035	0.755	1.197	1.315	*2.210	0.951
Downsizing	Coef.	Robust S.E.	Coef.	Robust S.E.	Coef.	Robust S.E.
property tax rate Q1 (0%-0.56%)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
property tax rate Q2 (0.56%-0.85%)	-0.040	0.524	-0.318	0.458	-0.195	0.606
property tax rate Q3 (0.85%-1.17%)	0.703	0.532	0.417	0.492	0.106	0.640
property tax rate Q4 (1.17%-1.68%)	+0.999	0.557	0.233	0.691	-0.767	0.807
property tax rate Q5 (1.68% and over)	0.885	0.658	0.247	1.030	-1.126	0.899
Number of observations	3,502		2,929		2,269	
Number of failures (Renting/Downsizing)	51/54		49/56		34/27	
Pseudo R2	0.149		0.169		0.179	
Log pseudolikelihood	-428.49		-421.76		-256.58	

$^{+}p \leq 0.10$. $*p \leq 0.05$. $**p \leq 0.01$. $***p \leq 0.001$

* All other variables were controlled.

Table 14 MNL regression on the probability of renting and downsizing by housing values

Wave	2004-2006		2008-2010		2012-2014	
Renting (reference: stayer)	Coef.	Robust S.E.	Coef.	Robust S.E.	Coef.	Robust S.E.
housing value Q1 ($0-$99,999)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.

housing value Q2 ($100,000-$156,999)	*-1.297	0.540	-0.362	0.590	-0.605	0.706
housing value Q3 ($157,000-$224,999))	**-1.841	0.685	0.127	0.641	-0.087	0.746
housing value Q4 ($225,000-$349,999)	*-1.864	0.794	-0.700	0.851	-0.936	0.895
housing value Q5 ($350,000 and over)	*-2.113	1.070	-0.023	0.998	-0.995	1.075
Downsizing	Coef.	Robust S.E.	Coef.	Robust S.E.	Coef.	Robust S.E.
housing value Q1 ($0-$99,999)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
housing value Q2 ($100,000-$156,999)	-0.017	0.599	-0.193	0.794	1.331	1.213
housing value Q3 ($157,000-$224,999))	-0.649	0.783	+1.222	0.693	+2.266	1.217
housing value Q4 ($225,000-$349,999)	0.879	0.677	0.617	0.767	**3.352	1.225
housing value Q5 ($350,000 and over)	*1.832	0.782	+1.417	0.814	***4.171	1.297
Number of observations		3,502		2,929		2,269
Number of failures (Renting/Downsizing)		51/54		49/56		34/27
Pseudo R2		0.158		0.174		0.186
Log pseudolikelihood		-423.58		-418.87		-254.23

$^{+}p \leq 0.10$. $*p \leq 0.05$. $**p \leq 0.01$. $***p \leq 0.001$

* All other variables were controlled.

Table 15 MNL regression on the probability of renting and downsizing by LTV ratios

Wave	2004-2006		2008-2010		2012-2014	
Renting (reference: stayer)	Coef.	Robust S.E.	Coef.	Robust S.E.	Coef.	Robust S.E.
LTV Q1 (0-25%)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
LTV Q2 (26-50%)	-0.065	0.645	0.288	0.663	0.208	0.815
LTV Q3 (51-75%)	***1.670	0.478	*1.370	0.657	0.243	1.062
LTV Q4 (75% and over)	0.907	1.087	**2.214	0.837	*1.761	0.741
Downsizing	Coef.	Robust S.E.	Coef.	Robust S.E.	Coef.	Robust S.E.
LTV Q1 (0-25%)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
LTV Q2 (26-50%)	0.197	0.454	*0.801	0.376	+1.109	0.605
LTV Q3 (51-75%)	0.167	0.643	-0.907	1.042	0.073	1.073
LTV Q4 (75% and over)	0.752	0.807	0.688	0.805	+1.605	0.860
Number of observations		3,502		2,929		2,269
Number of failures (Renting/Downsizing)		51/54		49/56		34/27
Pseudo R2		0.152		0.169		0.182
Log pseudolikelihood		-426.60		-421.44		-255.76

$^{+}p \leq 0.10$. $*p \leq 0.05$. $**p \leq 0.01$. $***p \leq 0.001$

* All other variables were controlled.

4.8. Discussion

By relying on the competing hazard risk regression for each competing risk (renting versus downsizing) for the 2004-2014 HRS datasets, this paper investigated whether property taxes affect a senior's decision to end homeownership or trade down under the circumstance of decreasing housing value and the presence of mortgage debts. In addition, we tested how variables denoting the number of property tax abatement programs relate to a senior's decision in the model. In simulations conducted to determine how important variables affect housing adjustments during the different time periods surrounding the recession, we examined the extent to which property tax rates, housing value, and the LTV ratio drove senior homeowners to liquidate their housing wealth.

In Table 8-10, our findings suggest that rising property taxes and reliance on mortgage debts significantly increase the probability of housing adjustments by ending homeownership and trading down. Nonetheless, higher housing values and income consistently correlate with the likelihood of maintaining homeownership through downsizing to less expensive housing. Several scholars have consistently highlighted the effects of income and housing value on downsizing (Painter and Lee, 2009; Bian, 2016). These findings indicate that only affluent household could maintain their homeownership through trading down; in contrast, low income households are most likely to end homeownership. This means that the impact of property tax abatement programs does not appear to align with our expectations. Even more, only sub-samples without mortgage debts show that seniors are likely to move to places that offer generous tax abatement programs when seniors consume their

housing wealth through downsizing. Still, those coefficients are not statistically significant. The findings suggest that tax abatement programs have been relatively effective for affluent seniors who do not rely on mortgage debts.

Additionally, the presence of mortgage debts does not have a significant effect on housing adjustments that might otherwise be influenced by increasing property taxes and decreasing housing value. In two models (Table 9-10) that examine how property taxes and housing values affect housing adjustments under the presence and absence of mortgage debts – when controlling for other household, location, and time factors – we find little supporting evidence for the expectation that reliance on mortgage debts would make a difference in the coefficients between the two models. These findings suggest that life-cycle factors – such as marital status, retirement, and hospitalization – serve as more critical drivers for dissaving housing wealth. Indeed, many initial scholars have highlighted the significance of precipitating shocks in life-cycle factors – such as health deterioration and/or the loss of a spouse – on housing consumption behaviors for seniors. (Feinstein and McFadden, 1989; Venti and Wise, 1989, 1990, 2004). Still, rising property taxes drive seniors to consume housing wealth, and for wealthier seniors, a rise in property taxes increases the likelihood of downsizing, regardless of one's reliance on mortgage debts.

Through interactions to observe a more detailed relationship between property taxes and abatement programs (Table 11), we found that seniors are likely to move and become renters in places that offer generous abatement programs when they face higher property taxes. Most likely, these findings can be explained by the fact that low income seniors do not maintain their homeownership in response to rising

property taxes. Nonetheless, the combination of limit and relief programs has a positive effect on the likelihood of decreasing to end homeownership. In contrast, we found that seniors tend to downsize in response to rising property tax rates in places with generous benefits from abatement programs. One possible explanation is that affluent seniors tend to maintain homeownership by trading down when they face rising property taxes; nevertheless, the hazard of trading down is so modest that seniors who never would have otherwise moved are the primary beneficiaries of tax abatement programs.

In simulations, we found that increasing property taxes played a minor role in increasing the likelihood of moving before the recession, but it significantly increased the probability of senior mobility during and after the recession (Table 12). Conversely, decreasing housing values had a significant effect on the propensity to move before the recession, but its effect became smaller during the recession. These findings suggest that higher property taxes become burdensome to senior homeowners when they experience decreasing housing value. Another interpretation of these findings is that seniors are more reluctant to pay property taxes than to withstand decreases in housing value, given that the majority of senior homeowners rely on limited income. Table 13 supports this evidence. During the recession of 2008-2010, senior homeowners often consumed their housing wealth through renting at the lower property tax rates (Q2); but it increases to Q3-4 and Q5 before and after the recession, respectively. Furthermore, higher housing value significantly decreases the likelihood that a household will become a renter, especially before a recession (Table 14). Nonetheless, richer households tend to downsize to less expensive

housing, especially in the period following a recession. Overall findings suggest that affluent seniors tend to maintain homeownership by downsizing, but poor seniors are willing to end homeownership to be renters, regardless of economic conditions. During and after the recession, LTV ratios that drive senior homeowners to be renters ranged from Q3 to Q4 with decreasing housing value (Table 15). Likewise, LTV ratios of Q4 prompt senior homeowners to downsize willingly with decreasing housing value during and after the recession. These findings are consistent with recent evidence provided by Bian (2016), which suggests that an LTV ratio greater than 80 percent forces seniors to downsize to less expensive homeownership.

Chapter 5: Housing Accessibility and Unmet Needs

5.1. Introduction

The U.S. aging population has grown at an increasing rate because the leading edge of the baby boomer generation has already reached age 65. A large portion of today's baby boomers have indicated a strong desire to remain in their home as they age, rather than enter institutional long-term care. According to the survey conducted by the 2018 American Association of Retired Persons (AARP), nearly 90 percent of seniors aged 65 or older would like to remain in their current residence, and 80 percent consider their current homes to be their permanent living places. Nonetheless, as seniors age, they face a greater likelihood of experiencing one or more functional disabilities. These challenges in physical or cognitive abilities often prohibit seniors from living in their own homes and communities unless the physical environment and/or availability of assistance meet their daily needs. In response to the lack of suitable housing to accommodate the aging population, the 1990 Americans with Disabilities Act (ADA) required buildings to be readily accessible to and usable by individuals with disabilities wherever construction began after January 1992. In September 2010, ADA regulations were revised to incorporate enforceable accessibility standards known as the 2010 ADA Standards for Accessible Design**.** To date, ADA regulations do not cover private housing, except for housing funded through governmental housing programs. Further, the Fair Housing Act requires only multifamily dwellings designed and constructed after March 1991 to be accessible to

and usable by individuals with disabilities. Additionally, a few states – including Minnesota, Pennsylvania and Texas – enacted statutes for affordable housing developers to install accessibility features in single-family homes (Farber et al., 2011), but most states have not yet adopted similar statutes.

Under these circumstances, housing researchers and gerontologists have examined the distribution and occupancy of accessible homes that allow seniors to manage functional disabilities and that extend opportunities to age in place[3]. Despite the large body of research concerning housing accessibility for seniors, few researchers have attempted to distinguish stayers from movers in samples. It might be of particular importance to focus on stayers – those who have remained in their place of dwelling since reaching the retirement age of 65 – as they are likely to age in their current homes and are even more likely to remodel their homes to fit their changing needs. Although many people still work beyond the age of 65, 2017 American Community Survey five-year estimates show that the percentage of those employed significantly drops from 53.7 to 24.6 percent when comparing the 60-to-64-year-old population with the 65-to-74-year-old population. The percentage plummets to 6.2 percent when evaluating the 75-and-over age group. Nevertheless, 65 years of age is a significant point at which many aging adults start to face retirement. Today, nearly half of total expenditures for home improvements trace back to older homeowners; historically, this group accounted for roughly 30 percent of the share of home improvement expenditures (Joint Center of Housing Studies of Harvard University,

[3] The U.S. Centers for Disease Control and Prevention (CDC) defines aging in place as "the ability to live in one's own home and community safely, independently and comfortably, regardless of age, income or ability level".

2015). As the aging population continues to grow in the coming decades, the number of new constructions or modifications made to housing units to incorporate basic accessibility features is projected to rise considerably in the United States. Joint Center of Housing Studies of Harvard University (2015) argues that, over the next decade, approximately 40 percent of those newest to the 65 or older age bracket are projected to live in inaccessible homes; this highlights a need for improvements to existing homes to satisfy the supply-demand gap.

This study investigates the living conditions that current stayers face, estimating how accessible their housing is to meet the daily needs for aging in place – particularly for seniors with mobility and grasping disabilities. The lack of housing stock designed to meet the needs of the aging population poses significant housing policy challenges. Using American Housing Survey (AHS) data, this study provides useful insights on this issue.

5.2. Literature Review

To date, much research has focused on the effects of individual characteristics, home environments, and neighborhood attributes on aging in place. Newman (2003) examined whether the housing settings for disabled seniors facilitated or impeded their ability to age in place before and after passage of the 1990 Americans with Disabilities Act. According to the 1995 AHS with supplementary analysis of the 1978 AHS, 14 percent of senior Americans had a housing-related disability. Forty-nine percent of those who reported such a disability made at least one dwelling modification, and 23 percent of those who made a dwelling modification still had an

unmet need for a home modification. As housing modifications to meet accessibility needs became more prevalent over the period of 1978 to 1995, the percentage of seniors who had an unmet need declined. Still, the unmet need was greater for non-white, female, and poor seniors. Using survey data from a representative Hispanic population sample of 729 individuals over 55 years of age, Costa-Font et al. (2009) argued that 22 percent and 16 percent of adults of this age group needed help with taking medicines and going to sleep, respectively. These adults were more likely to have modifications made to their housing, while respondents with only mobility difficulties had a negative coefficient. Additionally, adults – those closest to retirement age – demonstrated a greater likelihood to improve their housing conditions, conversely, persons with limited education proved less likely to improve their housing conditions.

Safran-Norton (2010) investigated the relationship between physical housing features and aging in place for single and couple households. Using two waves (1998-2000) of data from the Health and Retirement Survey, it was evident that only single households proved likely to remain in a home in instances where small interior modifications improved their accessibility (such as the addition of ramps, railings, or wheelchair accessibility equipment). Nonetheless, single households had a higher likelihood of moving out if the modification included only the installation of bathroom equipment. For couple households, overall, housing modifications were not driving factors for aging in place. Based on a postal survey of 6,859 persons and semi-structured interviews in Australia, Boldy et al. (2011) reported that 44 percent of respondents had made home modifications in order to remain in their homes for the

remainder of their life. As older populations aged, they become increasingly likely to make housing modifications such as by installing rails, non-slip steps or flooring, or by making updates to the bathroom. Greiman and Ravesloot (2016) explored accessibility features within the American housing stock, with a paritcular focus on subgroups based on homeownership and disability status. Findings put forth by the 2011 AHS suggested that high levels of inaccessibility were evident across all subgroups. In particular, a large portion of households with a mobility disability still lived in housing that lacked accessibility features, although their housing typically offered improved accessibility compared with housing for those without a mobility disability. Similarly, many scholars suggested that people with disabilities faced significant challenges when trying to secure housing that was adequate, accessible, and affordable (Souza et al., 2011; She and Livermore, 2009; Hoffman and Livermore, 2012). The works by Donald (2009) and Simpson (2010) suggested that home modifications – including home care assistance and updated technology – decreased the probability of hazards that would impede an older person's ability to age in place and retain independence for longer.

There are few studies in line with the purpose of this article that examined the scarcity of accessible units in the U.S. housing stock. Bo'sher et al. (2015) developed an index with three levels of accessibility by using 2011 AHS accessibility variables; (1) potentially modifiable – a home that is not yet accessible, but has the essential structures that would enable it to be modified; (2) livable – a home that meets the needs of individuals with moderate mobility difficulties; and (3) wheelchair accessible – a home that is accessible to a wheelchair user. The authors examined the

percentage of the U.S. housing stock that meets the requirements of each of these three levels. Their findings revealed that approximately one-third of the U.S. housing stock could be potentially modifiable to meet the needs of a person with a mobility disability. Less than 5 percent of the U.S. housing stock was deemed livable, and less than 1 percent of the housing stock was considered to be wheelchair-accessible. Chan and Ellen (2017) expanded upon their previous study (Bo'sher et al., 2015) by examining additional questions using multivariate models. The results aligned with those from the previous study. Only one-third of homes were considered to be potentially modifiable. Fewer than 4 percent of the housing stock met the definition of a livable home, and only 1 percent met the requirements for those who need wheelchair accessibility. Furthermore, the authors found that federally subsidized units and homes in the lowest rent or market value quartile were likely to offer greater accessibility. Recently constructed structures offered reduced accessibility relative to those built in the mid-1990s. Of those seniors who lived in a home that offered accessibility features, only 15 percent of those with mobility difficulties resided in a home that was considered livable for individuals with moderate mobility difficulties. Older, severely disabled, and those of a single marital status had a higher chance of living in homes with greater accessibility. Between 2009 and 2011, a significant portion moved into homes more suitable for aging; still, Chan and Ellen (2017) showed that the scarcity of accessible units in the U.S. housing stock was critical.

5.3. Research Questions

Despite myriad empirical studies concerning housing accessibility for seniors, there are no existing studies that attempt to distinguish stayers from movers in samples. Focusing on stayers – those who have remained in their place of dwelling since reaching the retirement age of 65 – this study attempts to address four primary research questions related to the links between aging, disability, and housing accessibility. These questions are described as below:

(1) Which stayer household characteristics relate to living in the home, per each accessibility level?
(2) Which housing characteristics for stayers – categorized by degree of disability – relate to the number of unmet needs?

To address these questions, 2011 AHS data can be used to estimate which seniors live in accessible homes and what types of homes meet the needs of seniors with a disability. More specifically, this paper focuses on the degree of disability as it correlates with living in the home at each accessibility level, and how housing characteristics for stayers stratified by degree of disability are associated with the number of unmet needs. The definition of unmet needs is described in more detail within the following *Variable* section. These analyses can be used to explain the living conditions that current stayers face, estimating how accessible their housing is to meet daily needs, particularly for seniors with mobility and grasping disabilities.

(3) Has the number of unmet needs affected recent movers with a disability between 2009 and 2011?

(4) What degree of disability drove home modifications between 2011 and 2013?

In addition, this paper examines if the number of unmet needs positively correlates with recent movers with disability between 2009 and 2011. Relying on the *recent mover* module of the 2011 AHS, one could expect that seniors with disability are likely to move, if or when they face an increasing number of unmet needs. If expectations align with findings, employing the *home improvement* module of the 2013 AHS, one can observe the degree of disability that increases the likelihood that a household made home improvements between 2011 and 2013. These analyses can be used to explain the significance of unmet needs and disabilities on residential mobility and home modification, respectively.

5.4. Data and Methodology

5.4.1. Data utilized: American Housing Survey (AHS)

This paper used a sample collected for the 2011 AHS, a biennial survey of housing units and households sponsored by the U.S. Department of Housing and Urban Development (HUD) and conducted by the U.S. Census Bureau. For only 2011, the AHS provides a unique module with information on the presence and use of housing accessibility features. Additionally, the 2011 AHS provides information on accessibility-related difficulties such as challenges with using faucets, kitchen cabinets, sinks, the stove, and/or a bathroom. Since the 2011 AHS accessibility features focuses largely on one's ability to walk and one's ability to use their hands,

this study focused on *Mobility disability*, as defined by difficulties with walking or climbing stairs, and *Grasping disability*, defined as difficulties with using fingers to grasp small objects. The 2011 AHS asked respondents questions with a Yes/No option to recognize whether or not one has mobility and grasping disabilities. The questions included are as follow: "Do you have serious difficulty walking or climbing stairs?" and "Without the use of any special equipment, do you have difficulty using fingers to grasp small objects?"

