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MORTGAGE LOANS AND FINANCIAL SECURITY AMONG MIDDLE-AGED AND OLDER AMERICANS

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MORTGAGE LOANS AND FINANCIAL SECURITY AMONG MIDDLE-AGED AND
OLDER AMERICANS

DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Agriculture, Food and Environment
at the University of Kentucky

By
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Lexington, Kentucky

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ABSTRACT OF DISSERTATION

MORTGAGE LOANS AND FINANCIAL SECURITY AMONG MIDDLE-AGED AND OLDER AMERICANS

Mortgage loan debt is prevalent among middle-aged and older Americans. With higher average outstanding balances, many people are unlikely to pay off their mortgage debt by retirement. Meanwhile, as people age, health shocks are more likely to occur. Medical expenses may compete with mortgage payments and relate to financial insecurity in later years. In order to alleviate financial strain during times of financial hardship, senior homeowners may find reverse mortgage the solution they are looking for. Targeting American adults age 50 and older, this dissertation investigates mortgage loan debt and financial security using panel data from the Health and Retirement Study. Chapter 1 provides an overview of this dissertation and three studies. Chapter 2 investigates whether retirement preparedness plays a role in mortgage status at retirement, shown here as whether a person has mortgage debt and how much the remaining balance is (Waves 2004-2014). Chapter 3 examines health impact on likelihood of paying off mortgage loans under different health conditions, with estimates on expected time to mortgage payoff (Waves 2004-2014). Chapter 4 focuses on reverse mortgages and their impact on senior borrowers' financial satisfaction and liquidity constraint (Waves 2010-2016). Chapter 5 summarizes major findings in three studies and highlights the contribution of this dissertation toward middle-aged and older Americans' financial security. Limitations of three studies are discussed in Chapter 6. Three studies provide evidence on 1) the importance of preparedness on reduced mortgage burden; 2) adverse impact of health shock on likelihood of mortgage payoff; and 3) using reverse mortgages to reduce financial strain and increase financial satisfaction. Implications are addressed in each study.

KEYWORDS: Mortgage Loans, Retirement Preparedness, Health Shock, Reverse Mortgage, Financial Satisfaction

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MORTGAGE LOANS AND FINANCIAL SECURITY AMONG MIDDLE-AGED AND
OLDER AMERICANS

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Date: April 22, 2019

To truth.

To the irrational and the rational.

To the well-being of every household.

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CHAPTER 1. DISSERTATION OVERVIEW

This dissertation focuses on mortgage loans and financial security among American adults age 50 and older. Aiming to promote middle-aged and older adults' financial security, and therefore, their overall wellbeing, three issues pertaining to managing mortgage debts are examined. Bringing mortgage loan debts into focus, three research questions closely relate to financial challenges that face older people: lack of retirement planning before retired, declining health with aging, and lack of financial resources in retirement. Adopting a three-chapter format, each study is allocated to address one pressing issue related to mortgage loans that middle-aged and older Americans encounter.

1.1 Retirement as a New Life Stage

For many retirees, retirement means leisure and freedom; for others, however, it brings financial challenges. With traditional defined-benefit plans, individuals usually have little control over their pension benefits. Of course, they could choose to work longer, but mostly, employers take care of employees' retirement benefits. Since the late 1970s, with the shift from defined-benefit plans to defined-contribution plans, employees have had more choices in managing their own savings and investments. Apart from employers' matching contributions, an employee makes the decision on whether he or she saves and when to begin saving. While the current retirement system grants more opportunities to accrue lifetime wealth, it also stresses individual responsibility and imposes challenges in retirement planning.

Retirement planning outcome, unfortunately, is not satisfying. Many employees are

unprepared and underprepared, which results in low personal savings and high unsecured and secured debts. Inadequate savings manifest in limited resources in retirement, while leveraging infers competing financial needs from debt payments in later years. Due to insufficient resources and financial needs to sustain retirement life, today's middle-aged and older people are more vulnerable to liquidity constraint and financial insecurity.

In order to promote financial wellbeing in later years, research on household resource management has kept pace with these pressing issues. Regarding low savings, extensive studies elucidate why people do not save, from the financial, cognitive or behavioral perspectives. With abundant empirical evidence, strategies are implemented to motivate personal savings. A typical example is the retirement seminar, an educational scheme that is widely used in companies, nonprofit organizations and education institutions, aiming to inform employees of the importance of saving for retirement and to teach them how to save.

Parallel with savings and investment is research on debt, specifically, debt impact on older adults' financial wellbeing. Empirical evidence in this area is fruitful, yielding findings on debt demand, debt attitude and debt managing behaviors. In the last decade, studies have advanced by incorporating health problems—a prevailing issue facing older people—to examine how certain health conditions—for example, chronic disease or acute health shocks—influence older people's net worth and leveraging, and ultimately their financial security in retirement.

1.2 A Brief on Three Studies

Among all types of debt, mortgages are a segment constituting the largest share of household debt balance. Due to changes in lifestyle, people now tend to delay first-time home buying. Low interest rates back in the 2000s have been an incentive to purchasing larger homes. While mortgages allow people to afford a home earlier, in the long run, they may become a financial burden when people approach retirement. As commonly seen, many near-retirees cannot pay off their mortgage debts at retirement and will have to continue mortgage payments in retirement, when living primarily on Social Security income. Given low savings, having mortgage debts in later years is a financial issue that calls for more attention.

Considering the prevalence of mortgage debts among near-retirees and retired homeowners, it is important to ask why some people are able to pay off mortgage loans before they retire whereas others cannot. Is it because they are not well prepared for retirement, or they simply do not know that they should prepare for it? Prior research indicates preparedness promotes wealth growth. When focusing on mortgage debts, does preparedness still play a role?

Second, health declines with aging. Older adults are more vulnerable to health shocks and on average have more chronic diseases. Earlier studies show health impact on increased unsecured debts. Mortgage debts and their relationship with health, however, are relatively under-studied. With rising healthcare costs and longevity, when a mortgagor has chronic illnesses or experiences health shocks, would mortgage payoff be deterred by health problems; and if so, how likely? Furthermore, under different health conditions, what is an

expected time for them to pay down mortgage debts?

Third, resource inadequacy is prevalent among seniors, and thus, older people have demands for extra income to fund living expenses in retirement. Theoretically, home equity may be released as supplemental income. A reverse mortgage allows homeowners beyond age 62 to access their home equity. Through releasing equity, older people have additional liquid assets to pay living expenses. Although there is empirical evidence using macroeconomic data, in the real world few seniors choose reverse mortgages for smoothing consumption. Given this disparity, it is important to understand whether a reverse mortgage is helpful with improving a senior borrower's financial situation.

Taken together, for the population of American adults age 50 and older, in explaining their mortgage-managing behaviors and decisions, Study 1 focuses on preparedness, addressing the advantage of planning before onset of retirement for a less financially stressful retirement. Study 2 is an accession to Study 1, showing the negative impact of health shock—an unexpected life event that could happen to anyone including mortgagors approaching retirement or retired people—suggesting that mortgage payoff could be hindered by health shock. Both studies provide insights into strategically managing mortgages as a rational consumer, reducing financial burdens from mortgage debt and maximizing lifetime satisfaction.

As people age, they become more vulnerable to insufficient resource and tightened budgets, which are revealed as higher demands to liquidate home equity to sustain an acceptable standard of living. Study 3, therefore, seeks solutions to mitigate liquidity constraint resulting from lack of resources. Its focus is the reverse mortgage, a financial product that functions in a similar way to a home equity line of credit but is only available to adults age

62 and older. Use of reverse mortgage could help relieve seniors' financial strain, which needs examining the impact of reverse mortgage on borrowers' financial situations. Results are likely to inform researchers and educators of practical insights into older people's wealth management.

In all, these three studies share a core concept of mortgage loans, while separately addressing their relationship with retirement preparedness, health impact, and effect of reverse mortgage on financial satisfaction, weaving into a dissertation that covers time periods before the beginning of retirement, transition to retirement and retirement life. Overall, the three studies contribute to the mortgage loan literature and gerontological studies by showing the importance of 1) properly managing mortgage debts through preparedness; 2) shielding against negative impact from health shock; and 3) attaining potential financial satisfaction from reverse mortgages.

Longitudinal data from the Health and Retirement Study (HRS) are used for statistical analyses in three studies. The HRS began to collect data on Americans over age 50 biannually since 1992. Essential information used in this dissertation is repeatedly collected, including household assets, debt, retirement planning and physical and psychological health. Selection of waves for analyses depend on availability of main variables.

Figure 1.1 provides an overview of components of older people's wellbeing in retirement. It illustrates pathways connecting financial resource management, financial security and eventually financial satisfaction. Bold words highlight the focus of each study.

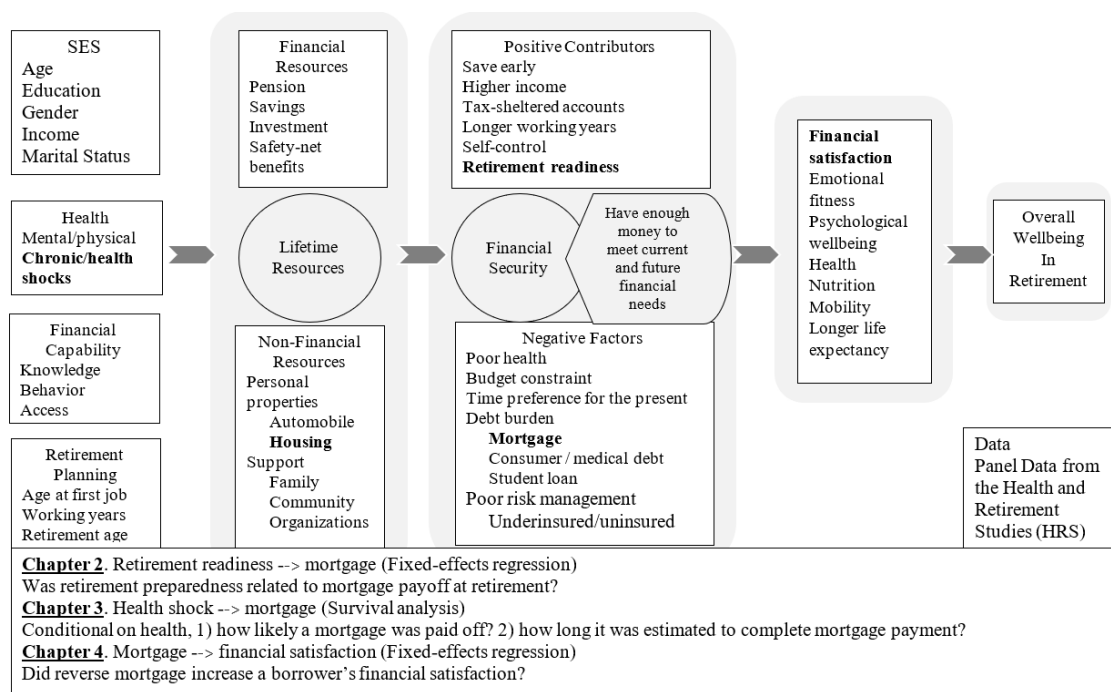


Figure 1.1: Components of Older Adults' Wellbeing in Retirement.

1.3 Background

1.3.1 The Life-Cycle Hypothesis on Demand for Mortgage Loans

The classical economic model of the life-cycle hypothesis suggests that, for a rational consumer with perfect knowledge on the market, debt demand is determined by age and life time resources. Across life stages, keeping constant marginal utility is crucial to smoothing consumption and lifetime utility maximization. In working years, income exceeds consumption, resulting in surplus, and then wealth grows, part of it going toward debt payment. Wealth peaks at retirement and debts are expected to be paid off by retirement. Wealth is distributed through remaining years to maintain the same standard of living.

Buying a home is an important financial decision. For people at different life stages, home purchase has different meanings. Before midlife, buying a home signifies “settling down” and “establishing a family.” With mortgage payments, a buyer pays interest and principal and thus, accrues home equity over time. Home equity remains the biggest share of household assets for people approaching retirement, functioning mainly as buffer capital to guard against financial shocks. Of course, a buyer could pay cash should he or she have enough funds. In most cases, however, people use mortgages to finance home buying.

A mortgage loan is a type of debt secured by housing property. Homebuyers borrow from lenders to buy a house with the promise to repay both principal and interest (using future income) within a certain timeframe. Before applying for a mortgage, saving for down payment is almost always necessary. Upon obtaining the loan, the financial obligation of making on-time payments becomes a priority.

From the life-cycle hypothesis perspective, when current income is lower than its pro-

portional life time income, borrowing is needed to keep consumption level constant across the lifespan. People in early or mid-adulthood who earn entry salaries are likely to be in such a situation. Therefore, when a person is in his or her earlier working years, a mortgage makes home buying affordable for now—through borrowing against future income.

Understandably, when making a home buying decision, it is recommended to take an affordable mortgage relative to earned income, so that a mortgagor will not feel stress from mortgage payments in the long run. Ideally, when retirement approaches, mortgages are expected to be paid down. Retirement is the time when wealth peaks, and the source of income switches from earned income to unearned income such as fixed Social Security benefits and pensions. In other words, wealth accumulated in working years is carried over into retirement, and then is spent to maintain a similar standard of living that a person had when employed. When necessary, home equity may be released to pay living expenses and to smooth consumption for utility maximization.

1.3.2 Mortgage Debt among Middle-Aged and Older Americans

In recent years, concerns have been aroused by middle-aged and older Americans' high mortgage debts and their higher outstanding balances than earlier cohorts. Mortgages account for nearly half of older adults' total debt balance and remain Americans' biggest household debt over the last decade. About 40% of Americans do not pay off their mortgage balances, averaging \$75,000, when they retire. In 2010, among borrowers ages 57 to 61, outstanding mortgage balance averaged \$74,602, representing 264% over the 1992 cohort.

Holding mortgages in retirement has ramifications. When a pre-retiree has mortgage

debts, tradeoff between mortgage payment and retirement savings has to be made. Generally, mortgage payment as a financial obligation to repay debts is given higher priority than saving. Therefore, it is common to see saving deterred by mortgage payments among near-retirees. In addition, having mortgage debt lowers older people's quality of life in retirement. When a big share of monthly income is allocated for debt payment, disposal income that could be used to cover daily expenses is reduced. This is when an older person experiences a tightened budget. In this situation, older adults are unlikely to sustain the standard of living that they had when they were employed. As a result, they must cut back on living expenses to repay mortgage debts or to strategically reduce their mortgage loan balances.

Ample studies have sought explanations on heavy mortgages among middle-aged and older Americans. Factors identified include market incentives, low financial literacy and evaporation of home equity from the Great Recession. For example, over the last thirty years, mortgage interest rates gradually decreased from approximately 12.0% in the 1980s to around 4.5% in the first quarter of 2017. Low interest rates are an incentive to home purchasing. While lower interest rates permit many Americans to buy their own homes, they may experience financial burden if their loan is unaffordable given their current and future income. Sadly, many consumers are not able to foresee financial hardships resulting from mortgages when retirement is about to begin. Meanwhile, low financial literacy results in high-cost borrowing or confusion about mortgage terms. Finally, home equity that plummeted in the aftermath of the Great Recession results in loss in total household or personal wealth.

1.3.3 Lack of Resources in Retirement

Another factor inflicting insecurity on older people's financial situation is lack of financial resources, in both domains of Social Security benefits and personal savings and pensions. The function of the Social Security system is to maintain older adults' basic standard of living. That said, living only on Social Security income is unlikely to fully cover total living expenses should an older person wish to have the same quality of life that he had in his working years. For example, Social Security benefits averaged \$1,409 in 2018 for a single worker retired at age 65. Meanwhile, approximately \$1,257 was spent on housing-related items, including mortgage payments, compared with \$434 spent by mortgage-free homeowners. These numbers straightforwardly inform us that, when having mortgage debts in retirement, Social Security benefits alone are not enough to repay debts.

Apart from Social Security benefits, personal savings is not promising. For Americans ages 51-56, all savings accounts included—for instance, an Individual Retirement Account or 401(k)—median savings was \$47,500. In other words, nearly half of pre-retirees have savings below \$47,500. Retirees, taking ages 61-75 as an example, have drastically lower median savings, at \$14,000.

1.3.4 Declining Health with Aging

Deterioration in health status faces the retired population, resulting in higher medical expenses and healthcare costs, which competes with financial needs from consumption and debt repayment. According to reports from the Centers for Disease Control and Prevention in 2016, the proportion of older Americans with chronic disease was high: about 45.7%

of older adults had one chronic condition. Two in three had two or more types of chronic illnesses. Chronic disease usually requires continuous medical attention over a long period of time. As a leading cause of death, chronic illnesses require treatment and maintenance that accounts for 90% of older adults' annual healthcare costs after adjusting for health insurance reimbursement. Depending on the number and severity of health conditions, older adults' out-of-pocket expenses on chronic disease are between \$1,000 and \$2,000. In addition, about 10% of older Americans do not have any health insurance, and their healthcare costs are on average substantially higher than their insured counterparts.

Aside from chronic diseases, middle-aged and older adults are more likely to experience unexpected health events, or health shock. For example, about 15% of adults before age 60 have unanticipated falls or surgeries severe enough to force them to temporarily withdraw from work. This implies that what comes with health shocks can include forgone salaries. Health shocks generate large out-of-pocket expenses, which is also unexpected when a household lacks emergency funds. The onset of one severe health event is estimated to bring out-of-pocket expenses as high as \$17,000. To conclude, health shocks, chronic illnesses and medical expenses threaten older people's financial security.

Overall, in connection with mortgage burdens discussed above, in later life financial needs from healthcare and mortgage payments compete. Reconciling financial demands from mortgage payments and medical expenses is crucial for financial security.

1.3.5 Home Equity as an Additional Source of Income

Older adults' wealth primarily comprises assets in two forms: financial assets and home equity. As discussed above, financial assets alone, including Social Security benefits and

personal savings, are insufficient to pay daily expenses. Home equity at this point becomes increasingly important in times of financial difficulties in later years. For example, adults ages 62-75 have median savings of \$14,000, whereas their home equity has a median of \$115,000. This financial situation is called “house rich, cash poor,” a condition that is common among senior homeowners. The problem with home equity is that, when financial shocks occur, it may not be quickly released and converted into cash, because a home sale takes time. In other words, many older adults, although they have a home and some savings, still feel financially pressured to sustain a comfortable life in retirement. To help resolve this financial problem, home equity, if released and used rationally, would enhance older adults’ quality of life. In addition, using one’s own wealth to fund retirement reduces dependence on social welfare and financial help-seeking, bringing independence and a sense of autonomy.

Applying classical economic theory to real life, financial products are available for homeowners to release equity, including reverse mortgages. A reverse mortgage is a type of home equity loan for homeowners beyond age 62. Taking the loan, homeowners borrow against their own equity and receive payments from the lender. On average, a borrower releases a maximum of 80% of their home equity through a reverse mortgage.

Despite economic benefits that are documented in the literature, few seniors use reverse mortgages. Some older people are prudent about tapping into home equity, even if they need additional income. From the perspective of the life-cycle hypothesis, home equity accumulated through mortgage payments is wealth accrued in working years. If allocated to retirement, when income is low, it helps to maintain the same consumption level throughout life stages and to maximize lifetime satisfaction.

1.4 Research Questions

Problems relating to middle-aged and older Americans' financial security have been briefly discussed, including mortgage debt burdens, limited financial resources, financial impact from declining health and demand for home equity for additional income. This dissertation intends to help promote financial security in later years. Using mortgage debts as a thread, three studies are connected, each examining one aspect of unpreparedness, health impact and effect of reverse mortgage loans.

1.4.1 Study 1

When asked why many people could not pay off their mortgage before or at retirement, we rely on the assumption that people have knowledge that a mortgage should be paid down before onset of retirement. What if this assumption does not hold true for most mortgagors? Maybe a fundamental question that is overlooked is: do mortgagors know they should plan for their own retirement and manage mortgages as an important part in retirement planning? In other words, many people carry mortgage debts into later years because they almost never thought about retirement. Thus, insight into the role of retirement planning and preparedness on mortgage status is imperatively needed.

Research question. The first study examines the impact of retirement preparedness on mortgage status at retirement, shown as whether a near-retiree or retired person has any mortgage loan and, if they carry mortgage debt into retirement, how is the amount of the mortgage loan balance related to their retirement preparedness level?

1.4.2 Study 2

Declining health is an important segment in gerontology studies. Efforts have been made to link health to debts. Earlier research in this realm focuses on financial outcomes from health problems, for example incurrence of consumer debt. In recent years, mortgages constituting the largest share of household debt receive increasing attention. Nevertheless, more studies could be done in terms of health impact on mortgage loan status, so as to motivate older people to speed up mortgage payments before health shocks occur.

Research question. To enrich the literature, Study 2 bridges mortgage loans and health shock, investigating 1) how likely health shocks deter mortgage payment, shown as reduced likelihood of mortgage payoff; and 2) estimated expected time to payment completion under different health conditions.

1.4.3 Study 3

Once retired, most people switch from earned income to unearned fixed income. Since Social Security benefits are generally insufficient to meet financial needs, an older person may choose to utilize personal savings and pensions to maintain a base level of consumption. In the long run, one consequence is wealth exhaustion and budget constraint. To live comfortably, seniors may be forced to tap into home equity to buffer against lack of income. Reverse mortgages, a financial tool allowing older homeowner access to equity, theoretically provide a potential to mitigate the problems. It enables intertemporal resource transfer of equity accrued earlier in life to retirement, helping to maintain the same consumption level in retirement years and to maximize borrowers' lifetime satisfaction. Despite benefit

potentials, in reality, reverse mortgages are not widely accepted or commonly used among qualified older homeowners. Empirically, little is known about their effectiveness on mitigating budget constraint.

Research question. Study 3 examines the impact of reverse mortgages on changes in financial satisfaction, with quantifications on the impact: specifically, whether a reverse mortgage increases a borrower's financial satisfaction and decreases liquidity constraint, and by how much.

CHAPTER 2. RETIRING WITH NO MORTGAGE DEBT: THE ROLE OF PREPAREDNESS

2.1 Abstract

Mortgage loans were usually planned to be paid off by retirement. However, recent trends showed that many American near-retirees were unlikely to pay off mortgages by the time they retired, inflicting financial insecurity in later years. Previous studies identified predictors of holding mortgage debt among older homeowners. Yet a basic question remaining unanswered was whether pre-retirees had thought about retirement, a key to retirement planning. This study focused on Americans over age 50 and investigated whether retirement preparedness was a predictor of their mortgage status at retirement. Two specific questions were asked: what was the impact of retirement preparedness on whether a homeowner had a mortgage loan; and, in case they carried mortgage debt into retirement, how was the mortgage balance related to preparedness and to what extent? Six biannual waves (2004-2014) of the Health and Retirement Studies were used. Results showed that near-retirees who “prepared a lot” were 25% less likely to continue holding mortgages than those who reported “hardly at all” in preparedness. Non-retired mortgagors’ LTV ratio was reduced by 0.02 (i.e., 2% of average home value). Implications for deleveraging in retirement planning were addressed.

Keywords: retirement preparedness, mortgage loans, middle-aged and older Americans

2.2 Introduction

Many middle-aged and older Americans had one or more types of debt [75]. Among other debts, mortgage loans as a key drive to higher household leveraging accounted for approximately half of older adults' debt balance [59, 113]. Between 2001 and 2011, the number of homeowners over age 65 who had mortgage loans increased from 22% to 30%. The average mortgage loan balance reportedly nearly doubled from \$43,300 to \$79,000 [29]. From the classical economic point of view, mortgage loans allowed people to afford a home in times of low income or insufficient savings. A mortgage was presumed to be paid off by retirement when wealth peaked [10, 85]. Against theoretical predictions, we have seen many near-retirees lagging behind the suggested timing of mortgage payoff, implying that they had to carry mortgage loans into retirement, when people lived primarily on Social Security benefits, pensions and savings [75]. Considering that Social Security income and low savings may not fully cover retirees' living expenses, mortgages could compete with other financial needs, resulting in financial pressure and financial difficulty.

Previous studies seeking explanations of holding mortgages among near-retirees and the retired examined domains of economics, behavior and cognition, revealing that the decision on carrying the loan related to low savings (i.e., smaller down payment), luxury lifestyle (e.g., larger home) [79] and financial illiteracy (e.g., high-cost borrowing) [86]. Ideally, as stipulated in the life-cycle and permanent income hypotheses, paying down a mortgage by retirement was essential to keeping marginal utility constant and to maximizing lifetime satisfaction within limited resources. The reality that consumers had limited knowledge on rationally managing debts made this financial goal hard to achieve. Truly, completing

mortgage payments by retirement was a complex financial task. Mortgagors should set a financial goal, undertake appropriate actions and evaluate strategies over at least a decade. More importantly, this goal was suggested to be completed before retirement, so that debtors had enough time to make adjustments where necessary [7]. Hence, awareness of retirement was a prerequisite to preparedness and planning. Without such recognition, the propensity for carelessness about retirement could deter mortgage debt management, giving rise to undesirable financial outcomes. That was why we asked whether debtors were mindful of retirement and whether that awareness was related to a “mortgage-free” retirement life.

The concept of preparedness was not new to personal finance. The use of retirement preparedness to understand recognition of retirement and planning behaviors was documented as early as the 1980s [47, 60]. Recently, Lusardi and Mitchell [77] found a positive association between retirement preparedness and wealth at older ages. Despite this evidence, “preparedness” needed to extend its application to household finance. Considering the inability of many American near-retirees and retired people to pay down mortgages in time, it was important to explore if preparedness played a role in mortgage loan status. Targeting American adults over age 50, this study investigated the question whether an individual’s mortgage loan status was an effect of preparedness. The primary research question came down to two specific questions: was retirement preparedness related to whether a near-retiree or retired person had a mortgage loan; and, if they carried mortgage debt into retirement, was the amount of the mortgage loan balance related to preparedness, and by how much? Six biannual waves (2004-2014) of the Health and Retirement Studies (HRS) were used to investigate the questions. Findings denoted considerations on mortgage loan handling strategies and research potentials.

2.3 Literature Review

2.3.1 Mortgage Debt among Middle-Aged and Older Americans

Mortgage loans constituted the largest portion of debt balance among middle-aged and older Americans [41]. Multiple studies reported increases both in the percentage of those who had mortgages and their average outstanding balance [69,88]. In 2011, about one third (30%) of homeowners over age 65 had mortgages, 1.3 times higher than the percentage in 2001 (22%) [28]. By age group, mortgagors accounted for 43% (ages 55-64), 30% (ages 65-74) and 14% (age 75+) [14]. Homeowners age 75 and older experienced the largest percent growth in mortgage debt: more than twofold from 2001 (8.4%) to 2011 (21.2%) [115].