Furthermore, the 2011 AHS incorporates supplementary questions with information on recent movers. The topical module allows one to figure out the fraction of recent movers who moved into their homes since 2009. Lastly, this study employed the 2013 AHS to collect information on home improvements made for accessibility enhancement in the last two years. Such modifications include creating a bathroom, bedroom, kitchen, or other inside room from an unfinished space, structural changes or remodeling; and adding or replacing doors or windows/driveways or walkways in the home.

The 2011 AHS contains a sample of 339,453 persons, comprised of 186,448 households. For the purpose of this study, persons aged 65 or older were selected first. Then, with regards to households that have more than one person aged 65 or older, a person with a disability was considered to reflect demographic and socio-economic characteristics in the analysis. The result was a total of 33,183 persons. Moreover, stayers – defined as those who have remained in their place of dwelling since reaching the retirement age of 65 – were selected. After excluding movers from the dataset, only 21,583 out of 33,183 were selected for this study. Finally, in cases

where households do not meet inclusion criteria, households that include respondents coded as “-7: Don't know”, “-8: Refused”, and “-9: Not reported” were excluded. The final sample was comprised of 21,224 persons. 4,700 of the 21,224 surveyed were households that include a person aged 65 or older with a mobility disability. 910 of the 4,700 surveyed were households that include a person aged 65 or older with mobility and grasping disabilities. Using a unique identifier coded as “Control,” 21,224 persons’ records have been linked to datasets on households and housing units. The identifier allowed the core dataset to be combined with supplementary modules of *recent mover* between 2009 and 2011 and *home modification* between 2011 and 2013.

5.4.2. Variables

The AHS provides a wealth of information on both households and housing units. Besides the standard set of demographics on age, sex, race, education, marital status, citizenship, and other aspects of household characteristics, information available in the AHS contains several aspects of housing attributes such as median rent, median housing value, housing type, size, and age, and federally subsidized units. Table 16 describes the list of variables we use for analyses.

As noted earlier, only the 2011 AHS data makes available information on the presence and use of accessibility features. The data includes interior and exterior accessibility features for housing, which allows such features to be categorized into five levels of accessibility. This study employed the methodology used in the Joint Center for Housing Studies of Harvard University (2014) to establish five levels of accessibility, despite the fact that the AHS variables used are not identical. Instead of

employing an index with three levels of accessibility as developed by Bo'sher et al. (2015), using a more detailed index with five levels of accessibility allowed us to determine whether or not to offer advanced accessorial features along with basic structural features.

The five categories are (A) no-step entries; (B) single-floor living without requiring one to climb up or down stairs; (C) lever-style handles on doors and faucets; (D) extra-wide hallways and doors to accommodate wheelchairs; and (E) accessible electric controls with switches and outlets that are reachable from any height. Table 2 presents housing features that represent the degree of accessibility from Levels A through E.

Level A represents a home that has exterior accessibility for seniors with disability. Residents can enter the home without having to climb up or down stairs, or they can use ramps from the exterior of the home. In addition, the home features both a bathroom and a bedroom on the entry level or an elevator inside the unit. The home still needs further interior modifications to accommodate disabled residents.

Level B represents a home that offers basic interior accessibility for seniors with moderate mobility or grasping difficulties. In addition to all the features noted in Level A, residents can move between rooms without stairs; otherwise, the home features a handrail or grab-bars inside the unit. Nonetheless, the home still needs further modifications inside a room or a bathroom.

Level C represents a home that offers advanced interior accessibility for seniors with moderate mobility or grasping difficulties. In addition to all the features

noted in Level A and B, residents can use the handrail or grab-bars in the bathroom. Additionally, doors inside the unit feature handles instead of knobs.

Level D represents a home that has basic interior accessibility for seniors with severe mobility challenges (such as reliance on a wheelchair) or grasping difficulties. In addition to all the features noted in Level A, B, and C, residents can use extra-wide doors or hallways; the kitchen and bathroom are wheelchair accessible.

Level E represents a home that has advanced interior accessibility for seniors with severe mobility challenges or grasping difficulties. In addition to all the features noted in Level A, B, C, and D, residents can use wheelchair-accessible electrical outlets, switches, and climate controls. The kitchen also features wheelchair-accessible cabinets and countertops.

Unmet Needs is defined as whether or not accumulated criteria of Levels A-E is met (see Table 17). For example, the level of housing accessibility that meets all the accumulated criteria of Levels A-E is represented by "0" unmet needs because seniors with a disability live in fully accessible housing with all the accessibility features of Levels A-E. Likewise, meeting only the accumulated criteria of Levels A-C would be assigned a "2" in unmet needs because the housing still fails to meet the needs of Levels D-E. Finally, meeting none of the needs of Levels A-E would be assigned a "5" in unmet needs.

Table 16 Variable description

Variable	Definitions
Household Characteristics	
Disability (Reference: No disability)	
Mobility disability	1 = including a person with difficulties walking or climbing stairs; 0 = otherwise
Grasping disability	1 = including a person with difficulties using fingers to grasp small objects; 0 = otherwise
Age (Reference: 65-74 years old)	
75-84 years old	1 = age of the household head 75-84; 0 = otherwise
≥ 85 years old	1 = age of the household head ≥ 85; 0 = otherwise
Sex (Reference: Male)	
Female	1 = household head is female; 0 = otherwise
Race (Reference: White, non-Hispanic)	
Black, non-Hispanic	1 = household head is Black; 0 = otherwise
Asian, non-Hispanic	1 = household head is Asian; 0 = otherwise
Hispanic	1 = household head is Hispanic; 0 = otherwise
Others	1 = household head is other than White, Black, Asian, and Hispanic; 0 = otherwise
Education (Reference: High school or below)	
Some college degree or above	1 = household head is a college graduate or more; 0 = otherwise
Marital status (Reference: Married)	
Divorce/Separate/ Never married	1 = household head is widowed/divorced/never married; 0 = otherwise
Citizenship (Reference: Native-born citizen)	
Foreign-born citizen	1 = household head is a foreign-born citizen; 0 = otherwise
Non-US citizen	1 = household head is a non-US citizen; 0 = otherwise
Household composition	
At least 1 resident aged 18 or less	1 = household contains at least 1 resident aged 18 or less; 0 = otherwise
2 or more residents aged 65 or more	1 = household contains 2 or more residents aged 65 or more; 0 = otherwise
Household income (Reference: Lowest quartile)	
Quartile 2	1 = household income is included in the second quartile; 0 = otherwise
Quartile 3	1 = household income is included in the third quartile; 0 = otherwise
Highest quartile	1 = household income is included in the fourth quartile; 0 = otherwise
Occupancy length (Reference: Less than 2 years)	
2 to 5 years	1 = household's occupancy length is between 2 and 5 years; 0 = otherwise
6 to 10 years	1 = household's occupancy length is between 6 and 10 years; 0 = otherwise
More than 10 years	1 = household's occupancy length is between 10 years or more; 0 = otherwise
Housing Characteristics	
Median rent (Reference: Lowest quartile)	
Quartile 2	1 = median rent is included in the second quartile; 0 = otherwise
Quartile 3	1 = median rent is included in the third quartile; 0 = otherwise
Highest quartile	1 = median rent is included in the fourth quartile; 0 = otherwise
Median value (Reference: Lowest quartile)	
Quartile 2	1 = median housing value is included in the second quartile; 0 = otherwise
Quartile 3	1 = median housing value is included in the third quartile; 0 = otherwise
Highest quartile	1 = median housing value is included in the fourth quartile; 0 = otherwise
Building type (Reference: Mobile home)	
Single family detached home	1 = housing type is single family detached housing; 0 = otherwise
Single family attached home	1 = housing type is single family attached housing; 0 = otherwise
Multi-family home 2-5	1 = housing type is multi-family housing with 2-5 units; 0 = otherwise
Multi-family home 6-10	1 = housing type is multi-family housing with 6-10 units; 0 = otherwise

Multi-family home 11-25	1 = housing type is multi-family housing with 11-25 units; 0 = otherwise
Multi-family home 26+	1 = housing type is multi-family housing with 26+ units; 0 = otherwise
Size of floor (ft^2) (Reference: Less than 1,000)	
1,000 to 2,000	1 = housing size is between 1,000 and 2,000; 0 = otherwise
2,000 to 3,000	1 = housing size is between 2,000 and 3,000; 0 = otherwise
3,000 to 4,000	1 = housing size is between 3,000 and 4,000; 0=otherwise
Over 4,000	1 = housing size is over 4,000; 0=otherwise
Building age (Reference: Built before 1920)	
Built in 1920s-1930s	1 = housing was built between 1920s and 1930s; 0 = otherwise
Built in 1940s-1950s	1 = housing was built between 1940s and 1950s; 0 = otherwise
Built in 1960s-1970s	1 = housing was built between 1960s and 1970s; 0 = otherwise
Built in 1980s-1990s	1 = housing was built between 1980s and 1990s; 0 = otherwise
Built in 2000s-2010s	1 = housing was built between 2000s and 2010s; 0 = otherwise
Home improvement (Reference: 0)	
1-5	1 = housing has 1-5 improvements; 0 = otherwise
6-10	1 = housing has 6-10 improvements; 0 = otherwise
10+	1 = housing has 10+ improvements; 0 = otherwise
Federally subsidized units	
Public housing	1 = housing is a public housing unit; 0 = otherwise
Housing Voucher	1 = housing is a voucher subsidized unit; 0 = otherwise
Privately owned subsidized	1 = housing is a privately owned subsidized unit; 0 = otherwise
Urban status (Reference: Central cities)	
Central cities	1 = Central cities of the MSA; 0 = otherwise
Suburbs	1 = Suburb of the MSA; 0 = otherwise
Nonmetropolitan areas	1 = Outside MSA; 0 = otherwise
Census region (Reference: Northeast)	
Northeast	1 = ME, NH, VT, MA, RI, CT, NY, NJ, PA; 0 = otherwise
Midwest	1 = OH, IN, Il, MI, WI, MN, IA, MO, ND, SD, NE, KS; 0 = otherwise
South	1 = DE, MD, DC, VA, WV, NC, SC, GA, FL, KY, TN, AL, MS, AR, LA, OK, TX; 0 = otherwise
West	1 = MT, ID, WY, CO, NM, AZ, UT, NV, WA, OR, CA, AK, HI; 0 = otherwise
The number of sample observations	The sample size for analyses
Weighted count of samples	The national level estimate of the number of samples

Table 17 Housing accessibility features by AHS variables

Housing part	AHS variables used	Variable description	Level				
			A	B	C	D	E
Exterior accessibility for disability	NOSTEP HMRAMPS	Enter home without climbing up or down steps or ramps in unit	X	X	X	X	X
	HMENTBTH HMELEVATE	Bathroom on entry level or elevator in unit	X	X	X	X	X
	HMENTBD HMELEVATE	Bedroom on entry level or elevator in unit	X	X	X	X	X
Basic interior accessibility for moderate disability	HMLEVEL HMHNDRL	Presence and use of no steps between rooms or handrail/grab bars in unit		X	X	X	X
Advanced interior accessibility for moderate disability	HMBRL	Presence and use of handrail or grab bars in bathroom			X	X	X
	HMHNDLE	Presence and use of door handle instead of knobs			X	X	X
Basic interior	HMXWDR	Presence and use of extra-wide doors/hallways				X	X

accessibility for wheelchair disability	HMKIT	Presence and use of wheelchair accessible kitchen				X	X
	HMBROOM	Presence and use of wheelchair accessible bathroom				X	X
Advanced interior accessibility for wheelchair disability	HMOUTLET	Presence and use of wheelchair accessible electrical outlets					X
	HMSWITCH	Presence and use of wheelchair accessible electrical switches					X
	HMCLCTRL	Presence and use of wheelchair accessible climate controls					X
	HMACAB	Presence and use of wheelchair accessible kitchen cabinets					X
	HMCOUNT	Presence and use of wheelchair accessible countertops					X

Source: Author's coding (A-E) from the 2011 American Housing Survey

5.4.3. Sample Description

Figure 4 illustrates descriptive statistics regarding the ways in which housing accessibility levels differ for stayers stratified by disability levels. Disability consistently increased the likelihood of living in accessible housing over the range of Levels A-E. Only 1 percent of seniors with no disability lived in housing units of Level C (advanced accessibility for moderate difficulties), while 4.18 percent of those with mobility and grasping disabilities lived in housing of this level. Similarly, only 0.08 percent of seniors with no disability lived in housing units of Level E (advanced accessibility for severe difficulties), while 0.42 percent of seniors with mobility and grasping disabilities lived in housing of this level.

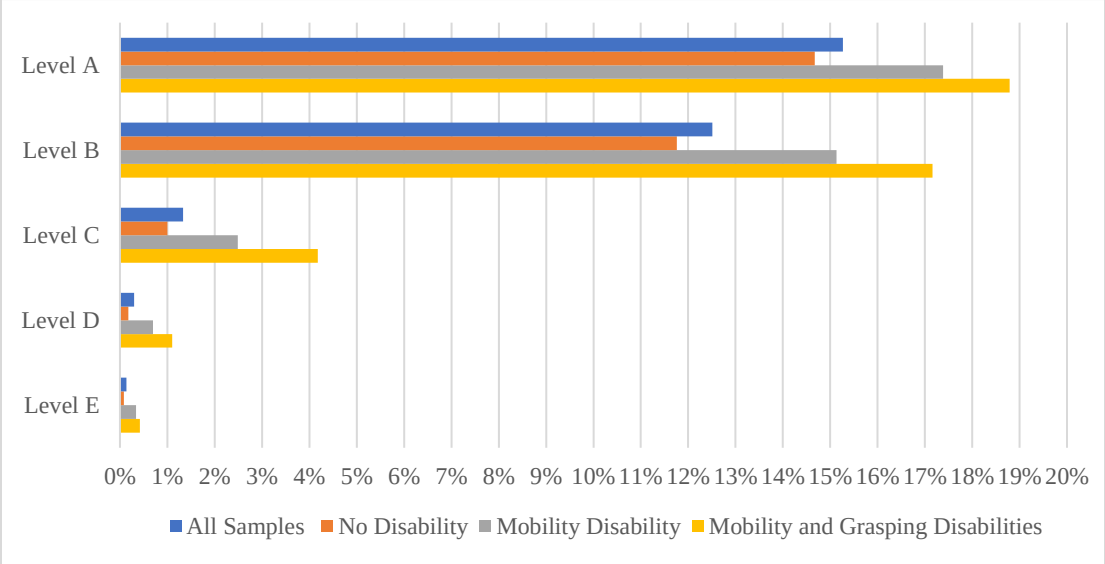

Figure 4 Housing accessibility levels for stayers stratefied by disability levels

Table 18 describes the summary statistics of household characteristics for stayers stratified by disability levels. As expected, age positively correlated with disability, especially for females. Blacks were more likely to have a disability compared with whites. Those with higher education and married households were less

likely to have a disability. Households with two or more seniors tended to encounter a mobility disability, while households with at least one child were likely to be comparatively healthy. Affluent seniors had fewer disabilities relative to those of poorer wealth status. Living within the same home for ten or more years had a positive correlation with households with a disability. The share of seniors rose with disability for all three types of federally subsidized units. Particularly, privately-owned subsidized units accounted for 6 percent of households with a mobility disability, and it reached 8 percent if those households also had a grasping disability. Geographically, seniors with disability were concentrated in the central cities while those with no disability were concentrated in suburban areas.

Table 18 Household characteristics for stayers stratified by disability levels

Household Characteristics	A member aged 65+ (%)	A member aged 65+ with no disability (%)	A member aged 65+ with mobility disability (%)	A member aged 65+ with mobility and grasping disabilities (%)
Housing tenure				
Owners	86.56	88.18	80.85	78.68
Renters	13.44	11.02	19.15	21.32
Age				
65-74 years old	61.46	65.54	47.11	44.18
75-84 years old	28.44	26.69	34.56	33.88
≥ 85 years old	10.13	7.78	18.34	21.99
Sex				
Male	51.20	55.04	37.70	32.42
Female	48.80	44.96	62.30	67.58
Race				
White, non-Hispanic	76.68	77.09	75.21	73.63
Black, non-Hispanic	11.12	10.23	14.23	14.95
Asian, non-Hispanic	3.99	4.44	2.40	2.09
Hispanic	6.81	6.92	6.45	7.36
Others	1.40	1.32	1.71	1.97
Education				
Below high school	19.83	17.51	27.96	33.41
High school	29.35	28.64	31.83	28.35
Some college degree	25.01	25.12	24.55	23.20
Bachelor's degree	25.82	28.72	15.66	15.06
Marital status				
Married	47.78	49.46	41.89	35.71
Widowed	30.76	29.10	36.62	40.33
Divorce/Separate	16.08	16.16	15.81	18.35
Never married	5.38	5.30	5.68	5.60
Citizenship				
Native-born citizen	88.95	88.27	91.34	90.44
Foreign-born citizen	8.39	8.90	6.57	7.69
Non-US citizen	2.67	2.83	2.09	1.87

Household composition				
At least 1 resident aged 18 or less	5.79	6.15	4.53	4.07
More than 2 residents aged 65 or more	33.34	32.23	37.28	30.77
Household income				
Lowest quartile	25.53	23.12	34.00	39.45
Quartile 2	24.47	23.59	27.57	25.60
Quartile 3	25.05	25.73	22.66	20.77
Highest quartile	24.95	27.57	15.77	14.18
Occupancy length				
Less than 2 years	0.60	0.68	0.34	0.55
2 to 5 years	5.24	5.36	4.81	5.06
6 to 10 years	9.98	10.46	8.29	7.70
More than 10 years	84.18	83.50	86.56	86.69
Federally subsidized units				
Public housing	0.89	0.64	1.77	1.98
Housing Voucher	0.78	0.59	1.47	1.76
Privately owned subsidized	2.76	1.85	5.96	8.02
Urban status				
Central cities	18.68	18.26	20.13	21.87
Suburbs	48.09	49.19	44.21	43.08
Nonmetropolitan areas	33.24	32.55	35.66	35.05
Census region				
Northeast	16.77	16.34	18.28	16.04
Midwest	24.91	24.50	26.34	25.05
South	29.10	28.85	29.98	31.10
West	29.22	30.31	25.40	27.80
The number of sample observations	21,224	16,524	4,700	910
Weighted count of samples	18,934,411	14,728,705	4,205,706	753,645

Source: Author's calculations from the 2011 American Housing Survey

Table 19 illustrates the descriptive estimations of housing characteristics for stayers stratified by accessibility levels. Renter-occupied units tend to be accessible relative to owner-occupied units across all levels of accessibility. Nonetheless, 23 percent of renter-occupied units met the criteria for Level A and only 0.6 percent met the requirements for Level E. Dwelling units that have rent in the lowest quartile and value in the highest quartile had a higher level of accessibility. Multi-family homes were better equipped with accessible elements than single-family homes. Particularly, multi-family homes that have 26 units or more were far more likely to be accessible relative to multi-family homes that have a smaller number of units. Similarly, dwelling units that have a floor size greater than 3,000 square feet had a higher chance of being accessible. Newly constructed buildings achieved a better accessibility level despite the mixed evidence on Levels D-E. Homes with accessible features had a higher chance of achieving ten or more home improvements, despite

the fact that those that have not undergone home improvements still tend to be accessible. Federally subsidized units contributed to creating an accessible home environment with the greatest contribution from privately-owned subsidized units. Geographically, dwelling units that have Levels A-C accessibility were concentrated in suburban and non-metropolitan areas while those that have Levels D-E accessibility were concentrated in the central cities.

Table 19 Stayer housing characteristics stratified by accessibility levels

Housing Characteristics	The number of sample observations	Weighted count of households	Level A (%) Exterior accessibility for disability	Level B (%) Basic interior accessibility for moderate disability	Level C (%) Advanced interior accessibility for moderate disability	Level D (%) Basic interior accessibility for wheelchair disability	Level E (%) Advanced interior accessibility for wheelchair disability
Housing tenure							
Owner occupied unit	18,371	16,987,352	14.12	11.35	0.90	0.14	0.07
Renter occupied unit	2,853	1,947,058	22.68	19.94	4.07	1.33	0.60
Median rent							
Lowest quartile	652	338,628	29.60	27.30	7.82	2.45	1.07
Quartile 2	644	428,490	23.60	21.58	4.19	1.24	0.47
Quartile 3	649	463,922	20.96	17.57	2.77	1.39	0.92
Highest quartile	641	410,853	20.44	16.54	2.65	0.78	0.16
Median housing value							
Lowest quartile	4,626	4,825,540	9.60	7.91	0.61	0.13	0.09
Quartile 2	4,704	4,467,533	14.37	11.88	0.81	0.00	0.00
Quartile 3	4,813	4,477,353	15.75	12.76	1.12	0.19	0.08
Highest quartile	4,228	3,216,927	16.93	12.94	1.09	0.24	0.09
Building type							
Single family detached home	16,652	14,931,784	14.16	11.36	0.86	0.14	0.07
Single family attached home	1,050	869,304	11.05	8.29	0.48	0.10	0.00
Multi-family home 2-5	958	735,976	12.21	9.92	0.73	0.31	0.10
Multi-family home 6-10	469	306,943	25.16	21.11	2.99	0.00	0.00
Multi-family home 11-25	359	277,857	29.81	27.30	3.90	0.84	0.28
Multi-family home 26-50	235	169,784	43.83	41.28	11.91	5.53	1.70
Multi-family home 50+	658	423,507	48.94	43.62	10.64	3.04	1.67
Manufacture (mobile) home	843	1,219,256	0	0	0	0	0
Size of floor (ft^2)							
Less than 1,000	5,322	3,968,150	16.85	14.32	2.35	0.68	0.30
1,000 to 2,000	8,839	8,434,345	10.85	8.93	0.70	0.11	0.06
2,000 to 3,000	4,590	4,356,640	16.51	13.27	1.00	0.15	0.07
3,000 to 4,000	1,462	1,294,528	25.03	19.97	1.71	0.41	0.21
Over 4,000	1,011	880,748	25.82	20.08	2.37	0.40	0.20
Building age							
Built before 1920	1,376	1,479,933	12.94	9.96	0.65	0.07	0.00
Built in 1920s	868	752,576	12.21	9.22	0.58	0.00	0.00
Built in 1930s	873	851,140	11.00	9.28	0.69	0.00	0.00
Built in 1940s	1,539	1,347,596	12.15	10.33	0.32	0.06	0.06
Built in 1950s	3,331	2,872,682	13.84	11.56	0.72	0.06	0.06
Built in 1960s	3,717	3,125,796	14.99	12.46	1.24	0.19	0.05
Built in 1970s	4,147	3,914,229	15.65	12.42	1.33	0.34	0.12
Built in 1980s	2,541	2,055,420	16.80	13.66	2.05	0.43	0.24
Built in 1990s	1,936	1,729,314	19.68	16.53	2.69	1.03	0.52
Built in 2000s	891	801,312	22.11	18.74	3.14	0.79	0.34
Built in 2010s	5	4,412	40.00	20.00	0.00	0.00	0.00
Home improvement							

0	10,199	9,488,209	16.17	13.62	1.81	0.52	0.25
1-5	10,194	8,875,698	14.38	11.45	0.87	0.06	0.03
6-10	737	520,623	14.65	11.80	0.81	0.41	0.00
10+	94	49,881	19.15	12.77	2.13	1.06	0.00
Federally subsidized units							
Public housing	188	100,513	22.34	19.15	4.79	2.13	0.53
Housing Voucher	133	137,027	24.70	21.69	3.61	2.41	0.60
Privately owned subsidized	585	127,433	43.42	40.34	12.82	4.44	2.22
Urban status							
Central cities	3,964	1,096,856	12.76	10.34	1.19	0.33	0.18
Suburbs	10,206	2,024,406	16.05	13.02	1.16	0.25	0.10
Nonmetropolitan areas	7,054	15,813,149	15.55	12.99	1.66	0.34	0.17
Census region							
Northeast	3,559	3,961,522	19.13	15.90	1.63	0.34	0.28
Midwest	5,286	4,357,914	20.15	16.86	1.74	0.36	0.11
South	6,177	6,896,776	12.11	10.07	1.02	0.26	0.11
West	6,202	3,718,198	12.04	9.29	1.11	0.26	0.10

Source: Author's calculations from the 2011 American Housing Survey

5.4.3. Statistical Analysis

This study used multivariate regression to examine the first and second research questions. This study used homes per each accessibility level (i.e., A-E) and stayers categorized by degree of disability (i.e., no disability, mobility disability, and mobility and grasping disabilities) as binary dependent variables for the first and second models, respectively. Additionally, the logistic specification was employed to explore the third and fourth research questions. The third and fourth models defined whether to move between 2009 and 2011 and whether to make home modifications between 2011 and 2013 as binary dependent variables, respectively. The models were estimated in STATA13 using the *reg* and *logit* commands. Significance levels of less than 0.01, 0.01, 0.05, and 0.10 were reported to interpret regression coefficients.

5.5. Results

5.5.1. Household Characteristics

Table 20 illustrates that disability clearly increased one's propensity to live in housing with accessibility features. In particular, coefficients denoting the extent of disability show that seniors were more likely to live in accessible homes – with the exception of Level E – once they have mobility and grasping disabilities. Seniors aged 75 or older were more likely to reside in housing of Levels A-C than younger seniors. Nonetheless, seniors aged 75 or older were negatively associated with living in fully accessible housing of Levels D-E. Blacks and Hispanics had a lower likelihood of living in housing with accessibility features. With higher levels of education, seniors

tend to have greater access to accessible homes, except for Level E. U.S.-born citizens were more likely to reside in accessible housing relative to foreign-born or non-U.S. citizens. Households that have at least one child aged 18 or less tend to live in inaccessible homes while those with two or more seniors positively correlated with living in accessible homes. Affluent seniors had a much higher likelihood of living in housing of Levels A-B. Living within the same home for two or more years significantly decreased the probability of residing in housing of Level C. Federally subsidized units tend to be very accessible. Households with accessibility features (Levels A-C) were more concentrated in suburban or non-metropolitan areas than in the central cities.

5.5.2. Housing Characteristics

Table 21 shows which housing characteristics for stayers stratified by disability relate to the number of unmet needs. Renter-occupied units negatively correlated with the number of unmet needs that disabled stayers faced. Rental units in lower-rent quartiles and ownership units in higher-value quartiles tend to meet the needs of seniors. Multi-family housing significantly decreases the likelihood that seniors have unmet needs. Similarly, housing units that have a floor size greater than 3000 square feet and housing built after the year 2000 were more likely to meet the physical environment needs for seniors with disability. The greater the number of home improvements made, the lower the probability that a household will have unmet needs. The magnitudes of those coefficients were strongest once senior adults had mobility and grasping disabilities. Rental units that receive federal assistance presented mixed results. Public housing units did not address the needs of seniors

while privately owned subsidized units and housing voucher units more often provided seniors with accessible features. Nonetheless, seniors with mobility and grasping disabilities still faced unmet needs across all federally assisted units. Geographically, seniors were more likely to experience an increase in unmet needs in the central cities.

Table 20 Multivariate regression on how stayer household characteristics relate to living in the home of each accessibility level

Household Characteristics	Lv. A (%) Exterior accessibility for disability		Lv. B (%) Basic interior accessibility for moderate disability		Lv. C (%) Advanced interior accessibility for moderate disability		Lv. D (%) Basic interior accessibility for wheelchair disability		Lv. E (%) Advanced interior accessibility for wheelchair disability	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Disability characteristics										
No disability	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mobility	*0.013	0.007	**0.016	0.006	**0.006	0.002	**0.003	0.001	***0.002	0.001
Mobility and Grasping	0.014	0.013	+0.023	0.012	***0.018	0.004	*0.004	0.002	-0.002	0.001
Housing tenure										
Owner	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Renter	***0.034	0.009	***0.033	0.008	+0.005	0.003	0.001	0.001	0.000	0.001
Age										
65-74 years old	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
75-84 years old	*0.013	0.006	*0.014	0.006	0.001	0.002	*-0.002	0.001	*-0.002	0.001
≥ 85 years old	***0.034	0.009	***0.036	0.008	0.005	0.003	+-0.003	0.001	*-0.002	0.001
Sex										
Male	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Female	-0.003	0.006	-0.003	0.005	0.002	0.002	0.001	0.001	-0.000	0.001
Race										
White, non-Hispanic	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Black, non-Hispanic	***-0.028	0.008	***-0.033	0.008	***-0.009	0.003	*-0.003	0.001	*-0.002	0.001
Asian	0.008	0.015	0.017	0.013	-0.004	0.005	-0.002	0.002	-0.002	0.002
Hispanic	*-0.026	0.011	+-0.019	0.010	*-0.007	0.003	**-0.004	0.002	*-0.002	0.001
Others	-0.001	0.021	0.006	0.019	0.007	0.007	0.002	0.003	0.001	0.002
Education										
High school or below	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Some college degree or above	***0.022	0.005	***0.018	0.005	+0.003	0.002	0.001	0.001	-0.000	0.001
Marital status										
Married	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Widowed	0.004	0.009	0.009	0.008	-0.001	0.003	0.000	0.001	0.001	0.001
Divorced/Separated/Never Married	-0.003	0.008	0.005	0.008	0.000	0.003	0.001	0.001	0.000	0.001
Citizenship										
Native-born citizen	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Foreign-born citizen	*-0.023	0.010	*-0.023	0.009	-0.001	0.003	-0.000	0.002	0.001	0.001
Non-US citizen	*-0.040	0.016	+-0.029	0.015	+-0.009	0.005	-0.002	0.002	0.000	0.002
Household composition										
At least 1 resident aged 18 or less	0.010	0.011	-0.002	0.010	-0.002	0.003	-0.001	0.002	-0.000	0.001
2 or more residents aged 65 or more	0.005	0.007	0.007	0.007	+0.004	0.002	0.002	0.001	0.001	0.001
Household income										
Lowest quartile	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Quartile 2	-0.009	0.007	-0.008	0.007	*-0.005	0.002	0.001	0.001	0.001	0.001
Quartile 3	0.012	0.008	0.007	0.007	-0.003	0.002	0.000	0.001	0.000	0.001
Highest quartile	***0.048	0.008	***0.032	0.007	0.003	0.003	0.001	0.001	0.000	0.001
Occupancy length										
Less than 2 years	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.

2 to 5 years	0.034	0.033	0.039	0.030	**-0.029	0.011	-0.002	0.005	-0.005	0.003
6 to 10 years	0.009	0.032	0.019	0.030	*-0.025	0.010	0.004	0.005	-0.002	0.003
More than 10 years	-0.022	0.032	-0.009	0.029	***-0.034	0.010	-0.001	0.005	-0.005	0.003
Federally subsidized units										
Public housing	**0.076	0.027	**0.064	0.025	***0.035	0.009	***0.020	0.004	0.005	0.003
Housing voucher	***0.099	0.029	***0.091	0.026	*0.021	0.009	***0.021	0.004	0.005	0.003
Privately owned subsidized	***0.272	0.017	***0.262	0.016	***0.112	0.005	***0.042	0.003	***0.021	0.002
Urban status										
Central cities	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Suburbs	***0.029	0.007	***0.024	0.006	0.002	0.002	0.000	0.001	-0.001	0.001
Nonmetropolitan areas	0.007	0.007	0.006	0.007	0.002	0.002	-0.001	0.001	-0.001	0.001
Constant	***0.141	0.034	***0.100	0.031	***0.036	0.011	-0.000	0.005	+0.007	0.004
Region dummy		Yes		Yes		Yes		Yes		Yes
Adjusted R squared		0.0377		0.0382		0.0346		0.0207		0.0102
The number of sample observations		3,241		2,655		282		63		29
Weighted count of samples		2,585,678		2,115,372		195,232		26,694		12,440

$^{+}p \leq 0.10$. $*p \leq 0.05$. $**p \leq 0.01$. $***p \leq 0.001$.

Table 21 Multivariate regression on how housing characteristics for stayers stratified by disability levels relate to the number of unmet needs

Housing Characteristics	A member aged 65+ (%)		A member aged 65+ With no disability (%)		A member aged 65+ with mobility disability (%)		A member aged 65+ with mobility and grasping disabilities (%)	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Housing tenure								
Owner occupied unit	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Renter occupied unit	-.017	.029	.002	.035	-.049	.053	*-.217	.120
Median rent								
Lowest quartile	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Quartile 2	-.002	.034	-.010	.042	-.001	.060	.206	.129
Quartile 3	*.058	.035	.041	.042	.083	.064	.106	.146
Highest quartile	.023	.035	.006	.042	.037	.071	.089	.177
Housing value								
Lowest quartile	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Quartile 2	***-.039	.014	-.019	.016	***-.115	.029	**-.155	.066
Quartile 3	***-.047	.014	**-.038	.016	***-.084	.032	-.129	.082
Highest quartile	***-.077	.016	***-.072	.018	***-.101	.038	-.108	.089
Building type								
Mobile home	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Single family detached home	***-.182	.025	***-.176	.028	***-.209	.049	*-.205	.109
Single family attached home	***-.146	.031	***-.157	.035	-.103	.069	-.094	.156
Multi-family home 2-5	***-.300	.031	***-.301	.035	***-.306	.063	-.216	.150
Multi-family home 6-10	***-.569	.043	***-.516	.049	***-.766	.091	***-1.16	.207
Multi-family home 11-25	***-.754	.050	***-.756	.059	***-.756	.099	**-.554	.234
Multi-family home 26+	***-.818	.040	***-.788	.047	***-.885	.077	***-1.014	.173
Size of floor (ft^2)								

Less than 1,000	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
1,000 to 2,000	.004	.013	-.004	.014	.027	.026	.0344	.059
2,000 to 3,000	***-.081	.015	***-.096	.017	-.034	.033	.018	.080
3,000 to 4,000	***-.205	.021	***-.220	.023	***-.167	.054	-.127	.139
Over 4,000	***-.207	.024	***-.213	.026	***-.205	.057	**-.261	.116
Building age								
Built before 1920	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Built in 1920s-1930s	-.016	.023	-.023	.027	-.001	.048	.058	.113
Built in 1940s-1950s	***-.078	.020	***-.102	.023	-.008	.041	*.171	.095
Built in 1960s-1970s	***-.077	.020	***-.101	.022	-.023	.041	.124	.094
Built in 1980s-1990s	***-.112	.021	***-.130	.024	*-.087	.045	.078	.105
Built in 2000s-2010s	***-.192	.029	***-.210	.031	**-.171	.073	-.169	.171
Home improvement								
0	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
1-5	-.007	.010	-.005	.011	-.012	.023	**-.134	.055
6-10	-.005	.025	.009	.028	-.047	.055	-.051	.109
10+	-.038	.067	-.057	.071	.079	.188	-.145	.267
Federally subsidized units								
Public housing	.051	.051	.093	.066	.040	.085	*.330	.195
Housing voucher	-.060	.052	-.020	.066	-.103	.088	.051	.192
Privately owned subsidized	***-.107	.036	*-.086	.046	-.071	.063	.009	.145
Urban status								
Central cities	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Suburbs	***-.054	.013	***-.052	.014	*-.052	.028	**-.154	.063
Non-metropolitan areas	-.017	.013	-.005	.015	*-.052	.029	-.090	.065
Constant	***5.075	.0325	***5.104	.0374	***4.999	.0666	***4.960	.1518
Region dummy		Yes		Yes		Yes		Yes
Adjusted R squared		0.0726		0.0626		0.1058		0.1509
The number of sample observations		21,224		16,524		4,700		910
Weighted count of samples		18,934,411		14,728,705		4,205,706		753,645

$^{+}p \leq 0.10$. $*p \leq 0.05$. $**p \leq 0.01$. $***p \leq 0.001$.

5.5.3. Recent Movers

The second column of Table 22 shows the effect of unmet needs on recent movers with disability between 2009 and 2011. As people age, they tend to develop functional disabilities. In the regression, the age variable was excluded to explicitly show the effect of disability on recent movers. The findings reveal that the number of unmet needs itself did not affect the probability that one would leave their current home. However, if a disabled senior faces unmet needs in a dwelling unit, it was likely that he or she would move. This tendency was stronger when seniors had both mobility and grasping disabilities. Seniors who are single as a result of widowhood, divorce, separation, or no marriage were more likely to leave their current homes, but the coefficients were not statistically significant. Households that have at least one child had the tendency to leave their homes, while those with two or more seniors were more likely to age in place. Affluent households and those who have a tenure of six years or more were unlikely to move. Seniors were likely to move to multi-family homes, along with a significant tendency toward moving to those with two to five units. Seniors were more likely to move if there were an opportunity to move into smaller housing and/or newer housing. Geographically, non-metropolitan areas were more likely to attract seniors compared with central cities.

5.5.4. Home Modifications

The third column of Table 22 demonstrates the degree of disability that drove households to make accessibility enhancements between 2011 and 2013. First, the seriousness of disability significantly increases the likelihood that a household makes a home improvement. Black, Hispanic, and Asian seniors showed a consistent

propensity toward making their homes accessible, compared with whites, but the coefficients were not statistically significant. Seniors with a higher level of education were more likely than those with only a high school degree to make efforts to enhance their housing accessibility. Single seniors were unlikely to make home modifications; it was significantly strong for widowed seniors. Foreign-born citizens and non-U.S. citizens were consistently more likely than U.S.-born citizens to make home improvements. Affluence has a positive effect on the likelihood that seniors make their homes accessible. Contrary to expectations, there was no significant coefficient for housing characteristics. Geographically, non-metropolitan areas had a higher incidence of home accessibility improvements relative to central cities, but seniors in suburban areas were less likely to make home modifications.