Parallel with the substantial increase in percentage of those holding mortgages was the rising mortgage loan balance. In 2010, among borrowers ages 57 to 61, the outstanding mortgage balance averaged \$74,602, representing 264% and 133% growth over 1992 (\$28,221) and 2004 (\$56,066)¹, respectively [75]. In addition to loan balance, another distinction between current and earlier cohorts was the ever-increasing loan-to-value (LTV) ratio. The median LTV ratio surged from 5% in 1992 to 30% in 2010 [30], suggesting higher leveraging in today's middle-aged and older mortgagors.

2.3.2 Mortgage Burdens in Retirement

Considerable research showed that many middle-aged and older Americans endured competing financial needs. Commonly seen were consumer debt and healthcare costs. For instance, Americans ages 62 to 67 had an average credit card debt of \$4,948 and an an-

¹Lusardi et al. made an inflation adjustment to 2010 U.S. dollar values.

nual out-of-pocket (OOP) medical expense of \$2,251 [37]. As high as consumer debt and healthcare costs were, the amount of savings was not promising. About 45% of near-retirees had no retirement savings despite incentives such as employers' "matching strategy" [5]. Apart from savings and investment, another important segment of lifetime wealth—home equity—tumbled in the aftermath of the Great Recession. On average, home values dropped by 13.8% with the bursting of the housing bubble in 2008 [83]. Therefore, financial needs and inadequate resources remained two burdens that many older Americans had to handle.

It was conceivable that, in transition to retirement, living on limited wealth could be unsustainable in the long run. For any near-retiree or retired person, financial standing may be harmed by unpaid mortgage loans. For example, according to the Social Security Administration [105], older individuals with mortgage loans spent approximately \$1,257 per month on housing services, compared with \$434 by mortgage-free homeowners. Considering that Social Security benefits averaged \$1,409 (as of March 2018), mortgage payments evidently took up a sizeable portion of, or even exhausted, an older individual's disposable income.

Burdens from living costs along with mortgage loans imposed negative ramifications on a near-retiree or retired person's wellbeing. Financially, it was documented that middle-aged and older mortgagors had less access to financial services. For example, they were less likely to get approval on a home equity line of credit when LTV ratio was high [88]. In addition, as a good portion of income went to mortgage payments, middle-aged and older borrowers had to face opportunity cost, forgoing savings, investment and capital growth from compound interest [8]. Psychologically, older mortgagors were weary of their financial situation, reporting lower financial satisfaction [102], feeling the pressure from on-

time payment [39]. Indeed, compared with younger counterparts, middle-aged and older mortgagors were more likely to be delinquent or in default and to go through foreclosure. Unsurprisingly, losing a home at older ages was found to be traumatic, manifesting in low appetite [3], emotion instability [62,68] and frequent and severe depressive symptoms [17].

2.3.3 Factors Impeding Mortgage Payoff by Retirement

Research on postponement of mortgage payoff provided a series of explanations. From a demographic viewpoint, racial minorities, larger family size, poorer health and consumer debt were found to be associated with having mortgage debt as a retiree [65]. Financial illiteracy also played a role in cognition. For example, deficiency in understanding mortgage contracts was a hurdle to timely payment [13]. Low literacy was also a predictor of high-cost borrowing [109]. This was particularly found among mortgagors choosing adjustable-rate mortgages (ARM), where future payments tended to rise due to higher interest rates [32]. This situation inflicted risk of lapsed payments and the possibility of defaulting on a mortgage loan [45]. In addition to high-cost borrowing and the perils of default, financially illiterate borrowers were less likely to take advantage of lower interest rates in the market or to seize the optimum time to refinance, thus missing the opportunity to accelerate their payment progress [1].

In sum, mortgage burdens among middle-aged and older Americans received more attention in recent years. Ramifications of holding mortgage debt in near- and post-retirement years were consequential, given competing needs and limited wealth. Explanations on jeopardized payment process produced informative evidence. Yet a deeper understanding was needed regarding why people nearing retirement carried mortgage debt, if consequences

were shown to be detrimental. Hitherto, a fundamental question that may provide further explanation pertained to awareness of the beginning of retirement, a prerequisite to financial planning including deleveraging. In other words, was it crucial to think about retirement beforehand? To add to the literature, this paper focused on American middle-aged and older mortgagors, investigating if retirement preparedness had an impact on whether an individual could pay off mortgage debt by retirement. If payments could not be completed when retired, we further asked how remaining mortgage balance was related to preparedness and to what extent.

2.3.4 Link Retirement Preparedness to Mortgage Status

Preparedness. “Preparedness” was defined in the Merriam-Webster Dictionary as being ready for a situation, or the state of being prepared. With regard to personal finance, ample research showed its impact on financial behavior and financial outcomes. For example, retirement preparedness was predictive of ownership of pension and/or savings plans [57], better saving outcomes [81] and self-reported retirement readiness [61]. Preparedness was also found to be associated with proactive adjustments to transition to retirement, both financially and psychologically [9, 118]. In a nutshell, empirical evidence almost consistently suggested that retirement preparedness promoted financial and psychological wellbeing among older Americans. In recent years, the focus of research shifted to explore determinants of preparedness; in other words, what attributes were related to higher preparedness. Although not as fruitful, some studies yielded informative evidence. For example, anticipated retirement age influenced the timing of retirement planning, while higher quality of planning was affected by time preference for the future [26].

Mortgage and retirement preparedness. A mortgage loan was a product to finance home buying. Mortgages denoted different meanings for people at different life stages. For individuals in young and early mid-adulthood, mortgages made it affordable for these people to purchase a home. Their current level of savings was usually lower than needed to pay for a house, so borrowing against future income was needed to smooth consumption. Understandably, it was not urgent for borrowers in earlier life stages to pay off a mortgage, since retirement was still in the far future.

As people aged, retirement planning became a major financial task; age 50 was a conventional benchmark, suggesting that preparation for retirement was now imperative [16]. Defying the guideline, many Americans were not getting ready for retirement at that age. Managing mortgage loans, a topic that was more complex than savings or investment, was paid even less attention.

When a near-retiree planned for a debt-free retired life, a workable approach was to accelerate mortgage payment so as to shorten the payment timeframe, paying down a mortgage ahead of the contracted schedule. To achieve this goal, one strategy was to increase the monthly payment. Through raising the payment, a mortgagor had two benefits: shortening the mortgage life and saving on total interest. In fact, simply by adding \$100 to a monthly payment of a 30-year \$100,000 loan at a 4.5% interest rate, the loan would be paid off eight years earlier, along with saving \$26,300 on interest. These financial actions required careful planning: for example, adjusting one's budget. The preceding step was a decisive goal to get prepared for retirement. On the contrary, lacking the mindset of getting ready to transition to retirement, a mortgagor was less likely to endeavor to reduce debt. Consequently, with little-to-no preparedness, he may also be less likely to proactively manage mortgage

loans, such as by calculating the interest or searching for information on the current housing market. Therefore, retirement preparedness was postulated to speed up payoff by increasing mortgage payment.

Next, in addition to raising payments, an alternative approach to accelerate mortgage payoff was to reduce the remaining balance. Downsizing was a feasible plan. Through switching to a smaller house, mortgage loan balance was likely to decrease, along with property tax and the cost of homeowner's insurance. A third possible approach to reducing financial burden was to defray monthly payments. For example, turning the residential home into a rental home, with rents paying the mortgage. Since for most people it was a serious decision to transform a home to a shared property, the decision-making and inception of these actions may not be implemented unless an individual held the philosophy of planning for a financially stable retirement. Without conscious awareness or preparedness, people nearing retirement may not be motivated to maneuver mortgage debt. Therefore, retirement preparedness was assumed to accelerate mortgage payoff by reducing the remaining loan balance or defraying monthly payments.

Fourth, preparation for retirement could also be enhanced by refinancing, a means to acquire a new loan with more favorable interest and contracted terms, for example, switching from an adjusted-rate mortgage to a fixed-rate one. Please note that, in order to qualify for refinancing, a home appraisal was necessary (usually by a disinterested third party) to get the home value. So, at the borrower's end, good condition of the house was critical to obtain a fair interest rate from the refinance. This was related to retirement preparation, as people who were mindful about managing mortgage debt through refinancing may have paid more attention to home maintenance to avoid value deflation. Therefore, retirement

preparedness was presumed to be related to refinancing for a favorable interest rate and loan balance.

Lastly, getting ready for retirement may also be reflected in quick remedial actions in case of payment difficulty. As mentioned earlier, older adults tended to have higher delinquent and default rates [3]. When payment disruption occurred, it generally took longer for older people to get back on track [74]. Given these findings, those who were prepared for retirement were likely to actively shield perils of default. For instance, they may be wary of early signs of financial hardship and payment difficulty, taking prompt action to reverse the situation through proper interventions [110]. For a middle-aged or older adult, the ability to adopt preventive strategies to manage mortgage loans attested this observation, thinking and planning. Therefore, retirement preparedness was assumed to prevent lapsed payments by lowering possibility of delinquency or default.

Hypothesis 1. It was hypothesized that retirement preparedness reduced the possibility of holding a mortgage loan in retirement.

Hypothesis 2. It was hypothesized that retirement preparedness was related to smaller remaining balance on a mortgage loan in retirement.

2.4 Method

2.4.1 Data

This research used panel data from the Health and Retirement Study (HRS). Starting from 1992, HRS surveyed a representative sample of American adults age 50 and older every other year, collecting information on middle-aged and older Americans' financial

standing, retirement planning and wealth. Since the variable of retirement preparedness first became available in Wave 2004, six waves from 2004 to 2014 were used to merge into panel data.

2.4.2 Sample

Table 2.1 showed an overview of the panel sample, along with two subsamples of “Non-retired” and “Retired.” The panel sample contained 113,547 responses from 27,636 unique respondents. Each respondent participated in an average of 4.1 waves. The mean age of the panel sample was 73.3 years old, with 41.9% being Male and 76.5% being White. Married respondents accounted for 59.6%. Respondents had an average of 12.5 years of education. More than one third (36.7%) had a paid job. Regarding retirement preparedness, the main predictor of this study, about 37.9% of the respondents fell in the group of “Hardly at all.” Participants answering “A little” and “Some” were 14.5% and 23.5%, respectively. The rest 24.1% rated “A lot” on their retirement preparedness. Each respondent had an annual household income of \$75,984, possessing non-housing net worth of an average of \$116,838. About 76.6% of respondents owned a home. About 37.2% of homeowners had a mortgage loan. During the six-wave period, about 38.9% of mortgagors had a mortgage payoff. Mean home present value and mean mortgage outstanding balance were \$229,684 and \$127,501, respectively, yielding a mean LTV ratio of 0.41.

“Non-retired” and “retired” subgroups had sample sizes of 47,263 and 54,172, respectively. The “non-retired” were 66.1 years old and the “retired” were 78.3. Regarding retirement preparedness, percentage of “Hardly at all” for “non-retired” and “retired” groups were 34.6% and 40.8%, respectively, while “prepared a lot” accounted for 24.9% and

Table 2.1: Descriptive Statistics of Panel Sample

Variables (Mean)	All respondents (N = 113,547)		Non-retired (n =47,263)		Retired (n=54,172)	
Number of unique respondents	27,636		12,594		15,042	
Average waves participated	4.1		3.6		4.5	
Demographics						
Age (Years, <i>SD</i>)	73.3	11.4	66.1	8.5	78.3	9.8
Sex (%)						
Male	41.9		44.8		40.0	
Female	58.1		55.2		60.0	
Race (%)						
White	76.5		71.9		79.5	
Black	16.9		19.1		15.3	
Others	6.6		9.0		5.2	
Marital status (%)						
Married	59.6		64.8		56.0	
Divorced/separated	15.1		19.5		1.9	
Widowed	20.6		9.5		28.4	
Others	4.7		6.2		3.7	
Education (years)	12.5		13.1		12.3	
Work for pay (%)	36.7		80.9		2.5	
Retirement Preparedness (%)						
Hardly at all	37.9		34.6		40.8	
A little	14.5		16.2		12.9	
Some	23.5		24.3		22.8	
A lot	24.1		24.9		23.5	
Financial status (\$, <i>SD</i>)						
Household income	75,984	100,741	104,621	116,971	43,120	67,181
Non-housing net worth	116,838	210,849	160,088	203,899	118,000	221,764
Housing and mortgage status						
Homeownership (%)	76.6		76.7		70.5	
Homeowners having mortgage loans (%)	37.2				48.4	
Paid off mortgage loans (%)	38.9		34.7		46.9	
Home present value (\$, <i>SD</i>)	229,684	149,656	236,000	154,588	206,000	142,612
Mortgage outstanding balance (\$, <i>SD</i>)	127,501	78,678	136,981	80,267	107,240	73,140
Loan-to-value ratio among mortgagors	0.41		0.43		0.37	

Note. Panel dataset included six biannual waves from 2004-2014. Age in the panel dataset referred to the age in Year 2014. All dollar values were converted into 2014 dollars using Consumer Price Index.

23.5%. Financially, “non-retired” respondents had a mean annual household income of \$104,621, and the “retired” averaged of \$43,120. Non-housing net worth for the two groups were \$160,088 and \$118,000, respectively. Homeownership of “non-retired” and “retired”

were 76.7% and 70.5%, among whom, about 48.4% and 24.2% had a mortgage. Percentages of payoff observed were 34.7% and 46.9%. The “non-retired” had a mean home present value of \$236,000 and a mean mortgage outstanding balance of \$136,981, leading to a LTV ratio of 0.43. The “retired” had a mean home present value of \$206,000 and an average mortgage outstanding balance of \$107,240, resulting in a LTV ratio of 0.37.

2.4.3 Measures

Dependent variable of mortgage status. Two types of dependent variables were used to indicate mortgage status: a binary variable for whether an individual had mortgage debt²; and, if yes, a continuous variable of its LTV ratio. In particular, the question, “Do you have a mortgage, land contract, or any other loan that uses the property as collateral?” was asked to elucidate if the respondent had a mortgage when surveyed. The answer, “Yes, mortgage,” indicated presence of a mortgage loan, coded “1”; otherwise “0.” A switch from “yes” to “no” between waves indicated mortgage payoff.

To obtain the LTV ratio, first, mortgage outstanding balance was measured by asking “About how much do you still owe on the mortgage?” Self-reported balance was recorded. And then current home value was found by asking “What is its present value? I mean, what would it bring if it were sold today?” Respondents’ self-reported home values were recorded. Last, the LTV ratio was calculated by dividing mortgage balance by home value.

Independent variable of retirement preparedness. The measure of retirement preparedness was group-specific depending on retirement status. To clarify an individual’s retirement status, the question “Do you consider yourself completely retired, partly retired,

²This study included only the mortgage of the primary residency.

or not retired at all?” was asked. Answers of “Completely retired,” “Partly retired” and “Not retired at all” were dichotomized into “Retired” (i.e., originally “retired”), coded “1”; and “Non-retired” (i.e., originally “partly retired” or “not retired at all”), coded “0.”

For retired participants, the question, “Before you retired, how much did you think about retirement: a lot, some, a little, or hardly at all?” was asked. The non-retired counterparts were asked, “How much have you thought about retirement: a lot, some, a little, or hardly at all?” Both questions were measured on a four-point Likert scale including “A lot” (1), “Some” (2), “A little” (3) and “Hardly at all” (4).

Relevant independent variables. Demographic variables of age, sex, race, marital status, education, income and net worth were included.

2.4.4 Analysis

Retirement preparedness as the main predictor was described among panel sample and subsamples of the non-retired and retired. Chi-squared test and F-test were performed to show the relationship between preparedness and (1) if having mortgage debt and (2) LTV ratio, respectively.

Fixed-effects logistic regression examined and quantified the impact of preparedness on whether a mortgage loan was paid off when retired. The same procedures were repeated on non-retired and retired subsamples. Next, for cases in which mortgage loans were not yet paid off, in order to examine whether preparedness influenced the remaining balance, fixed-effects multiple regressions were conducted on panel sample and non-retired and retired subgroups alike. To attest the robustness of the above fixed-effects models, sensitivity tests were performed. In particular, among six waves, each participant’s first response to

“preparedness” and last response to mortgage status were extracted to compile into a new sample. In addition, time (in years) between first observation of “preparedness” and last observation of mortgage loan status was calculated. Its purpose was to detect if duration (between preparing and latest mortgage condition) had statistical impact on mortgage status. Multiple regression was then conducted to examine whether preparedness reduced the possibility of holding a mortgage (or smaller balance). The same procedures were repeated on non-retired and retired subgroups.

Since fixed-effects models adopted a differential method, aiming to detect if change in the dependent variable was a result of change in an independent variable, only respondents participating in at least two waves and two waves that had different values were retained. In other words, responses from two waves produced one differential, which was then usable to fixed-effects estimation. In addition, the differentiating process eliminated time-invariant variables (e.g., race or sex), focusing on time-variant predictors (e.g., preparedness). Given the core idea of fixed-effects methods, respondents who participated in only one wave were eliminated in fixed-effects regressions.

2.5 Result

Table 2.2 described the main predictor, “retirement preparedness.” In particular, across two subgroups of “Non-retired” and “Retired,” first, the distribution of four categories in “preparedness” was described: “Hardly at all,” “A little,” “Some” and “A lot.” Then, its association with whether or not having mortgage loans was shown. In the panel sample, there were 76,856 homeowners, and 30,179 reported having mortgage loans. Among 19,358 non-retired mortgagors, about 29.8% fell in the category of “Hardly at all” in retirement

preparedness. Percentage for “A little” and “Some” were 16.2% and 27.3%, and about 26.7% thought they had prepared “A lot” ($\chi^2(3) = 194.78, p < .001$). Moving to retired mortgagors ($n = 10,090$), about 38.3%, a much higher percentage than their non-retired counterparts, selected “Hardly at all” for their retirement preparedness. Percentage for “A little,” “Some” and “A lot” categories were 12.4%, 23.4%, and 25.9% ($\chi^2(3) = 21.16, p < .001$).

Table 2.2: Panel Sample: Had Mortgage Loans by Preparedness among Homeowners

Preparedness	Non-retired ($n = 19,358$)			Retired ($n = 10,090$)		
	%	$\chi^2(3)$	p	%	$\chi^2(3)$	p
Hardly at all	29.8			38.3		
A little	16.2			12.4		
Some	27.3			23.4		
A lot	26.7	194.78	<.001	25.9	21.16	<.001

Note. In the Panel sample, there were 76,856 homeowners, and 30,179 reported having mortgage loans.

Table 2.3 described the dependent variable of mortgage outstanding balance, along with statistics of home present value and LTV ratio. All homeowners included (Table 2.3a), home present value was \$229,684, and the outstanding balance on mortgage was \$127,501. Comparison between mortgage-free homeowners and those having mortgages showed that the mortgage-free group had a mean home present value of \$211,768, while their mortgagor counterparts had a higher home present value of \$256,336, with the mean outstanding balance being \$127,501.

Table 2.3: Home Present Value, Mortgage Outstanding Balance and Loan-to-Value Ratio

(a) Panel Sample: Mean Home Present Value and Mortgage Outstanding Balance

All homeowners		Mortgage-free		Had mortgage	
HPV	Balance	HPV	Balance	HPV	Balance
(n =	(n =	(n =	n/a	(n =	(n =
44,891)	16,143)	26,845)		18,046)	17,756)
229,684	127,501	211,768	n/a	256,336	127,501

(b) Panel Mortgagors: Mean Home Present Value and Mortgage Outstanding Balance by Preparedness

Preparedness	Non-retired		Retired	
	HPV	Balance	HPV	Balance
	(n = 30,318)	(n = 16,143)	(n = 30,994)	(n = 7,794)
Hardly at all	235,066	128,249	218,794	106,355
A little	245,109	123,862	219,324	106,078
Some	258,161	125,414	219,616	109,526
A lot	252,667	125,793	219,564	110,533

(c) Panel Mortgagors: Mean Loan-to-Value Ratio by Preparedness

Preparedness	Non-retired (n = 16,080)				Retired (n = 7,767)			
	<i>M</i>	<i>SD</i>	<i>F</i>	<i>p</i>	<i>M</i>	<i>SD</i>	<i>F</i>	<i>p</i>
	(3,16076)				(3,7763)			
Hardly at all	0.47	0.29			0.41	0.25		
A little	0.44	0.27			0.35	0.24		
Some	0.41	0.26			0.36	0.22		
A lot	0.41	0.23	46.40	<.001	0.36	0.21	26.68	<.001

Note. HPV = Home present value. Home present value and mortgage loan outstanding balance were self-reported. All dollar values were converted into 2014 dollars using the Consumer Price Index.

Next, the dependent variable of mortgage outstanding balance was described with its relationship to the main predictor of retirement preparedness, and this description was retirement-status-specific as well (Table 2.3b). For the “Non-Retired” mortgagors who prepared “Hardly at all,” mortgage loans amounted to an average of \$128,429 out of the mean home present value of \$235,066. Although home present value for categories of “A little,” “Some,” and “A lot” were in comparison higher than individuals in the “Hardly at all” group, the mean outstanding balance in these three categories were relatively lower, being \$123,862, \$125,414 and \$125,793. Moving to the subsample of retired mortgagors, overall, respondents had lower home present values and smaller outstanding balances than their non-retired counterparts across all preparedness levels. For example, those who prepared “Hardly at all” had a mean home present value of \$218,794 and owed an average of \$106,355 on the mortgage. While home present values on each level of retirement preparedness were not drastically different, mortgage balances were higher for those who prepared “Some” and “A lot,” being \$109,526 and \$110,533, respectively.

Lastly, LTV ratios across four preparedness categories were described and compared (Table 2.3c). Among non-retired mortgagors, the mean LTV ratio decreased with more preparedness. In particular, from “Hardly at all” to “A lot,” the mean ratio dropped from 0.47 to 0.41 ($F(3, 16067) = 46.40, p < .001$). A similar pattern was found in the “Retired” group: that is, mean LTV ratio got smaller when mortgagors were more “prepared.” The ratio was 0.41 for those who prepared “Hardly at all,” while the ratio was 0.36 when mortgagors prepared “A lot” ($F(3, 7763) = 26.68, p < .001$).

Table 2.4 displayed results of fixed-effects logistic regression predicting whether a homeowner had a mortgage loan. All homeowners in the panel sample included, individuals

showing change in loan status, that is, switching from reporting having a mortgage loan to reporting not having the loan anymore, were included in the model, yielding a total response of $n = 11,848$ in the logistic fixed-effects model. Model 1 regressed the main predictor, retirement preparedness, on the binary variable of “Having mortgage loan,” indicating that, compared with “Hardly at all,” those who prepared “Some” were 13.9% more likely to carry mortgage loans ($p = .048$). Using the same sample, Model 2 added demographic variables, showing that “Some” preparedness still had an impact, which was 17.4% higher likelihood of carrying a mortgage loan ($p = .021$). Age was negatively related to whether a homeowner had a mortgage loan. In particular, compared with respondents age 50-64, mortgagors ages 65-74 were 46.2% less likely to have a mortgage loan ($p < .001$), and those age 75+ were 89.6% more likely to complete mortgage payment ($p < .001$). Homeowners who had paid jobs were 27.1% more likely to carry a loan than the non-working counterparts ($p = .001$). Higher household income predicted a 9.4% higher likelihood of having a mortgage loan ($p = .018$), whereas higher non-housing net worth predicted a 5.1% lower likelihood of having a loan ($p = .002$). Dummy wave variable indicated that, after Year 2008, homeowners were nearly three times less likely (odds ratio = 2.8) to carry a mortgage loan ($p < .001$).

Examination of the effect of preparedness on whether a homeowner had a mortgage loan was also conducted on two subsamples of “Non-retired” and “Retired” using fixed-effects logistic regression. As seen in Table 2.5, Panel 1, Model 1 merely contained the main predictor of retirement preparedness, indicating that pre-retirees with “A lot” of preparedness were 40.5% less likely to have mortgage loans ($p = .001$). Model 2 added demographic and financial status variables, showing that preparing “A lot” still had an impact (i.e., 25%

Table 2.4: Panel Sample: Fixed-Effects Logistic Regression Predicting Whether a Homeowner Had a Mortgage Loan (N =11,848)

Variable	Model 1			Model 2		
	<i>Coef</i>	<i>se</i>	<i>p</i>	<i>Coef</i>	<i>se</i>	<i>p</i>
Preparedness						
A little	0.11	0.07	.110	0.15	0.08	.053
Some	0.13	0.07	.048	0.16	0.07	.021
A lot	0.06	0.07	.419	0.04	0.08	.557
Age						
65-74				-0.38	0.08	<.001
75+				-0.64	0.15	<.001
Marital status						
Divorced/separated				0.12	0.18	.516
Widowed				-0.30	0.17	.076
Others				-0.07	0.51	.149
Years of education				-0.07	0.04	.055
Work for pay				0.24	0.07	.001
Household income (log)				0.09	0.04	.018
Non-housing net worth (log)				-0.05	0.02	.002
After year 2008				-1.00	0.05	<.001
Pseudo R^2	0.001		0.098			

Note. Reference groups were “Hardly at all,” “Age 50-64,” “Married” and did not have a paid job.

less likely) to carry mortgage loan ($p = .041$). Age was inversely related to the status of having mortgage loan. That is, compared with counterparts younger than 65 years old, those between 65-74 were 53.7% less likely to have a loan ($p < .001$), and individuals age 75+ were 3.4 times less likely to have mortgages ($p < .001$). Widowhood reduced the likelihood of holding a mortgage by 66.5% ($p = .036$). The likelihood of having a mortgage was decreased by about 11% with more education ($p < .010$) and by 7.2% with larger non-housing net worth ($p = .004$). After Year 2008, homeowners were 2.8 times less likely to have a mortgage loan ($p < .001$).