Table 22 Binary logistic regression on the effects of unmet needs and disabilities on recent movers and home modifications

	Recent movers between 2009 and 2011		Home modifications between 2011 and 2013	
Characteristics	Coef.	Std. Err.	Coef.	Std. Err.
Unmet needs characteristics				
Unmet needs	-0.063	0.066	-	-
Unmet needs * Mobility	*0.053	0.024	-	-
Unmet needs * Mobility and Grasping	+0.071	0.041	-	-
Disability characteristics				
No disability	-	-	Ref.	Ref.
Mobility	-	-	-0.009	0.103
Mobility and Grasping	-	-	*0.421	0.194
Sex				
Male	Ref.	Ref.	Ref.	Ref.
Female	-0.114	0.103	-0.002	0.086
Race				
White, non-Hispanic	Ref.	Ref.	Ref.	Ref.
Black, non-Hispanic	0.078	0.141	0.116	0.137
Asian	-0.031	0.290	0.039	0.260
Hispanic	0.084	0.170	+0.269	0.154
Others	0.379	0.284	-0.447	0.354
Education				
High school or below	Ref.	Ref.	Ref.	Ref.
College degree or above	0.049	0.098	**0.224	0.081
Marital status				
Married	Ref.	Ref.	Ref.	Ref.
Widowed	+0.291	0.152	**-0.375	0.125
Divorced/separated/never married	0.176	0.154	-0.079	0.128
Citizenship				
Native-born citizen	Ref.	Ref.	Ref.	Ref.
Foreign-born citizen	0.042	0.183	0.094	0.166
Non-US citizen	0.362	0.242	*0.469	0.239

Household composition				
At least 1 or more resident aged 18 or less	***0.544	0.168	0.086	0.162
2 or more residents aged 65 or more	*-0.286	0.144	-0.119	0.099
Household income				
Lowest quartile	Ref.	Ref.	Ref.	Ref.
Quartile 2	-0.091	0.120	0.017	0.118
Quartile 3	**-0.391	0.139	0.126	0.118
Highest quartile	*-0.301	0.153	**0.341	0.125
Occupancy length				
Less than 2 years	Ref.	Ref.	Ref.	Ref.
2 to 5 years	0.210	0.459	-0.073	0.782
6 to 10 years	-0.120	0.454	-0.054	0.764
More than 10 years	-0.280	0.447	0.019	0.757
Housing type				
Mobile home	Ref.	Ref.	Ref.	Ref.
Single family detached home	0.064	0.215	0.082	0.187
Single family attached home	0.243	0.277	-0.012	0.251
Multi-family home 2-5	**0.649	0.246	-0.341	0.317
Multi-family home 6-10	0.051	0.370	-	-
Multi-family home 11-25	0.243	0.397	-1.175	1.043
Multi-family home 26+	0.442	0.274	-0.541	0.506
Size of floor (ft^2)				
Less than 1,000	Ref.	Ref.	Ref.	Ref.
1,000 to 2,000	-0.043	0.124	0.102	0.116
2,000 to 3,000	-0.021	0.157	+0.213	0.129
3,000 to 4,000	-0.103	0.234	-0.105	0.176
Over 4,000	-0.135	0.263	-0.101	0.205
Housing age				
built before 1920	Ref.	Ref.	Ref.	Ref.
built in 1920s-1930s	0.089	0.257	0.042	0.177
built in 1940s-1950s	*0.429	0.217	-0.230	0.156
built in 1960s-1970s	*0.505	0.209	0.012	0.146
built in 1980s-1990s	*0.453	0.222	-0.242	0.162
built in 2000s-2010s	+0.506	0.295	+-0.515	0.264
Urban status				
Central cities	Ref.	Ref.	Ref.	Ref.
Suburbs	**-0.585	0.227	***-0.855	0.205
Non-metropolitan areas	***2.250	0.181	***2.491	0.162
Constant	***-5.088	0.670	***-4.537	0.817
Region dummy		Yes		Yes
Pseudo R squared		0.1613		0.2040
The number of sample observations		21,224		17,899
Weighted count of samples		18,934,411		16,105,657

$^{+}p \leq 0.10$. $*p \leq 0.05$. $**p \leq 0.01$. $***p \leq 0.001$.

5.6. Discussion

This study first analyzed data from the 2011 AHS to examine how the U.S. housing stock accommodates seniors stratified by disability (See Figure 4). The more severe the disability, the higher the probability that seniors will live in an accessible home through the range of Levels A-E. Nonetheless, the findings suggest that the scarcity of accessible housing suitable for seniors with disability is serious, especially for Level D-E accessible housing units.

With regards to household characteristics for stayers (See Table 18), vulnerable adults – including females, blacks, those with lower education attained and single seniors – have a higher likelihood of disability. Households with two or more seniors tend to have a mobility disability, while households with at least one child are less likely to have a disability. Interestingly, the majority of households with disability have long tenure relative to non-disabled households. This statistic suggests that seniors with disability are less likely to move than those with no disability; therefore, homes that lack basic accessibility features might require home modifications to meet the household's future daily needs.

Regarding housing characteristics for stayers (See Table 19), homes in the lowest rent quartile and in the highest value quartile tend to be accessible. These findings suggest that federal assistance for rental housing can be a driving factor, and may indicate why the lowest rent units achieve high accessibility ratings. In contrast, affluent seniors living in the highest-value housing are most likely to make home modifications. Multi-family homes that have 26 or more units are more likely to be accessible than single-family homes or multi-family homes with fewer units. Similarly, homes that have a floor size greater than 3,000 square feet have a higher likelihood of being accessible. Consistently, newly constructed buildings have a higher probability of featuring accessible homes. These findings suggest that the 1990 ADA regulations and the Fair Housing Act have been effective in increasing the accessibility of multifamily dwellings designed and constructed after the early 1990s. Of federally subsidized units, privately-owned units are more likely than others to be accessible. This finding suggests that the Low-Income Housing Tax Credit (LIHTC)

program greatly contributes to the creation of accessible rental housing for low-income seniors.

This paper takes into account seniors who live in housing with accessibility of Levels A-E (See Table 20). Most importantly, the degree of disability is positively associated with the probability of living in accessible homes. This estimation suggests that seniors with a disability improved the accessibility of their housing through home modifications, or they moved to homes with accessible features before the age of 65. This tendency is strong until seniors reach Level C. Similarly, seniors aged 75 or older tend to live in housing that meets Level C conditions, but not in housing that meets Levels D-E. These findings suggest that seniors still have a lower likelihood of living in fully accessible housing regardless of disability. Seniors with a tenure of 10 years or more are less likely than seniors of shorter tenure to live in homes with accessibility features. As noted earlier, this finding suggests that seniors still live in inaccessible homes in large part because they would like to age in their current place.

Additionally, this paper observes which types of homes relate to the number of unmet needs for stayers stratified by disability levels (See Table 21). Overall, there are no clear differences between the number of unmet needs and housing characteristics for senior adults with and without disability. Nonetheless, there are some differences in the magnitude and significance of coefficients in housing characteristics. The effects of median rent and value are the greatest if or when seniors have mobility and grasping disabilities. Similarly, seniors with mobility and grasping disabilities are less likely to face unmet needs in multi-family housing with 6 to 10 and 26 or more units. Additionally, disabled seniors are less likely to have

unmet needs in recently constructed housing units that are more than 2,000 square feet in size. These findings suggest that the current stock of single-family housing requires policy enforcement to drive the installation of accessibility features.

Finally, this study examines the link between unmet needs and the likelihood of mobility between 2009 and 2011, and the effect of degree of disability on the decision to make home modifications between 2011 and 2013 (See Table 22). The number of unmet needs itself does not show a positive coefficient on the likelihood of mobility. Regarding seniors with mobility and grasping difficulties who face unmet needs in the current homes, the coefficient shows a significantly positive correlation with mobility. Furthermore, this study shows that seniors with a severe disability were increasingly likely to make home improvements between 2011 and 2013. These findings suggest that seniors tend to move and make home modifications once they develop both mobility and grasping disabilities at the same time. Additionally, the findings highlight the importance of socio-economic attributes as determinants of home modifications, compared with housing attributes.

This study raises many questions for future research. First, the number of observations is quite low, particularly for accessibility levels D and E (see Table 20). The small observation size might yield very limited – and sometimes unreliable – outcomes. Using a suitable sample size will resolve these issues. Second, the AHS provides limited information on home modifications, compared with a number of accessibility features prescribed by universal design. By using a new dataset to include a greater variety of home modifications, future research could yield more insights on this issue. Third, more importantly, the major reason why seniors are

reluctant to make home improvements may be due to high costs as well as the unavailability of financial sources. Understanding the relationship between financial sources and policy intervention may prove useful in determining the extent to which seniors make home modifications.

Chapter 6: Elderly Migration and Housing Consumption

6.1. Introduction

With the aging of the baby boomer generation and increased longevity, America's 50-and-over population is projected to reach 132 million in 2030. As part of this demographic upheaval, the enormous baby boomer generation has long outpaced other demographic groups in first-home purchases, subsequent move-up housing, and, most recently, in relocating and exiting from homeownership. Since much of the early cohort of baby boomers has progressed into retirement, seniors' migration patterns and housing consumption are seen as one of the most influential factors on the near-future housing market.

A steady trend of out-migration toward suburbs has occurred since World War II. Suburban households tend to enjoy high equity homeownership, as those who see an increase in income before retirement tend to spend more on housing. As such, affluent persons could afford to live in their preferred suburban location. Still, retirement marks a reduction income for many persons; as such, they might encounter financial challenges when searching for housing in low-density suburban areas. The decrease in income often forces retirees to transition out of home equity into a high-density urban center (Jones, 1997; VanderHart, 1998; Painter and Lee, 2009). In leaving homeownership, retirees tend to become renters, or they opt to live in less expensive and older dwelling units. Some researchers argue that later-life migration can be attributed to the fact that non-economic events related to aging often change

one's needs and housing preferences. These life cycle events include time-varying factors such as the loss of a spouse, depreciating health, and changing family size (Megbolugbe et al., 1999; Sabia, 2008; Angelini et al., 2014). Furthermore, some researchers see different characteristics in locations as push or pull factors of migration. The push-pull model highlights the effects of origin and destination characteristics on elderly migration (Walters, 2002; Liaw et al., 2002; Plane and Jurjevich, 2009). Despite widespread acceptance of elderly migration-related hypotheses and their implications, studies of American baby boomers' residential mobility and housing decisions have not garnered much attention.

This study sheds light on the intersection between residential mobility and housing consumption for seniors who make in-migration from the outer suburbs of the Baltimore MSA, with a particular focus on marital status. One's decision of whether and where to move is highly associated with housing market conditions such as housing affordability, availability of the desired housing type, and financing opportunities for the house. At the same time, housing market conditions are greatly affected by magnitudes of inflows and outflows of migrants. Furthermore, marital status might be one of the critical drivers in determining residential mobility and housing consumption. In particular, the loss of a spouse has a significant positive effect on residential mobility at older ages; a surviving spouse may want to adjust their housing wealth by either becoming a renter or by downsizing to less expensive homeownership. Nevertheless, affluent seniors' housing behaviors may vary if or when they migrate from the outer suburbs.

To address research questions, probit and multinomial logistic specifications are developed with the dataset drawn from the Maryland population and housing samples from the 2013-2017 Public Use Microdata Sample (PUMS). Additionally, by employing the household projection provided by the Maryland Department of Planning (MDP), this paper proposes some overall guidance meant to deliver potential housing strategies for the Baltimore metropolitan statistical area (MSA). This study seeks to provide an assessment of predictions regarding future mobility rates by characterizing elderly movers at the different marital status; it aims to provide a better understanding of the varied correlation between residential mobility and housing consumption in the Baltimore MSA.

6.2. Literature Review

The standard monocentric model offers a common explanation for the direction of intra-metropolitan residential mobility. Muth (1969) focuses on investigating the effects of (1) income, (2) housing prices, and (3) transportation cost on the equilibrium location. Considering these three factors, each household determines its optimal location (e.g., an urban center vs. suburbs) and amount of housing consumption (e.g., housing size and quality) for each of the type categories (e.g., single-family homes vs. multi-family homes). Then, each household determines its utility maximization by selecting the housing that yields the greatest utility. Even though the monocentric model provides a consistent prediction based on common reasons for residential mobility and housing consumption, this model is limited in that it does not address elderly behaviors. Most often, income and transportation cost for

commuting are the main factors in determining one's equilibrium location, but retired seniors no longer commute to a place of employment nor do they typically earn labor income. As such, seniors – particularly those considered empty-nesters – might sell their suburban homes to purchase homes in urban areas in order to take advantage of urban amenities. As such, there is a variety of reasons we cannot explain elderly behaviors using the monocentric specification.

In efforts to provide an appropriate explanation for elderly migration, there have been myriad hypotheses on why seniors migrate. One explanation relates to the life cycle theory. When a person reaches a certain life event such as the death of a spouse, new disability, or transition into life as an empty-nester, such factors can lead to dissatisfaction with one's housing conditions; this, in turn, can alter what one considers to be their desired location or type of housing. Retirement, in particular, signifies a major life change and affects needs and preferences in housing, in large part because a work commute no longer poses an issue. Many scholars have attempted to classify the migration patterns of seniors over different life stages. Each migrant group has a unique set of life course attributes, which serve as the driving factors for moving. Litwak and Longino (1987) divide elderly migration into three types: *retirement move* to gain desired amenities, *comfort move* to deal with a deteriorating health condition, and *care move* to describe one's move to an institution due to challenges with self-care or the difficulty associated with the absence of a family. Similarly, Walters (2002) categorizes the elderly migration into three types: *amenity migrant,* who moves for amenity reasons and has the desire to pursue to a leisure-oriented lifestyle; *assistance migrant,* who lives below the average poverty

threshold and moves in search of economic security; and *disability migrant,* who moves for health reasons having suffered a deteriorating disability over time. Pope and Kang (2010) divide elderly migration into *Proactive* and *Reactive* moves. *Proactive* movers are defined as those who move in preparation of future needs and as the least vulnerable elderly – those who are youngest, the most educated, and the wealthiest. In contrast, *Reactive* movers determine mobility in response to an event that urges them to move. Such stressful encounters include the deterioration of one's health, one's poor economic status, or the loss of one's partner.

Other explanations for later-life migration focus not on the socioeconomic or demographic characteristics of movers, but on the different characteristics between locations that serve as push or pull factors. This model encourages out-migration and in-migration if it is undesirable or desirable, respectively. Walters (2002) examines the impact of origin and destination characteristics on the migration of retired groups. *Amenity migrants* are strongly drawn to pleasant climates and favorable economic conditions, but tend to avoid large metropolitan areas. *Assistant migrants* do not choose the counties or metropolitan areas with the lowest average rents, but instead select low-cost housing within particular areas. *Disability migrants* are likely to leave those places where nursing home facilities are inadequate. Similarly, Liaw et al. (2002) suggest that the location of adult children and environmental amenities are among the most important attractions for the primary migration of elderly people. The findings reveal that the elderly are likely to move to destinations that have a warmer winter, more sunny days, and locations on the Atlantic or Pacific coast. Plane and Jurjevich (2009) also reveal that the elderly who leave from large metropolitan areas

prefer to move into micropolitan and rural counties since such locations offer special climatic and other natural amenities. Additionally, many studies present locations that provide desirable climates and atmospheres, less congestion and crime, and a lower cost of housing and living; such locations can become destinations for later-life migration (Conway and Houtenville, 2003).

There are few studies in line with the purpose of this article that considers a simultaneous association of migration and housing consumption for older households. Bonnet et al. (2010) estimate the effect of a transition to widowhood on housing decisions and location choices using the French Housing Surveys. Widowhood has a significant effect on increasing residential mobility for older elderly and those who have children. Widowed seniors tend to choose smaller homes, more often apartment, and the rental status in larger municipalities with more accessible services. Marois et al. (2018) examine how the young-elderly behave to deal with the duality of dwelling and neighborhood characteristics in the Montreal metropolitan area. The findings reveal that retirees prefer to move to housing with three to four rooms, a high-rise building, and a low-density neighborhood. Additionally, the geographical location for previous housing deeply relates to that of new housing. Lastly, socioeconomic factors serve as critical drivers to determine those choices.

While the baby boomer generation has been growing in importance in the U.S. housing market, there have been relatively few empirical studies about the simultaneous association of migration and housing consumption of older Americans. Especially, to the best of my knowledge, there are very few studies that investigate elderly behaviors separately on an urban center, inner suburbs, and outer suburbs in

the Metropolitan region, although some scholars (Détang-Dessendre et al., 2008; Jeong Kim and Morrow-Jones, 2011) explore intrametropolitan residential mobility based on young age groups. With a particular focus on marital status, this study examines how seniors determine residential mobility and housing consumption when making migrating toward the inner city from the outer suburbs of the Baltimore MSA.

6.3. Research Questions

(1) How does elderly migration for each sub-group (e.g., couple, single, cohabiting with children, and having more than two persons) relate to individual and housing characteristics?

To address this question, I used the 2013-2017 PUMS to estimate how individual and housing characteristics affect the decision of moving from the outer suburbs for each sub-group. With a stayer as a reference, I conduct binary probit regression of seniors who make a decision regarding residential mobility. I expect that seniors are likely to move if or when they face recent changes (e.g., loss of a spouse) in marital status that result in a single status. The results provide an assessment of estimations regarding mobility rates by characterizing elderly movers at the different household formation.

(2) Which individual and housing attributes affect one's location decision when choosing to migrate inward from the outer suburbs of the Baltimore MSA?

I investigated the ways in which individual and housing attributes affect one's location decision when seniors decide to migrate inward from outer suburbs. Given

that the majority of rental multi-family housing is concentrated in the urban center and inner suburbs, I expect that seniors tend to move inward to become renters after retirement. Low income might be a key factor in a senior homeowner's decision to liquidate their home equity; in such cases, seniors are likely to move into urban areas. Nevertheless, elderly behaviors may vary based upon other life changes. These estimations suggest which attributes attract individuals to and repel individuals from the outer suburbs of the Baltimore MSA.

(3) What are housing needs and preferences for seniors facing the decision to migrate inward from the outer suburbs of the Baltimore MSA?

This question aims to provide evidence regarding housing needs and preferences for seniors. I conduct empirical analyses of elderly households who make decisions between (1) single- and multi-family housing; (2) 0-2 bedroom housing and 3+ bedroom housing; and (3) structures built before 1969 and structures built between 1970 and 2017 with stayers as a reference. I hypothesize that seniors tend to become renters in multi-family housing when choosing to make an in-migration move from the outer suburbs. Otherwise, seniors might downsize to housing with fewer bedrooms. These findings can serve as a reference point for estimating future housing demand.

6.4. Baltimore Metropolitan Area

This article focuses on the residential mobility and housing decisions of the elderly population in the Baltimore MSA. Vicino (2008) suggests that the Baltimore MSA represents a desirable case since it is a medium-sized region with inner suburbs, and it

mostly grew during the 20th century. Vicino argues that we can obtain broad lessons from the case of Baltimore. Additionally, Puentes and Orfield (2002) and Vicino (2008) support that Baltimore and many regions of the Midwest share similar characteristics that can be traced back to a common set of public problems.

Before analyses, it is important to identify the geographical boundaries between an urban center, inner suburbs, and outer suburbs of the Baltimore MSA. Many scholars suggest that inner suburbs are made up of low-density residential areas with single-family homes built between 1950 and 1969; the oldest suburbs are located nearest the city, as a result of the mass suburbanization following World War II. Since there is little existing literature that provides concrete spatial definitions for suburbs, this study relies on two criteria (e.g., spatial criterion and housing criterion) employed by Hanlon and Vicino (2007) and Vicino (2008) to classify a suburb as either an inner or outer suburb. In the case of the Baltimore MSA, the first criterion classifies geographical areas into inner suburbs if they share a boundary with the city of Baltimore. This study uses Public Use Microdata Areas (PUMAs) as geographical areas, which represent the smallest geographic areas containing at least 100,000 people, for which individuals are identified in the American Community Survey (ACS). If suburbs do not meet the first criterion, the second criterion considers the age of housing for suburbs that do not share a boundary with the central city. If more than half of the housing stock was built before 1970, the geographical areas in question are classified as inner suburbs. Figure 5 and Table 23 show the results that are examined by the two criteria.

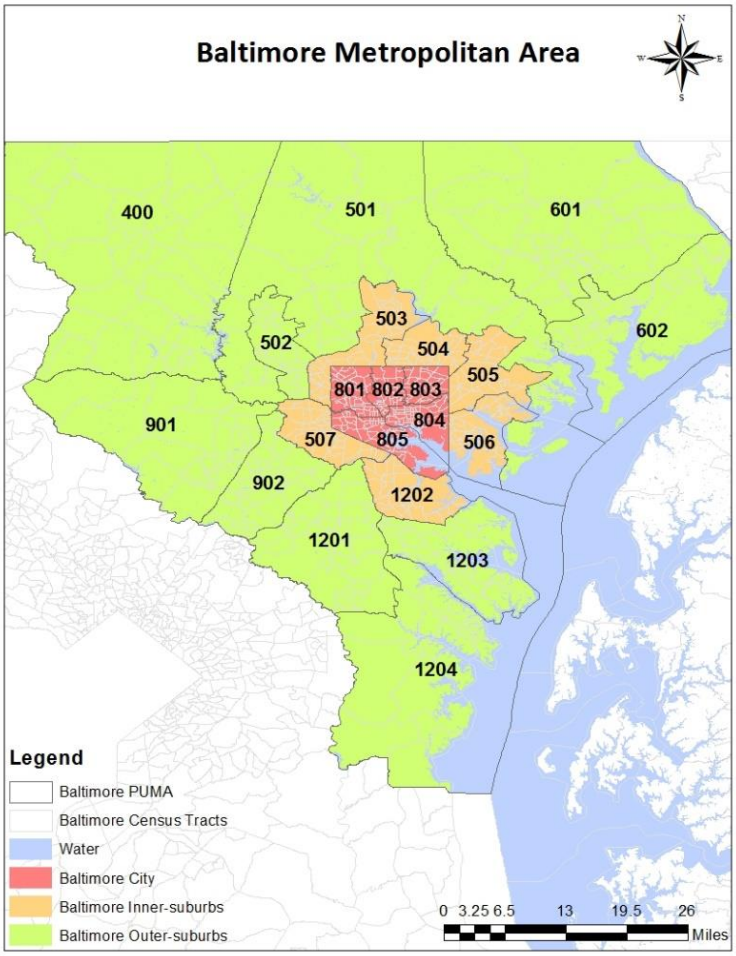

Figure 5 The spatial structure of the Baltimore MSA

Table 23 Baltimore MSA defined by housing and spatial criteria

No.	Public Use Microdata Areas (PUMAs)	Housing Criteria	Spatial Criteria	City/County
801	Sandtown-Winchester, Ashburton & Mount Washington	81%	Central city	Baltimore City
802	Guilford, Roland Park & Druid Lake	84%	Central city	Baltimore City
803	Frankford, Belair-Edison & Loch Raven	87%	Central city	Baltimore City
804	Inner Harbor, Canton & Bayview	75%	Central city	Baltimore City
805	Irvington, Ten Hills & Cherry Hill	81%	Central city	Baltimore City
503	Pikesville (South), Lochearn, Cockeysville & Mays Chapel	52%	Adjacent	Baltimore Co.
504	Towson (East & Central), Parkville & Carney	57%	Adjacent	Baltimore Co.
505	Perry Hall, Middle River & Rosedale	36%	Adjacent	Baltimore Co.
506	Dundalk, Essex & Edgemere	74%	Adjacent	Baltimore Co.
507	Catonsville, Woodlawn & Arbutus	61%	Adjacent	Baltimore Co.
1202	Glen Burnie, Pasadena, Ferndale & Brooklyn Park	50%	Adjacent	Anne Arundel Co.
400	Carroll County	28%	Not adjacent	Carroll Co.
501	Baltimore County (Outer)	33%	Not adjacent	Baltimore Co.
502	Randallstown (East), Owings Mills, Milford Mill & Reisterstown	27%	Not adjacent	Baltimore Co.
601	Bel Air Town, Fallston & Jarrettsville	26%	Not adjacent	Harford Co.
602	Aberdeen & Havre de Grace Cities	27%	Not adjacent	Harford Co.
901	Columbia (West) & Ellicott City (Northwest)	17%	Not adjacent	Howard Co.
902	Columbia (East), Ellicott City (Southeast) & Elkridge	11%	Not adjacent	Howard Co.

1201	Severn, Odenton, Crofton, Maryland City & Fort Meade	18%	Not adjacent	Anne Arundel Co.
1203	Severna Park, Arnold & Lake Shore	30%	Not adjacent	Anne Arundel Co.
1204	Annapolis City, Parole, Annapolis Neck & Edgewater	34%	Not adjacent	Anne Arundel Co.

6.5. Data and Methodology

This paper uses the PUMS file of the 2013-2017 U.S. Census. The PUMS captures approximately 5 percent of all moves that occurred from 2013 to 2017. The sample used in this study includes elderly households, defined as aged 60 or older. By comparing the PUMAs of departure and destination between 2013 and 2017, primary migrants are defined as those whose PUMAs of residences are different between 2013 and 2017. The remaining individuals are defined as stayers whose PUMAs of residences are the same in that period. The set of independent variables includes individual and housing characteristics (see Table 24). Additionally, this study employs 2013-2017 ACS Five-Year Estimates for defining geographical boundaries, summarizing the characteristics of elderly migrants and residents, and illustrating the distribution of senior facilities available. The 2040 household projection provided by the MDP is also used to assess future population growth. Finally, the numbers of hospital and nursing home beds, according to the Maryland Health Care Commission, and those of government subsidized units from the U.S. Department of Housing and Urban Development's 2017 Picture of Subsidized Households (PSH) and 2016 Low-Income Housing Tax Credit (LIHTC) databases are used to gather information on the senior facilities available.

Table 24 Variable description

Attribute	Description
Individual Characteristics	
age60	Reference variable
age65	Binary variable 1 if a householder's age is between 65 and 69, otherwise 0

age70	Binary variable 1 if a householder's age is between 70 and 74, otherwise 0
age75	Binary variable 1 if a householder's age is between 75 and 79, otherwise 0
age80	Binary variable 1 if a householder's age is over 80, otherwise 0
male	Reference variable
female	Binary variable 1 if a householder is female, otherwise 0
white	Reference variable
black	Binary variable 1 if a householder is Black, otherwise 0
otherrace	Binary variable 1 if a householder is other races, otherwise 0
belowhighschool	Reference variable
highschool	Binary variable 1 if a householder has a high school degree, otherwise 0
associate	Binary variable 1 if a householder has an associate degree, otherwise 0
bachelor	Binary variable 1 if a householder has a bachelor's degree or above, otherwise 0
unemployment	Binary variable 1 if a householder is unemployed, otherwise 0
disability	Binary variable 1 if a householder is disabled, otherwise 0
medicare	Binary variable 1 if a householder relies on Medicare, otherwise 0
medicaid	Binary variable 1 if a householder relies on Medicaid, otherwise 0
income quartile 1	Reference variable
income quartile 2	Binary variable 1 if natural logarithm of household income is the 2nd quartile, otherwise 0
income quartile 3	Binary variable 1 if natural logarithm of household income is the 3rd quartile, otherwise 0
income quartile 4	Binary variable 1 if natural logarithm of household income is the 4th quartile, otherwise 0
Housing/Tenure Characteristics [a]	
house	Reference variable
apartment	Binary variable 1 if a home is a multi-family unit, otherwise 0
ownership	Reference variable
renter or free renter	Binary variable 1 if a household become a renter or a free renter, otherwise 0
Household Composition	
married	Reference variable
single	Binary variable 1 if a householder is single, otherwise 0
widow12	Binary variable 1 if a householder was widowed within the past 12 months, otherwise 0
children	Binary variable 1 if a householder cohabits with a child, otherwise 0
three or more persons	Binary variable 1 if a household contains more than two persons, otherwise 0
Year Dummies	
year2013	Reference variable
year2014	Binary variable 1 if a householder migrated in 2014, otherwise 0
year2015	Binary variable 1 if a householder migrated in 2015, otherwise 0
year2016	Binary variable 1 if a householder migrated in 2016, otherwise 0
year2017	Binary variable 1 if a householder migrated in 2017, otherwise 0

Methodologically, this study begins with the basic assumption that households are likely to maximize the utility when they choose the bundle of housing consumption (e.g., location) based on their household attributes. This paper assumes that households migrate when the utility derived from a new residential location potentially outweighs that of their current residence. To estimate the parameters of various variables that influence a household's optimal migration and housing consumption, this study employs a probit model. In this model, the dependent variable is a dummy equal to 1 for the event of migration to the destination, and 0 otherwise. Additionally, this study employs a multinomial logistic model (MNL) to investigate how seniors behave, in order to determine housing consumption when one

moves to a subarea of the Baltimore MSA. Specifically, separate multinomial logit regression models were run for three housing decisions with stayer as a reference: (1) *Housing type*: single-family housing vs. multi-family housing, (2) *Housing size*: 0 to 2 bedrooms compared with three or more bedrooms, and (3) *Housing age*: housing built before 1969 vs. housing built between 1970 and 2017.

A commonly known problem with a multinomial logit model is the potential violation of the independence of irrelevant alternatives (IIA) assumption (McFadden, 1978). Although many scholars typically rely on structuring a nested logit model (Kim et al., 2005; Lee and Waddell, 2010) and a mixed logit or probit model (Détang-Dessendre et al., 2008; Marois et al., 2018) for solutions, the absence of alternative specific variables allows us to use multinomial logit specification without biased estimations. Bonnet et al. (2010) argue the multinomial logistic specification is preferred over a nested logit in cases where there is no alternative specific variable. Focusing on the comparison of movers to a specific subarea and stayers, migration decisions and housing consumption for relocation to the central city, inner suburbs, and outer suburbs are examined separately at the household level.

6.6. Results

6.6.1. Descriptive Statistics

Figure 6 illustrates elderly migration by departure that occurred in the Baltimore MSA between 2013 and 2017. The majority of seniors are non-movers, a classification that accounts for greater than 93 percent of all age groups. Seniors aged 70 to 74 are most likely to age in place, while those aged 60 to 64 are less likely to

become non-movers. Seniors prefer to choose the same county or state when moving, and they represent the population least likely to move to a different state or abroad. Table 25 provides some information on the characteristics of elderly residents in the Baltimore MSA. Seventy-seven percent of elderly households consist of homeowners; married households account for the greatest portion (47 percent) of homeowners. Non-family householders who live alone make up 37 percent of all homeowner households. In contrast, the majority of renters are non-family householders living alone; this accounts for 70 percent of the overall renter population, of which the smallest portion (2.3 percent) are single male householders.

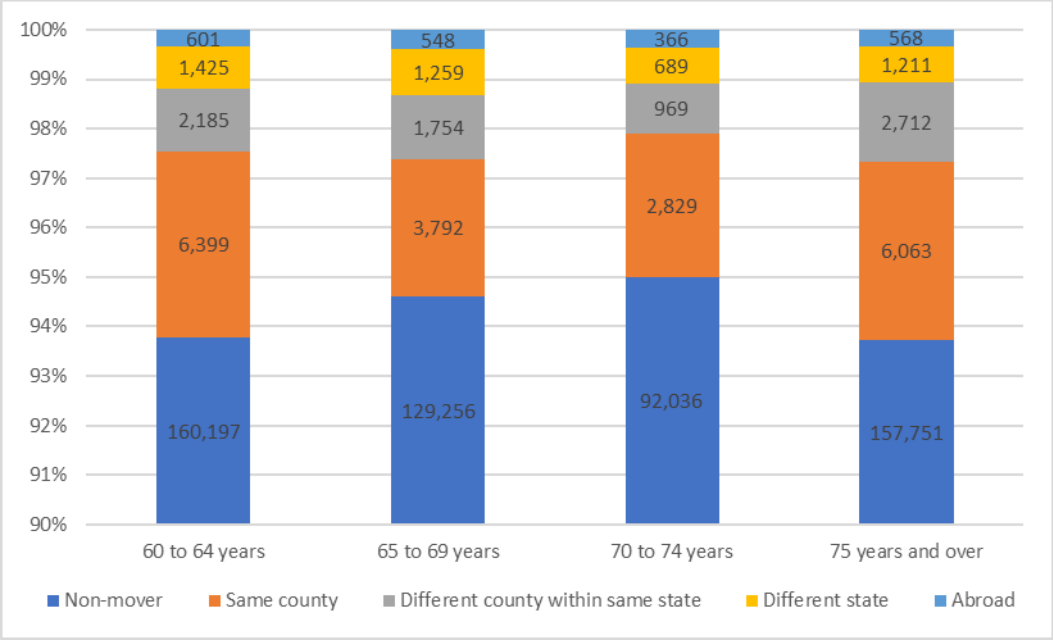

Figure 6 Elderly migration by departure in the Baltimore MSA

Table 25 Brief summary of elderly residents in the Baltimore MSA

	Household type	Homeowner		Renter	
Family	Married householder 65 years and over	90,116	47.1%	8,303	14.7%
	Male householder 65 years and over	6,201	3.2%	1,273	2.3%
	Female householder 65 years and over	20,242	10.6%	5,281	9.4%
Non family	Householder living alone 65 years and over	69,704	36.5%	39,595	70.3%
	Householder not living alone 65 years and over	4,925	2.6%	1,871	3.3%
Total number of households		191,188	100.0%	56,323	100.0%

Table 26 presents the summary statistics for independent variables used in regression. On average, the majority of seniors are non-movers; non-movers make up 97.2 percent of outer suburbs of the Baltimore MSA, and 2.8 percent of this population consists of elderly migrants. Mobility tends to decrease as seniors grow older until they reach the age of 69, but it rises again when seniors reach age 70. The youngest grouping of seniors – those aged 60-64 – shows the highest migration rate (3.3 percent), along with the smallest probability of migration of seniors aged 65 to 69 (2.0 percent). A female householder is more likely to move than a male householder. As expected, those who identify as white are less likely to move compared with those of other races. Education is inversely correlated with mobility – the higher one's education level, the more their mobility decreases. Nonetheless, seniors who have a bachelor's degree or higher degree tend to be more mobile in the outer suburbs. Unemployment slightly raises the probability of moving. Unlike seniors with Medicare[4], seniors with Medicaid[5] or disability are likely to move. As a householder's income increases, the likelihood of moving decreases when seniors move into the urban city. With regards to housing attributes, apartment availability is more likely to draw one to move, compared with house offerings. Furthermore, elderly migrants tend to be renters or free renters rather than homeowners. Finally, seniors who identify their marital status as single are more likely to move, particularly if they are seniors who experienced the loss of a spouse within the past 12 months. Cohabitation with children increases the probability of moving. Likewise, households with more than two persons moderately increases the likelihood of moving.

[4] Medicare is for people 65 and older, or people with certain disabilities
[5] Medicaid includes itself, medical assistance, or any kind of government-assistance plan for low-income or disabled persons

Table 26 Descriptive statistics

Departure	Outer Suburbs			
Variable	Sample size (#)	Number of movers (#)	Mobility toward urban city/inner suburbs (%)	Mobility within outer suburbs (%)
age60	3,052	102	0.3%	3.0%
age65	2,411	49	0.2%	1.8%
age70	1,772	47	0.5%	2.2%
age75	1,155	34	0.7%	2.3%
age80	1,527	43	0.6%	2.2%
male	5,317	141	0.4%	2.3%
female	4,600	134	0.5%	2.5%
white	8,257	216	0.4%	2.2%
black	1,172	34	0.6%	2.3%
otherrace	488	25	0.2%	4.9%
belowhighschool	794	33	1.0%	3.1%
highschool	2,439	79	0.6%	2.6%
associate	2,543	63	0.3%	1.0%
bachelor	4,141	100	0.3%	2.1%
unemployment	6,152	174	0.6%	2.3%
disability	2,325	83	0.7%	2.9%
medicare	6,759	173	0.5%	2.1%
medicaid	787	36	1.0%	3.6%
income quartile 1	1,588	47	0.9%	2.1%
income quartile 2	2,143	87	0.4%	3.7%
income quartile 3	2,661	63	0.4%	2.0%
income quartile 4	3,525	78	0.3%	2.0%
house	8,473	157	0.2%	1.6%
apartment	1,444	118	1.6%	6.6%
ownership	8,669	144	0.2%	1.4%
renter or free renter	1,248	131	1.7%	8.8%
married	5,713	118	0.3%	1.8%
single	4,204	157	0.5%	3.2%
widow12	223	11	1.3%	3.6%
children	524	25	0.4%	4.4%
three or more persons	2,165	70	0.4%	2.9%

6.6.2. Mobility

Table 27 presents the results of the binary probit model in which the dependent variable is equal to 1 in the event of a move and 0 otherwise. The models compare movers with stayers as a point of reference. Overall, it is clear that older seniors are less likely than younger seniors to move. In particular, older seniors are less likely to migrate when they are cohabiting with children, but the coefficients are not statistically significant. Female headship consistently decreases the likelihood of moving across all subsamples. Black householders are unlikely to move regardless of their household formation in the outer suburbs. Higher educational attainment

decreases the probability of moving except for households cohabiting with children, but those coefficients are not statistically significant. Unemployment status and disability consistently increase the likelihood that one would migrate from the outer suburbs. In addition, one's dependence on Medicare and Medicaid does not have a consistent effect on the likelihood of moving. Although income appears to be an important driver that affects one's residential mobility, findings indicate that the greater one's income is, the lower the probability is that he or she will choose to stay in their current residency. For housing attributes, seniors tend to choose apartments, which indicates a tendency to become a renter.