Table 2.5: Panel Subsamples: Fixed-Effects Logistic Regression Predicting Whether a Homeowner Had a Mortgage Loan

Panel 1: Non-retired (n =5,920)						
Variable	Model 1			Model 2		
	<i>Coef</i>	<i>se</i>	<i>p</i>	<i>Coef</i>	<i>se</i>	<i>p</i>
Preparedness						
A little	-0.01	0.10	.921	0.05	0.10	.627
Some	0.01	0.10	.972	0.06	0.10	.530
A lot	-0.34	0.10	.001	-0.22	0.10	.041
Age						
65-74				-0.43	0.12	<.001
75+				-1.23	0.32	<.001
Marital status						
Divorced/separated				0.39	0.23	.156
Widowed				-0.51	0.30	.036
Others				-0.69	0.59	.230
Years of education				-0.10	0.04	.010
Work for pay				0.03	0.13	.839
Household income (log)				0.05	0.05	.291
Non-housing net worth (log)				-0.07	0.02	.004
After year 2008				-1.02	0.07	<.001
Pseudo R^2		0.005			0.092	
Panel 2: Retired (n =3,765)						
Variable	Model 1			Model 2		
	<i>Coef</i>	<i>se</i>	<i>p</i>	<i>Coef</i>	<i>se</i>	<i>p</i>
Preparedness						
A little	0.23	0.13	.076	0.30	0.13	.028
Some	0.16	0.12	.155	0.23	0.12	.061
A lot	0.18	0.13	.169	0.17	0.14	.216
Age						
65-74				-0.30	0.14	.034
75+				-0.62	0.23	.006
Marital status						
Divorced/separated				-0.07	0.36	.889
Widowed				-0.30	0.23	.196
Others				-0.64	1.13	.570
Years of education				0.30	0.15	.040
Work for pay				-0.08	0.25	.752
Household income (log)				0.11	0.07	.110
Non-housing net worth (log)				0.02	0.03	.600
After year 2008				-0.80	0.09	<.001
Pseudo R^2		0.001			0.072	

Note. Reference groups were “Hardly at all,” “Age 50-64” and “Married.”

Table 2.5 Panel 2 showed the impact of retirement preparedness on mortgage loan status among the retired sample. All predictors included (as seen in Model 2), a retiree who prepared “A little” before retirement was 35.0% more likely to take mortgage loans into retirement ($p = .028$). Age still had a statistical impact. Compared with the reference age group of 50-64, ages 65-74 and 75+ reduced the likelihood of having a mortgage loan by 35.0% ($p = .034$) and by 85.9% ($p = .006$), respectively. Similarly, respondents were 2.2 times less likely to have a mortgage loan in Year 2008 and aftermath ($p < .001$).

Results predicting loan burden, presented as continuous dependent variable of LTV ratio, were shown in Table 2.6. Model 1 contained retirement preparedness, and Model 2 factored in all relevant independent variables. Model 1 indicated that higher preparedness level was statistically related to a smaller LTV ratio. That is, “Some” and “A lot” of preparedness decreased the ratio by 0.01 ($p < .001$). All independent variables included (as seen in Model 2), higher preparedness still had a reverse statistical impact on the ratio. Namely, “Some” and “A lot” of preparedness both reduced the ratio by 0.01 ($p = .001$). Older age was associated with smaller ratios. Specifically, the ratio decreased by 0.02 and 0.04 by age groups 50-64 ($p < .001$) and 65+ ($p < .001$), respectively. Widowhood statistically reduced the ratio by 0.05 ($p < .001$). Similarly, in the aftermath of Year 2008, LTV ratio dropped by 0.04 ($p < .001$).

Table 2.6: Panel Sample: Fixed-Effects Regression Predicting Loan-to-Value Ratio (N=19,145)

Variable	Model 1			Model 2		
	<i>Coef</i>	<i>se</i>	<i>p</i>	<i>Coef</i>	<i>se</i>	<i>p</i>
Preparedness						
A little	-0.01	0.01	.400	-0.01	0.01	.338
Some	-0.01	0.01	<.001	-0.01	0.01	.001
A lot	-0.01	0.01	<.001	-0.01	0.01	.001
Age						
50-64				-0.02	0.01	<.001
65+				-0.04	0.01	<.001
Marital status						
Divorced/separated				-0.01	0.01	.543
Widowed				-0.05	0.01	<.001
Others				-0.02	0.03	.567
Years of education				0.01	0.01	.492
Work for pay				-0.01	0.01	.386
Household income (log)				-0.01	0.01	.730
Non-housing net worth (log)				-0.01	0.01	.862
After year 2008				-0.04	0.01	<.001
Constant	0.41	0.01	<.001	0.44	0.03	<.001
R^2 (Within)		0.002			0.036	

In line with Table 2.6, Table 2.7 showed results from fixed-effects multiple regressions on two subsamples of the “Non-retired” (see Panel 1) and “Retired” (see Panel 2). As shown in Panel 1, the pre-retired group retained 13,165 responses, and that for the retiree group was $n = 5,980$. For both subsamples, Model 1 had only the main predictor of retirement preparedness, while Model 2 added all relevant independent variables. For the pre-retired group, preparedness had an adverse statistical impact on LTV ratio. In Model 1, “Some” and “A lot” of preparedness decreased the ratio by 0.02 ($p < .001$) and 0.03 ($p < .001$), respectively. Model 2 revealed that “Some” and “A lot” of preparedness reduced the ratio by 0.02 ($p < .001$) and 0.02 ($p < .001$) alike. In addition, ratios got smaller by 0.03 with higher age for both age groups of 50-64 ($p < .001$) and 0.03 ($p = .027$). Widowhood decreased the ratio by 0.03 ($p < .001$). Wave dummy variable indicated that ratio was reduced by 0.04 in post-2008 years.

Table 2.7: Panel Subsamples: Fixed-Effects Regression Predicting Loan-to-Value Ratio

Panel 1: Non-retired (n =13,165)						
Variable	Model 1			Model 2		
	<i>Coef</i>	<i>se</i>	<i>p</i>	<i>Coef</i>	<i>se</i>	<i>p</i>
Preparedness						
A little	-0.01	0.01	.037	-0.01	0.01	.034
Some	-0.02	0.01	<.001	-0.02	0.01	<.001
A lot	-0.03	0.01	<.001	-0.02	0.01	<.001
Age						
50-64				-0.03	0.01	<.001
65+				-0.03	0.02	.027
Marital status						
Divorced/separated				-0.01	0.01	.758
Widowed				-0.05	0.01	<.001
Others				-0.03	0.03	.331
Years of education				0.01	0.01	.607
Work for pay				-0.01	0.01	.141
Household income (log)				0.01	0.01	.917
Non-housing net worth (log)				-0.01	0.01	.630
After year 2008				-0.04	0.01	<.001
Constant	0.44	0.01	<.001	0.46	0.04	<.001
R^2 (Within)		0.004			0.035	
Panel 2: Retired (n =5,980)						
Variable	Model 1			Model 2		
	<i>Coef</i>	<i>se</i>	<i>p</i>	<i>Coef</i>	<i>se</i>	<i>p</i>
Preparedness						
A little	0.01	0.01	.177	0.01	0.01	.134
Some	-0.01	0.01	.467	-0.01	0.01	.711
A lot	0.01	0.01	.945	-0.01	0.01	.736
Age						
50-64				-0.02	0.01	.006
65+				-0.04	0.01	.001
Marital status						
Divorced/separated				-0.03	0.06	.107
Widowed				-0.05	0.04	<.001
Others				0.10	0.21	.077
Years of education				0.01	0.01	.639
Work for pay				0.01	0.01	.261
Household income (log)				-0.01	0.01	.369
Non-housing net worth (log)				0.01	0.01	.334
After year 2008				-0.03	0.01	<.001
Constant	0.37	0.01	<.001	0.39	0.09	<.001
R^2 (Within)		0.002			0.045	

In Panel 2, results indicated that preparedness had no statistical impact on the ratio among retired mortgagors. The ratio decreased, however, with higher age. Age groups 50-64 and 65+ reduced the ratio by 0.02 ($p = .006$) and 0.04 ($p = .001$), respectively. Similarly, the ratio also decreased by 0.05 with widowhood ($p < .001$). In the aftermath of Year 2008, LTV ratio dropped by 0.03 ($p < .001$).

In order to test the robustness of the fixed-effects models, sensitivity tests were conducted (see Table 2.8). Specifically, sensitivity test models consisted of the same sample of homeowners having mortgage loans. The predictor was the first observation of a mortgagor's preparedness, with the dependent variable (i.e., LTV ratio) being the latest observation during all waves participated. Multiple regression revealed that more preparedness statistically reduced LTV ratio. The ratio decreased by "A little," "Some" and "A lot" by 0.07 ($p < .001$), 0.08 ($p < .001$) and 0.13 ($p < .001$). Similar to the fixed-effects model's prediction, older age was related to smaller ratio (i.e., reduced by 0.01, $p < .001$). Racial minorities had larger LTV ratios; ratios increased by 0.09 ($p < .001$) and by 0.06 ($p = .013$) when being Black and Others, respectively. Divorce statistically related to larger ratio (i.e., increased by 0.03, $p = .026$). Financially, higher non-housing net worth reduced the ratio by 0.01 ($p < .001$). Lastly, regressions on subsamples of the non-retired and the retired yielded consistent results, showing that higher preparedness and older age statistically related to smaller LTV ratio by latest observation (see Table 2.9).

Table 2.8: Sensitivity Test Using Pooled Sample: Retirement Preparedness and Loan-to-Value Ratio (N =6,324)

Variable	<i>Coef</i>	<i>se</i>	<i>p</i>
Preparedness			
A little	-0.07	0.02	<.001
Some	-0.08	0.01	<.001
A lot	-0.13	0.01	<.001
Age	-0.01	0.01	<.001
Male	0.02	0.01	.065
Race			
Black	0.09	0.02	<.001
Others	0.06	0.02	.013
Marital status			
Divorced/separated	0.03	0.02	.026
Widowed	0.01	0.02	.788
Others	0.04	0.03	.148
Years of education	-0.01	0.01	.327
Work for pay	-0.02	0.01	.174
Household income (log)	0.01	0.01	.544
Non-housing net worth (log)	-0.01	0.01	<.001
Constant	0.91	0.10	<.001
R^2		0.047	

Table 2.9: Sensitivity Test Using Pooled Subsamples: Retirement Preparedness and Loan-to-Value Ratio

Panel 1: Non-retired (n =4,847)			
Variable	<i>Coef</i>	<i>se</i>	<i>p</i>
Preparedness			
A little	-0.06	0.02	.002
Some	-0.09	0.02	<.001
A lot	-0.14	0.02	<.001
Age	-0.01	0.01	<.001
Male	0.02	0.01	.156
Race			
Black	0.10	0.02	<.001
Others	0.06	0.02	.023
Marital status			
Divorced/separated	0.02	0.02	.182
Widowed	-0.01	0.03	.847
Others	0.04	0.03	.146
Years of education	-0.01	0.01	.611
Work for pay	-0.05	0.02	.014
Household income (log)	0.01	0.01	.626
Non-housing net worth (log)	-0.01	0.01	<.001
Constant	0.90	0.12	<.001
R^2		0.044	
Panel 2: Retired (n =1,477)			
Variable	<i>Coef</i>	<i>se</i>	<i>p</i>
Preparedness			
A little	-0.11	0.03	.001
Some	-0.07	0.03	.008
A lot	-0.12	0.02	<.001
Age	-0.01	0.01	.001
Male	0.05	0.02	.029
Race			
Black	0.07	0.03	.030
Others	0.05	0.05	.378
Marital status			
Divorced/separated	0.08	0.03	.016
Widowed	0.04	0.03	.367
Others	0.03	0.06	.743
Years of education	-0.01	0.01	.222
Work for pay	-0.06	0.05	.226
Household income (log)	0.01	0.01	.927
Non-housing net worth (log)	-0.01	0.01	.001
Constant	0.80	0.18	<.001
R^2		0.054	

2.6 Discussion

Targeting American adults over age 50, this study uses six waves from the HRS data (2004-2014) to examine and quantify the impact of retirement preparedness on mortgage status in transition to retirement, shown in forms of (1) whether a mortgagor is able to complete payment and (2) in case of no payoff, the LTV ratio. Overall, our findings show that, transitioning to retirement, preparedness promotes mortgage payoff and, in situations of not yet paid off, smaller LTV ratio, that is, less remaining mortgage balance.

Specifically, the first hypothesis assumes that preparedness reduces the likelihood of having mortgage debt. Results nicely align with this hypothesis—but only on the non-retired sample—showing that a middle-aged or older mortgagor with some levels of retirement preparation is more likely to experience mortgage payoff than non-prepared counterparts (i.e., 25% higher likelihood), even after accounting for impacts from demographic and financial variables. This is a novel finding in the field of consumers' mortgage debt, suggesting first the importance of preparation in order to reduce mortgage burden when retirement approaches, and second, the timing to initiate planning, that is, to prepare in advance. Nevertheless, for retirees who have switched from living on earned income to Social Security benefits and pensions, it may be already late to enact mortgage strategies. Preparation therefore would be of little help when it comes to alleviating mortgage burdens. That may explain why the impact on the retired sample is too weak to be discerned. Confirming earlier findings by Lusardi and Mitchell [77] that retirement preparedness promoted wealth growth, our result is clear evidence that reducing debt, especially mortgage loan debt, may be as essential as savings and investment to wealth accumulation and financial well-being.

In all, preparedness, if done ahead of retirement, leads to mortgage payoff, thus making a smoother transition to retirement.

Our findings furthermore show that older mortgagors are less likely to have mortgage debt than younger counterparts. Caveats here suggest that time itself will solve the mortgage issue while neglecting the impact of preparedness. Of course, as time goes by, an individual naturally approaches the maturation of a mortgage loan (i.e., mortgage payoff). Yet the concern pertains to increasing financial vulnerability as people age. As mentioned earlier, senior mortgagors tend to have higher delinquency and default rates [45]. Accounting for older people's medical expenses and moderate income, mortgage would inflict excessive burden. So, age or time per se may not overshadow the importance of retirement preparation when it comes to seniors' mortgage loans. Furthermore, widowed individuals are found less likely to hold a mortgage. Informed by previous research that the widowed had lower homeownership than married people [6], it is possible that the widowed may choose to sell their homes after the decease of their spouse. Having done so, their mortgage debt is paid off through home sale.

Next, we also find that larger (non-housing) net worth leads to mortgage payoff, suggesting that a near-retiree can allocate savings and investments or other types of net worth to pay off a mortgage debt. It is worth noting that, without perseverance on asset accumulation and constant planning over a long period of time, a person may rarely attain large net worth. This again stresses the importance of retirement preparedness and planning in advance. Unsurprisingly, discontinuity of holding mortgage debt becomes prevalent after 2008. This is likely to be owing to loss of homes from home sale or foreclosure following the bursting of the housing bubble in 2008. Lastly, higher education reduces a near-retiree's likelihood

of having mortgage debt. A possible explanation is that people with better education tend to have higher financial literacy. Since financial literacy contributes to effective mortgage managing, for example, avoidance of high-cost borrowing or keen perception of the housing market [109], it is reasonable that higher education level is a predictor of mortgage payoff. Apart from the above factors influencing completion of mortgage loans, our paper also yields some interesting findings. For example, retirees who prepared “A little” tend to hold mortgages into retirement. This may be a purposeful financial decision relating to tax benefits. That is to say, for some retired people, reducing taxable income via deductible mortgage interest may be an incentive to continue holding mortgages³. Although statistics of retirees’ use of mortgage interest deduction is somewhat scant, the report shows that, all ages considered, mortgage interest deduction remains the largest dollar amount claimed category (followed by medical expenses among U.S. tax filers) [54]. Therefore, tax incentives may be a sensible explanation of this finding.

The second hypothesis assumes that, if a mortgage loan is not yet paid off, higher retirement preparedness relates to a smaller LTV ratio, meaning that should home price be the same, those who once prepared tend to owe less. This hypothesis is supported by our results—still, only on the non-retired sample, suggesting that one-level increase in preparedness⁴ reduces the LTV ratio by 0.02, equaling 2% of home price. Straightforwardly speaking, a non-retired mortgagor’s balance would be reduced by \$4,000 on a \$200,000 house with more preparation—and only when it is done before retirement. Factors contributing to smaller LTV ratios are found to be consistent with the first hypothesis (i.e., if

³The home mortgage interest deduction only applies to the first \$1 million of mortgage debt [73].

⁴Preparedness is measured on a four-point Likert scale of “Hardly at all” “A little” “Some” and “A lot”.

an individual has paid off a mortgage). For example, older age, being widowed and after the Great Recession of 2008. Preparedness one more time plays no role on the retired subsample, which may be seen as a red flag of late initiation of preparation.

In short, when it comes to managing mortgage loans, planning ahead of retirement is the key. A pre-retiree is suggested to give sufficient time for preparation to take effect; once retired, it may be too late for strategies to become effective. This finding is in accordance with results from sensitivity tests, which aim to examine the robustness of the above results. In particular, people who have smaller LTV ratio tend to prepare farther ahead of retirement (i.e., longer duration between preparedness and payoff), stressing the impact of “think early” on a less stressful mortgage situation in later years.

Despite these findings, the following issues, if improved in future research, will help researchers to better understand retirement planning and consumers’ mortgage debt. First, self-reported home present value and mortgage balance may not be accurate enough to yield a precise LTV ratio, possibly bringing in some “noise” when quantifying the impact of retirement preparedness on LTV ratio. Second, voluntary and involuntary mortgage payoff may be distinguished, as “voluntary” implies successful completion while “involuntary” may result from foreclosure or unanticipated loss of home.

2.7 Implication

This paper highlights the impacts of preparedness as a crucial component in retirement planning on mortgage debt manageability and the importance of preparing early. Using Wave 2010 as an example, we further detect that, among near-retirees ages 55-60 who initially reported “Hardly at all” in preparedness, about 47.6% showed no increase in pre-

paredness level in any of the following waves participated (see Appendix A). In other words, approaching retirement, nearly half of people who did not know they should prepare for it still have little knowledge about it today. This attests to the imperative needs to increase awareness and recognition on retirement readiness.

In line with this target, pedagogy is vital. First, financial education—especially mortgage managing strategies—ought to reach more mortgagors and as early as possible. For the first objective, seminars at the workplace present an opportunity. Specifically, educators may consider adding topics relating to mortgages in curriculum, which traditionally only cover savings such as 401(k) or Health Savings Accounts. Considering that mortgage debt is somehow a complex area, educators may turn to the CFPB website for help, where learning materials such as how to understand your statement and what to do when having payment difficulty are listed in detail⁵. With increased awareness and knowledge, many people are likely to begin to think about their retirement life and evaluate their mortgage status, tasks they otherwise would not be aware of.

Secondly, please note that planning cannot be extricated from an individual's time preference [26]. In reality, there are people who choose to “live in the present,” despite knowing the concept of retirement preparation. Therefore, maneuvering to reduce their LTV ratio may be a workable strategy. To implement, educators may recommend that mortgagors save for higher monthly payments so as to speed up payment progress. To do this, a simple and valid question identifying people with time preference for the present is needed.

In addition to raising attention on preparedness, the second goal is to start early. This suggests that the “notice” of handling mortgage as part of retirement preparation should

⁵<https://www.consumerfinance.gov/consumer-tools/mortgages/>

be given as early as possible, since time is essential for financial planning to take effect given the changing macro-economic situation and the housing market in general. Employers may consider making it mandatory to attend retirement seminars and recruiting younger employees, for example, individuals in their early 30s. Someone in his or her 30s may seem young for a retirement seminar; however, considering delayed first-time home buying and the popularity of 30-year loans, having mortgage debt in one's 60s would be very possible for current middle-aged cohorts.

CHAPTER 3. HEALTH SHOCKS AND MORTGAGE DEBT PAYOFF: AN APPROACH OF SURVIVAL ANALYSIS

3.1 Abstract

Mortgage debt inflicted financial strains on middle-aged and older Americans. Meanwhile, as health declined, they also anticipated more medical expenses. Under limited resources, demands of mortgage payments and healthcare costs competed. One concern was whether mortgage payoff was deterred by health condition and, if delayed, then for how long. Targeting American adults age 50 and older, two questions were examined using survival analysis: how did health affect likelihood of mortgage payoff, and what was the estimated payoff time by health shock? Six biannual waves (2004-2014) of panel data from the Health and Retirement Study were used. Results showed that both chronic health conditions (5-8 types) and health shock reduced the likelihood of payoff by 22%. Furthermore, health impact on retirement preparedness became worse with age: At age 60, estimated time to payoff for a mortgagor with health shock was two months longer than without health shock (9.3 vs. 9.1 years). The disparity at age 75 widened to 10 months, from 7.6 (no shock) to 8.4 (had shock) years. Implications for alleviating older adults' financial strains of mortgage and health expenses are addressed.

Keywords: mortgage loan, health shock, chronic health condition, survival analysis, middle-aged and older Americans

3.2 Introduction

Over the last ten years, mortgage remained Americans' biggest household debt. Nearly 40% of middle-aged and older homeowners retired with mortgage balances averaging \$75,000 [69]. Theoretically, debts were paid off by retirement. Savings accumulated in working years were then released to maintain a similar standard of living for smooth consumption. Practically, having mortgage at older ages gave rise to financial concerns, one of the many being hardship on payments and lower quality of life in general [89].

Meanwhile, health declined with aging. Older adults tended to have more chronic conditions and were susceptible to health shock. Among adults age 65 and beyond, about three out of four had two or more chronic illnesses. Individuals over 65 paid an average annual out-of-pocket (OOP) health expense of \$1,215, and the expense may vastly increase with new health events [23]. Debilitating health had financial consequences. Studies revealed health shock as a predictor of financial fragility [75], associating with liquidity constraint and higher unsecured debts [64, 122].

Wealth of today's middle-aged and older Americans was largely insufficient for life in later years. Upon retirement, source of income switched from earned income to Social Security benefits and pensions, likely not fully covering living expenses [108]. Furthermore, wealth loss from the Great Recession resulted in higher debts relative to assets (Consumer Financial Protection Bureau¹, 2014 [28]). Therefore, under limited resources, fulfilling mortgage and medical financial obligations could be a hurdle to financial security, imposing perpetual budget constraint and resulting in exploitation of net worth. To reconcile

¹Abbreviated as CFPB

needs from mortgage debt and medical expenses, an important step was to understand the interrelation between the two: in this paper, health impact on mortgage loan payoff.

This study contributed to the literature by bridging health shock including chronic conditions and the biggest share of household debt: mortgage loans. Its primary purpose was to explore whether health had any impact on mortgage payoff. Two specific research questions were asked. Among American mortgagors age 50 and older, what impact did health shock have on likelihood of mortgage payoff, and what was the estimated payoff time under different health conditions? Using panel data from six waves (2004-2014) of the Health and Retirement Study (HRS), survival analysis incorporating both observed mortgage payoff and unobserved payoff (i.e., censored data) provided estimates for both research questions.

3.3 Literature Review

3.3.1 Determinants of Using a Mortgage

Economic perspective. The classical economic model of the life-cycle hypothesis (LCH) suggested that, assuming a rational consumer with perfect knowledge about the future, debt demand was determined by age [85]. Across lifespan, keeping constant marginal utility was essential to smoothing consumption and lifetime utility maximization. That said, at younger ages, when income earned was lower than its proper share of lifetime wealth, buying a home was unaffordable, and borrowing against future income was therefore necessary. As noted by Jones [56], accruing equity through mortgage payments was a theoretically optimum financial decision to maximize satisfaction. In working years, wealth grew, part of it allocated for paying debts. By retirement, debts were paid off, and wealth peaked;

net worth was then carried over to retirement to maintain the same standard of living. Therefore, in contrast to their younger counterparts' higher mortgage demand, middle-aged and older people had a propensity to reduce their mortgage debts.

Empirically, previous studies revealed mortgage affordability as a main economic predictor of the borrowing decision. People preferred mortgages that were affordable given their financial situation so as to live within their means. Affordability was in part determined by cost of mortgage relative to income. So younger individuals or people earning lower income chose mortgages with less total cost [98] or adjustable-rate mortgages (ARMs) offering lower initial payments [32]. When a mortgage became unaffordable (likely resulting from larger loan-to-value ratio or increased future payments) [40], a mortgage was modified, refinanced or consolidated, or terminated [11].

Behavioral perspective. Individuals' risk preference played a role in the decision to use a mortgage loan. Risk preference, known as the extent to which a person was willing to take in an investment, affected the decision whether to prepay a mortgage (i.e., earlier payoff). Mortgage as an investment generated returns from home value appreciation over time, of course, with risks of value falling [15]. People who were uncomfortable with taking investment risks attempted to minimize loss by speeding up mortgage payments just to be safe. So risk-averse borrowers used available resources for prepayment, eliminating future risks of home value depreciation and high leveraging [34]. On the contrary, risk-tolerant homeowners strategically held their mortgage and used capital (saved from prepayment) to generate returns from other investments for asset diversification [84]. Apart from risk preference, time preference also explained the willingness to use a mortgage. A preference for the present impaired the decision to take a mortgage loan, because instant gratification

through consumption for now was more tempting than accumulating home equity through mortgage payments for future use [94].

Another predictor of using mortgages was the motive of precaution. As the second largest retirement asset (following pensions and savings), home equity accumulated through mortgage payments functioned as a buffer capital or financial cushion under precautionary motive. This to some extent explained why longevity was suggested as a contributing factor of keeping a mortgage loan among older adults [52]. Aside from precaution, bequest motive was also indirectly related to mortgage decisions: bequeathing was found to lower the likelihood of releasing home equity using reverse mortgage or home equity line of credit (HELOC) [33].

Last, tax policy provided compensation for mortgage payers through mortgage interest payment deduction from taxable income, lowering the cost of using a mortgage. This could be an incentive to keeping homeownership and thus mortgage debt. For example, in itemized deduction, mortgage interest payment was the category with the highest dollar value claimed. About 83.1% of homeowners age 50 and older used itemized deductions to claim tax benefits, yielding an average tax savings of \$2,000 [96]. In all, the decision to use a mortgage was dependent on multiple factors in both the economic model on age and affordability and behavioral aspects on personal preferences and motives, along with tax policies at a macro level [18, 70].

3.3.2 Financial Burdens from Mortgage and Medical Expenses

Mortgage debt. Delayed first-time home buying implied that many Americans had to take their mortgage debt into retirement [75]. Given resource inadequacy—a common

financial situation among middle-aged and older people—mortgage debt could be a threat to financial security in later years. First, mortgage debt deterred saving. About 45% of near-retirees had no savings in their retirement accounts [99]. As retirement approached, people generally had fewer working years left, anticipating less future income and making it harder to reach the desirable savings amount before retirement. With mortgage debt, tradeoffs between savings and mortgage payments had to be made. Since debt repayment as a contracted financial obligation was often given higher priority, savings as a result could be impeded [28].