Regarding marital status, single status significantly increase the probability of leaving one's current residency. Likewise, recently widowed seniors are found to be more mobile than others. Seniors who have children are found to be more mobile than those who are childless. As household size increases, seniors are likely to move, but the effect is not significant. In models indicating the differences between sub-samples based on marital status, as income increases – setting aside the fact that single households are found to be more mobile than others – there are no distinct differences between sub-samples.

Table 27 Binary probit regression results on the determinants of mobility

Sample	Whole sample		Couple HH		Single HH		HH cohabiting with children		HH with more than two persons	
Variable (reference: stayer)	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
age60	0.184	0.141	0.130	0.234	0.248	0.182	0.713	0.506	0.044	0.278
age65	0.057	0.104	0.042	0.170	0.052	0.135	0.246	0.437	-0.038	0.227
age70	+0.169	0.101	0.203	0.167	0.085	0.133	0.245	0.448	0.164	0.223
age75	+0.181	0.110	0.133	0.183	0.194	0.137	0.526	0.473	0.318	0.233
female	+-0.111	0.062	-0.131	0.097	-0.039	0.085	-0.162	0.222	-0.087	0.118
black	*-0.212	0.088	-0.236	0.162	+-0.190	0.107	-0.399	0.312	-0.224	0.170
highschool	-0.018	0.102	-0.026	0.175	-0.050	0.127	0.216	0.414	0.059	0.195
associate	-0.148	0.107	-0.229	0.180	-0.153	0.135	0.030	0.433	-0.171	0.212
bachelor	-0.102	0.105	-0.184	0.173	-0.122	0.135	0.442	0.421	-0.008	0.200
unemployment	0.074	0.072	0.078	0.099	0.120	0.106	0.230	0.271	0.046	0.140
disability	0.039	0.069	0.089	0.105	0.035	0.091	0.101	0.242	0.041	0.138
medicare	-0.137	0.126	-0.030	0.195	-0.254	0.167	0.217	0.380	-0.104	0.222
medicaid	0.045	0.092	-0.158	0.189	0.126	0.108	0.371	0.281	+0.296	0.175
Income Q2	0.112	0.084	0.208	0.147	0.005	0.108	0.172	0.620	0.282	0.341
Income Q3	*0.233	0.092	0.213	0.152	**0.340	0.114	0.849	0.587	*0.740	0.324
Income Q4	*0.239	0.101	*0.311	0.156	**0.381	0.133	+1.000	0.608	+0.627	0.328
apartment	***0.376	0.081	**0.344	0.128	***0.337	0.101	0.521	0.450	*0.456	0.228
renter or free renter	***0.742	0.080	***0.962	0.122	***0.633	0.104	**0.947	0.333	***0.722	0.175
single	*0.148	0.069	-	-	-	-	-	-	-	-
widow12	+0.308	0.161	-	-	-	-	-	-	-	-
children	+0.232	0.119	-	-	-	-	-	-	-	-
three or more persons	0.119	0.081	-	-	-	-	-	-	-	-
constant	***-2.482	0.196	***-2.461	0.303	***-2.256	0.252	***-3.494	0.857	***-2.507	0.461
Year dummies		Yes		Yes		Yes		Yes		Yes
LR chi2		282.36		124.54		146.80		27.03		48.53
Prob > chi2		0.00		0.00		0.00		0.00		0.00
Pseudo R2		0.11		0.11		0.11		0.13		0.08
Log likelihood		-1,115.91		-512.32		-596.78		-86.94		-284.81
# of observations		9,917		5,713		4,204		524		2,165

$^{+}p \leq 0.10$. $*p \leq 0.05$. $**p \leq 0.01$. $***p \leq 0.001$.

6.6.3. Inward Migration

To shed more light on the effects of individual and housing attributes on location decisions, this paper references the simultaneous decision of housing and location choices using multinomial logistic regression with three categories: stayer (reference), moving to the urban city or inner suburbs, and moving within the outer suburbs. This model is meant to describe the determinants of housing and location choices when moving from the outer suburbs. Table 28 shows that younger seniors are likely to migrate from the outer suburbs. Female and black households are very unlikely to migrate from the outer suburbs. As education attainment increases, seniors are unlikely to migrate inward; these coefficients are statistically significant beginning with an associate degree. As expected, unemployment status and disability consistently show positive effects on the likelihood of leaving one's current place. Affluent seniors tend to migrate either into the urban center or within the outer suburbs. For housing attributes, seniors consistently show a tendency toward choosing an apartment; by doing so, they tend to become renters regardless of their chosen location.

With regards to marital status, single status seniors have a tendency to migrate within the outer suburbs and are much less likely to migrate to urban life. Nonetheless, recent widowhood has positive effects on migrating from one's current place; such effects are more significant when seniors migrate inward. Cohabiting with children has a positive effect on one's decision to live within the outer suburbs. Finally, growth in family size decreases the probability of moving from the outer suburbs.

Table 28 MNL regression on the determinants of migration

Departure	Outer Suburbs			
Destination (reference: stayer)	Baltimore City/ Inner Suburbs		Outer Suburbs	
Characteristics	Coef.	S.E.	Coef.	S.E.
age60	0.378	0.742	0.425	0.335
age65	-0.040	0.572	0.170	0.258
age70	0.277	0.512	0.385	0.252
age75	0.613	0.508	0.403	0.275
female	-0.150	0.352	-0.203	0.148
black	-0.110	0.438	**-0.606	0.218
highschool	-0.199	0.455	0.024	0.250
associate	+-0.951	0.544	-0.160	0.261
bachelor	-0.816	0.520	-0.039	0.258
unemployment	+0.940	0.494	0.105	0.175
disability	0.091	0.361	0.048	0.168
medicare	-0.146	0.726	-0.381	0.292
medicaid	0.329	0.429	-0.017	0.224
Income Q2	0.380	0.448	0.212	0.205
Income Q3	+0.961	0.495	*0.478	0.222
Income Q4	0.144	0.668	*0.597	0.245
apartment	***1.554	0.448	***0.672	0.196
renter or free renter	**1.195	0.444	***1.755	0.192
single	-0.226	0.401	*0.404	0.168
widow12	*1.430	0.643	0.602	0.384
children	-0.082	0.826	*0.611	0.277
three or more persons	0.234	0.501	0.267	0.200
constant	***-6.901	1.059	***-5.163	0.476
# of events	41		234	
Year dummies	Yes			
LR chi2	307.72			
Prob > chi2	0.00			
Pseudo R2	0.11			
Log likelihood	-1,219.04			
# of observations	9,917			

$^{+}p \leq 0.10$. $*p \leq 0.05$. $**p \leq 0.01$. $***p \leq 0.001$.

6.6.4. Housing Consumption

Table 29 describes the empirical findings that determine housing type for elderly migrants. Overall, younger seniors are likely to move to multi-family housing when migrating inward from the outer suburbs. Conversely, younger seniors tend to choose single-family housing when moving within the outer suburbs. Female headship consistently decreases the likelihood of choosing single-family housing regardless of location. Black households are reluctant to choose multi-family housing when they migrate either inward from or within outer suburbs. As education attainment increases, seniors are reluctant to migrate inward and choose to live in single-family housing. Unemployment status and disability show a tendency that seniors choose to

move and live in multi-family housing regardless of location. Affluent seniors migrating to urban areas still tend to choose multi-family housing but are likely to choose single family housing in the outer suburbs. Throughout the Baltimore MSA, elderly migrants tend to be renters, regardless of housing type.

With regards to marital status, single status does not appear to be a critical factor in a senior's choice of housing type within the outer suburbs. In contrast, single households are likely to choose multi-family housing when moving inward from the outer suburbs. Nonetheless, recent widowhood has a greater effect on a senior's decision to migrate inward and choose single-family housing. Cohabiting with children increases the probability that one may choose single-family housing in the outer suburbs. Finally, households with three or more persons tend to choose single-family housing regardless of location.

Table 30 illustrates the empirical results that determine housing size for elderly movers. In general, younger seniors are likely to choose housing with fewer bedrooms. In particular, when seniors migrate within the outer suburbs, the coefficients are statistically significant. Female headship increases the likelihood of downsizing to housing with 0-2 bedrooms when seniors move either inward from or within outer suburbs. Black households appear reluctant to move within the outer suburbs, but when they do so, they are not influenced by the number of rooms offered. As education attainment increases, seniors are unlikely to migrate inward from the outer suburbs. Unemployment status and disability have a positive effect on the likelihood of moving; seniors with unemployment status or disability tend to downsize to dwelling units with fewer bedrooms when they migrate inward. Reliance

on Medicare or Medicaid negatively correlates with the likelihood of trading down to smaller housing. Additionally, higher income status positively correlates with living in housing with three or bedrooms when migrating within the outer suburbs. In contrast, affluent households still tend to downsize to smaller housing with 0 to 2 bedrooms when they decide to migrate inward. Throughout the Baltimore MSA, elderly migrants tend to be renters, regardless of the number of bedrooms offered, but they show a strong tendency toward choosing an apartment with 0 to 2 bedrooms.

Regarding household composition, single status does not have an effect on in-migration from the outer suburbs. Single households are reluctant to move inward. Conversely, single seniors still tend to migrate within the outer suburbs with or without adjusting their housing wealth. Still, the death of a spouse within the past 12 months increases the likelihood that a senior will choose smaller housing by migrating inward. Nonetheless, recent widowhood significantly increases the likelihood of choosing housing with three or more bedrooms in urban areas. Cohabiting with children significantly increases the probability of moving to housing with three or more bedrooms in the outer suburbs. Furthermore, households with three or more persons are shown to be reluctant to live in housing with fewer bedrooms.

Table 31 presents empirical evidence regarding the determinants of housing age when elderly households decide to move. When migrating inward from the outer suburbs, younger seniors are more likely than older seniors to move into older housing; in contrast, older seniors tend to choose newer housing. Nonetheless, younger seniors are likely to choose newer housing when migrating within the outer

suburbs. Black households have a strong tendency not to choose to live in older housing in the outer suburbs. As education attainment increases, seniors who decide to migrate inward have a significant tendency to choose not to move to newer housing built between 1970 and 2017. Unemployment status and disability positively correlates with the likelihood of choosing older housing when migrating inward; conversely those variables indicate a tendency toward choosing newer housing when moving within the outer suburbs. Higher income increases the likelihood of moving to newer housing, regardless of location. Seniors are likely to become renters throughout the Baltimore MSA, regardless of whether they do so by opting for older or newer housing.

As for the household formation, single seniors are reluctant to move inward, but they still tend to move and choose older housing within the outer suburbs. Nonetheless, recently widowed seniors tend to migrate inward and are often willing to live in older housing built before 1969. Cohabiting with children increases the likelihood that one will move; this has contributed to an influx of seniors into older housing throughout the urban city, as well as into newer housing in the outer suburbs. Finally, households with three or more persons are reluctant to choose newer housing built between 1970 and 2017 in the urban city, but the effect is not statistically significant.

Table 29 MNL regression on the determinants of housing type

Departure	Outer Suburbs							
Destination	Baltimore city/Inner suburbs				Outer suburbs			
Housing type	Single-family home		Multi-family home		Single-family home		Multi-family home	
Characteristics	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
age60	0.661	1.053	0.296	0.982	0.726	0.462	0.213	0.496
age65	-0.666	0.929	0.402	0.732	0.367	0.364	-0.022	0.379
age70	0.192	0.748	0.460	0.716	0.509	0.366	0.371	0.355
age75	0.119	0.791	1.094	0.676	0.591	0.391	0.314	0.397
female	-0.489	0.544	0.179	0.477	*-0.429	0.193	0.137	0.234
black	+1.010	0.560	-1.195	0.766	-0.363	0.279	**-0.872	0.336
highschool	-0.029	0.626	-0.469	0.682	0.135	0.341	-0.155	0.364
associate	+-1.513	0.902	-0.642	0.721	-0.282	0.361	0.010	0.367
bachelor	+-1.390	0.838	-0.404	0.711	-0.128	0.353	0.189	0.371
unemployment	0.125	0.685	**1.910	0.742	-0.056	0.213	0.440	0.304
disability	0.271	0.538	0.047	0.487	0.083	0.222	0.036	0.253
medicare	0.742	1.053	-0.802	0.903	-0.211	0.373	-0.631	0.462
medicaid	0.635	0.626	-0.005	0.596	0.344	0.287	-0.530	0.346
Income Q2	-0.425	0.674	0.909	0.587	0.353	0.298	0.172	0.286
Income Q3	-0.133	0.704	**1.770	0.669	*0.758	0.300	0.064	0.367
Income Q4	-0.884	0.945	1.078	0.916	*0.813	0.326	0.284	0.412
apartment	-	-	-	-	-	-	-	-
renter or free renter	-0.097	0.699	***3.794	0.571	***1.149	0.227	***3.535	0.284
single	-0.460	0.620	0.199	0.535	*0.447	0.209	+0.498	0.280
widow12	*1.833	0.837	0.885	1.072	0.653	0.481	0.394	0.620
children	-0.778	1.099	2.776	2.056	*0.745	0.293	-0.344	0.818
three or more persons	+0.963	0.583	+-3.644	2.069	+0.379	0.225	-0.486	0.425
constant	***-6.199	1.401	***-9.272	1.516	***-5.606	0.637	***-6.823	0.744
# of events		18		23		139		95
Year dummies				Yes				Yes
LR chi2				109.53				342.37
Prob > chi2				0.00				0.00
Pseudo R2				0.19				0.14
Log likelihood				-238.31				-1,093.81
# of observations				9,683				9,876

$^{+}p \leq 0.10$. $*p \leq 0.05$. $**p \leq 0.01$. $***p \leq 0.001$.

Table 30 MNL regression on the determinants of housing size

Departure	Outer Suburbs	
Destination	Baltimore city/Inner suburbs	Outer suburbs

Housing type	Bedroom 0-2		Bedroom 3 or more		Bedroom 0-2		Bedroom 3 or more	
Characteristics	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
age60	0.442	0.983	0.611	1.070	0.496	0.482	0.293	0.482
age65	0.454	0.786	-0.471	0.844	+0.587	0.351	-0.177	0.378
age70	0.700	0.676	-0.264	0.810	+0.572	0.345	0.164	0.372
age75	1.042	0.670	0.098	0.795	0.440	0.389	0.364	0.393
female	0.393	0.478	-0.725	0.572	0.281	0.225	**-0.620	0.209
black	-0.739	0.646	0.705	0.606	*-0.650	0.290	+-0.614	0.329
highschool	-0.266	0.667	-0.148	0.642	-0.241	0.354	0.141	0.357
associate	-0.638	0.718	-1.463	0.906	-0.071	0.351	-0.354	0.384
bachelor	-0.390	0.703	-1.386	0.852	0.125	0.353	-0.250	0.375
unemployment	*1.890	0.748	0.037	0.682	0.228	0.283	0.046	0.225
disability	0.104	0.473	0.040	0.570	0.034	0.240	0.036	0.237
medicare	-1.205	0.926	1.259	1.107	-0.545	0.451	-0.375	0.400
medicaid	-0.096	0.599	0.712	0.637	-0.356	0.316	0.314	0.314
Income Q2	0.815	0.554	-0.529	0.750	0.179	0.268	0.524	0.342
Income Q3	+1.273	0.681	0.250	0.699	0.130	0.339	**0.985	0.339
Income Q4	0.761	0.923	-0.629	0.964	0.036	0.414	**1.143	0.360
apartment	***3.650	0.847	-1.433	1.170	***1.833	0.311	**-1.086	0.386
renter or free renter	**1.624	0.569	0.618	0.754	***2.076	0.299	***1.595	0.266
single	-0.485	0.518	-0.156	0.628	0.362	0.274	+0.395	0.222
widow12	1.048	1.084	*1.724	0.841	0.643	0.552	0.554	0.540
children	-	-	0.065	0.857	-0.979	1.084	**0.831	0.292
three or more persons	-0.858	1.132	0.724	0.621	-0.245	0.427	0.356	0.233
constant	***-10.192	1.663	***-6.145	1.419	***-7.057	0.721	***-5.229	0.671
# of events	24		17		109		125	
Year dummies	Yes				Yes			
LR chi2	130.85				415.96			
Prob > chi2	0.00				0.00			
Pseudo R2	0.22				0.16			
Log likelihood	-227.36				-1060.63			
# of observations	9,683				9,876			

$^{+}p \leq 0.10$. $*p \leq 0.05$. $**p \leq 0.01$. $***p \leq 0.001$.

Table 31 MNL regression on the determinants of housing age

Departure	Outer Suburbs							
Destination	Baltimore city/Inner suburbs				Outer suburbs			
Housing type	Built before 1969		Built between 1970-2017		Built before 1969		Built between 1970-2017	
Characteristics	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
age60	+1.900	1.021	-1.304	1.103	0.696	0.628	0.334	0.393

age65	0.188	1.062	-0.038	0.691	-0.170	0.498	0.280	0.298
age70	1.052	0.910	-0.115	0.661	-0.709	0.622	*0.625	0.282
age75	1.097	0.947	0.518	0.616	0.207	0.548	0.476	0.315
female	-0.642	0.541	0.276	0.485	-0.370	0.278	-0.151	0.174
black	0.153	0.608	-0.365	0.648	**-1.723	0.605	-0.332	0.235
highschool	0.789	0.809	-0.970	0.608	-0.319	0.435	0.167	0.303
associate	-0.205	0.948	*-1.380	0.689	-0.563	0.470	0.011	0.313
bachelor	-0.115	0.938	+-1.254	0.648	-0.229	0.455	0.058	0.311
unemployment	0.515	0.691	+1.251	0.722	-0.302	0.332	0.251	0.205
disability	0.264	0.542	-0.067	0.486	-0.436	0.355	0.203	0.190
medicare	0.648	0.889	-1.249	0.957	-0.071	0.561	-0.459	0.338
medicaid	0.306	0.630	0.321	0.597	0.565	0.368	-0.315	0.284
Income Q2	-0.360	0.689	0.860	0.594	-0.089	0.392	0.315	0.238
Income Q3	-0.195	0.765	**1.787	0.658	0.155	0.417	*0.622	0.260
Income Q4	-0.709	0.980	0.738	0.909	0.090	0.478	**0.812	0.283
apartment	0.545	0.687	***2.324	0.593	*-0.732	0.364	***1.227	0.228
renter or free renter	**1.686	0.656	0.828	0.565	***2.625	0.326	***1.367	0.225
single	-0.479	0.623	-0.127	0.536	*0.614	0.314	+0.323	0.196
widow12	**2.289	0.849	0.833	1.067	0.544	0.753	0.643	0.441
children	0.218	0.892	-	-	0.580	0.535	*0.640	0.320
three or more persons	0.870	0.673	-0.399	0.817	0.151	0.374	0.299	0.235
constant	***-8.568	1.495	***-6.853	1.459	***-5.376	0.842	***-6.035	0.573
# of events		18		23		63		171
Year dummies				Yes				Yes
LR chi2				98.21				297.35
Prob > chi2				0.00				0.00
Pseudo R2				0.17				0.12
Log likelihood				-243.97				-1094.59
# of observations				9,683				9,876

$^{+}p \leq 0.10$. $*p \leq 0.05$. $**p \leq 0.01$. $***p \leq 0.001$.