Next, having mortgage debt lower older people's quality of life. Once retired, Social Security benefits and pensions substituting for earned income were insufficient to sustain standard of living from working years [108]. With mortgage payments and reduced discretionary income, budget constraints occurred. As shown by Munnell and colleagues using the National Retirement Risk Index, households had to make financial adjustments, for example cutting back on living expenses, to fulfill debt obligation and support everyday living [89]. If high debt service-to-income ratio persisted [44], mortgage debts could become burdensome, imposing higher risks of delinquency or default on mortgage loans [69]. Therefore, with inadequate wealth, mortgage debt inflicted financial hardship through lowered standard of living.

Medical expenses. The proportion of older Americans with chronic disease was considerably high. Nearly half (45.7%) of older adults had one chronic condition, and two out of three had two or more [20]. Chronic illnesses as a leading cause of death required continuous medical attention for an extended period of time, accounting for over 90% of older adults' healthcare costs [23]. Although health insurance (from private or public sources)

covered most health service on chronic conditions, patients were still responsible for co-pays. Depending on the number and severity of health conditions, over 60% of older adults' OOP expenses were between \$1,000 and \$2,000, with costs being higher for the uninsured² [93].

Aside from chronic diseases, new health events, or health shock, and their financial consequences received increasing attention. Since health shocks were usually unexpected, when lacking emergency funds, medical expenses incurred could be a financial threat. For example, medical expenses on health shock increased with age after controlling for insurance reimbursement [36]. The onset of one severe health event induced OOP expenses as high as \$17,000 [104]. Net worth was reduced up to \$200,000 over a period of 16 years by a severe health shock [95]. Additionally, disparity of the severity of financial consequence was found: It was more difficult to pay health shock OOP expense for rural households, older adults and African Americans [2].

Medical expenses from health shocks had a trickle-down effect on a person's financial standing, for example, depletion of net worth, forgoing earned income due to poorer health and OOP expenses from ongoing medical attention on related illnesses [55]. This explained why buffering financial shocks from health events became a primary reason for saving, or on the flipside hesitance to spend, among middle-aged and older Americans [36].

In short, in later life, wealth withdrawal began, and health needed more attentive care. Reconciling financial demands from mortgage payments and medical expenses was crucial for financial stability. It was unclear whether health impacted mortgage payments. This study focused on American adults over age 50, examining the effect of health on mortgage

²Among adults age 65+, about 10.7% had no health insurance [114].

payment: how likely there would be an impact and estimated time to payoff by health. Results helped to identify from the health perspective “at-risk” individuals for mortgage difficulty, providing interventions to relieve medical and mortgage burdens among middle-aged and older Americans.

3.4 Hypothesis

3.4.1 Health Impact on Mortgage Payoff

Medical expenses incurred with health shocks, competing mortgage payment within limited resources. Mortgage payments, as a result, were either accelerated or jeopardized depending on household financial situation and decision. Under budget constraint, one approach to offset medical costs from new health shocks was home sale, with proceeds paying down mortgage debt. The next step after home sale was sometimes relocation to nursing homes or senior-friendly apartments. Therefore, the financial decision to sell one’s home led to a quicker transition to a mortgage-free state. In other words, home sale in the aftermath of health shock was likely to shorten the duration of carrying mortgage loans, increasing the likelihood of payoff.

As an alternate approach, a homeowner may turn to a HELOC to defray medical expenses or mortgage payments. An underlying risk was over-withdrawal of home equity, along with HELOC interest to pay. Should wealth exhaustion occur, delinquency or default on a mortgage could result in home loss [3], or a faster transition to mortgage termination.

Last, a method to relieve financial strain from health shock and mortgage payments was to arrange for smaller mortgage payments. Homeowners could modify the mortgage

for a lower interest rate or deferred payments. They could also refinance to transfer existing mortgage to a new loan or consolidate current debts into a new single loan. One element in common with these debt management strategies was smaller payments, implying an extended repayment timeframe. It therefore took longer to pay off the principal and interest of a mortgage loan. Hence, in case of health shock and incurrence of medical expenses, mortgage payoff was protracted if a person chose refinancing, modification or consolidation.

Overall, health impact on mortgage payoff remained inconclusive. A payoff could either be accelerated (i.e., increased likelihood) through home sale or HELOC, or slowed down (i.e., reduced likelihood) if one refinanced, modified, or consolidated the loan. Worth noting, however, older adults displayed a tendency to maintain homeownership; only about 10% of those owning a house (both with and without mortgages) gave up homeownership [42]. On the one hand, this decision may relate to precautionary or bequest motives, a factor for using mortgages as mentioned earlier. On the other hand, home was a place of identity, denoting a sense of security and independence [117]. Emotional attachment may discourage older people from selling their homes, suggesting that many older adults may make efforts to avoid home loss and choose to keep their homes even when experiencing financial hardship. So at this point we presumed that, when health shock occurred, older adults tended to maintain homeownership and keep their mortgage loans with protracted payment timeframes.

3.4.2 Hypothesis

It was hypothesized that health shock among middle-aged and older Americans was likely to reduce likelihood of paying off mortgage loans.

3.5 Method

3.5.1 Data

This study used data from six biannual waves of the Health and Retirement Study (HRS) (2004-2014). The HRS was a longitudinal study of middle-aged and older Americans. Information on health situations, including self-rated health, chronic illnesses, health shocks and health insurance were collected on a sample representing general U.S. population. Mortgage status and household financial status, such as income, debts and assets were covered in the HRS surveys, allowing us to examine the relationship between health and mortgage payment. Six waves spanned ten years, covering the Great Recession, thus permitting examination of macroeconomics on household mortgage status.

3.5.2 Sample

Figure 3.1 and Table 3.1 provided an overview of six-wave homeowners and mortgagors. Figure 3.1 showed the trend for homeowners (N = 78,769) with mortgage loans from Year 2004 to 2014. Over ten years, the percent of homeowners carrying mortgages remained around 40%, with Year 2010 having the highest mortgage rate of 43% and the lowest being 38% in Year 2014.

Table 3.1 described respondents having mortgage loans. Among six waves, 10,000 unique mortgagors participated for an average of 3.6 waves, yielding a total observation of N = 36,194. Over the course of observation, 4,262 respondents (out of 10,000) had paid off their mortgage loans. Mortgagors on average were 60.5 years old. Group specific, about 38.1% of mortgagors were between ages 50-59, followed by age group 60-69 (36.2%).

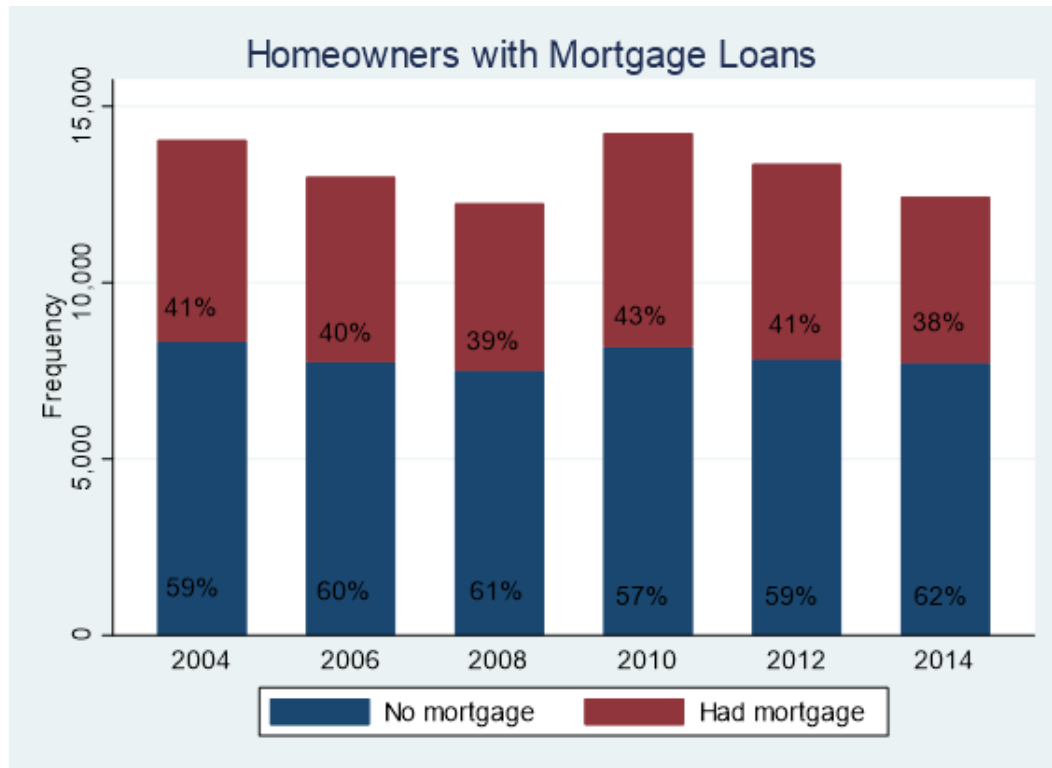


Figure 3.1: Homeowners Having Mortgage across Waves (%).

Note. There were 78,769 homeowners in the six-wave dataset. Specifically, numbers of homeowners of Years 2004, 2006, 2008, 2010, 2012 and 2014 were $n = 13,963$, $n = 12,942$, $n = 12,185$, $n = 14,114$, $n = 13,248$ and $n = 12,317$.

Of all mortgagors, about one in five (20.2%) fell in age group 70-79. More than half of mortgagors were Female (54.5%) and the majority were White (77.7%). About 71.6% of mortgagors were married. “Divorced or separated” and widowed respondents constituted 14.1% and 11.1%, respectively. Regarding health situation, about 40.9% experienced health shocks within the ten-year period, and the number of health shocks averaged 1.9 per person. In addition, most mortgagors (90.0%) had an average of two chronic conditions. Compared with Medicare or Medicaid (43.2%), more mortgagors had employer- or self-purchased private insurance (56.8%). In terms of financial status, mortgagors had an average household income of \$75,032 and a mean non-housing equity of \$174,209. Mean mortgage outstanding balance was \$154,668 and the average mortgage-to-income ratio was 4.3.

Table 3.1: Description of Mortgagors (obs. = 36,194)

Variables	All Mortgagors	
Number of unique respondents	10,000	
Payoff observed	4,262	
Average waves participated	3.6	
Demographics		
Age (mean, <i>SD</i>)	60.5	8.2
Age group (%)		
50-59	38.1	
60-69	36.2	
70-79	20.2	
80-89	5.0	
90+	0.5	
Sex (%)		
Male	45.5	
Female	54.5	
Race (%)		
White	77.7	
Black	15.5	
Others	6.8	
Marital status (%)		
Married	71.6	
Divorced/separated	14.1	
Widowed	11.1	
Others	3.2	
Education (mean, <i>SD</i>)	13.3	3.0
Health Situation		
Had health shock (%)	40.9	
Average number of health shocks	1.9	1.1
Had chronic conditions (%)	90.0	
Number of chronic conditions (mean, <i>SD</i>)	2.1	1.4
Had health insurance (%)	79.9	
Medicare / Medicaid	43.2	
Employer / Self-purchased	56.8	
Financial situation (mean, <i>SD</i>)		
Household income	75,032	63,052
Non-housing net worth	174,209	304,786
Housing and mortgage status		
Mortgage outstanding balance (mean, <i>SD</i>)	154,668	114,194
Balance-to-income ratio (mean)	4.3	

Notes. 1. Panel data contained six biannual waves (2004-2014). 2. "Payoff" was defined as transition from "Had mortgage" to "Had no mortgage." 3. Numbers were based on observation; no censored data were used in calculation. 4. Health shock referred to occurrence of surgery, unexpected fall, or emergency treatment since last interview. 5. Dollar amounts were in U.S. currency and were inflation adjusted to Year 2014.

3.5.3 Measures

Dependent variable. Mortgage payoff as the dependent variable was either observed or unobserved by the last wave of survey. An observed mortgage payoff referred to a transition in mortgage status in two (participated) consecutive waves. Specifically, the HRS asked “Do you have a mortgage, land contract, second mortgage, or any other loan that uses the property as collateral?” Answers of “Yes, mortgage” preceding “No” in two consecutive surveys indicated observed payoff, coded “1.” Answers of “Yes, mortgage” by latest wave suggested that payoff was not yet observed (i.e., censored data), although it could occur in the future, coded “0.”

Independent variable. Health shocks in this study referred to the onset of a new health event that occurred between consecutive waves, use of emergency treatment, or unexpected surgery [116]. To further classify, a dichotomous variable indicating onset of a new health event was created, with “1” indicating onset of a new health problem, and “0” otherwise. Regarding chronic conditions, the HRS inquired information on eight types of chronic illnesses commonly seen among older adults: cancer, lung disease, cardiovascular disease, stroke, diabetes, hypertension, arthritis and psychiatric symptoms. Number of chronic illnesses was grouped, with zero condition coded “1,” one to four conditions grouped and coded “2” and “3” for five conditions or more. This classification was informed by an earlier study showing that financial strains resulted from the presence of four or more chronic conditions [93].

Relevant independent variables. Demographic variables of age, sex, marital status, education and health insurance were included. Financial variables of income, net worth and

mortgage loan balance-to-income ratio were considered.

3.5.4 Analysis

Age at (observed) mortgage payoff was shown using Wave 2004. Percent of health shock in each wave was then described. Wilcoxon test of equality was performed to describe statistical difference in mortgage payoff by whether there was a health shock, taking into account both observed and censored payoff.

Survival analysis was used in regression. Survival analysis featured analyzing the likelihood of occurrence of an event, here mortgage payoff and, in case of no observed event, time to (future) payoff. Both observed and unobserved payoff were used, reducing bias from eliminating cases whose outcomes were unknown for now but could occur in the future. Please note that health declined with aging. Survival analysis allowed variables to change over time, making it possible to detect how payoff was affected by changes in health over time [4].

In our analysis, each respondent entered with a mortgage, so mortgagors in the sample were retained for survival regression. For each mortgagor, age at entry and state at entry (i.e., had mortgage) were recorded. When mortgage payoff was observed, the respondent exited and did not re-enter (i.e., single non-repeated) the analysis. At this point, his/her corresponding age and state at exit (i.e., payoff) were recorded. If by latest wave participated no mortgage payoff occurred, data were censored. Age at last participated wave and state at exit (i.e., no observed payoff yet) were recorded. Therefore, each mortgagor in the sample had two “markers”: at entry and at exit; and each “marker” contained two pieces of information: age and state of mortgage (i.e., had mortgage or payoff had occurred). For

observed payoff, two age markers produced time duration to its occurrence, and state markers showed its status transition. For censored payoff, age markers recorded time duration till last wave, and likewise, state markers kept track of its status. Combining both observed and censored payoff, the hazard, or probability, of occurrence of event was calculated [27].

Survival analyses were conducted on Wave 2004 homeowners only. Specifically, homeowners at Wave 2004 were identified and were kept track of till their exit. In survival analysis, Wave 2004 as the first wave in our dataset was advantageous to following waves in a way that it allowed maximum time (i.e., up to 12 years) to observe whether a respondent's mortgage payoff had occurred. In this case, we were able to attain the largest number of observations (of payoff) relative to unobserved (i.e., censored) payoff, increasing the robustness of survival estimates.

Three regression models were built: A baseline model containing demographics and chronic conditions (given the prevalence of chronic conditions among the target population), a model with the occurrence of health shock at the top of the baseline model and a model revamped from the basic model containing duration of health shock to mortgage payoff (or, in case of censored "payoff," duration to last participated wave). Last, for censored payoff, survival analysis from the above three models further predicted time to payment completion using follow-up estimation.

3.6 Result

Table 3.2 described 5,421 mortgagors unique to Wave 2004 by mortgage status across age groups out of 13,963 homeowners. First, on a five-year incremental age scale, it was indicated that respondents tend to become mortgage-free with increased age. Starting from

age group 50-54, the majority of homeowners had mortgage loans (70.9%). Reaching ages 60-64, percent of no mortgage loans (51.6%) began to outweigh that of having mortgages (48.4%), with the corresponding observed mean age at payoff being 67.5 years old. More than one fourth of homeowners (28.1%) ages 70-74 carried mortgage loans. Mean observed age at payoff of this group was 76.7 when payoff was observed. Between ages 75-79, nearly one in five (21.0%) were homeowners with mortgages, and the payoff under observation was at age 81.0. Second, within the ten-year period, ratio of payoff-to-no payoff demonstrated a hump shape, starting from 0.73 (ages 50-54), peaking at 0.97 (ages 65-69) and reducing to 0.53 for age 85+.

Table 3.2: Age Distribution among Wave 2004 Homeowners (N=13,963)

Age in 2004	All Homeowners (n)	No Mortgage (%)	Had Mortgage (n = 5,421)			Age at Payoff (mean)
			No Payoff (%)	Payoff (%)	Ratio of Payoff/No Payoff	
50-54	1,786	29.1	41.1	29.8	0.73	57.9
55-59	1,891	35.6	36.6	27.8	0.76	62.3
60-64	2,306	51.6	25.3	23.1	0.91	67.5
65-69	2,588	60.7	20.0	19.3	0.97	72.0
70-74	2,015	71.9	14.8	13.3	0.90	76.7
75-79	1,494	79.0	12.8	8.2	0.64	81.0
80-84	1,111	86.8	9.0	4.2	0.47	86.8
85+	772	89.9	6.6	3.5	0.53	90.9

Table 3.3 described health shock experienced by 2004 mortgagors. In 2004, mortgagors on average were 61.9 years old. Over the ten-year period, as respondents got older, health shock prevailed, gradually increasing from 13.2% (2004) to 21.3% (2014). Wilcoxon test of equality showed that the occurrence of mortgage loan payoff had statistical difference by health shock, $\chi^2 = 31.65, p < .001$.

Table 3.3: Health Shock among Wave 2004 Mortgagors (%)

	2004 (n = 5,421)	2006 (n = 5,219)	2008 (n = 4,197)	2010 (n = 3,407)	2012 (n = 2,710)	2014 (n = 2,197)
Had Health Shock	13.2	15.9	18.1	18.3	17.9	21.3

Note. Mean age in 2004 was 61.9 years old.

Parametric estimates of hazard of mortgage payoff were shown in Table 3.4. Model 1 included mortgagors' basic information of demographics, financial standing, mortgage status and chronic conditions. One year older in age (at first observation) increased likelihood of mortgage loan payoff by 2%, $p < .001$. Being Black and other racial minorities increased the hazard of payoff by 22% ($p = .003$) and 46% ($p < .001$) over White, respectively. Compared with the married, the divorced or separated were 19% less likely to pay off the loan ($p = .005$). Each additional year in education decreased hazard by 4% ($p < .001$). Compared with loan-to-income ratio < 1 , a loan-to-income ratio ≥ 1 reduced the hazard of payoff. That is, having a ratio of 1-3, 3-5 and 5+ decreased the hazard by 48% ($p < .001$), 45% ($p < .001$) and 50% ($p < .001$). Having health insurance reduced the likelihood of payoff by 35% than the not insured. One unit increase in log income decreased the hazard by 14% ($p < .001$). One additional unit in log non-housing equity increased the hazard by 1% ($p = .016$). Having 5-8 chronic illnesses reduced likelihood of mortgage payoff by 22% ($p = .021$). In post-2008 waves, mortgage payoff was 14.6 times more likely to occur than in pre-2008 years.

Table 3.4: Parametric Estimates of Hazard of Mortgage Payoff

Variable	Model 1 (n = 18,338)			Model 2 (n = 18,338)			Model 3 (n = 18,338)		
	hazard ratio	se	p	hazard ratio	se	p	hazard ratio	se	p
Age at entry to survey	1.02	0.00	<.001	1.03	0.00	<.001	1.03	0.00	<.001
Male	0.99	0.04	.779	0.98	0.04	.728	0.99	0.04	.788
Race									
Black	1.22	0.08	.003	1.20	0.08	.006	1.19	0.08	.011
Others	1.46	0.13	<.001	1.45	0.13	<.001	1.44	0.13	<.001
Marital status									
Divorced/separated	0.81	0.06	.005	0.82	0.06	.007	0.81	0.06	.006
Widowed	0.89	0.06	.095	0.89	0.06	.091	0.90	0.06	.132
Never married	0.95	0.14	.727	0.94	0.13	.670	0.94	0.13	.653
Education	0.96	0.01	<.001	0.96	0.01	<.001	0.96	0.01	<.001
Loan-to-income ratio									
1-3	0.52	0.03	<.001	0.52	0.03	<.001	0.52	0.03	<.001
3-5	0.55	0.05	<.001	0.54	0.05	<.001	0.54	0.05	<.001
5	0.50	0.04	<.001	0.50	0.04	<.001	0.50	0.04	<.001
Had health insurance	0.65	0.04	<.001	0.65	0.04	<.001	0.66	0.04	<.001
(log) Income	0.86	0.03	<.001	0.85	0.03	<.001	0.85	0.03	<.001
(log) Non-housing equity	1.01	0.01	.016	1.01	0.01	.017	1.01	0.01	.025
Chronic conditions									
1-4 conditions	0.88	0.06	.057	0.90	0.06	.102	0.91	0.06	.185
5-8 conditions	0.78	0.09	.021	0.85	0.10	.139	0.91	0.10	.406
Had health shock				0.78	0.05	<.001			
Health shock duration							0.94	0.01	<.001
After Year 2008	14.61	1.25	<.001	14.47	1.23	<.001	14.07	1.20	<.001
Constant	0.01	0.01	<.001	0.01	0.01	<.001	0.01	0.01	<.001

Note. 1. This model contained 4,787 individuals and 2,149 payoffs. 2. Reference groups were Female, White, Married, loan-to-income ratio <1, had no health insurance, had no chronic condition and had no health shock. 3. Data followed Weibull distribution as suggested by Akaike's Information Criterion (AIC).

Model 2 was built on Model 1 by adding whether or not a mortgagor experienced health shock. The result showed that health shock reduced the hazard by 22% ($p < .001$). Different from Model 1, chronic health conditions did not statistically affect likelihood of mortgage payoff. Other factors were similar to Model 1. Factors that statistically increased hazard of payoff were higher age (HR= 1.03, $p < .001$), Black (HR = 1.20, $p < .006$) and other racial minorities (HR = 1.45, $p < .001$), higher non-housing equity (HR = 1.01, $p = .017$) and post-2008 years (HR = 14.47, $p < .001$). Contrarily, divorce or marital separation (HR = 0.82, $p = .007$), additional year in education (HR = 0.96, $p < .001$), loan-to-income ratios larger than one (i.e., ratio 1-3, HR = 0.52, $p < .001$; ratio 3-5, HR = 0.54, $p < .001$; ratio 5+, HR = 0.50, $p < .001$), had health insurance (HR = 0.65, $p < .001$) and one more unit in log income (HR = 0.85, $p < .001$) decreased hazard of payoff.

Model 3 was also built on Model 1 by including time duration between first health shock and mortgage payoff or, in case of no payoff observed, last wave of observation. Results showed that one more year in time duration since the occurrence of health shock reduced the hazard by 6% ($p < .001$). Similar to Model 1, variables that increased likelihood of payoff were higher age (HR= 1.03, $p < .001$), Black (HR = 1.19, $p = .011$) and other racial minorities (HR = 1.44, $p < .001$), higher non-housing equity (HR = 1.01, $p = .025$) and years after 2008 (HR = 14.07, $p < .001$). Conversely, factors that reduced the hazard of mortgage payoff were being divorced or separated (HR = 0.81, $p = .006$), one more year in education (HR = 0.96, $p < .001$), loan-to-income ratios larger than one (i.e., ratio 1-3, HR = 0.52, $p < .001$; ratio 3-5, HR = 0.54, $p < .001$; ratio 5+, HR = 0.50, $p < .001$), had health insurance (HR = 0.66, $p < .001$) and one additional unit in log income (HR =

0.85, $p < .001$). Chronic conditions had no impact on hazard of mortgage payoff.

Until now, regression models estimated hazard, or likelihood, of mortgage payoff using both observed and censored data. Next, as a follow-up procedure, regression Model 1 was applied to censored data—namely, those who had not yet paid off the loan by the end of survey—to calculate expected time to payoff. Figure 3.2 showed the predicted mean time to mortgage payoff for all mortgagors with 95% confidence interval. Overall, starting from age 50, time to mortgage payoff showed a descending trend, with slight fluctuations. In other words, the higher a mortgagor's age, the less time it would take to pay down the mortgage loan. On average, it would take a mortgagor at age 50 10.26 years to complete the loan payment. Mean time to payoff for a 55- and a 60- year old mortgagor were estimated to be 10.04 years and 9.19 years, respectively. Mortgage loans of a 65- and 70-year old individual were expected to be paid down in 8.80 and 8.73 years.