6.6.5. Housing Strategies

Using the 2040 MDP household projection, this paper proposes some overall guidance meant to deliver potential housing strategies for each subarea of the Baltimore MSA. As shown in Table 32, the MDP household projection suggests that the population of seniors aged 70 or older will consistently rise in the Baltimore MSA over the next 20 years, due in part to natural population growth. Nonetheless, this article attempts to explain this population growth using estimations derived from regression models for intra-metropolitan migration.

Table 32 Household projection provided by Maryland Department of Planning

Location	Year	60-64	65-69	70-74	75-79	80-84	85+	Total (0-85+)
Baltimore city	2020 (#)	35,231	28,001	20,805	13,233	8,032	8,494	590,259
	2030 (+ or - in %)	-18.2%	3.8%	22.9%	38.7%	41.8%	4.1%	1.4%
	2040 (+ or - in %)	-10.6%	-14.8%	3.3%	50.5%	86.8%	43.5%	4.2%
Inner suburbs	2020 (#)	57,271	47,334	37,005	23,458	15,239	20,484	824,997
	2030 (+ or - in %)	-13.2%	6.8%	22.9%	45.4%	54.7%	8.4%	1.7%
	2040 (+ or - in %)	-17.6%	-8.1%	12.1%	62.3%	92.6%	50.8%	3.6%
Outer suburbs	2020 (#)	89,774	71,976	58,102	38,635	22,928	22,497	1,312,644
	2030 (+ or - in %)	-4.9%	23.6%	27.7%	43.9%	77.4%	50.7%	5.4%
	2040 (+ or - in %)	-18.7%	-1.6%	23.5%	80.1%	131.5%	147.5%	9.3%

This study (see Table 28) found that seniors aged 75 to 79 have a higher likelihood of moving toward the urban center or inner suburbs. This is consistent with the MDP household projection that the population of seniors aged 75 to 79 will grow the most (+21,296) over the next 20 years. This category might be primarily comprised of affluent seniors who make mobility decisions on their own. These urban migrants might be healthy and relatively affluent retirees. Attractions such as shopping opportunities, recreational or leisure amenities, and public services are some of the characteristics affluent seniors look for in urban destinations. Nevertheless, a rapidly deteriorating health status may be closely linked with one's decision to move,

at which time proximity to hospitals and medical facilities might represent top priorities. Indeed, we can see that the distribution of nursing home beds is concentrated in the urban center and inner suburbs (See Table 32). Another explanation for the migration of seniors aged 75 to 79 is that the move may result from relocation to a suburban home near kin. Nevertheless, the findings of this study do not support the hypothesis that cohabiting with children increases the likelihood that a senior will move inward.

The potential housing strategies impacted by these findings can prove crucial for the efficient dissemination of federal housing subsidies – most of which are located in the urban center and inner suburbs – as well as distribution of medical assistance and facilities that offer benefits to older seniors aged 75 to 79. Furthermore, seniors' overall preferred dwelling type is multi-family housing with 0 to 2 bedrooms; typically, seniors are willing to choose a structure built before 1969 (see Table 29-31). Such characteristics should be taken into consideration for future housing demands with a focus on seniors aged 75 to 79.

The study (see Table 28) indicates that younger seniors are likely to live in the outer suburbs. In contrast to urban movers, younger seniors in the outer suburbs are typically more affluent, have higher rates of homeownership, and tend to move less frequently. However, the MDP household projection suggests that the population of seniors aged 75 or older will grow significantly over the next 20 years, with the greatest increase (+33,183) in the age group of 85 or older. The substantial growth of this aging population can also be explained similarly by urban migration, sparked in part by proximity to hospitals or medical facilities. Otherwise, affluent seniors can

afford to live in their suburban homes; therefore, the pleasures of space and privacy of suburban life outweigh a variety of public amenities offered by the urban center. In addition, there are still many federal housing subsidies for LIHTC and Section 8 Vouchers, as well as opportunities for shopping, recreation, and public services (See Table 32).

The potential housing strategies that support effective housing incentives to prompt seniors to age in place can make a particular impact in the outer suburbs. Seniors' overall preferred dwelling type is multi-family housing with a small number (0 to 2) of bedrooms, built after 1970. Nonetheless, single-family housing is preferred by younger seniors. Given these housing attributes, it can prove useful to focus housing development strategies on the oldest age group – 85 and older – in response to the significant population growth.

Table 33 Distribution of senior facilities available in the Baltimore MSA

Senior facilities	Urban Center	Inner Suburbs	Outer Suburbs
Hospital facilities (#)			
Hospital beds per 1,000 residents	6.05	1.22	0.96
Nursing home beds per 1,000 seniors	44.77	44.61	23.25
Shopping/Recreation/Health/Service amenities (%)			
Retail/Wholesale opportunity	0.096	0.114	0.101
Recreation opportunity	0.089	0.085	0.073
Health care opportunity	0.313	0.261	0.234
Service opportunity	0.049	0.050	0.048
Housing subsidies (#)			
LIHTC	11,514	4,995	6,440
Public housing	9,760	678	1,268
Section 8	7,796	1,807	3,740
Section 202	769	1,266	517
Section 811	234	129	138

Opportunity calculation: each industry's employees / total number of employees)

6.7. Discussion

For residential mobility, this study found that younger seniors are more likely to migrate from the outer suburbs than seniors aged 80 or older; this pattern was

consistent across the subsamples. These findings suggest that older seniors are unlikely to move, and prefer to remain in their homes as long as they can afford to do so. Counter to expectations, higher education attainment does not have a significant effect on the likelihood of moving. This insignificance is not surprising, since residential mobility related to education choices would have likely occurred earlier in one's life (Bonnet et al., 2010). More importantly, the decision to move may be more closely linked to one's rapidly deteriorating health status if it necessitates closer proximity to hospitals and medical facilities. Some studies argue that the elderly are likely to migrate if and when they experience an increasing or worsening disability, compared with gradual long-term health challenges (De Jong et al., 1995; Longino et al., 1991). Additionally, income is not in line with my expectation that greater income would lower the probability that one may leave their current dwelling. The probability that one may choose to remain a suburbanite increases in instances where seniors are in good enough health to care for their homes and to drive a car, as this makes it possible to enjoy the pleasures of space and privacy likely provided by suburban life. Nonetheless, seniors with poor health conditions may prefer to stay in the dense central city as it offers the broadest range of public amenities.

Regarding migrating inward from or within the outer suburbs, younger seniors are found to be more mobile than older seniors from the outer suburbs. This prediction can be explained by the fact that seniors who lived as homeowners in the outer suburbs tend to make a transition to become renters after retirement; otherwise, such seniors may attempt to downsize to less expensive housing. Most likely, elderly renters prefer to enjoy public amenities provided by the urban city. In contrast,

seniors who lived in the outer suburbs might not wish to move inward since they prefer to have the pleasure of privacy or space provided by the outer suburbs. For example, empirical results show that female and black households move less frequently from the outer suburbs. Most likely, affluent black households along with households that have female headship are reluctant to move if they lived in the outer suburbs as homeowners; otherwise, seniors with low income might show a preference to urban life. As expected, unemployment status and disability have a strong correlation with the move inward from the outer suburbs. As noted earlier, one possible explanation is that unemployment forces seniors to make housing adjustments through ending homeownership or trading down. Furthermore, deteriorating health status necessitates closer proximity to a wide array of public amenities including hospitalization. Affluent seniors have the strong tendency to move within the outer suburbs. This estimation may show that financial status serves as an important factor in maintaining seniors' homeownership in the outer suburbs.

As for housing consumption, seniors tend to choose apartments regardless of location, which indicates a tendency to become a renter. This demonstrates that seniors tend to liquidate their housing wealth through ending homeownership. Similarly, seniors tend to adjust housing by downsizing to housing with fewer bedrooms. In particular, newly widowed seniors are likely to migrate inward. This is not surprising as newly widowed seniors might move into smaller housing or rental housing to adjust their housing consumption; otherwise, newly widowed seniors might be more inclined to move in search of a social network. Given that the change to single status decreases one's likelihood of moving inward from the outer suburbs,

this pattern suggests that widowhood prompts in-migration, particularly in instances where the partner's death occurred within the past 12 months. This evidence coincides with findings put forth by Chevan (1995) and Bonnet et al. (2010). Nonetheless, recent widowhood increases the likelihood that one would choose single-family housing when migrating inward. Given that seniors are likely to be renters, widowed seniors might still choose single-family housing when maintaining their status as renters. Cohabiting with children has a positive effect on one's decision to live within the outer suburbs; in this scenario, seniors are likely to choose single-family housing built between 1970 and 2017 with three or more bedrooms. This can be explained by the fact that parents tend to relocate closer to their children to receive support or provide care for their grandchildren (Bonnet et al., 2010; Laditka and Laditka, 2001).

Chapter 7: Conclusions and Policy Implications

7.1. Conclusions

The aging of the baby boomer generation born between 1946 and 1964 has been a dominant force across many sectors of the housing economy in the United States. Since the 1970s, the large baby boomer population has been the major driver in first-home purchasing, subsequent move-up housing, and now, relocating and exiting from homeownership. Without a doubt, this age cohort has consistently provided the largest driving surge in a housing market over each stage of the life cycle. With the aging of the baby boomer generation and the population's increased longevity, America's older population (ages 50 and older) is projected to reach 132 million in 2030. Under this demographic upheaval, older households will continue to serve as the most influential key factor on the housing market in the near future.

Despite the fact that research concerning senior housing is growing in importance in the United States, there is relatively little empirical evidence regarding housing demand and tenure choice for senior citizens. This dissertation examines the three challenges – housing affordability, availability of accessible housing, and housing demands based on geographical locations – through empirical analyses. In the first section of my dissertation, I aim to shed light on the reasons why older seniors make a downward transition from homeownership, with a particular focus on the significance of property taxes on housing behaviors. While I investigate why seniors make the transition from homeownership in the first section, the second

section focuses on an assessment of the U.S. housing stock that accommodates seniors for aging in place, examining federal policies that can help older adults age in place. The purpose of the third essay is to explore the pattern of senior migration and housing consumption in the Baltimore metropolitan region.

The findings reveal that low-income seniors are more likely than others to end homeownership without obtaining benefits from tax abatement programs. Rather, the wealthiest populations who likely never would have moved have been the main beneficiaries of tax abatement programs. Furthermore, the majority of seniors live independently in their own homes and prefer to continue to do so for as long as possible. However, as the proportion of older adults with one or more functional limitations increases with age, the current U.S. home stocks for older adults are not entirely designed to accommodate these changes in aging residents' abilities. Finally, intra-metropolitan migration significantly correlates with the adjustment of housing wealth through renting or downsizing, but such behaviors are not deeply associated with location.

This dissertation provides useful evidence for state and local governments to consider fiscal policies that attract and retain senior homeowners within their jurisdictions. A better understanding of the housing behaviors of aging populations associated with housing demand are critical in the current context of limited budgets for housing stability in the United States. This research will provide timely and new evidence, which will help decision-makers better understand baby boomers' housing choice behaviors in the U.S. housing market.

7.2. Policy Implications

7.2.1. Housing Affordability

All 50 states and Washington, D.C. offer some type of property tax abatement programs for senior homeowners. These programs allow homeowners to avoid excessive tax burdens by lowering the costs of homeownership and by sparing them the possible hardship of moving. Nonetheless, current policy approaches to increase housing stability for seniors have proven largely unsuccessful. The main beneficiaries of tax abatement programs have been the wealthiest populations who likely never would have moved. This group is followed by seniors who live in higher value housing or who have a higher income; these seniors receive a pure transfer from abatement programs, but the effects are modest. Nonetheless, tax abatement programs fail to provide tax subsidies targeted to low income seniors in need; such households are likely to become renters by ending homeownership even in places with generous abatement program benefits available.

Affordable homeownership costs allow aging Americans to remain in their home; in turn, this enables them to choose not to spend money on relocating. The U.S. senior population will grow significantly over the next several decades. Policymakers need to consider effective policies and interventions to plan future housing environments in response to significant demand for affordable homeownership for seniors.

7.2.2. Housing Accessibility

The Fair Housing Act obliges builders to meet accessibility requirements for both privately owned and publicly assisted multi-family housing with four or more units built for first occupancy after March 1991. All federally assisted new housing construction with five or more units must make up 5 percent of the dwelling units in order to be accessible for persons with mobility disabilities. Additionally, the passing of the 1990 ADA contributes to progress in accessibility enhancement for housing provided by public entities. Nonetheless, policy approaches to grow the accessible housing stock have proven largely unsuccessful. The current level of the U.S. housing stock suggests that policy efforts have been insufficient in improving accessibility in housing. Under these circumstances, seniors with disability face the possible hardship of moving more likely with relocating to other housing and place to meet their daily needs.

Accessibility-enhanced housing allows aging Americans to remain in their homes and communities longer; this, in turn, enables seniors to choose not to spend money on relocating to other housing or institutional long-term care. Given that the current U.S. housing stock faces a scarcity of well-equipped dwelling units to meet the daily needs of seniors, policymakers need to consider sufficient resources and effective mechanisms in order to retrofit homes to allow the older population to age safely and comfortably. As the interest in aging in place grows in the coming decades, the lack of the housing stock designed to meet the needs of the aging population poses an important housing policy concern. Appropriate policy intervention is needed

to plan future housing environments in response to the significant demand for accessible housing features.

7.2.3. Elderly Migration

When migrating throughout the Baltimore MSA, seniors show a strong tendency toward downsizing and becoming renters – particularly of apartments – regardless of. The findings reveal that later-life migration significantly correlates with an adjustment of housing wealth by ending homeownership or trading down. The downward adjustment of housing wealth usually reduces housing maintenance tasks. Likewise, apartments offer easier maintenance than houses. With these characteristics in mind, senior migrants in the Baltimore MSA have a clear tendency toward liquidating their housing wealth.

When seniors move, single status itself does not drive those who live in the outer suburbs to migrate inward nor does it drive one to adjust their housing wealth. Instead, single-status seniors still tend to choose to move within the outer suburbs. Most likely, affluent seniors prefer to enjoy suburban life. Nonetheless, recent widowhood significantly increases one's propensity to move inward; but it does not point to a tendency to dissave housing wealth. Given that seniors who live in the outer suburbs tend to be relatively affluent, recent widows who have high mobility might be more inclined to move in search of a social network. Finally, the move to cohabit with children allows seniors to receive health support or care for grandchildren; this has contributed to the modest influx of seniors into spacious housing throughout urban areas. In contrast, the influx of seniors into spacious housing throughout the outer suburbs is significant.

The MDP household projection shows that the population of seniors aged 75 to 79 will grow in the urban center and inner suburbs of the Baltimore MSA over the next 20 years. Developing an estimate for housing demand based on housing characteristics that attracted or repelled moves into each subarea can prove beneficial for potential housing strategies; this should be taken into account along with an understanding of the elderly age groups projected to grow the most. Seniors' residential relocation and housing decisions will have important implications on the housing market. If a large enough number of baby boomers return to urban cores from the suburbs and leave homeownership to become renters, it could have a significant impact on population densities in cities. The findings presented here should be of interest to policymakers and planners throughout the Baltimore MSA.

References

Acolin, Arthur, Jesse Bricker, Paul Calem, and Susan Wachter. 2016. "Borrowing constraints and homeownership." *American Economic Review* 106, no. 5: 625-29.

Acolin, Arthur, Laurie Goodman, and Susan M. Wachter. 2019. "Accessing homeownership with credit constraints." *Housing Policy Debate* 29, no. 1: 108-125.

Andrew, Mark, Donald Haurin, and Abdul Munasib. 2006. "Explaining the route to owner-occupation: A transatlantic comparison." *Journal of Housing Economics* 15, no. 3: 189-216.

Angelini, Viola, Agar Brugiavini, and Guglielmo Weber. 2014. "The dynamics of homeownership among the 50+ in Europe." *Journal of Population Economics* 27, no. 3: 797-823.

Aratani, Yumiko. 2011. "Socio-demographic variations of homeowners and differential effects of parental homeownership on offspring's housing tenure." *Housing Studies* 26, no. 5: 723-746.

Archer, Wayne R., David C. Ling, and Brent C. Smith. 2010. "Ownership duration in the residential housing market: the influence of structure, tenure, household and neighborhood factors." *The Journal of Real Estate Finance and Economics* 40, no. 1: 41-61.

Artle, Roland, and Pravin Varaiya. 1978. "Life cycle consumption and homeownership." *Journal of Economic Theory* 18, no. 1: 38-58.

Barakova, Irina, Paul S. Calem, and Susan M. Wachter. 2014. "Borrowing constraints during the housing bubble." *Journal of Housing Economics* 24: 4-20.

Bian, Xun. 2016. "Leverage and elderly homeowners' decisions to downsize." *Housing Studies* 31, no. 1: 20-41.

Boehm, Thomas P. and Alan M. Schlottmann. 1999. "Does home ownership by parents have an economic impact on their children?." *Journal of Housing Economics* 8, no. 3: 217-232.

Boehm, Thomas P. and Alan M. Schlottmann. 2002. *Low-income homeownership: Examining the unexamined goal: Housing and wealth accumulation: intergenerational impacts.* Washington DC: The Brookings Institution.

Boehm, Thomas P., and Alan M. Schlottmann. 2004. "The dynamics of race, income, and homeownership." *Journal of Urban Economics* 55, no. 1: 113-130.

Boehm, Thomas P., and Alan M. Schlottmann. 2014. "The dynamics of housing tenure choice: Lessons from Germany and the United States." *Journal of Housing Economics* 25: 1-19.

Boldt, Rebecca, Bradley Caruth, and Andrew Reschovsky. 2010. "Are Property Taxes Forcing the Elderly Out of their Homes?" *Lincoln Institute of Land Policy.* Accessed March 14, 2020. https://www.lincolninst.edu/publications/working-papers/are-property-taxes-forcing-elderly-out-their-homes

Boldy, Duncan, Linda Grenade, Gill Lewin, Elizabeth Karol, and Elissa Burton. 2011. "Older people's decisions regarding 'ageing in place': A Western Australian case study." *Australasian Journal on Ageing* 30, no. 3: 136-142.

Bonnet, Carole, Laurent Gobillon, and Anne Laferrère. 2010. "The effect of widowhood on housing and location choices." *Journal of Housing Economics* 19, no. 2: 94-108.

Bo'sher, Luke, Sewin Chan, Ingrid Gould Ellen, Brian Karfunkel, and Hsi-Ling Liao. "Accessibility of America's Housing Stock: Analysis of the 2011 American Housing Survey (AHS)." *U.S. Department of Housing and Urban Development* https://www.huduser.gov/portal/sites/default/files/pdf/accessibility-america-housingStock.pdf

Bourassa, Steven C., and Ming Yin. 2006. "Housing tenure choice in Australia and the United States: impacts of alternative subsidy policies." *Real Estate Economics* 34, no. 2: 303-328.

Bricker, Jesse, Brian Bucks, Arthur Kennickell, Traci Mach, and Kevin Moore. 2012. "The financial crisis from the family's perspective: Evidence from the 2007–2009 SCF panel." *Journal of Consumer Affairs* 46, no. 3: 537-555.

Brueckner, Jan K. 2011. *Lectures on urban economics*. Massachusetts: MIT Press.

Carter, Steven. 2011. "Housing tenure choice and the dual income household." *Journal of Housing Economics* 20, no. 3: 159-170.

Chan, Sewin, and Ingrid Gould Ellen. 2017. "Housing for an aging population." *Housing Policy Debate* 27, no. 2: 167-192.

Chevan, Albert. 1995. "Holding on and letting go: Residential mobility during widowhood." *Research on aging* 17, no. 3: 278-302.

Clark, William AV, and Valerie Ledwith. 2006. "Mobility, housing stress, and neighborhood contexts: evidence from Los Angeles." *Environment and Planning A* 38, no. 6: 1077-1093.

Conway, Karen Smith, and Andrew J. Houtenville. 2003. "Out with the old, in with the old: A closer look at younger versus older elderly migration." *Social Science Quarterly* 84, no. 2: 309-328.

Costa-Font, Joan, David Elvira, and Oscar Mascarilla-Miró. 2009. "Ageing in place'? Exploring elderly people's housing preferences in Spain." *Urban studies* 46, no. 2: 295-316.

Cox, David R. 1972. "Regression models and life-tables." *Journal of the Royal Statistical Society: Series B (Methodological)* 34, no. 2: 187-202.

Dawkins, Casey J. 2005. "Racial gaps in the transition to first-time homeownership: The role of residential location." *Journal of Urban Economics* 58, no. 3: 537-554.

De Jong, Gordon F., Janet M. Wilmoth, Jacqueline L. Angel, and Gretchen T. Cornwell. 1995. "Motives and the geographic mobility of very old Americans." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 50, no. 6: S395-S404.

Deng, Yongheng, Stephen L. Ross, and Susan M. Wachter. 1999. "Employment Access, Residential Location and Homeownership" *Real Estate Center, Wharton School of the University of Pennsylvania.* Accessed March 14, 2020. http://realestate.wharton.upenn.edu/working-papers/employment-access-residential-location-and-homeownership/

Deng, Yongheng, Stephen L. Ross, and Susan M. Wachter. 2003. "Racial differences in homeownership: the effect of residential location." *Regional Science and Urban Economics* 33, no. 5: 517-556.

Détang-Dessendre, Cécile, Florence Goffette-Nagot, and Virginie Piguet. 2008. "Life cycle and migration to urban and rural areas: estimation of a mixed logit model on French data." *Journal of Regional Science* 48, no. 4: 789-824.

Domazlicky, Bruce. 2002. "Population growth in rural Missouri counties in the 1990s: yet another turnaround." *Journal of Economic Insight (formerly the Journal of Economics (MVEA))* 28, no. 2: 31-45.

Donald, Ian P. 2009. "Housing and health care for older people." *Age and ageing* 38, no. 4: 364-367.

Drew, Rachel Bogardus, and Christopher E. Herbert. 2013. "Postrecession drivers of preferences for homeownership." *Housing Policy Debate* 23, no. 4: 666-687.

Fallis, George. 2014. *Housing economics*. Oxford: Butterworth-Heinemann.

Farber, Nicholas, Douglas Shinkle, Jana Lynott, Wendy Fox-Grage, and Rodney Harrell. 2011. "Aging in Place, Under A State Survey of Livability Policies and

Practices.” *AARP Public Policy Institute*. Accessed March 14, 2020. https://assets.aarp.org/rgcenter/ppi/liv-com/aging-in-place-2011-full.pdf.

Farnham, Martin, and Purvi Sevak. "2006. State fiscal institutions and empty-nest migration: Are Tiebout voters hobbled?." *Journal of Public Economics* 90, no. 3: 407-427.

Feinstein, Jonathan, and Daniel McFadden. 1989. "The dynamics of housing demand by the elderly: Wealth, cash flow, and demographic effects." In *The economics of aging*, pp. 55-92. Chicago: University of Chicago Press.

Fine, Jason P., and Robert J. Gray. 1999. "A proportional hazards model for the subdistribution of a competing risk." *Journal of the American statistical association* 94, no. 446: 496-509.

Fuster, Andreas, and Basit Zafar. 2016. "To buy or not to buy: Consumer constraints in the housing market." *American Economic Review* 106, no. 5: 636-40.

Gabriel, Stuart, and Gary Painter. 2003. "Pathways to homeownership: An analysis of the residential location and homeownership choices of black households in Los Angeles." *The Journal of Real Estate Finance and Economics* 27, no. 1: 87-109.

Gabriel, Stuart A., and Gary Painter. 2008. "Mobility, residential location and the American dream: The intrametropolitan geography of minority homeownership." *Real Estate Economics* 36, no. 3: 499-531.

Galster, George, Dave E. Marcotte, Marvin B. Mandell, Hal Wolman, and Nancy Augustine. 2007. "The impact of parental homeownership on children's outcomes during early adulthood." *Housing Policy Debate* 18, no. 4: 785-827.

Goodman, Allen C. 2002. "Estimating equilibrium housing demand for stayers" *Journal of Urban Economics* 51, no. 1: 1-24.

Goodman, Allen C. 2003. "Following a panel of stayers: Length of stay, tenure choice, and housing demand." *Journal of Housing Economics* 12, no. 2: 106-133.

Goodman, Allen C., and Masahiro Kawai. 1982. "Permanent income, hedonic prices, and demand for housing: New evidence." *Journal of Urban Economics* 12, no. 2: 214-237.

Greiman, Lillie, and Craig Ravesloot. 2016. "Housing characteristics of households with wheeled mobility device users from the American Housing Survey: do people live in homes that facilitate community participation?." *Community Development* 47, no. 1: 63-74.

Gyourko, Joseph. 2003. "Access to homeownership in the United States: The impact of changing perspectives on constraints to tenure choice." *Real Estate Center, Wharton School of the University of Pennsylvania.* Accessed March 14, 2020.

http://realestate.wharton.upenn.edu/wp-content/uploads/2017/03/400.pdf

Gyourko, Joseph, Peter Linneman, and Susan Wachter. 1999. "Analyzing the relationships among race, wealth, and home ownership in America." *Journal of Housing Economics* 8, no. 2: 63-89.

Halket, Jonathan, and Santhanagopalan Vasudev. 2014. "Saving up or settling down: Home ownership over the life cycle." *Review of Economic Dynamics* 17, no. 2: 345-366.

Hanlon, Bernadette, and Thomas J. Vicino. 2007. "The fate of inner suburbs: Evidence from metropolitan Baltimore." *Urban Geography* 28, no. 3: 249-275.

Haurin, Donald R., and H. Leroy Gill. 2002. "The impact of transaction costs and the expected length of stay on homeownership." *Journal of Urban Economics* 51, no. 3: 563-584.

Heckman, James. 1979. "Sample Selection Bias as a Specification Error." *Econometrica: Journal of the econometric society* 47, no. 1: 153-161.

Henderson, J. Vernon, and Yannis M. Ioannides. 1983. "A model of housing tenure choice." *The American Economic Review* 73, no. 1: 98-113.

Hoffman, Denise W., and Gina A. Livermore. 2012. "The house next door: A comparison of residences by disability status using new measures in the American Housing Survey." *Cityscape*: 5-33.

Houle, Jason N., and Lawrence Berger. 2015. "Is student loan debt discouraging homeownership among young adults?." *Social Service Review* 89, no. 4: 589-621.

Hubbard, R. Glenn, Jonathan Skinner, and Stephen P. Zeldes. 1994. "Expanding the life-cycle model: Precautionary saving and public policy." *The American Economic Review* 84, no. 2: 174-179.

Hurd, Michael D. 1990. "Research on the elderly: Economic status, retirement, and consumption and saving." *Journal of economic literature* 28, no. 2: 565-637.

Ioannides, Yannis M., and Kamhon Kan. 1996. "Structural estimation of residential mobility and housing tenure choice." *Journal of Regional Science* 36, no. 3: 335-363.

Ioannides, Yannis M., and Stuart S. Rosenthal. 1994. "Estimating the consumption and investment demands for housing and their effect on housing tenure status." *The Review of Economics and Statistics*: 127-141.

Jeong Kim, Moon, and Hazel A. Morrow-Jones. 2011. "Intrametropolitan residential mobility and older inner suburbs: A case study of the Greater Columbus, Ohio, metropolitan area." *Housing Policy Debate* 21, no. 1: 133-164.

Jones, Lawrence D. 1997. "The tenure transition decision for elderly homeowners." *Journal of Urban Economics* 41, no. 2: 243-263.

Joint Center for Housing Studies of Harvard University. 2018. Housing America's older adults. Accessed March 14, 2020. https://www.jchs.harvard.edu/sites/default/files/Harvard_JCHS_Housing_Americas_Older_Adults_2018_1.pdf.

Joint Center for Housing Studies of Harvard University. 2014. Housing America's older adults: meeting the needs of an aging population. Accessed March 14, 2020. https://www.jchs.harvard.edu/sites/default/files/jchs-housing_americas_older_adults_2014_1.pdf.

Joint Center for Housing Studies of Harvard University. 2015. Aging in Place: Implications for Remodeling. Accessed March 14, 2020. https://www.jchs.harvard.edu/sites/default/files/w15-4_will_1.pdf.

Kim, Jae Hong, Francesca Pagliara, and John Preston. 2005. "The intention to move and residential location choice behaviour." *Urban studies* 42, no. 9: 1621-1636.

Kan, Kamhon. 2000. "Dynamic modeling of housing tenure choice." *Journal of Urban Economics* 48, no. 1: 46-69.

Laditka, James N., and Sarah B. Laditka. 2001. "Adult children helping older parents: Variations in likelihood and hours by gender, race, and family role." *Research on Aging* 23, no. 4: 429-456.

Lee, Brian HY, and Paul Waddell. 2010. "Residential mobility and location choice: a nested logit model with sampling of alternatives." *Transportation* 37, no. 4: 587-601.

Lee, Hyojung, Dowell Myers, Gary Painter, Johanna Thunell, and Julie Zissimopoulos. 2018. "The role of parental financial assistance in the transition to homeownership by young adults." *Journal of Housing Economics*: 101597.

Lee, Kwan Ok. 2014. "Why do renters stay in or leave certain neighborhoods? The role of neighborhood characteristics, housing tenure transitions, and race." *Journal of Regional Science* 54, no. 5: 755-787.

Lee, Kwan Ok, and Gary Painter. 2013. "What happens to household formation in a recession?" *Journal of Urban Economics* 76: 93-109.

Lee, Kwan Ok, and Gary Painter. 2014. "Housing tenure transitions of older households: what is the role of child proximity?." *Real Estate Economics* 42, no. 1: 109-152.

Letkiewicz, Jodi C., and Stuart J. Heckman. 2018. "Homeownership among young Americans: A look at student loan debt and behavioral factors." *Journal of Consumer Affairs* 52, no. 1: 88-114.

Levin, Laurence. 1998. "Are assets fungible?: Testing the behavioral theory of life-cycle savings." *Journal of Economic Behavior & Organization* 36, no. 1: 59-83.

Liaw, Kao-Lee, William H. Frey, and Ji-Ping Lin. 2002. "Location of adult children as an attraction for black and white elderly primary migrants in the United States." *Environment and Planning A* 34, no. 2: 191-216.

Lindblad, Mark R., Hye-Sung Han, Siyun Yu, and William M. Rohe. 2017. "First-time homebuying: attitudes and behaviors of low-income renters through the financial crisis." *Housing Studies* 32, no. 8: 1127-1155.

Litwak, Eugene, and Charles F. Longino Jr. 1987. "Migration patterns among the elderly: A developmental perspective." *The Gerontologist* 27, no. 3: 266-272.

Longino Jr, Charles F., David J. Jackson, Rick S. Zimmerman, and Julia E. Bradsher. 1991. "The second move: Health and geographic mobility." *Journal of Gerontology* 46, no. 4: S218-S224.

Marois, Guillaume, Sébastien Lord, and Catherine Morency. 2019. "A mixed logit model analysis of residential choices of the young-elderly in the Montreal metropolitan area." *Journal of Housing Economics* 44: 141-149.

McFadden, Daniel. "Modeling the choice of residential location.1978. " *Transportation Research Record* 673.

Megbolugbe, Isaac F., Jarjisu Sa-Aadu, and James D. Shilling. 1997. "Oh, yes, the elderly will reduce housing equity under the right circumstances." *Journal of Housing Research*: 53-74.

Megbolugbe, Isaac, Jarjisu Sa-Aadu, and James D. Shilling. 1999. "Elderly female-headed households and the decision to trade down." *Journal of Housing Economics* 8, no. 4: 285-300.

Mezza, Alvaro, Daniel Ringo, Shane Sherlund, and Kamila Sommer. 2020. "Student loans and homeownership." *Journal of Labor Economics* 38, no. 1: 215-260.

Muth, R.F. 1969. *Cities and Housing; The Spatial Pattern of Urban Residential Land Use*, Chicago: University of Chicago Press.

Newman, Sandra. 2003. "The living conditions of elderly Americans." *The gerontologist* 43, no. 1: 99-109.

Painter, Gary. 2000. "Tenure choice with sample selection: differences among alternative samples." *Journal of Housing Economics* 9, no. 3: 197-213.

Painter, Gary, Stuart Gabriel, and Dowell Myers. 2001. "Race, immigrant status, and housing tenure choice." *Journal of Urban Economics* 49, no. 1: 150-167.

Painter, Gary, and KwanOk Lee. 2009. "Housing tenure transitions of older households: Life cycle, demographic, and familial factors." *Regional Science and Urban Economics* 39, no. 6: 749-760.

Plane, David A., and Jason R. Jurjevich. 2009. "Ties that no longer bind? The patterns and repercussions of age-articulated migration." *The professional geographer* 61, no. 1: 4-20.

Pope, Natalie D., and Byungdeok Kang. 2010. "Residential relocation in later life: a comparison of proactive and reactive moves." *Journal of Housing for the Elderly* 24, no. 2: 193-207.

Puentes, R. and Orfield, M. 2002. "Valuing America's first suburbs: a policy agenda f or older suburbs in the Midwest." In *Brookings Institution Center on Urban and Metr opolitan Policy*. Washington DC: Brookings Institution.

Raymond, Elora Lee, Jessica Dill, and Yongsung Lee. 2018. "Millennial first-time homebuyers and location choice." *Journal of Planning Education and Research*: 0739456X18807751.

Riley, Sarah F., Giang Nguyen, and Kim Manturuk. 2015. "House price dynamics, unemployment, and the mobility decisions of low-income homeowners." *Journal of Housing and the Built Environment* 30, no. 1: 141-156.

Robb, Cliff A., Samantha L. Schreiber, and Stuart J. Heckman. 2019. "The Role of Federal and Private Student Loans in Homeownership Decisions." *Journal of Consumer Affairs*.

Robst, John, Richard Deitz, and KimMarie McGoldrick. 1999. "Income variability, uncertainty and housing tenure choice." *Regional Science and Urban Economics* 29, no. 2: 219-229.

Sabia, Joseph J. 2008. "There's no place like home: A hazard model analysis of aging in place among older homeowners in the PSID." *Research on Aging* 30, no. 1: 3-35.

Safran-Norton, Clare E. 2010. "Physical home environment as a determinant of aging in place for different types of elderly households." *Journal of Housing for the Elderly* 24, no. 2: 208-231.

Seslen, Tracey Nicole. 2003. "Housing price dynamics and household mobility decisions." PhD diss., Massachusetts Institute of Technology.

Shan, Hui. 2010. "Property taxes and elderly mobility." *Journal of Urban Economics* 67, no. 2: 194-205.

She, Peiyun, and Gina A. Livermore. 2009. "Long-term poverty and disability among working-age adults." *Journal of Disability Policy Studies* 19, no. 4: 244-256.

Shore, Stephen H., and Todd Sinai. 2010. "Commitment, risk, and consumption: do birds of a feather have bigger nests?." *The Review of Economics and Statistics* 92, no. 2: 408-424.

Simpson, Roy L. 2010. "Technologies enable seniors to age in place." *Nursing administration quarterly* 34, no. 2: 178-182.

Skaburskis, Andrejs. 1999. "Modelling the choice of tenure and building type." *Urban studies* 36, no. 13: 2199-2215.

Souza, Maria Teresa, Rob Collinson, Marge Martin, Barry Steffen, David A. Vandenbroucke, and Yung-Gann David Yao. 2011. "Worst Case Housing Needs of People with Disabilities-Supplemental Findings of the Worst Case Housing Needs 2009: Report to Congress." *US Department of Housing and Urban Development, Office of Policy Development and Research*.

Merchak, Aaron and Kail Padgitt. 2010. "Fiscal Fact. Property Tax Revenue Increased As Property Values Fell." *Tax Foundation*. Accessed March 14, 2020. https://files.taxfoundation.org/legacy/docs/ff243.pdf

Turner, Margery Austin, and Kirkman O'Neal. 1986. "Household tenure choice: review of the empirical literature." *US Department of Housing and Urban Development, Office of Policy Development and Research*. Accessed March 14, 2020. https://www.huduser.gov/portal/Publications/pdf/HUD-11683.pdf

VanderHart, Peter G. 1998. "The housing decisions of older households: A dynamic analysis." *Journal of Housing Economics* 7, no. 1: 21-48.

Venti, Steven F., and David A. Wise. 1989. "Aging, moving, and housing wealth." In *The economics of aging*, pp. 9-54. Chicago: University of Chicago Press.

Venti, Steven F., and David A. Wise. 1990. "But they don't want to reduce housing equity." In *Issues in the Economics of Aging*, pp. 13-32. Chicago: University of Chicago Press.

Venti, Steven F., and David A. Wise. 2004. "Aging and housing equity: Another look." In *Perspectives on the Economics of Aging*, pp. 127-180. University of Chicago Press.

Vicino, Thomas J. 2008. "The spatial transformation of first-tier suburbs, 1970 to 2000: The case of metropolitan Baltimore." *Housing Policy Debate* 19, no. 3: 479-518.

Wasi, Nada, and Michelle J. White. 2005. Property tax limitations and mobility: the lock-in effect of California's Proposition 13. No. w11108. *National Bureau of Economic Research.*

Walters, William H. 2002. "Place characteristics and later-life migration." *Research on Aging* 24, no. 2: 243-277.

Yun, Lawrence, and Nadia Evangelou. 2016. "Social benefits of homeownership and stable housing." *National Association of Realtors, Research Division*.