Model 2 was also applied to censored data as a follow-up estimate on expected time to payoff depending on occurrence of health shock. Figure 3.3 showed mean time to mortgage loan payoff by health shock. First, group comparison by health shock showed that, on average, those experiencing health shocks were expected to spend a longer time to pay off their mortgage than counterparts of the same age with no health shock. Specifically, a mortgagor of age 50 with no health shock was predicted to take 10.22 years to payoff; and, in case of health shock, 10.40 years. At age 60, a mortgagor without health shock was expected to take 9.07 years to complete payments, while 60-year-old counterparts with health shock would take 9.32 years to payoff (+0.25 yrs). At age 70, mean time to payoff was predicted to be 8.47 (no shock) and 8.82 (had shock) years (+0.35 yrs), respectively. As shown by the above description, between mortgagors with and without health shocks,

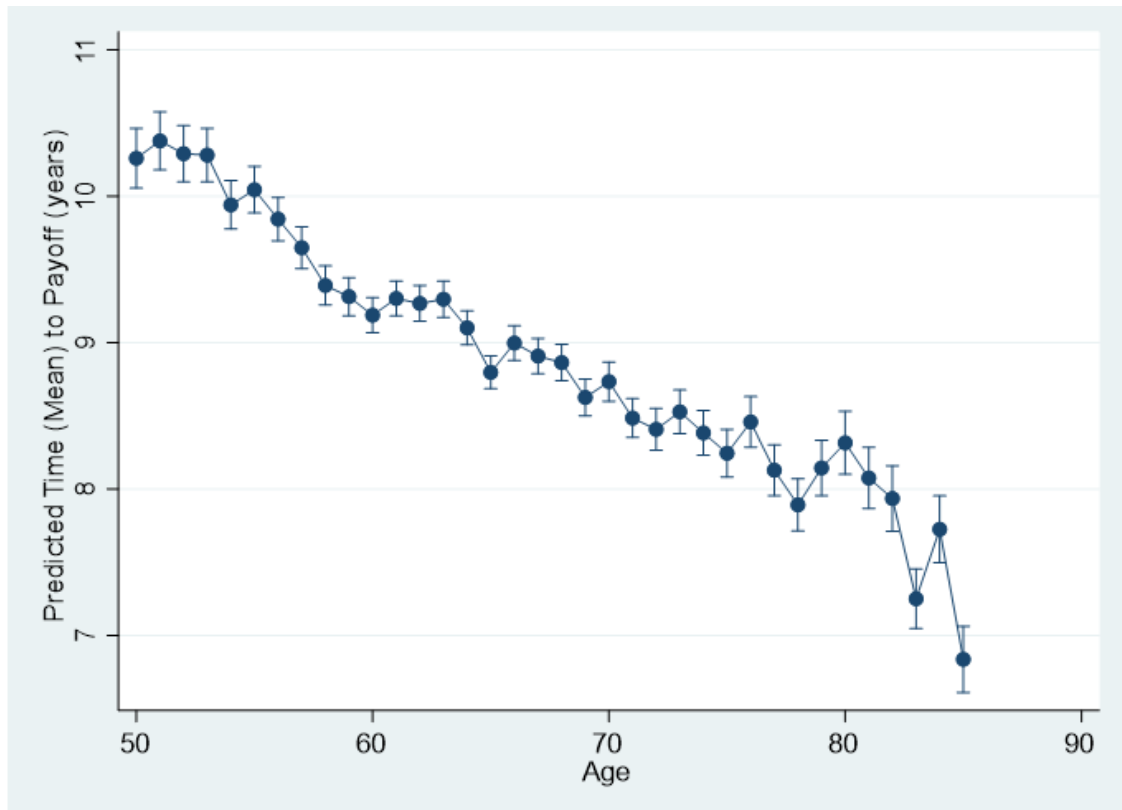


Figure 3.2: Prediction on Time (Mean) to Mortgage Payoff with 95% Confidence Interval.

mean time to mortgage loan payoff was predicted to widen with older age.

3.7 Discussion

This paper focuses on American adults age 50 and older and investigates health impact on likelihood of mortgage payoff. It is instructive that we include both health shock and chronic conditions, and examine this relationship from two aspects: first, depending on health, what is the likelihood of mortgage payoff; and second, what is the estimated time to payoff by mortgagors' health condition? We find that likelihood of mortgage payoff depends crucially on health: both chronic condition and health shock reduces likelihood of paying off a mortgage by 22%. And expected payoff time (for current mortgagors) is postponed 2 to 10 months with a health shock, with older people experiencing a longer

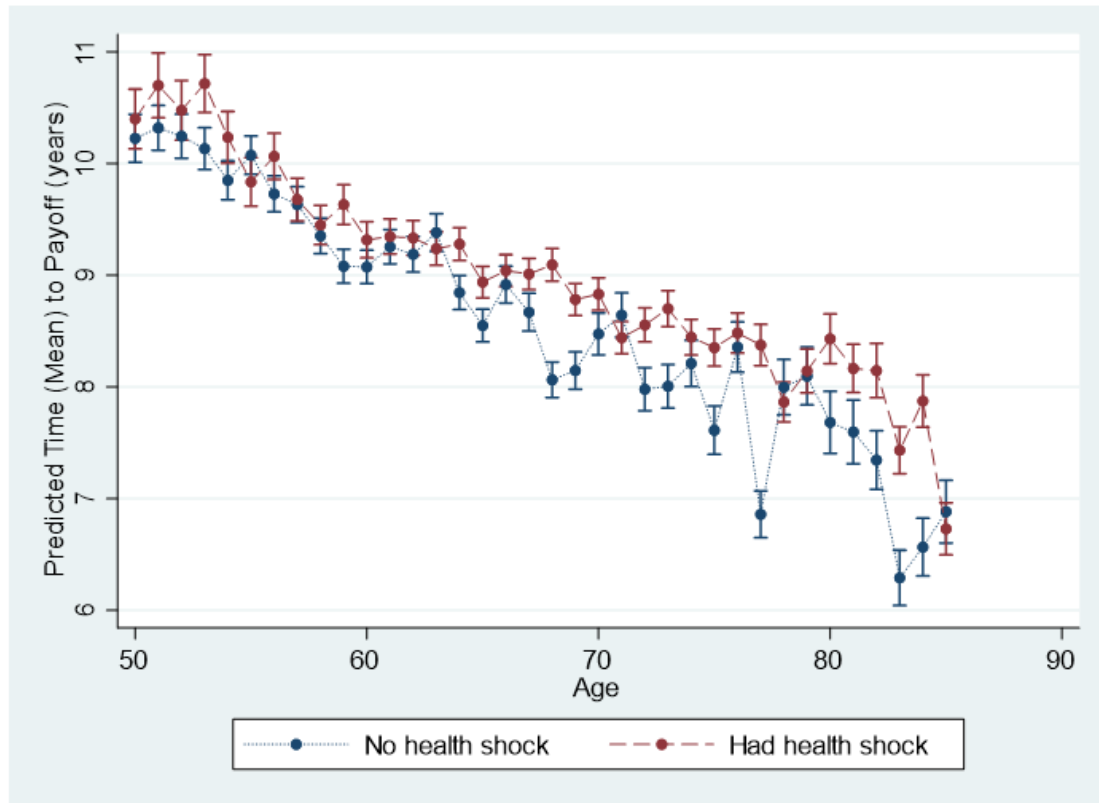


Figure 3.3: Prediction on Time (Mean) to Mortgage Payoff by Health Shock with 95% Confidence Interval.

delay. These novel findings provide important enrichment to debt research on middle-aged and older Americans, showing that, aside from wealth depletion [64] and unsecured debts [122], health shock and chronic disease also threatens secured loans by reducing likelihood of mortgage payment completion. Hence, given declined health with aging, endeavoring to pay off a mortgage for financial security is just as vital as deleveraging of unsecured debts—before deterioration of physical health and incurrence of unexpected medical expenses.

In order to answer the first research question, three survival models (including both observed and censored payoff) are built for a step-by-step examination: a base model with chronic condition and demographics, a model with occurrence of health shock at the top

of the baseline model and a model augmenting the base model by including duration from latest health shock to observed payoff. In particular, in the absence of health shock, having 5 to 8 types of chronic illnesses, compared with having no chronic condition, reduces payoff likelihood by 22%, and having 1-4 types decreases likelihood by 12%³. Considering that over 90% of older people's medical expenses go toward chronic illnesses [23], it is not surprising that chronic disease inhibits mortgage payoff, likely through financial loss from OOP expenses or forgone earned income from unemployment [55]. In addition, expenses from chronic condition tend to incur over the entire later life given its needs for continuing attentive care. Without adequate resources, a person may have little resilience to make financial adjustments, resulting in budget constraint. In this circumstance, mortgage payment disruption—for example, late or missed payments—could occur, decreasing likelihood of mortgage payoff.

Next, when factoring in health shock, effects from chronic conditions diminish; health shock as the prominent predictor reduces likelihood of payoff by 22%. Health shock, usually unanticipated, generates high medical costs, leaving little time for patients and families to prepare financially should there not be enough emergency funds or credit to borrow. For example, in 2011, average OOP cost of emergency department (ED) visit was \$1,354 in the U.S. [101], which exceeds average monthly Social Security benefit of \$1,241 in 2011⁴ [106]. In this situation, an individual may have to trade off mortgage payments for paying health shock medical bills, so as to have a tentative “cushion” to buffer this financial shock. In other words, mortgage payments may be a concession to medical ex-

³Having 1-4 types of chronic condition is marginally statistically significant with a p-value of .057.

⁴In 2011 U.S. currency, for a single worker retired at age 65

penses when health shock suddenly occurs, resulting in interrupted mortgage payments and reduced likelihood to pay off mortgage debts.

Third, the test of lingering effect of health shock on paying one's mortgage indicates that each two-year increase⁵ in duration since (latest) health shock reduces likelihood of mortgage payoff by 6%. Counterintuitively, once paying the medical bills in full, a person is free from further financial obligation; thus, its impact on mortgage payoff should decrease. However, informed by previous research, health shock is rarely extricated from existing chronic illnesses—ED treatment or surgery is oftentimes a consequence of sudden deterioration of chronic symptoms. Therefore, continuation to control chronic disease or complications in the aftermath of health shock may negatively impact one's budget, imposing financial strain over time, and eventually threatening successful mortgage completion. For example, infection induced by arthritis, a type of chronic disease affecting 23% of U.S. adults [21], accounts for 24.7% of ED visits [80]. This indirectly testifies to our finding stated above that chronic conditions deter mortgage payoff. Therefore, given our findings, impact of health shock on lower mortgage payoff likelihood possibly has two mechanisms: one in itself, and another through its interwoven relationship with associated chronic conditions.

In addition to health, a few factors predicting likelihood of mortgage payoff are worth mentioning. First, non-housing equity in the forms of savings and investment promotes mortgage payoff by 1% after controlling for health, suggesting that should there be a health problem, wealth as a buffer capital is crucial to get over financial shocks. The small magnitude of impact may be interpreted as hesitance to release wealth for debt repayment out

⁵The HRS collects data every two years.

of precautionary motive [19] or a bequest motive to leave a legacy [51].

Furthermore, health insurance surprisingly interferes with the progress of mortgage payments. A closer look into the sample reveals that effects are age-specific. Beyond age 64, the transition stage to using Medicare, health insurance has no profound impact. Before age 64, however, health insurance reduces likelihood of mortgage payoff, implying that premiums, deductibles, or co-pays on employer-sponsored or privately-purchased health insurance may be high enough to compete with other financial needs such as mortgage payments. Moreover, after 2008, likelihood of mortgage payoff is 14 times higher than before 2008, suggesting that “mortgage-free” may in some cases mean an involuntary mortgage termination from home foreclosure.

Moving to the second research question on estimating time to pay off a mortgage for censored observation, overall, all mortgagors considered, expected time to payoff shortens with increasing age (with minor fluctuations). In other words, the general trend shows that, the higher the age, the less time it takes to reach payoff. For example, a mortgagor of age 55 pays off the loan in 10.0 years, at around 65 years old. Payoff ages for a 65- and a 70-year-old is 73.8 (+8.8 years) and 78.7 (+8.7 years), respectively. Note, however, that the expected time to payoff is not proportional to the mortgagor’s age. As shown in the above example of a 65- and a 70- year old, their age differential of 5 years corresponds to only 1-month difference. This finding deserves more attention, since it indicates that older mortgagors are approaching mortgage payoff at a slower pace than younger counterparts, implying ever-increasing difficulty to make mortgage payments and financial vulnerability in general among senior mortgagors.

Further examination by health shock shows a novel finding: health shock impedes mort-

gage payoff, and the delay in payoff (from health shock) widens with older age. For example, a 60-year-old without and with health shock waits 9.1 and 9.3 years until mortgage payoff, a postponement of about three months. Having and not having health shock for a 75-year-old mortgagor correspond to 7.6 and 8.4 years, respectively, to mortgage payoff, producing a 10-month delay. Therefore, a conclusion is that impact of health shock on reduced likelihood of mortgage payoff exacerbates with older age, testifying again to financial insecurity and mortgage burden among older Americans.

Whereas this paper provides clear evidence on negative impact of health shock on mortgage payment completion, future work in this field may be advanced in the following aspects. First, OOP⁶ expenses if included in estimates will help to understand how actual expenditures influence mortgage payments and to what extent. In this paper, however, by factoring in OOP, size of observation drastically decreased from 18,338 to 1,606, with no observed mortgage payoff, so we cannot perform survival analysis. Second, mortgage payoff as a state of being mortgage-free results either from successful payment completion or home loss from foreclosure or other unspecified reasons. These situations may be further distinguished to identify voluntary and involuntary mortgage discontinuation.

3.8 Implication

Undoubtedly, the worst situation of mortgage default or lengthy payment timeframe is home loss, imperiling the already financially fragile elder population. Therefore, given the prevalence of chronic illnesses (e.g., about 45.7% have at least one) and frequency of

⁶The HRS collects OOP on four categories of hospital treatment, surgery cost, nursing home cost and doctor visit.

health shock (e.g., about one in six have shock each wave) and limited financial resources in general, education tailored specifically to those having health issues is greatly needed. The primary teaching goal is to speed up mortgage payment, regardless of whether health shock has occurred or not. To break down this teaching goal, two steps may be taken. First, information should be delivered to seniors on the adverse impact of health shock on potential mortgage difficulty. Many mortgagors simply do not know that their mortgage payment could be in peril if their health worsens, and few can anticipate the occurrence of health shock. When equipped with such knowledge, people at least would have some perception on their mortgage status given their age and self-rated health, making them less likely to be completely unprepared in the event of health shock. Second, on this knowledge basis, strategies for managing mortgage debts may be offered. Prioritizing financial needs is a good start. For example, some financial aspects to be evaluated include emergency funds (e.g., enough or not), savings (e.g., save more), unnecessary expenses (e.g., cut them back). Eventually seniors may allocate any surplus funds to increase mortgage payments in order to pay it off earlier. By doing so, under the same resources, budget adjustment to avoid delay in payoff may be achieved.

One final concern is exacerbated financial vulnerability to mortgage burden among senior mortgagors, who are approaching mortgage completion at a much slower pace than younger borrowers with similar health. Policy makers may consider extra tax benefits through mortgage interest deduction for those having health shock or multiple chronic conditions (e.g., more than five types). Of course, seniors tend to fall into a lower marginal tax bracket due to smaller income. For those having health issues, however, their financial standing may be further ameliorated through a higher deduction limit. For example, start-

ing from 2018, the deduction limit is \$10,000 [53]. Raising this limit for mortgagors age 75 and older may better accommodate seniors given their declining health and mortgage interest payments.

CHAPTER 4. REVERSE MORTGAGE AND FINANCIAL SATISFACTION AMONG OLDER AMERICANS

4.1 Abstract

Reverse mortgage was a financial product allowing the homeowner access to home equity. Borrowing against their own housing wealth, older homeowners obtained payments to add to their savings and pensions, thus mitigating liquidity constraint in later years. The latest descriptive work contrasted financial situations before and after use of reverse mortgages, but studies investigating their impact on older borrowers' financial wellbeing were still limited. This paper as an important accession examined whether reverse mortgages contributed to increased financial satisfaction among borrowers, while quantifying the magnitude of the impact. Four waves (2010-2016) of the Health and Retirement Study were used to build fixed-effects models. Evidence clearly suggested improved financial situations from using reverse mortgages. On a 1-5 scale, financial and income satisfaction increased by 0.46 and 0.69, and difficulty paying bills decreased by 0.77; financial strain decreased by 0.69 on 1-4 measuring scale. Additionally, financial wellbeing was more likely to be ameliorated for seniors beyond age 80 and respondents whose income exceeded 150% of the federal poverty line. Implications on utilizing reverse mortgage as a source of income to fund retirement were discussed.

Keywords: reverse mortgage, financial satisfaction, liquidity constraint, older homeowners

4.2 Introduction

In studying conditions of retirement, an important question to ask was whether a retiree had enough money to sustain a comfortable life. Retirement on one's own terms faced the retiree with challenges such as inadequate wealth or savings, rising cost of living and longevity. Among others, one key factor was lack of liquid assets, which could easily be converted into cash for daily expenses and emergencies. When a household was short of cash¹, budgets tightened, resulting in liquidity constraint [31].

Home equity constituted a large share of household wealth. Yet, lockup of home equity was an issue confronting many homeowners, as equity could not be liquidated until home sale, which took time. Therefore, seniors may experience financial strain when wealth was in large part stored as home equity and liquid assets were few. Put another way, not having enough cash and lockup of home equity created a situation called "house rich, cash poor." As commonly seen, despite having a home and some savings, many older Americans had financial pressure to sustain the standard of living they had in working years [52].

Reverse mortgage loans, a financial product available for homeowners age 62 and above, provided a scheme to liquidate one's home equity. By taking a reverse mortgage, a person borrowed against his equity, which was released and converted to liquid assets by a lender, and then paid to the borrower. In other words, one's home equity was unlocked by reverse mortgage, providing cash for retirement. For elder persons hampered by low liquid assets, reverse mortgages could help. Theoretically, smooth consumption across lifespan maximized utility under lifetime wealth. Thus, to keep consumption levels constant across

¹In this paper, cash referred to cash and near-cash items including money in checking and savings accounts.

all life stages, it was necessary to transfer surplus assets from working years to times of inadequate income [85]. In practice, reverse mortgage loans made it possible to allocate accumulated home equity to retirement when income was generally low, maximizing satisfaction through intertemporal asset transfer. In addition, compared with home equity line of credit (HELOC), reverse mortgage loans had fewer requirements on borrowers' income or credit rating, accommodating seniors' financial situations. The lender began to collect repayments when the borrower deceased or moved out of the house. Therefore, borrowers felt little stress for repayment while they continued residing in their homes [103]. Lastly, living on one's own lessened reliance on social welfare or financial help-seeking [46, 50], denoting independence and a sense of autonomy [58, 121].

Overall, releasing equity for consumption in later years was assumed to be economically desirable; reverse mortgage loans, if used rationally, had financial and psychological advantages. Nevertheless, only one out of seven qualified borrowers chose reverse mortgage. Examination was needed on the change in wellbeing resulting from reverse mortgages. Building on recent descriptive work comparing financial conditions before and after using a reverse mortgage loan [87], this paper advanced the research by investigating the impact of reverse mortgage on borrowers' financial health. Specifically, was enhanced financial satisfaction an effect of taking a reverse mortgage loan? Second, to what extent did reverse mortgages increase financial satisfaction?

4.3 Literature Review

4.3.1 Retirement Wealth Components

Retirement wealth mainly consisted of Social Security benefits, pensions, savings and home equity. In 2017, the average monthly Social Security benefit was \$1,360² [107]. For pre-retirees ages 51-56, all savings accounts included³, retirement savings had a mean of \$220,700⁴, but the median was substantially lower, being \$47,500. Home equity, the market value of a house minus any mortgage debt, averaged \$127,280 and had a median of \$68,000. In all, mean retirement net worth was approximately \$387,000. Due to wealth disparity and inequality, median net worth was less than half of that, being \$152,000 [76].

As people got older, wealth composition gradually changed. Home equity took a larger share in total household wealth, whereas the proportion of financial assets shrank. For example, adults ages 62-75 had \$177,800 average savings, with the median being \$14,000. At the same time, mean home equity was \$281,000, and median home equity was \$115,000 [72].

Therefore, for elder persons with limited monetary assets, home equity became a main component of retirement wealth. Of course, under motives of precaution and bequest, older people were reluctant to release equity, since a home was treated as a buffer capital, a valuable possession, or a sign of “retirement in place.” However, in order to meet consumption needs, older adults’ equity may inevitably be released to mitigate tight budget.

²In 2017 U.S. currency, and all retired workers included

³Including pensions, 401(k) or similar plans and Individual Retirement Account (IRA)

⁴In 2004 U.S. currency

4.3.2 Reverse Mortgage Loans

Reverse mortgage. A reverse mortgage loan was a type of home equity loan for homeowners beyond age 62. With a traditional mortgage, consumers borrowed to buy a home, and paid it back using future income. For reverse mortgages, homeowners borrowed against their own equity and received either monthly or lump sum payments from the lender [63]. Loan repayment began when the borrower no longer occupied the residence (e.g., deceased or moved out). To repay the loan, the home was sold. Proceeds were then used to pay capital and interest [43].

Total loan amount was primarily determined by the appraised home value minus related fees and costs. On average, borrowers received a maximum of 80% of the appraised housing price [91]. Reverse mortgage loans offered diverse payment options. Generally, lump sum payments were more popular than monthly payments, which was helpful in case of financial shocks [103].

A risk for both borrowers and lenders were falling home prices. When home values depreciated, sales did not generate enough proceeds to cover capital and interest. Borrowers then did not receive enough money to pay back the loan and the lender was not paid in full. To prevent a lose-lose situation, lenders and borrowers were required to purchase insurance from the Federal Housing Administration (FHA). FHA insurance protected lenders from consumer default on loan repayment. At the borrowers' end, insurance reimbursed the difference if home sale did not fully repay their loan.

The working mechanism of a reverse mortgage was similar to a HELOC, but reverse mortgages were tailored to fit older people's financial situations. Unlike HELOCs requiring

decent income and prime credit, reverse mortgages imposed fewer restrictions [48]. Since approval of reverse mortgages relied more on home value and less on income credentials, it was more suitable for older borrowers living on fixed incomes [82].

Use of reverse mortgages among older homeowners. Recent trends showed remarkable growth in use of reverse mortgages—from 0.2% in 1997 to 1.4% in 2009, which increased further to 2.1% in 2011, with the highest increase seen at age 62 [92]. Although the number of reverse mortgage borrowers was still small, its soaring rate at age 62, the minimum qualifying age, implied rising demand to tap into home equity [38]. Households who chose reverse mortgages shared similar characteristics. For example, being single or widowed [43], having consumer debt [71] and having financial needs to cover property taxes [67].

On the other hand, the small percentage of those using reverse mortgages reflected older people's prudence about releasing home equity. Previous work pointed out drawbacks of reverse mortgages. For example, early and unnecessary depletion of equity was a shortcoming. In addition, lump sum payments could be an enticement for consumption, encouraging splurging, and thus deterring retirement saving among near-retirees [111]. Under most reverse mortgage terms, borrowers needed to begin repaying the loan if moving out. Considering the possibility of relocation, for example, downsizing or moving to nursing homes, the contracted "lock-in" in the residence was unfavorable to potential borrowers [24].

Despite the downsides, empirical evidence showed an array of benefits from using a reverse mortgage loan. "Financial cushion" was a main economic advantage [120]. For example, a primary reason for using reverse mortgages was to pay healthcare costs, including unexpected medical expenses [92] and financing long-term care or end-of-life arrange-

ments [33]. These findings were consistent with results showing that older adults with lower self-rated health were more likely to take reverse mortgages [25]. Psychologically, since older adults needed not to move out of the house, they earned a sense of belonging [66]. Reverse mortgages also allowed seniors to live on their own, bringing autonomy from less reliance on social welfare [90] and financial independence from reduced help-seeking [46].

In sum, there was evidence on reasons for using reverse mortgages, both benefits and drawbacks, from economic and psychological viewpoints. Releasing home equity in later years was a serious financial decision that required careful assessment, as the consequence of equity exhaustion was almost irreversible if used irrationally. Therefore, it was crucial to understand if reverse mortgages enhanced borrowers' financial wellbeing. In other words, did reverse mortgages increase seniors' financial satisfaction? Answers to this question could provide recommendations on managing wealth, helping seniors to improve their quality of life while reducing the risk of unnecessary wealth depletion.

4.4 Theoretical Framework

The classical economic model of the Life-Cycle Hypothesis (LCH) assumed that consumer utility or satisfaction was a function of current and future consumption. Each person's lifetime resources, including income and wealth, were limited. Therefore, in order to maximize lifetime utility, an optimum method was to smooth consumption across the lifespan, keeping constant marginal utility. This was achieved by evenly distributing wealth and income across all life stages. To that end, a rational person was expected to save when income exceeded expenses, and to spend when income was not enough to maintain a similar standard of living [12]. In a nutshell, intertemporal transfer of wealth accumulated in work-

ing years to retirement when living primarily on fixed incomes was economically ideal for utility maximization [85].

Home equity, or housing capital, was a major component of older adults' household wealth [52]. It was accumulated through mortgage payments over time. The mechanism of reverse mortgages was an application of the LCH. It enabled intertemporal resource transfer of equity accrued earlier in life to retirement, helping to maintain the same consumption level in retirement years and maximizing borrowers' lifetime satisfaction [97, 100, 103].

Hypothesis 1

It was hypothesized that a borrower was likely to have less financial constraint after taking a reverse mortgage loan.

Hypothesis 2

It was hypothesized that a borrower was likely to experience increased financial satisfaction after taking a reverse mortgage loan.

4.5 Method

4.5.1 Data

This study used longitudinal data from the Health and Retirement Study (HRS). Starting from 1992, HRS surveyed a representative sample of American adults over age 50 every two years, collecting information on Americans' work, retirement planning and wealth. The variable of reverse mortgage was first introduced in Wave 2010 and was available through the latest wave. In addition to the abundance of economic variables, the HRS strengthened its measurement on psychological status related to household financial situation. In 2004,

the Leave Behind (LB) questionnaire was added to core HRS face-to-face interviews⁵ to inquire about individuals' psychological health and general wellbeing in multiple life domains. The LB survey was conducted on a (rotating) randomly selected subsample drawn from core face-to-face interviewees. Therefore, sample size of LB in each wave was substantially smaller than the size in corresponding core interviews [112]. LB questionnaire covered satisfaction with household financial situations and financial strains, main dependent variables in this study. Four waves from 2010- 2016 were used to merge into a panel dataset. Since homeowners became eligible for reverse mortgages loans at age 62, panel data were further refined by retaining homeowners age 62 and beyond.

4.5.2 Sample

Four waves of data had a total of 37,797 responses from 13,231 homeowners age 62+. As shown in Table 4.1, mortgage-free homeowners included 8,097 unique respondents participating in an average 2.8 waves. Next, 4,919 respondents had a traditional mortgage, and they participated in 2.9 waves. Reverse mortgage borrower group contained 215 unique respondents, accounting for 1.62% of the sample, on average participating in 3.2 waves.

⁵The HRS also conducted telephone interviews and mail surveys.

Table 4.1: Description of Senior Homeowners (N = 37,797)

Variables	No Mortgage		Had Mortgage	
	Mean	SD	Traditional Mortgage	Reverse Mortgage
Number of unique respondents	8,097		4,919	215
Average waves participated	2.8		2.9	3.2
Demographics				
Age (mean, <i>SD</i>)	75.1	8.7	70.0	76.3
Age group (%)				
62-69	27.0		51.0	13.8
70-79	44.0		38.5	51.8
80+	29.0		10.5	34.4
Sex (%)				
Male	43.0		47.3	43.7
Female	57.0		52.7	56.3
Race (%)				
White	83.4		77.3	77.2
Black	11.7		16.3	18.1
Others	4.9		6.4	4.7
Marital status (%)				
Married	62.2		69.9	48.4
Divorced/separated	9.4		12.2	14.0
Widowed	25.8		15.2	33.9
Others	2.6		2.7	3.7
Education (mean, <i>SD</i>)	12.6	3.2	13.6	12.7
Health				
Self-rated health (mean, <i>SD</i>)	2.9	1.0	2.7	3.0

Continued on next page

Table 4.1 – Continued from previous page

Variables	Had Mortgage		
	No Mortgage	Traditional Mortgage	Reverse Mortgage
Had health insurance (%)	93.3	89.1	90.5
Medicare / Medicaid	93.9	83.0	98.5
Employer / Self-purchased	6.1	17.0	1.5
Annual household income (mean, <i>SD</i>)	50,525 40,835	75,053 44,876	42,773 35,472
Net worth			
Home equity (mean, <i>SD</i>)	178,822 58,498	104,968 48,990	199,673 60,848
Non-housing net worth (mean, <i>SD</i>)	149,079 181,766	124,317 171,258	75,085 133,262

Note. 1. Panel data were from four biannual waves of 2010 to 2016. 2. Respondents were homeowners age 62 years old and above.

For the no-mortgage group, average age was 75.1, and nearly half (44.0%) were between 70 to 79 years old. About 57.0% were female, and the majority (83.4%) were White. Married respondents constituted 62.2%. This group of respondents had 12.6 years of education. Sample had a mean household income of \$50,252. Home equity averaged \$178,822 and non-housing net worth was \$149,079. Respondents with traditional mortgage loans were 70.0 years old, half of whom (51.0%) were in the 62 to 69 age group. Nearly 52.7% were female, 77.3% were White and 69.9% were married. Average years of education were 13.6. Annual household income was \$75,053. Net worth in home equity and non-housing assets were \$104,968 and \$124,317, respectively. Regarding the reverse-mortgage group, respondents were on average 76.3 years old, and more than half (51.8%) were in the 70 to 79 age bracket. About 56.3% were female. White and married respondents constituted 77.2% and 48.4% of the subsample, respectively. Education attainment was 12.7 years. Annual household income was \$42,773, with home equity being \$199,673. Non-housing financial net worth was \$75,085.

In short, reverse mortgage borrowers were older than no-mortgage and traditional-mortgage counterparts, with half of them between ages 70-79. In addition, the reverse mortgage group had a higher proportion of single-household respondents (i.e., divorced, separated, or widowed). Average home equity of reverse mortgagors was the highest of all three subgroups; in contrast, their non-housing net worth was the lowest, representing a profile of “house rich, cash poor.”

4.5.3 Measures

Dependent variables. Financial satisfaction was measured using two variables: satisfaction with household income and satisfaction with financial situation. Two corresponding questions were “How satisfied are you with the total income of your household?” and “How satisfied are you with your present financial situation?” Answers on a five-point Likert scale included “Completely satisfied,” coded “1” to “Not at all satisfied,” coded “5.” They were further reverse coded for straightforward interpretation. Aside from satisfaction, liquidity constraint was also estimated to detect the effect of reverse mortgages. Two variables were “difficulty paying bills” and “financial strain.” To measure “difficulty paying bills,” the question, “How difficult is it for you to meet your monthly payments on bills?” was asked. Answers on a five-point Likert scale varied from “Not at all difficult,” coded “1”, to “Completely difficult,” coded “5.” Next, “financial strain” was measured using the question, “Please indicate how upsetting your financial strain has been in the last twelve months.” Four choices were “No, did not happen,” coded “1,” “Yes, but not upsetting,” coded “2,” “Yes, somewhat upsetting,” coded “3” and “Yes, very upsetting,” coded 4.”

Independent variables. A binary independent variable of whether or not having a reverse mortgage at the time of interview was used. The question “Do you have a mortgage, land contract, second mortgage, or any other loan that uses the property as collateral?” was asked. The answer of “Respondent has reverse mortgage” indicated that the participant had a reverse mortgage loan when surveyed, coded “1” and otherwise “0.”

Relevant independent variables. Other independent variables were whether a respondent had a traditional mortgage, respondent’s annual income, household net worth and de-

mographic information. To measure health status, respondents were asked to indicate their current self-rated health using “Excellent,” “Very good,” “Good,” “Fair” and “Poor,” coded from “1” to “5.”

4.5.4 Analysis

The first step was to describe dependent variables of financial satisfaction (i.e., satisfaction with household income and satisfaction with financial situation) and financial constraint (i.e., financial strain and difficulty paying bills). Particularly, among three subgroups of “mortgage-free,” “had traditional mortgage” and “had reverse mortgage,” the mean of the four dependent variables was shown, using data from the first waves of 2010 and the latest wave of 2016. Next, focus of analysis switched from all homeowners (62+) to reverse-mortgage respondents, aiming to demonstrate how four dependent variables changed over time among borrowers, from 2010 – 2016.

Comparison was also conducted descriptively on financial satisfaction and liquidity constraint before and after taking a reverse mortgage. Since our focus was to ascertain changes after using a reverse mortgage, this series of figures included only respondents who started with “having no reverse mortgage” and in any of the following waves “had a reverse mortgage.” In addition, given the sampling strategy of the HRS LB questionnaire mentioned earlier, LB had a drastically smaller sample size than the HRS core interviews. So, across four waves, approximately thirty unique reverse mortgage borrowers⁶ fulfilled the requirements for this description: first, started with no reverse mortgage and thereafter took a reverse mortgage loan; second, had responses for dependent variables both before

⁶Out of a total of 215 unique reverse mortgagors (see Table 4.1)

and after using the loan (See Appendix B).

Multicollinearity was checked to avoid correlation between financial variables. To examine whether any change in financial satisfaction was an effect of using reverse mortgages, fixed-effects regression was performed. Fixed-effects models adopted a differentiating process, eliminating time-invariant characteristics such as sex and race, allowing us to detect whether change in a dependent variable was statistically related to change in independent variables. Hausman test yielded $\chi^2(11) = 27.71, p < .001$, indicating that data structure fit fixed-effects models [119]. Four fixed-effects regression models were estimated, with each model containing one of the four dependent variables of “Satisfaction with financial situation,” “Satisfaction with household income,” “Financial strain” and “Difficulty paying bills.” Models detected whether changes in above four dependent variables were ascribed to changes in predictors. Thus, any respondents participating in two waves or more who showed differential values in both independent and dependent variables were usable in regression.

4.6 Result

Table 4.2 displayed senior homeowners’ financial situations in two selected waves—the first wave of 2010 and the last wave of 2016. Financial strain, difficulty paying bills, satisfaction with household income and satisfaction with financial situation⁷ were described group-specific: mortgage-free, had traditional mortgage and had reverse mortgage. Com-

⁷“Financial strain” was measured on a scale from 1 (“No, did not happen”) to 4 (“Yes, very upsetting”). “Difficulty paying bills” was measured on a scale from 1 (“Not at all difficult”) to 5 (“Completely difficult”). “Satisfaction with household income” was measured on a scale from 1 (“Not at all satisfied”) to 5 (“Completely satisfied”). “Satisfaction with financial situation” was measured on a scale from 1 (“Not at all satisfied”) to 5 (“Completely satisfied”).

pared with Table 4.1, drop in sample size in each group was ascribed to sampling of LB survey, which was conducted on a portion of randomly selected core HRS respondents. First, for financial strain, in both years, reverse mortgagors experienced the highest financial strain among all three groups. In 2010, reverse mortgagors' mean strain was 2.02 ($SD = 1.01$), whereas traditional mortgage borrowers and no-mortgage counterparts had mean strains of 1.81 ($SD = 0.96$) and 1.44 ($SD = 0.77$), respectively. Wave 2016 had the same pattern. Reverse-mortgage group had a mean strain of 1.90 ($SD = 1.02$), which was larger than mean strains for traditional borrowers ($M = 1.79$, $SD = 0.94$) and mortgage-free group ($M = 1.46$, $SD = 0.76$). Cross-sectionally, comparing 2010 with 2016, mean financial strain decreased for reverse mortgage borrowers from 2.02 ($SD = 1.01$) to 1.90 ($SD = 1.02$). Traditional borrowers' strain slightly alleviated, while the mortgage-free group had a slim increase in financial strain.

Table 4.2: Senior Homeowners' Financial Situations

	No Mortgage			Had Mortgage						
				Traditional Mortgage			Reverse Mortgage			
	n	Mean	SD	n	Mean	SD	n	Mean	SD	
Financial strain	2010	2,784	1.44	0.77	1,133	1.81	0.96	56	2.02	1.01
	2016	2,012	1.46	0.76	924	1.79	0.94	30	1.90	1.02
Difficulty paying bills	2010	2,830	1.68	0.86	1,138	2.02	1.01	56	2.39	1.10
	2016	2,016	2.02	1.01	927	1.94	0.96	28	2.25	1.24
Satisfaction with income	2010	2,820	3.64	1.05	1,133	3.25	1.12	56	2.98	1.18
	2016	2,039	3.60	1.06	933	3.21	1.12	30	3.23	1.25
Satisfaction with financial situation	2010	2,838	3.74	1.01	1,135	3.28	1.09	56	3.09	1.10
	2016	2,043	3.69	1.01	931	3.27	1.06	30	3.33	1.24

Note. 1. Homeowners were 62 and above. 2. "Financial strain" was measured on a scale from 1 ("No, did not happen") to 4 ("Yes, very upsetting"). 3. "Difficulty paying bills" was measured on a scale from 1 ("Not at all difficult") to 5 ("Completely difficult"). 4. "Satisfaction with household income" was measured on a scale from 1 ("Not at all satisfied") to 5 ("Completely satisfied"). 5. "Satisfaction with financial situation" was measured on a scale from 1 ("Not at all satisfied") to 5 ("Completely satisfied").

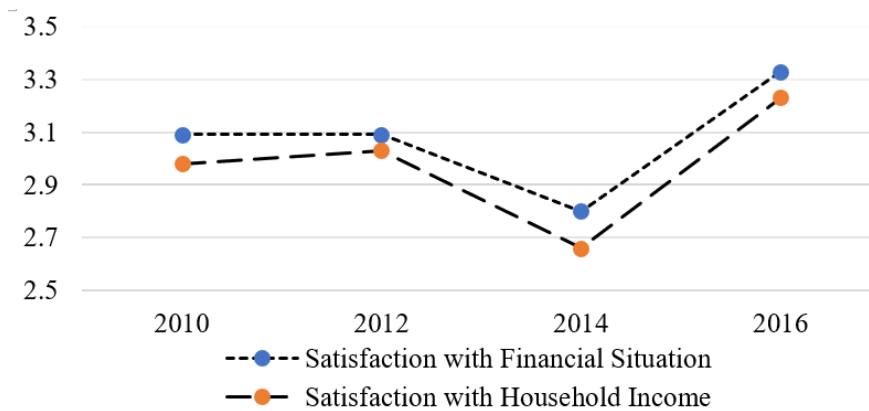
Next, regarding difficulty paying bills, in both waves, reverse mortgage borrowers had the most difficulty among three subgroups. In 2010, mean difficulty rated by reverse mortgagors was 2.39 ($SD = 1.10$), higher than 1.68 ($SD = 0.86$) among mortgage-free respondents and 2.02 ($SD = 1.01$) of the traditional mortgage group. Likewise, 2016 followed the same pattern. Mean difficulty for reverse mortgagors of 2.25 ($SD = 1.24$) was higher than that of no-mortgage ($M = 2.02$, $SD = 1.01$) and traditional mortgage borrowers ($M = 1.94$, $SD = 0.96$). In addition, comparison between 2010 and 2016 showed that reverse mortgage respondents had decreased difficulty paying bills from 2.39 ($SD = 1.10$) to 2.25 ($SD = 1.24$), so had traditional mortgage borrowers. Contrarily, no-mortgage group experienced higher difficulty paying bills.

Third, regarding income satisfaction, reverse mortgage borrowers had a mean income satisfaction score of 3.23 ($SD = 1.25$) in 2016, which increased from 2.98 ($SD = 1.18$) in 2010. In contrast, both traditional mortgagors and no-mortgage counterpart showed a reduction in income satisfaction from 3.25 in 2010 ($SD = 1.12$) to 3.21 ($SD = 1.12$) in 2016 and from 3.64 ($SD = 1.05$) in 2010 to 3.60 in 2016 ($SD = 1.06$), respectively. Despite an increase of reverse mortgagors' income satisfaction, it was still relatively low among the subgroups. In 2010, reverse mortgagors' mean satisfaction of 2.98 ($SD = 1.18$) ranked the lowest. Mortgage-free counterparts had the highest income satisfaction ($M = 3.64$, $SD = 1.05$), followed by the traditional mortgage group's mean of 3.25 ($SD = 1.12$). In 2016, no-mortgage respondents still had the highest income satisfaction of the three ($M = 3.60$, $SD = 1.06$). Reverse mortgagors' satisfaction level ranked second ($M = 3.23$, $SD = 1.25$), while the traditional mortgage group were on average least satisfied with income ($M = 3.21$, $SD = 1.12$).

Finally, in terms of satisfaction with financial situation, reverse mortgage was the only subgroup showing an increase, from a mean of 3.09 ($SD = 1.10$) in 2010 to 3.33 ($SD = 1.24$) in 2016. The other two groups experienced reductions. Specifically, traditional mortgage borrowers' satisfaction dropped from a mean of 3.28 ($SD = 1.09$) in 2010 to 3.27 ($SD = 1.06$) in 2016. Mortgage-free counterparts' 2010 mean of 3.74 ($SD = 1.01$) reduced to 3.69 ($SD = 1.01$) in 2016. In spite of its increase, reverse mortgage borrowers, however, were not the most satisfied with their financial situation. In 2010, their mean of 3.09 ($SD = 1.10$) was lower than traditional mortgagors' mean of 3.28 ($SD = 1.09$) and no-mortgage group's mean of 3.74 ($SD = 1.01$). In 2016, reverse mortgagors' mean of 3.33 ($SD = 1.24$), although higher than that of the traditional mortgage group ($M = 3.27$, $SD = 1.06$), but was still lower than the mean of mortgage-free counterparts ($M = 3.69$, $SD = 1.01$).

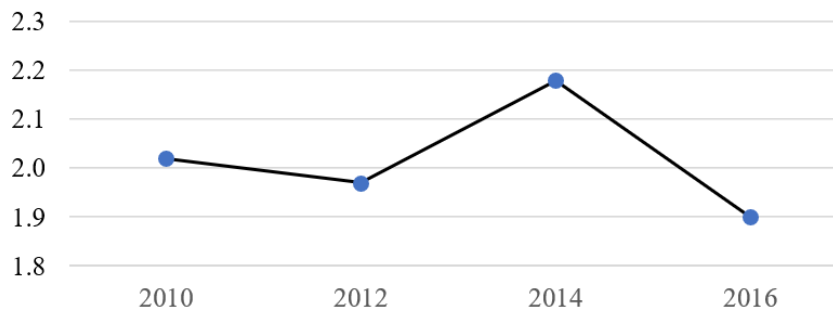
As noted earlier, the next step was to focus on reverse mortgage borrowers and to demonstrate their change in financial situation across four waves, shown in Figures 4.1a 4.1b and 4.1c. Figure 4.1a displayed trends of satisfaction with financial situation and with household income. Over six years, two satisfaction domains showed similar fluctuating patterns, hitting the trough in 2014 and peaking in 2016. On a 1-5 measuring scale, financial satisfaction started from 3.09 in 2010, being equal in 2012, and then in 2014 plummeted to 2.80. In 2016, it bounced back to 3.33, the highest point of all waves. Income satisfaction, also measured on a 1-5 scale, started from 2.98 in 2010 and slightly increased to 3.03 in 2012. A reduction to 2.66 was seen in 2014 and eventually rose to the highest of 3.23 in 2016.

Figure 4.1b depicted reverse mortgagors' financial strain over time. Financial strain demonstrated a fluctuating trend, in a reverse direction than satisfactions. On a 1-4 measur-



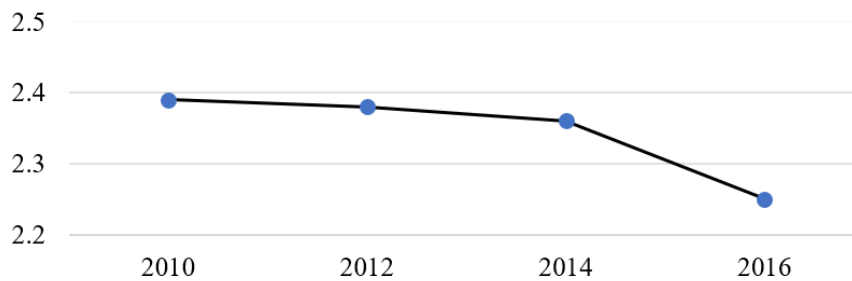
(a) Reverse Mortgage Borrowers' Financial Situations over Time.

Note. 1. Satisfaction with financial situation and satisfaction with household income were measured on a scale from 1 (Not at all satisfied) to 5 (Completely satisfied). 2. Number of reverse mortgage borrowers was 109 (2010), 112 (2012), 100 (2014), and 92 (2016).



(b) Reverse Mortgage Borrowers' Financial Strain Over Time.

Note. 1. Financial strain was measured on scale from 1 (no, did not happen) to 4 (yes, very upsetting). 2. Number of reverse mortgage borrowers was 109 (2010), 112 (2012), 100 (2014), and 92 (2016).



(c) Reverse Mortgage Borrowers' Difficulty Paying Bills Over Time.

Note. 1. Difficulty paying bills: measured on a scale from 1 (Not at all difficult) to 5 (Completely difficult). 2. Number of reverse mortgage borrowers was 109 (2010), 112 (2012), 100 (2014), and 92 (2016).

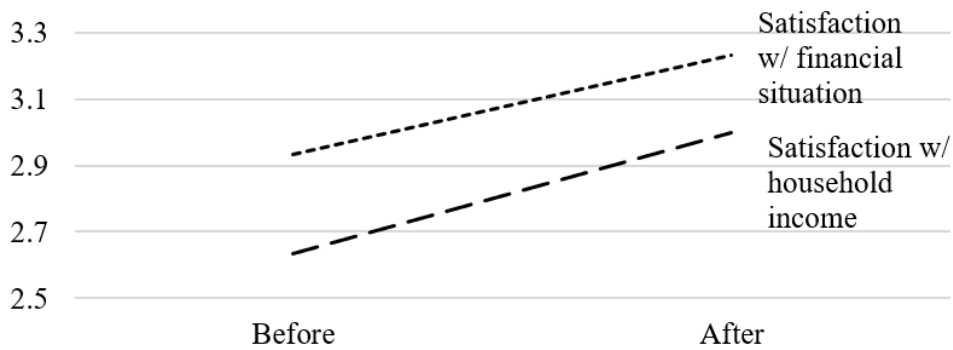
Figure 4.1: Reverse Mortgage Borrowers' Financial Situations Over Time.

ing scale, average financial strain in 2010 was 2.02, which dropped to 1.97 in 2012. Strain level increased to 2.18 in 2014, followed by a decrease to 1.90 in 2016. Finally, reverse mortgage borrowers' difficulty paying bills was shown in Figure 4.1c. Over four waves, on a 1-5 scale, difficulty paying bills experienced a steady decrease, from 2.39 in 2010 to 2.25 in 2016.

The next analysis procedure was to compare reverse mortgage borrowers' financial situations before and after taking the loan. Figures 4.2a–4.2c showed differences in satisfaction and liquidity constraint. Figure 4.2a showed changes in two satisfaction domains resulting from reverse mortgage. Average of all pre- and post- reverse mortgage waves was taken. The figure showed that satisfaction with financial situation and with household income both increased after using the loan. With financial situation, satisfaction rose from 2.93 to 3.23; and, for income, satisfaction increased from 2.63 to 3.00. Not surprisingly, financial strain decreased after taking a reverse mortgage, from 2.20 to 1.80 (Figure 4.2b). Difficulty paying bills (Figure 4.2c) fell from 2.57 to 2.11 after use of reverse mortgage.

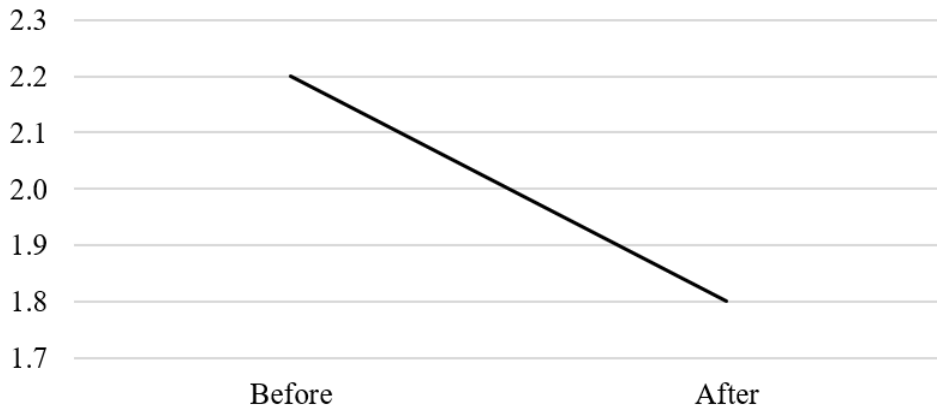
Table 4.3 showed results from fixed-effects regression using a categorical predictor of mortgage status: had no mortgage, had traditional mortgage and had reverse mortgage. Model 1 estimated satisfaction with financial situation. “Had reverse mortgage” (marginally) increased satisfaction of overall financial situation by 0.45 ($p = .062$) compared with the mortgage-free group. Coefficients of non-housing equity and annual income were 0.04 ($p < .001$) and 0.05⁸ ($p < .001$), respectively, indicating that additional 1% non-housing equity and income corresponded to 0.0004 and 0.0005 increases in in-

⁸On a 1 (not at all satisfied) to 5 (completely satisfied) scale. Due to level-log relationship between satisfaction scale and non-housing equity or income, coefficient was interpreted as “coefficient/100.” Income as an example, was 0.05/100, meaning that a 1% increase in income raised satisfaction by 0.0005.



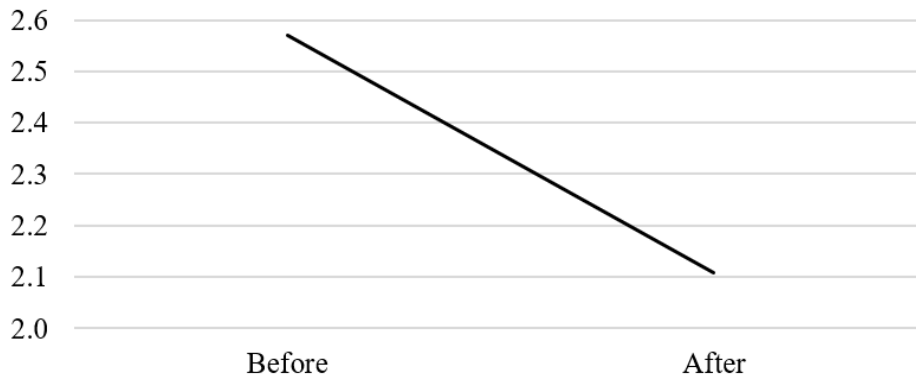
(a) Financial Situations Before and After Use of Reverse Mortgage.

Note. 1. $n = 30$. 2. Average of before- and after-waves was used. 3. Satisfaction with financial situation was measured on a scale from 1 (Not at all satisfied) to 5 (Completely satisfied).



(b) Financial Strain.

Note. 1. $n = 30$. 2. Average of before- and after-waves was used. 3. Financial strain was measured on a scale from 1 (No, did not happen) to 4 (Yes, very upsetting).



(c) Difficulty Paying Bills.

Note. 1. $n = 28$. 2. Average of before- and after-waves was used. 3. Difficulty paying bills: measured on a scale from 1 (Not at all difficult) to 5 (Completely difficult).

Figure 4.2: Financial Situations Before and After Using Reverse Mortgages.

come satisfaction scale. Having health insurance increased financial satisfaction by 0.24 ($p < .001$).

Model 2 estimated satisfaction with household income⁹. Compared with no-mortgage counterparts, having a reverse mortgage increased income satisfaction by 0.68 ($p = .006$). Similarly, regarding satisfaction with overall financial situation, non-housing equity and income increased income satisfaction by 0.0004 ($p < .001$) and 0.0006 ($p < .001$), respectively. Having health insurance also increased income satisfaction by 0.16 ($p = .007$). Financial strain¹⁰ was estimated in Model 3. Compared with the no-mortgage group, using a reverse mortgage decreased financial strain by 0.69 ($p = .001$). Age group 70-79, compared with cohorts ages 62-69, related to a 0.06 reduction in financial strain ($p = .041$). Each 1% increase in non-housing equity and income also reduced financial strain, by 0.0004 ($p < .001$) and 0.0003 ($p = .008$), respectively. Financial strain decreased by 0.12 ($p = .018$) if respondents had health insurance. Model 4 used “difficulty paying bills¹¹” as the dependent variable. Compared with mortgage-free respondents, a reverse mortgage reduced difficulty by 0.74 ($p = .001$). In addition, difficulty decreased by 0.0004 ($p < .001$) as non-housing equity and income increased 1 %. Health insurance alleviated difficulty paying bills by 0.22 ($p < .001$).

⁹Measured on a 1 (not at all satisfied) to 5 (completely satisfied) scale.

¹⁰Measured on a 1 (did not happen) to 4 (very upsetting) scale.

¹¹Measured on a 1 (not at all difficult) to 5 (completely difficult) scale.

Table 4.3: Impact of Reverse Mortgage on Financial Situations: Fixed-Effects Estimation

Variable	Model 1 (n = 10,904)		Model 2 (n = 10,888)		Model 3 (n = 10,798)		Model 4 (n = 10,895)	
	Coef	se	Coef	se	Coef	se	Coef	se
Mortgage status								
Had traditional mortgage	-0.04	0.04	-0.04	0.05	0.01	0.04	0.07	0.04
Had reverse mortgage	0.45	0.24	0.68	0.25	-0.69	0.21	-0.74	0.22
Age group								
70-79	0.05	0.03	0.03	0.04	-0.06	0.03	-0.01	0.03
80+	-0.02	0.05	-0.04	0.06	-0.08	0.05	-0.06	0.05
Marital status								
Divorced/separated	0.01	0.12	-0.19	0.13	0.20	0.11	0.13	0.10
Widowed	0.07	0.06	0.02	0.06	0.08	0.05	-0.06	0.05
Never married	0.09	0.29	0.06	0.32	-0.21	0.27	-0.19	0.26
Self-rated health	-0.03	0.02	-0.01	0.02	0.01	0.02	0.02	0.02
Had health insurance	0.24	0.06	0.16	0.06	-0.12	0.05	-0.22	0.05
Non-housing equity (log)	0.04	0.01	0.04	0.01	-0.04	0.01	-0.04	0.01
Income (log)	0.05	0.01	0.06	0.01	-0.03	0.01	-0.04	0.01
Constant	2.46	0.20	2.38	0.21	2.48	0.18	2.83	0.17
R^2 (overall)	0.089		0.086		0.095		0.131	

Note. 1. Four biannual waves of 2010, 2012, 2014, and 2016 were used to form the panel data. 2. Sample were homeowners aged 62+. 3. Reference groups were had no mortgage, age group of 62-69, married, and had no health insurance.

Table 4.4 showed regressions using the binary variable of whether having a reverse mortgage predicted satisfaction and liquidity constraint. In Model 1, similar to Table 4.3, satisfaction with financial situation was marginally related to having a reverse mortgage when compared with non-reverse mortgagors, increasing by 0.46 ($p = .054$). In addition, financial satisfaction was also positively related to non-housing equity and income. Each 1% increase in non-housing equity and income led to 0.0004 ($p < .001$) and 0.0006 ($p < .001$) increase in satisfaction scale, respectively. Health insurance predicted a 0.20 ($p = .001$) increase in financial satisfaction. Model 2 estimated satisfaction with household income, showing that, compared with respondents having no reverse mortgage, reverse mortgage borrowers increased income satisfaction by 0.69 ($p = .005$). An adverse predictor was “divorced or separated,” which reduced income satisfaction by 0.32 ($p = .022$). Similar to previous models, adding 1% in non-housing equity and in income increased income satisfaction by 0.0004 ($p = .001$) and 0.0006 ($p < .001$) on 1-5 measuring scale. Having health insurance promoted income satisfaction by 0.13 ($p = .041$). Model 3 used financial strain as the dependent variable, suggesting that a reverse mortgage reduced strain by 0.69 ($p = .001$). Consistent with Model 2, divorce or separation increased financial strain by 0.34 ($p = .004$). However, financial strain was reduced by 0.0005 ($p < .001$) and 0.0003 ($p = .021$), respectively, as non-housing equity and income rose by 1%. Finally, Model 4 estimated difficulty paying bills, highlighting that using a reverse mortgage reduced difficulty by 0.77 ($p < .001$). Furthermore, difficulty also decreased by 0.0004 ($p < .001$) and 0.0005 ($p < .001$) with 1% increase in non-housing equity and income. Having health insurance was associated with a 0.21 decrease ($p < .001$) in difficulty paying bills.

Table 4.4: Impact of Reverse Mortgage on Financial Situations: Fixed-Effects Estimation

Variable	Model 1 (n = 10,159)			Model 2 (n = 10,142)			Model 3 (n = 10,060)			Model 4 (n = 10,147)		
	Satisfaction with Financial Situation			Satisfaction with Household Income			Financial Strain			Difficulty Paying Bills		
	<i>Coef</i>	<i>se</i>	<i>p</i>	<i>Coef</i>	<i>se</i>	<i>p</i>	<i>Coef</i>	<i>se</i>	<i>p</i>	<i>Coef</i>	<i>se</i>	<i>p</i>
Had reverse mortgage	0.46	0.24	.054	0.69	0.25	.005	-0.69	0.21	.001	-0.77	0.22	<.001
Age group												
70-79	0.06	0.35	.096	0.03	0.04	.469	-0.05	0.03	.106	-0.03	0.03	.265
80+	-0.02	0.06	.698	-0.05	0.06	.420	-0.09	0.05	.072	-0.08	0.05	.073
Marital status												
Divorced/separated	-0.16	0.13	.228	-0.32	0.14	.022	0.34	0.12	.004	0.17	0.11	.141
Widowed	0.07	0.06	.278	0.04	0.07	.513	0.06	0.06	.289	-0.06	0.05	.302
Never married	0.03	0.31	.915	0.03	0.34	.920	-0.22	0.29	.450	-0.05	0.28	.867
Self-rated health	-0.03	0.02	.132	-0.01	0.02	.640	0.01	0.02	.461	0.01	0.02	.482
Had health insurance	0.20	0.06	.001	0.13	0.06	.041	-0.06	0.05	.296	-0.21	0.05	<.001
Non-housing equity (log)	0.04	0.01	<.001	0.04	0.01	.001	-0.05	0.01	<.001	-0.04	0.01	<.001
Income (log)	0.06	0.01	<.001	0.06	0.01	<.001	-0.03	0.01	.021	-0.05	0.01	<.001
Constant	2.43	0.21	<.001	2.36	0.22	<.001	2.36	0.19	<.010	2.83	0.18	<.001
R^2 (overall)	0.074			0.053			0.091			0.089		

Note. 1. Four biannual waves of 2010, 2012, 2014, and 2016 were used to form the panel data. 2. Sample were homeowners aged 62+. 3. Reference groups were had no reverse mortgage, age group of 62-69, married, and had no health insurance.

4.7 Discussion

This study uses four waves of the HRS panel data (2010-2016) to investigate the impact of reverse mortgages on senior homeowners' financial satisfaction and liquidity constraint. Two satisfaction domains and two aspects of liquidity constraint are examined, including satisfaction with financial situation and satisfaction with household income, as well as financial strain and difficulty paying bills. Findings indicate that using a reverse mortgage is profoundly related to older homeowners' increased financial and income satisfaction. Older people's liquidity constraints also diminishes after taking a reverse mortgage, shown as reduced difficulty paying bills and less financial strain. Current reverse mortgage studies are conducted primarily using macroeconomic data from the market perspective to show its benefits [92]. Our results from a borrower's point of view enrich the literature, suggesting that, in addition to the financial advantage of reduced liquidity strain, reverse mortgages also have a psychological impact through an individual's perception of enhanced financial wellbeing. Moreover, this study augments the latest descriptive work devoted to mean comparisons in financial variables before and after using a reverse mortgage [87]. Fixed-effects models in our work identify reverse mortgages as a prominent factor to explain higher satisfaction, and meanwhile, ascertain and quantify incremental changes in satisfaction attributed to reverse mortgages.

Hypotheses postulating that a reverse mortgage likely increases satisfaction and reduces liquidity strain are both supported. Specifically, higher financial satisfaction, higher income satisfaction, less financial strain and less difficulty paying bills are ascribed to using a reverse mortgage. Aside from these fundamental findings, there are a few important points

to make. First, four regression models indicate that non-housing equity promotes financial and income satisfaction, reducing strain and financial difficulty. As a reminder, non-housing equity is measured as the sum of balance in savings and investment accounts. This suggests that, controlling for reverse mortgage, financial assets by themselves play a vital role in older people's financial wellbeing [78]. Therefore, despite availability of reverse mortgages in the financial market, wealth accumulation as a momentous financial task in household resource management may always be a priority.

Second, overall age group as a categorical variable does not have a statistically significant impact on financial satisfaction or strain. We further test regression models on three subsamples consisting of respondents ages 62-69, 70-79 and 80+, revealing that the financial situation of respondents age 80 and above is statistically improved after taking a reverse mortgage. For example, financial satisfaction measured on 1-5 scale increases by 1.33¹² for those who take reverse mortgages; financial strain measured on 1-4 scale reduces by 1.93¹³. This novel finding delivers an important message, narrowing the age range likely to obtain the most financial and psychological benefits from using a reverse mortgage. Recall that one concern about using reverse mortgages is early equity exhaustion [111]. This finding suggests that postponing a reverse mortgage until one's late 70's or early 80's may help prevent unnecessary equity depletion and obtain financial benefit from the loan.

Aside from expounding the impact from reverse mortgages to promote seniors' financial security, we also identify three groups of individuals who are particularly at risk for financial vulnerability even if they may be eligible for reverse mortgages. First, having

¹² $p = .045$

¹³ $p = .001$

health insurance predicts higher financial satisfaction and lower strain after controlling for using reverse mortgages. A closer examination indicates that this impact holds true only if a respondent has Medicare or Medicaid; using privately-purchased health insurance, accounting for approximately 10% in our sample, does not show an effect. This finding infers that using government health insurance¹⁴ promotes an older person's financial stability and liquidity constraint, possibly due to affordable premiums and coverage of the plan. Thus, older people whose health plans are unaffordable, and who have limited coverage, are more susceptible to financial strain even though they may choose a reverse mortgage to cover living expenses.

Next, across four dependent variables, higher household income consistently improves financial wellbeing. However, when income is below the median income in our reverse-mortgagor sample, \$26,184, reverse mortgage does not show any impact on improved satisfaction or alleviated financial strain. Put another way, a reverse mortgage does not help financial situations for "the poorest of the poor." According to the U.S. Department of Health and Human Services [35], the federal poverty line (FPL) for a household of two is \$16,020¹⁵. Given our sample, only when an older person's household income exceeds 150% of the FPL would a reverse mortgage loan enhance his financial health. In other words, reverse mortgages may not save senior homeowners from tight budgets when their income barely meets the base level for a minimally acceptable standard of living.

Finally, controlling for reverse mortgage, divorce or marital separation reduces income satisfaction, adding financial strains. That is, single households are more vulnerable to

¹⁴In 2016, Medicare Part B monthly premium is \$121.8 for people who file an individual tax return with income lower than \$85,000 [22].

¹⁵ $26,184/16,020 = 1.63$

financial instability and budget constraint, which is consistent with findings in previous studies [43]. For seniors living alone, a reverse mortgage provides additional income. On the other hand, to abide by the loan contract, the borrower has to occupy the residence; otherwise, they must begin repaying the loan. Nevertheless, as part of living arrangements in later years, seniors tend to move to nursing homes or community apartments [87], and thus are ineligible for reverse mortgages. Therefore, seniors living in single households may need extra attention on their financial wellbeing.

Taken together, this study provides evidence for increased financial wellbeing resulting from reverse mortgages, with specifics on individual characteristics suggesting who may and may not attain such benefits. This study would be improved, however, if addressing the following aspects. First, all homeowners age 62+ considered (N = 13,231), there are 215 unique reverse mortgage borrowers, constituting 1.6% of the sample, which is under-representative of the general population of reverse mortgagors of 2.1% in 2011 [92].

Second, satisfaction domains are measured using LB questionnaire, a survey using subsamples from core HRS face-to-face interviews, resulting in reduced sample size from core HRS in all waves. Combining the above two aspects, reverse mortgagors having responses on, and showing changes in, satisfaction and liquidity constraints are limited. Across four waves, a total of 687 responses contain somewhere between 120 – 160 responses showing changes in dependent variables, which are then usable in fixed-effects estimates. This range of sample size, although small, meets the minimum number of responses recommended for regression analysis [49].

Finally, a few factors if added to the model would improve its estimation. For example, type of payment, especially lump sum payment, which usually is an enticement to potential

borrowers, affects borrowing decisions. However, the HRS does not contain such information. Another example is occurrence of health shocks, a prominent factor shown to influence the decision to use a reverse mortgage. Although relevant measures are available in the HRS, when combined with reverse mortgage measures, there are insufficient responses for valid estimates.

4.8 Implication

This paper provides evidence of reverse mortgages' impact on improved financial satisfaction and alleviated liquidity strain. In addition, we find that benefit potentials of reverse mortgages tend to maximize when homeowners reach age 80 and when household income is at least 150% of the FPL. In two ways, educators and policymakers committed to improving seniors' financial health may put the above findings into practice.

First, for educators, age 75 may be used as a criterion to assess risk of early equity exhaustion. Equity depletion at an old age is nearly irreversible, so any decision to release home equity should be handled with caution. Given longevity, it is noteworthy for counselors to clarify ramifications of early equity withdrawal. This is especially needed when the biggest increase in taking reverse mortgages is seen at age 62, the youngest eligible age [92], imposing perils of using up housing capital too soon. Along with the suggestion to postpone a reverse mortgage to an older age, counselors may also offer advice on supplementing income in the meantime: for example, younger seniors may take a part-time job if physical condition allows. By doing so, older people in need of additional income may reduce the possibility of or delay the occurrence of unnecessary depletion of equity.

Second, the fact that reverse mortgages do not help “the poorest of the poor” indicates

an imperative need for policymakers to ensure financial security among low-income seniors. That is, when income barely meets basic living needs, liquidating home equity does not solve one's problems; not to mention that eventually housing capital will probably be gone. Of course, the Social Security system serves the function of maintaining older adults' minimum standard of living. Apart from Social Security benefits, other strategies to assist low-income elder homeowners may be taken. Take the example of the homestead exemption statute, in which, upon approval, home property tax is reduced through deducting the exempted amount: the eligible age for the homestead exemption could be lowered from 65 to 62, which is also the minimum age to take a reverse mortgage and an age where the biggest increase is seen in use of reverse mortgages. States that do not offer the homestead exemption¹⁶ may consider implementing similar strategies to reduce property tax liability and to protect low-income seniors from losing their homes, especially when many homeowners take reverse mortgages to cover property tax [67].

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¹⁶States that do not offer homestead protection include New Jersey and Pennsylvania. States that offer the exemption include Kentucky and Kansas.

CHAPTER 5. SIGNIFICANCE OF THREE STUDIES

This dissertation focuses on American middle-aged and older adults' mortgage loans and examines the impact of mortgage debt in later years on their financial security. Three specific issues related to mortgage loans are investigated: 1) whether lack of retirement preparedness relates to larger loan amounts at retirement; 2) whether a health shock reduces likelihood of mortgage payoff; and 3) whether a reverse mortgage loan increases financial satisfaction in retirement.

Evidence is clear that managing mortgage loan debt is a critical component in building lifetime wealth and enhancing financial satisfaction in later years. The first study indicates that individuals with at least some preparation are less likely to carry mortgage debts into retirement. Even if they cannot pay down mortgage debts before or at retirement, remaining mortgage balances tend to be smaller with higher preparedness level. Study 2 finds that a health shock reduces likelihood of mortgage payoff. Estimation on time to payoff shows that given same health, older mortgagors are approaching mortgage maturation at a slower speed than younger counterparts. As suggested by Study 3, when liquidity is constrained, reverse mortgages relieve financial strain. That is, under limited resources, a senior may liquidate home equity in order to increase financial satisfaction.

In a nutshell, this dissertation delivers the following messages. In order to achieve financial security in retirement, first be prepared to manage mortgage debts—the earlier, the better. Second, make efforts to pay off mortgage debts before health shocks occur—the older a person is, the more difficult it would be for them to pay down mortgage loans.

Finally, to shield against financial strain in later years, home equity may be released to supplement income; and a reverse mortgage is one possibility to consider.

Specifically, the first study addresses mortgage loan debt among middle-aged and older Americans by examining whether having mortgage loans in later years results from unpreparedness or under-preparedness for retirement. A major finding from Study 1 is that retirement preparedness promotes mortgage payoff: people with at least some preparation for retirement are more likely to pay down their mortgages before onset of or at retirement. In addition, although some people are not able to pay off mortgage debts and therefore carry mortgage loans into retirement, when they have some level of retirement preparation, their loan-to-value ratios tend to be smaller. That is, given the same home price, older people with higher retirement preparation have smaller mortgage balances. It is worth noting that preparation is only prominent for pre-retirees in mortgage debt management, but not for the retired. Understandably, people who are not retired yet still have time to make financial adjustments and to implement mortgage management strategies as part of their retirement planning. After they are retired, preparation is of little help in alleviating mortgage debt burden. Therefore, apart from evidence on preparation and its impact on mortgage loan debt, another highlight in the findings is the importance of planning early.

Next, older people's declining health and increasing healthcare costs are two factors exacerbating financial hardship when wealth is limited and they have mortgage debt. As people age, demand for healthcare increases, with higher possibilities of experiencing health shocks. One ramification is financial shocks from large out-of-pocket medical expenses. Under this circumstance, when older people have mortgage debt to pay, we need deeper understanding of how their health may influence their mortgage payments.

In line with health, the second study in this dissertation examines mortgage payments in association with middle-aged and older Americans' health: how does health affect likelihood of mortgage payoff, and what is the expected payoff time by health conditions? A novel finding from Study 2 is that mortgage payoff is postponed when experiencing health shocks. The extent of postponement depends on a mortgagor's age, controlling for other predictors: when health shocks occur, the older a person is, the longer the delay. This result testifies that older mortgagors are more vulnerable to financial insecurity from health problems, stressing the importance of paying off mortgage debt as early as possible. In addition, health shocks have lingering effects on mortgage payments. Shocks occurring years ago still have an impact on the likelihood of paying a mortgage off today, possibly from expenses for health maintenance or related chronic illnesses.

The third study focuses on reverse mortgages, a type of loan available for homeowners age 62 and older, allowing access to home equity. While the first two studies aim to reduce mortgage loan debt by examining the role of preparedness and impact of health, Study 3 explores whether taking a reverse mortgage helps increase financial satisfaction and reduce liquidity constraint. Theoretically, equity in later years is a supplement to limited resources, helping to sustain quality of life by transferring assets accumulated in working years to times when income is low. In practice, understanding the effect of reverse mortgages on senior borrowers' financial situations is important for three reasons. First, older adults have demand for home equity. Second, equity, if not carefully handled, may be exhausted. Third, when used rationally, equity brings benefits.

Therefore, Study 3 investigates whether enhanced financial satisfaction results from a reverse mortgage, and the extent of satisfaction increase. Results identify reverse mortgages

as a prominent factor to explain higher satisfaction, and also reduced financial strain and difficulty paying bills. This is one of the few studies showing the impact of reverse mortgages from the perspective of the borrowers' financial wellbeing, quantifying the magnitude of impact. Furthermore, this study contributes to reverse mortgage literature by identifying three groups of people who may not attain these benefits: seniors younger than age 80, single-household individuals and elder people whose income is below 150% of the federal poverty line. These findings should be put into practice for better financial outcomes: in counseling sessions, potential reverse mortgage borrowers may be informed on 1) whether they should take a reverse mortgage; and 2) at what age they should take the loan.

CHAPTER 6. LIMITATION

This dissertation provides evidence on enhancing middle-aged and older Americans' financial security through mortgage management. Three studies navigate factors of retirement preparedness, health impact and use of reverse mortgages for better financial health. Despite the important findings, the following issues, if addressed, will improve the three studies.

First, this dissertation focuses on mortgage debt; so accurate dollar values of the home presently, mortgage balance, and thus home equity and loan-to-value ratio are important. HRS uses self-reported dollar values on measures of the above financial variables, likely to be different from actual dollar values: for example, numbers reflected on a bank statement.

Second, the concept "mortgage payoff" is used to stand for transitioning from the status of "Have a mortgage" to "Have no mortgage." However, status of "Have no mortgage" may result from either completion of payment or from foreclosure because of delinquency. These two mechanisms linking to "mortgage payoff" are not distinguished in this dissertation. Future studies may consider identifying reasons behind "mortgage payoff" for more informative results.

Next, in studying health impact on likelihood of mortgage payoff, dollar values of out-of-pocket expenses are not factored into survival analysis models. When adding the predictor of out-of-pocket expenses, due to missing responses, no mortgage payoff is observed. Since observation is a crucial component for survival analysis to build models, without observed payoff while having only censored data, model building is rendered impossible.

Finally, reverse mortgages are shown to improve financial satisfaction and reduce financial constraint. Factors shown to influence mortgage decisions may be added in regression models. For example, experience of health shock, large consumer debt, or decease of spouse. When adding these variables in this study, however, responses are too few to obtain valid estimates. There are two reasons. First, only 1.6 percent of homeowners age 62 in the sample use reverse mortgages. Second, measure of financial satisfaction is conducted on only a subsample of HRS core interviews. Considering the above two facts about data, model building is limited. Future studies may consider using larger sample on reverse mortgage borrowers or keeping track of the same borrowers for a longer period, to obtain more responses for model building.

Appendix A

(a) 1a. Percent of Near-Retirees Starting with No Preparedness

	2004	2006	2008	2010	2012	2014	Total
Age 50-54	(n = 2,464)	(n = 1,503)	(n = 622)	(n = 3,499)	(n = 2,109)	(n = 804)	(n = 11,001)
	41.6	40.8	47.0	43.1	40.4	42.7	42.1

(b) 1b. Percent of Near-Retirees Starting with No Preparedness Showing No Increase in Preparedness Over Time

	(n = 1,026)	(n = 613)	(n = 292)	(n = 1,509)	(n = 851)	(n = 343)	(n = 4,634)
Age 50-54	43.7	41.9	43.5	56.5	57.5	79.0	52.7

(a) 2a. Percent of Near-Retirees Starting with No Preparedness

	2004	2006	2008	2010	2012	2014	Total
Age 55-60	(n = 2,871)	(n = 2,991)	(n = 3,022)	(n = 4,282)	(n = 4,378)	(n = 4,292)	(n = 21,836)
	41.6	37.0	36.0	39.2	37.6	37.9	38.2

(b) 2b. Percent of Near-Retirees Starting with No Preparedness Showing No Increase in Preparedness Over Time

	(n = 1,193)	(n = 1,107)	(n = 1,089)	(n = 1,677)	(n = 1,645)	(n = 1,626)	(n = 8,337)
Age 55-60	43.0	37.6	38.8	47.6	48.1	50.3	45.1

Appendix B

Ever Used Reverse Mortgage		
N = 215		
Started with No Reverse Mortgage		Started with Reverse Mortgage
n = 91		n = 124
Had DV before using reverse mortgage		
n = 66		
No DV value before using reverse mortgage		
n = 25		
Had DV value after using reverse mortgage	No DV value after using reverse mortgage	
n = 28	n = 38	

Note. Panel sample had 215 unique reverse mortgage borrowers. DV = dependent variable. This table used "Difficulty Paying Bills" as an example.

REFERENCES

- [1] Agarwal, S., Driscoll, J. C., Gabaix, X., & Laibson, D. (2008). *Learning in the credit card market* (National Bureau of Economic Research Working Paper No. w13822). Retrieved from: http://users.nber.org/aging/roybalcenter/fees_apr24_2011.pdf.
- [2] Alam, K., & Mahal, A. (2014). Economic impacts of health shocks on households in low- and middle- income countries: A review of the literature. *Globalization and Health*, 10(1), 21. doi: <https://doi.org/10.1186/1744-8603-10-21>
- [3] Alley, D. E., Lloyd, J., Pagán, J. A., Pollack, C. E., Shardell, M., & Cannuscio, C. (2011). Mortgage delinquency and changes in access to health resources and depressive symptoms in a nationally representative cohort of Americans older than 50 years. *American Journal of Public Health*, 101(12), 2293-2298. doi: 10.2105/AJPH.2011.300245
- [4] Allison, P. D. (1984). *Event history analysis: Regression for longitudinal event data*. Thousand Oaks, CA: Sage.
- [5] Anguelov, C. E., & Tamborini, C. R. (2009). Retiring in debt: Differences between the 1995 and 2004 near-retiree cohorts. *Social Security Bulletin*, 69(2), 13-34. Retrieved from: <https://heinonline.org/HOL/Page?handle=hein.journals/ssbul69&id=97&collection=journals&index=>
- [6] Aughinbaugh, A. (2013). *Patterns of homeownership, delinquency, and foreclosure among youngest Baby Boomers* (Cornell University Federal Publications). Retrieved from: https://digitalcommons.ilr.cornell.edu/cgi/viewcontent.cgi?article=2030&context=key_workplace
- [7] Baltes, B. B., & Rudolph, C. W. (2012). The theory of selection, optimization, and compensation. In Wang, M. (Ed.). *The oxford handbook of retirement*. New York, NY: Oxford University Press.
- [8] Becker, T. A., & Shabani, R. (2010). Outstanding debt and the household portfolio. *Review of Financial Studies*, 23(7), 2900-2934. doi: <https://doi.org/10.1093/rfs/hhq023>
- [9] Blakeley, J. A., & Ribeiro, V. E. (2008). Early retirement among registered nurses: Contributing factors. *Journal of Nursing Management*, 16(1), 29-37. doi: 10.1111/j.1365-2934.2007.00793.x.
- [10] Bodie, Z., Treussard, J., & Willen, P. (2007). *The theory of life-cycle saving and investing*. (Federal Reserve Bank of Boston, Discussion Paper No. 07-3). Retrieved from: <https://www.econstor.eu/bitstream/10419/59251/1/568697014.pdf>
- [11] Brischetto, A., & Rosewall, T. (2007). *Loan approvals, repayments and housing credit growth* (Reserve Bank Bulletin). Retrieved from: <https://www.rba.gov.au/publications/bulletin/2007/jul/1.html>

- [12] Browning, M., & Lusardi, A. (1996). Household saving: Micro theories and micro facts. *Journal of Economic literature*, 34(4), 1797-1855. Retrieved from: <https://www.jstor.org/stable/2729595>
- [13] Bucks, B., & Pence, K. M. (2006). *Do homeowners know their house values and mortgage terms?* (Federal Reserve Board Divisions of Research & Statistics and Monetary Affairs). Retrieved from: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.591.9187&rep=rep1&type=pdf>
- [14] Bureau of Labor Statistics. (2016). *A closer look at spending patterns of older Americans*. Retrieved from: <https://www.bls.gov/opub/btn/volume-5/spending-patterns-of-older-americans.htm>
- [15] Butrica, B. A., & Mudrazija, S. (2016). *Home equity patterns among older American households* (Urban Institute Research Report). Retrieved from: http://www.urban.org/sites/default/files/publication/85326/home-equity-patterns-among-older-american-households_0.pdf
- [16] Cagetti, M. (2003). Wealth accumulation over the life cycle and precautionary savings. *Journal of Business & Economic Statistics*, 21(3), 339-353. doi: 10.1198/00
- [17] Cagney, K. A., Browning, C. R., Iveniuk, J., & English, N. (2014). The onset of depression during the great recession: foreclosure and older adult mental health. *American Journal of Public Health*, 104(3), 498-505. doi: 10.2105/AJPH.2013.301566
- [18] Campbell, J. Y., & Cocco, J. F. (2015). A model of mortgage default. *The Journal of Finance*, 70(4), 1495-1554. doi: <https://doi.org/10.1111/jofi.12252>
- [19] Carroll, C. D. (1997). Buffer-stock saving and the life-cycle/permanent income hypothesis. *Quarterly Journal of Economics*, 112(1), 1-55. doi: <https://doi.org/10.1162/003355397555109>
- [20] Centers for Disease Control and Prevention. (2016). *Chronic disease overview*. Retrieved from: <https://www.cdc.gov/chronicdisease/overview/>
- [21] Centers for Disease Control and Prevention. (2018). *Arthritis at a glance: Promoting quality of life for people with arthritis*. Retrieved from: <https://www.cdc.gov/chronicdisease/resources/publications/aag/pdf/2016/aag-arthritis.pdf>
- [22] Center for Medicare & Medicaid Services (2016). *2016 Medicare Parts A & B premiums and deductibles announced*. Retrieved from: <https://www.cms.gov/newsroom/press-releases/2016-medicare-parts-b-premiums-and-deductibles-announced>
- [23] Centers for Medicare & Medicaid Services. (2016). *Health expenditures by age and gender*. Retrieved from: <https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/Age-and-Gender.html>

- [24] Chiuri, M. C., & Jappelli, T. (2010). Do the elderly reduce housing equity? An international comparison. *Journal of Population Economics*, 23(2), 643-663. doi: <https://doi.org/10.1007/s00148-008-0217-4>
- [25] Chou, K. L., Chow, N. W., & Chi, I. (2006). Willingness to consider applying for reverse mortgage in Hong Kong Chinese middle-aged homeowners. *Habitat International*, 30(3), 716-727. doi: <https://doi.org/10.1016/j.habitatint.2005.04.008>
- [26] Clark, R. L., Hammond, R. G., Morrill, M. S., & Vanderweide, D. (2017). *Annuity Options in Public Pension Plans: The Curious Case of Social Security Leveling* (National Bureau of Economic Research Working Paper No. w23262). Retrieved from: <http://www.nber.org/papers/w23262>
- [27] Cleves, M., Gould, W. W., & Marchenko, Y. V. (2016). *An introduction to survival analysis using Stata*. College Station, TX: Stata Press.
- [28] Consumer Financial Protection Bureau. (2014). *Snapshot of older consumers and mortgage debt*. Retrieved from: http://files.consumerfinance.gov/f/201405_cfpb_snapshot_older-consumers-mortgage-debt.pdf
- [29] Consumer Financial Protection Bureau. (2017). *Snapshot of older consumers and student loan debt*. Retrieved from: http://files.consumerfinance.gov/f/documents/201701_cfpb_OA-Student-Loan-Snapshot.pdf
- [30] Copeland, C. (2015). Debt of the Elderly and Near Elderly, 1992-2013. *Employee Benefit Research Institute, Notes*, 36 (1). Retrieved from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2557538
- [31] Costa-Font, J., Gil, J., & Mascarilla, O. (2010). Housing wealth and housing decisions in old age: sale and reversion. *Housing Studies*, 25(3), 375-395. doi: <https://doi.org/10.1080/02673031003711014>
- [32] Coulibaly, B., & Li, G. (2009). Choice of mortgage contracts: evidence from the survey of consumer finances. *Real Estate Economics*, 37(4), 659-673. doi: <https://doi.org/10.1111/j.1540-6229.2009.00259.x>
- [33] Davidoff, T. (2010). Home equity commitment and long-term care insurance demand. *Journal of Public Economics*, 94(1), 44-49. doi: <https://doi.org/10.1016/j.jpubeco.2009.09.006>
- [34] Deng, Y., Quigley, J. M., & Van Order, R. (2000). Mortgage terminations, heterogeneity and the exercise of mortgage options. *Econometrica*, 68(2), 275-307. doi: <https://doi.org/10.1111/1468-0262.00110>
- [35] Department of Housing and Urban Development. (2016). *Home Equity Conversion Mortgages for Seniors*. Retrieved from: https://portal.hud.gov/hudportal/HUD?src=/program_offices/housing/sfh/hecm/hecmhome

- [36] De Nardi, M., French, E., & Jones, J. B. (2010). Why do the elderly save? The role of medical expenses. *Journal of Political Economy*, 118(1), 39-75. doi: <https://doi.org/10.1086/651674>
- [37] De Nardi, M., French, E., & Jones, J. B. (2016). Medicaid insurance in old age. *The American Economic Review*, 106(11), 3480-3520. doi: 10.1257/aer.20140015
- [38] Dillingh, R., Prast, H., Rossi, M., & Brancati, C. U. (2013). *The psychology and economics of reverse mortgage attitudes: evidence from the Netherlands* (Center for Research on Pensions and Welfare Policies No. 135). Retrieved from: http://fileserv.carloalberto.org/cerp/WP_135.pdf
- [39] Disney, R., & Gathergood, J. (2013). Financial literacy and consumer credit portfolios. *Journal of Banking & Finance*, 37(7), 2246-2254. doi: 10.1016/j.jbankfin.2013.01.013
- [40] Duca, J. V., Muellbauer, J., & Murphy, A. (2011). House prices and credit constraints: Making sense of the US experience. *The Economic Journal*, 121(552), 533-551. doi: <https://doi.org/10.1111/j.1468-0297.2011.02424.x>
- [41] Federal Reserve Bank of New York. (2017). *Quarterly report on household debt and credit*. Retrieved from: https://www.newyorkfed.org/medialibrary/interactives/householdcredit/data/pdf/HHDC_2016Q4.pdf
- [42] Fisher, J. D., Johnson, D. S., Marchand, J. T., Smeeding, T. M., & Torrey, B. B. (2007). No place like home: Older adults and their housing. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 62(2), S120-S128. doi: <https://doi.org/10.1093/geronb/62.2.S120>
- [43] Fratantoni, M. C. (1999). Reverse Mortgage Choices. *Journal of Housing Research*, 10(2), 189-208. Retrieved from: <https://aresjournals.org/doi/abs/10.5555/jhor.10.2.k0736x187532876t>
- [44] Fuster, A., & Willen, P. S. (2013). *Payment size, negative equity, and mortgage default* (National Bureau of Economic Research Working Paper No. w19345). Retrieved from: https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr582.pdf
- [45] Gerardi, K., Goette, L., & Meier, S. (2010). *Financial literacy and subprime mortgage delinquency: Evidence from a survey matched to administrative data* (Federal Reserve Bank of Atlanta Working Paper No. 2010-10). Retrieved from: <https://www.econstor.eu/bitstream/10419/70651/1/637330404.pdf>
- [46] Gillen, M., & Kim, H. (2014). Older Adults' Receipt of Financial Help: Does Personality Matter? *Journal of Family and Economic Issues*, 35(2), 178-189. doi: <https://doi.org/10.1007/s10834-013-9365-0>
- [47] Glamser, F. D. (1976). Determinants of a positive attitude toward retirement. *Journal of Gerontology*, 31(1), 104-107. doi: <https://doi.org/10.1093/geronj/31.1.104>

- [48] Greenspan, A., & Kennedy, J. (2008). Sources and uses of equity extracted from homes. *Oxford Review of Economic Policy*, 24(1), 120-144. doi: <https://doi.org/10.1093/oxrep/grn003> i:
- [49] Green, S. B. (1991). How many subjects does it take to do a regression analysis. *Multivariate Behavioral Research*, 26(3), 499-510. doi: https://doi.org/10.1207/s15327906mbr2603_7
- [50] Harper, S. (2014). Economic and social implications of aging societies. *Science*, 346(6209), 587-591. doi: 10.1126/science.1254405
- [51] Hurd, M. D. (1990). Research on the elderly: Economic status, retirement, and consumption and saving. *Journal of Economic Literature*, 28, 565-637. Retrieved from: https://www.jstor.org/stable/2727265#metadata_info_tab_contents
- [52] Hurst, E., & Stafford, F. P. (2004). Home is where the equity is: Mortgage refinancing and household consumption. *Journal of Money, Credit, and Banking*, 36(6), 985-1014. Retrieved from: https://www.jstor.org/stable/3839098?seq=1#metadata_info_tab_contents
- [53] Internal Revenue Service. (2018). *Itemized deduction*. Retrieved from: <https://www.irs.gov/taxtopics/tc500>
- [54] Internal Revenue Service. (2018). *Tips for seniors in preparing their taxes*. Retrieved from: <https://www.irs.gov/individuals/seniors-retirees/tips-for-seniors-in-preparing-their-taxes>
- [55] Jones, A. M., Rice, N., & Roberts, J. (2010). Sick of work or too sick to work? Evidence on self-reported health shocks and early retirement from the BHPS. *Economic Modelling*, 27(4), 866-880. doi: 10.1016/j.econmod.2009.10.001
- [56] Jones, L. D. (1993). The demand for home mortgage debt. *Journal of Urban Economics*, 33(1), 10-28. doi: <https://doi.org/10.1006/juec.1993.1002>
- [57] Joo, S. H., & Grable, J. E. (2005). Employee education and the likelihood of having a retirement savings program. In Xiao, J. J. (Ed.). *Handbook of consumer finance research*, 2nd edition. New York: Springer.
- [58] Kahn, J. R., & Pearlin, L. I. (2006). Financial Strain over the Life Course and Health among Older Adults. *Journal of Health and Social Behavior*, 47(1), 17-31. doi: <https://doi.org/10.1177/002214650604700102>
- [59] Karamcheva, N. S. (2013). *Is Household Debt Growing for Older Americans?* (Urban Institute Working Paper No. 2013-33). Retrieved from: <http://www.urban.org/sites/default/files/publication/23286/412742-is-household-debt-growing-for-older-americans.pdf>
- [60] Kilty, K. M., & Behling, J. H. (1985). Predicting the retirement intentions and attitudes of professional workers. *Journal of Gerontology*, 40(2), 219-227. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/3973365>

- [61] Kim, Y. T. & Hanna, S. D. (2015). Does financial sophistication matter in retirement preparedness? *Journal of Personal Finance*, 14(2), 9-20. Retrieved from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2651293
- [62] Kizito, O. (2015). Negative Effects of Home Foreclosures on Mental and Physical Health Risks. *International Journal of Risk and Contingency Management*, 14(2), 1-19. Retrieved from: <https://www.execrank.com/board-of-directors-articles/understanding-the-negative-effects-of-home-foreclosures-on-mental-and-physical-health>
- [63] Kutty, N. K. (1998). The scope for poverty alleviation among elderly home-owners in the United States through reverse mortgages. *Urban Studies*, 35(1), 113-129. doi: <https://doi.org/10.1080/0042098985104>
- [64] Lee, J., & Kim, H. (2008). A longitudinal analysis of the impact of health shocks on the wealth of elders. *Journal of Population Economics*, 21(1), 217-230. doi:10.1007/s00148-007-0156-5
- [65] Lee, Y. G., Lown, J. M., & Sharpe, D. L. (2007). Predictors of holding consumer and mortgage debt among older Americans. *Journal of Family and Economic Issues*, 28(2), 305-320. doi: 10.1007/s10834-007-9055-x
- [66] Leith, K. H. (2006). "Home is where the heart is... or is it?": A phenomenological exploration of the meaning of home for older women in congregate housing. *Journal of Aging Studies*, 20(4), 317-333. doi: <https://doi.org/10.1016/j.jaging.2005.12.002>
- [67] Leviton, R. (2002). Reverse mortgage decision-making. *Journal of Aging & Social Policy*, 13(4), 1-16. doi: https://doi.org/10.1300/J031v13n04_01
- [68] Lindblad, M. R., & Riley, S. F. (2015). Loan Modifications and Foreclosure Sales during the Financial Crisis: Consequences for Health and Stress. *Housing Studies*, 30(7), 1092-1115. Retrieved from: <https://communitycapital.unc.edu/research/loan-modifications-and-foreclosure-sales-during-the-financial-crisis-consequences-for-health-and-stress/>
- [69] Li, W., & Goodman, L. (2015). *Americans' debt styles by age and over time* (Urban Institute Working Paper). Retrieved from: <http://www.urban.org/sites/default/files/publication/72976/2000514-Americans-Debt-Styles-by-Age-and-over-Time.pdf>
- [70] Li, W., & White, M. J. (2009). *Mortgage default, foreclosure, and bankruptcy* (National Bureau of Economic Research Working Paper No. w15472). Retrieved from: <https://www.nber.org/papers/w15472.pdf>
- [71] Loonin, D., & Renuart, E. (2007). The life and debt cycle: The growing debt burdens of older consumers and related policy recommendations. *Harvard Journal on Legislation*, 44, 167. Retrieved from: https://heinonline.org/HOL/Page?collection=journals&handle=hein.journals/hjl44&id=172&men_tab=srchresults

- [72] Love, D. A., Smith, P. A., & McNair, L. C. (2007). *Do households have enough wealth for retirement?* (Federal Reserve Board). Retrieved from: <https://www.federalreserve.gov/Pubs/feds/2007/200717/200717pap.pdf>
- [73] Lowry, S. (2017). *Itemized tax deduction for individuals: Data analysis* (Congressional Research Service). Retrieved from: <https://fas.org/sgp/crs/misc/R43012.pdf>
- [74] Lusardi, A. (2011). *Americans' financial capability* (National Bureau of Economic Research No. w17103). Retrieved from: <https://core.ac.uk/download/pdf/6358631.pdf>
- [75] Lusardi, A., Mitchell, O. S., & Oggero, N. (2016). *Debt and Financial Vulnerability on the Verge of Retirement* (Stanford Institute for Economic Policy Research Working Paper). Retrieved from: http://siepr.stanford.edu/system/files/Lusardi%20and%20Mitchell_Debt_9-27-2016.pdf
- [76] Lusardi, A., & Mitchell, O. S. (2006). Baby boomer retirement security: The roles of planning, financial literacy, and household wealth. *Journal of Monetary Economics*, 54(1), 205-224. doi: <https://doi.org/10.1016/j.jmoneco.2006.12.001>
- [77] Lusardi, A., & Mitchell, O. S. (2011). *Financial literacy and planning: Implications for retirement wellbeing* (National Bureau of Economic Research Working Paper No. w17078). Retrieved from: <https://deepblue.lib.umich.edu/bitstream/handle/2027.42/49432/wp108.pdf?sequence=1&isAllowed=y>
- [78] Lusardi, A., & Mitchell, O. S. (2014). The economic importance of financial literacy: Theory and evidence. *Journal of Economic Literature*, 52(1), 5-44. doi: 10.1257/jel.52.1.5
- [79] Lusardi, A., & Scheresberg, C. D. B. (2013). *Financial literacy and high-cost borrowing in the United States* (National Bureau of Economic Research Working Paper No. w18969). Retrieved from: https://www.researchgate.net/profile/Jean_Fitoussi/publication/45125476_An_Economists%27_Manifesto_on_Unemployment_in_the_European_Union/links/55d1bb8308ae95c3504d5a78/An-Economists-Manifesto-on-Unemployment-in-the-European-Union.pdf#page=18
- [80] Mandelberg, J. H., Kuhn, R. E., & Kohn, M. A. (2000). Epidemiologic analysis of an urban, public emergency department's frequent users. *Academic Emergency Medicine*, 7(6), 637-646. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/10905642>
- [81] Mayer, R. N., Zick, C. D., & Marsden, M. (2011). Does calculating retirement needs boost retirement savings? *Journal of Consumer Affairs*, 45(2), 175-200. doi: 10.1111/j.1745-6606.2011.01199.x
- [82] Merrill, S. R., Finkel, M., & Kutty, N. K. (1994). Potential beneficiaries from reverse mortgage products for elderly homeowners: an analysis of American housing survey data. *Real Estate Economics*, 22(2), 257-299. doi: <https://doi.org/10.1111/1540-6229.00635>

- [83] Mian, A., Rao, K., & Sufi, A. (2013). Household balance sheets, consumption, and the economic slump. *The Quarterly Journal of Economics*, 128(4), 1687-1726. Retrieved from: <https://pdfs.semanticscholar.org/75a5/00894c5ffa5f9203a7e223e3a61f9eb7aa29.pdf>
- [84] Michelangeli, V. (2012). *Should you pay off your mortgage or invest?* *Economics Letters*, 115(2), 322-324. doi: <https://doi.org/10.1016/j.econlet.2011.12.021>
- [85] Modigliani, F., & Brumberg, R. (1954). Utility analysis and the consumption function: An interpretation of cross-section data. In K. K. Kurihara (Ed.), *Post-Keynesian economics* (pp. 388–436). New Brunswick: Rutgers University Press.
- [86] Moore, D. (2003). *Survey of financial literacy in Washington state: Knowledge, behavior, attitudes, and experiences* (Social and Economic Sciences Research Center Technical Report No. 03-39). doi: 10.13140/2.1.4729.4722
- [87] Moulton, S., Loibl, C., & Haurin, D. (2017). *Reverse mortgage motivations and outcomes insights from survey data* (U.S. Department of Housing and Urban Development Office of Policy Development and Research). Retrieved from: https://www.jstor.org/stable/pdf/26328299.pdf?casa_token=x89KuxrGYCUAAAAA:F1uPR-JgmNF0-eFunkk9nq3QdM2XIZWPt5iNhNep-Sp4i1VHD0WKxSKV2sXIf7k3OTwugbMX4dw0ovv7o2nrAZ_5r-roJySNHWQXtB1zm_tnSSpU6wnPg
- [88] Munnell, A. H., Golub-Sass, F., & Webb, A. (2007). *Is there really a retirement savings crisis? A National Retirement Risk Index analysis* (Center for Retirement Research at Boston College). Retrieved from: <http://www.prisha.co.il/UserFiles/File/pdf/mix-som14.pdf>
- [89] Munnell, A. H., Soto, M., Triest, R. K., & Zhivan, N. (2008). *How much do state economics and other characteristics affect labor force participation of older workers?* (Center for Retirement Research at Boston College Working Paper 2008-12). Retrieved from: http://crr.bc.edu/wp-content/uploads/2008/08/wp_2008-12.pdf
- [90] Munnell, A. H., Soto, M., & Aubry, J. P. (2007). *Do People Plan to Tap Their Home Equity in Retirement?* Chestnut Hill, MA: Center for Retirement Research at Boston College.
- [91] Nakajima, M. (2012). *Everything you always wanted to know about reverse mortgages but were afraid to ask* (Federal Reserve Bank of Philadelphia Quaterly 1, 19-31). Retrieved from: <https://ideas.repec.org/a/fip/fedpbr/y2012iq1p19-31.html>
- [92] Nakajima, M., & Telyukova, I. A. (2014). *Reverse mortgage loans: A quantitative analysis* (Federal Reserve Bank of Philadelphia Research Department No. 14-2). Retrieved from: <https://www.philadelphiafed.org/-/media/research-and-data/publications/working-papers/2014/wp14-27.pdf>

- [93] Paez, K. A., Zhao, L., & Hwang, W. (2009). Rising out-of-pocket spending for chronic conditions: A ten-year trend. *Health affairs*, 28(1), 15-25. doi: <https://doi.org/10.1377/hlthaff.28.1.15>
- [94] Perraudin, W. R., & Sørensen, B. E. (2000). The demand for risky assets: Sample selection and household portfolios. *Journal of Econometrics*, 97(1), 117-144. Retrieve from: <http://www.uh.edu/~bsorensen/Engelpublished.pdf>
- [95] Poterba, J. M., Venti, S. F., & Wise, D. A. (2017). The asset cost of poor health. *The Journal of the Economics of Ageing*, 9, 172-184. doi: <https://doi.org/10.1016/j.jeoa.2017.02.001>
- [96] Poterba, J., & Sinai, T. (2008). Tax expenditures for owner-occupied Housing: Deductions for property taxes and mortgage interest and the exclusion of imputed rental income. *The American Economic Review*, 98(2), 84-89. doi: 10.1257/aer.98.2.84
- [97] Redfoot, D. L., Scholen, K., & Brown, S. K. (2007). *Reverse mortgages: Niche product or mainstream solution?* (The American Association of Retired Persons Public Policy Institute No. 2007-22). Retrieved from: https://assets.aarp.org/rgcenter/consume/2007_22_rev mortgage.pdf
- [98] Retsinas, N. P., & Belsky, E. S. (Eds.). (2004). *Low-income homeownership: Examining the unexamined goal*. Washington, D.C.: Brookings Institution Press.
- [99] Rhee, N. (2013). *The retirement savings crisis* (National Institute on Retirement Security). Retrieved from: https://www.sco.ca.gov/Files-EO/2013_sco_flac_retirement_savings_crisis_final_natl_institute_retirement.pdf
- [100] Sass, S. A. (2017). *Is Home Equity an Underutilized Retirement Asset?* (Center for Retirement Research at Boston College No. ib2017-6). Retrieved from: http://crr.bc.edu/wp-content/uploads/2017/03/IB_17-6_rev.pdf
- [101] Schuur, J. D., Carney, D. P., & Lyn, E. T. (2014). A top-five list for emergency medicine: A pilot project to improve the value of emergency care. *Journal of American Medical Association Internal Medicine*, 174(4), 509-515. doi:10.1001/jamainternmed.2013.12688
- [102] Seay, M., Asebedo, S., Thompson, C., Stueve, C., & Russi, R. (2015). Mortgage holding and financial satisfaction in retirement. *Journal of Financial Counseling and Planning*, 26(2), 200-216. Retrieved from: http://afcpe.org/assets/pdf/volume_26_2/pages_200-216.pdf
- [103] Shan, H. (2011). Reversing the trend: the recent expansion of the reverse mortgage market. *Real Estate Economics*, 39(4), 743-768. doi: <https://doi.org/10.1111/j.1540-6229.2011.00310.x>
- [104] Smith, J. (2005). *Consequences and predictors of new health events* (The National Bureau of Economic Research Working Paper No. 10063). doi: 10.3386/w10063

- [105] Social Security Administration. (2010). *Income of the aged chart-book, 2010*. Retrieved from: https://www.ssa.gov/policy/docs/chartbooks/income_aged/2010/iac10.pdf
- [106] Social Security Administration. (2012). *Fast facts & figures about social security, 2012* (Social Security Administration). Retrieved from: https://www.ssa.gov/policy/docs/chartbooks/fast_facts/2012/fast_facts12.pdf
- [107] Social Security Administration. (2017). *Fact Sheet: 2017 Social Security Changes*. Retrieved from: <https://www.ssa.gov/news/press/factsheets/colafacts2017.pdf>
- [108] Springstead, G., & Biggs, A. G. (2008). *Alternate measures of replacement rates for social security benefits and retirement income* (Social Security Administration). Retrieved from: <https://www.ssa.gov/policy/docs/ssb/v68n2/v68n2p1.pdf>
- [109] Stango, V., & Zinman, J. (2013). *Borrowing high vs. borrowing higher: Sources and consequences of dispersion in individual borrowing costs* (National Bureau of Economic Research Working Paper No. w19069). Retrieved from: <https://ideas.repec.org/p/nbr/nberwo/19069.html>
- [110] Stark, D. P., & Choplin, J. M. (2010). A cognitive and social psychological analysis of disclosure laws and call for mortgage counseling to prevent predatory lending. *Psychology, Public Policy, and Law*, 16(1), 85. doi: <http://dx.doi.org/10.2139/ssrn.1482674>
- [111] Sun, W., Triest, R. K., & Webb, A. (2006). *Optimal retirement asset decumulation strategies: The impact of housing wealth*. Retrieved from: <https://crr.bc.edu/working-papers/optimal-retirement-asset-decumulation-strategies-the-impact-of-housing-wealth/>
- [112] The Health and Retirement Study. (2016). *Aging in the 21st century: Challenges and opportunities for Americans*. Retrieved from: http://hrsonline.isr.umich.edu/sitedocs/databook/inc/pdf/HRS-Aging-in-the-21st-Century.pdf?_ga=2.134119822.1068858311.1549996999-356537952.1537663574
U.S.
- [113] United States Census Bureau. (2013). *Fewer U.S. households have debt, but those who do have more*. Retrieved from: <https://www.census.gov/newsroom/press-releases/2013/cb13-51.html>
- [114] United States Census Bureau. (2016). *Health insurance coverage in the United States: 2015*. Retrieved from: <https://www.census.gov/content/dam/Census/library/publications/2016/demo/p60-257.pdf>
- [115] Vornovytsky, M., Gottschalck, A., & Smith, A. (2011). *Household debt in the US: 2000 to 2011* (U.S. Census Bureau). Retrieved from: <https://www.census.gov/people/wealth/files/Debt%20Highlights,202011>

- [116] Wallace, G. L., Haveman, R., & Wolfe, B. (2017). Health Status, Health Shocks, and Asset Adequacy Over Retirement Years. *Research on Aging*, 39(1), 222-248. doi: 10.1177/0164027516669567.
- [117] Wiles, J. L. Leibing, A., Guberman, N., Reeve, J., & Allen, R. (2012). The meaning of “aging in place” to older people. *Gerontologist*, 52(3), 357-366. doi: <https://doi.org/10.1093/geront/gnr098>
- [118] Wong, J. Y., & Earl, J. K. (2009). Towards an integrated model of individual, psychosocial, and organizational predictors of retirement adjustment. *Journal of Vocational Behavior*, 75(1), 1-13. doi:10.1016/j.jvb.2008.12.010
- [119] Yaffee, R. A. (2003). *A primer for panel data analysis* (Information Technology at New York University Report). Retrieved from: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.595.1905&rep=rep1&type=pdf>
- [120] Yang, S. S. (2011). Securitisation and tranching longevity and house price risk for reverse mortgage products. *The Geneva Papers on Risk and Insurance Issues and Practice*, 36(4), 648-674. doi: <https://doi.org/10.1057/gpp.2011.26>
- [121] Yogo, M. (2016). Portfolio choice in retirement: Health risk and the demand for annuities, housing, and risky assets. *Journal of Monetary Economics*, 80, 17-34. doi: <https://doi.org/10.1016/j.jmoneco.2016.04.008>
- [122] Zurlo, K. A., Yoon, W., & Kim, H. (2014). Unsecured consumer debt and mental health outcomes in middle-aged and older Americans. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 69(3), 461-469. doi: <https://doi.org/10.1093/geronb/gbu020>

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Kim, H., Shin, S., Zhang, Q., & Gillen, M. (2018). Age when first employed and retirement wealth of baby boomers. *Financial Service Review*, 27(1), 29-45.

Kim, H., Zhang, Q., & Svynarenko, R. (2017). Personality traits and health literacy. *Journal of Family Medicine & Community Health*, 4(1), 1102-1109.

Kim, H., Shin, S., Heath, C. J., Zhang, Q., & Higgins, E. T. (2017). Regulatory mode and willingness to increase retirement savings contribution. *Journal of Applied Social Psychology*, 47(8), 436-445. doi: <https://doi.org/10.1111/jasp.12450>

Zhang, Q. (2015). Promoting financial health: Helping couples reconcile financial disagreement for emotional fitness. *Proceedings of the Association for financial Counseling & Planning Education*, p.23.

Svynarenko, R., Zhang, Q., & Kim, H. (2015). Personality, health literacy, and health outcomes. *The Gerontologist*, 55(2), 127. doi: 10.1093/geront/gnv509.08