Reverse Mortgages: A Closer Look at HECM Loans

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Abstract

Housing wealth is often the most important wealth component for many elderly homeowners in the United States. Reverse mortgages allow elderly homeowners to consume housing wealth without having to sell or move out of their homes. However, very few eligible homeowners used reverse mortgages to achieve consumption smoothing until recent years when the reverse mortgage market in the U.S. has witnessed substantial growth. This paper examines all Home Equity Conversion Mortgage (HECM) loans that were originated between 1989 and 2007 and insured by the Federal Housing Administration (FHA). We show how characteristics of HECM loans and HECM borrowers have evolved over time, we compare borrowers with non-borrowers, and we analyze loan outcomes using a hazard model. In addition, we conduct numerical simulations on HECM loans that were originated in 2007 to illustrate how the profitability of the FHA insurance program depends on factors such as termination rates, housing price appreciation, and the payment schedule. The analysis performed in this paper serves as the first step to understand the implication of recent growth in the reverse mortgage market. Our results also suggest policy makers who are evaluating the current HECM program should practice caution in predicting future profitability.

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1 Introduction

One of the most important questions facing researchers and policy makers is whether Americans are saving enough for retirement. The answer to this question depends crucially on how housing wealth should be treated - are elderly homeowners willing and able to consume their housing equity in retirement? Housing wealth is often the largest non-pension wealth component for many elderly homeowners. For example, the 2004 Survey of Consumer Finances (SCF) data suggest that for 27.8% of homeowners aged 62 or above, housing wealth represents at least 80% of their total wealth. In addition, 13.3% of homeowners aged 62 or above have a house-value-to-income ratio of at least 10. Economists believe that reverse mortgages have the potential to increase consumption of house-rich but cash-poor elderly homeowners while allowing them to continue living in their homes.

Reverse mortgages are a financial product that is similar to home equity loans except that the borrower does not pay back the loan until she dies or permanently moves out of the house. They were first introduced about 20 years ago. The most common type of reverse mortgage loans is the Home Equity Conversion Mortgage (HECM), insured by the Federal Housing Administration (FHA) and constituting over 90% of all reverse mortgage loans originated in the U.S. market. Despite its economic appeal, using reverse mortgages to finance consumption after retirement has been the exception rather than the rule among elderly homeowners. From its inception in 1989 to the end of 2007, out of tens of millions of eligible homeowners, only about 400,000 loans have been originated through the HECM program. A number of factors have been suggested in explaining the small size of the reverse mortgage market, including but not limited to high costs, regulatory and legal barriers, moral hazard and adverse selection, financial awareness and literacy, perception of housing equity as a safety net for large medical expenses, bequest motives, and the difficulties associated with reverse mortgage securitization. Unfortunately, we have little evidence on to what extent each of these factors has prevented reverse mortgages from being more dominant among eligible homeowners.

On the other hand, the reverse mortgage market in recent years has experienced significant growth. In the early 1990s, only a few hundred HECM loans were originated each year. In contrast, over 100,000 reverse mortgage loans were originated through the HECM program in 2007 alone. Is the rapid growth due to higher house values, lower interest rate, increasing awareness of the product, or something else? Is the expansion transitory or will the trend continue in the coming years? Addressing these questions is not only essential to understanding of elderly homeowners' desire to consume housing wealth, but also provides supporting evidence for regulators to conduct cost-benefit analysis and to design more efficient policies.

In this paper, we examine all HECM loans that were originated between 1989 and 2007. The first part of the paper presents descriptive analysis of these HECM loans, focusing on showing the differences between borrowers and non-borrowers and between early borrowers and recent borrowers. The second part illustrates the effect of termination and housing price risks on the FHA insurance program using numerical simulations. Such a analysis is a key step toward understanding who reverse mortgage borrowers are and how various macroeconomic factors such as housing prices and termination rates may impact the reverse mortgage market and the profitability of the FHA insurance program. In addition, current policy makers are concerned that the premium charged to insure HECM loans are excessive. The well publicized Housing and Economic Recovery Act of 2008 will reduce such insurance premium for HECM borrowers. Our results will offer insight on how the reduction may impact the long-term viability of the HECM program.

To our knowledge, this is the first paper using all 18 years of HECM loan data to present systematic evidence on borrower and loan characteristics over time. It is also the first paper that performs simulations on 2007 HECM loans. Such features of this study enable us to draw conclusions that are more accurate and more relevant than previous literature. According to the Census Bureau, the number of persons above age 65 will increase to 40 million in 2010 and further to 81 million in 2040. The questions addressed by this paper will become increasingly important with population aging and baby-boomers' entering retirement age.

The rest of this paper proceeds as follows: Section 2 overviews the existing literature on reverse mortgages and introduces the HECM program in detail. In section 3, we describe the loan-level data that we analyze in this paper. We then show the characteristics of HECM loans and HECM borrowers observed in our data, with an emphasis on how these characteristics changed over time. In section 5, we perform numerical simulations to assess the impact of termination and housing value appreciation risks on the long-term viability of HECM loans. The last section concludes and points out future research directions.

2 Background

2.1 Overview of Existing Studies

The quesion whether Americans are financially prepared for retirement has inspired heated debates in the literature.[1] When evaluating retirement saving adequacy, economists and financial planners have to decide whether housing equity should be included as consumable wealth. Because housing is both a consumption good and an investment good, the correct treatment of housing equity may not be obvious in the retirement saving context. For example, while Mitchell and Moore (1998) add housing equity to household net worth, Bernheim

[1]See Skinner (2007) for a review on this topic.

et al. (2000) exclude it in their calculation. More recently, Sinai and Souleles (2008) suggest that the fraction of "consumable housing equity" ranges from 60% to 99% for elderly homeowners depending on their age.

To what degree we should consider housing equity as retirement savings depends on to what degree elderly homeowners are willing and able to consume their housing wealth. It is well known that many seniors prefer staying in their homes for as long as they can. For example, in a survey sponsored by the American Association of Retired Persons (AARP), 95% of persons 75 and older agreed with the statement "What I'd really like to do is stay in my current residence as long as possible."[2] A series of studies by Venti and Wise (e.g. Venti and Wise (1989, 1990, and 2004)) show that elderly homeowners do not reduce their housing wealth in the absence of precipitating events such as the death of a spouse or entry to a nursing home. If elderly homeowners have strong psychological attachment to their homes, then reverse mortgages, which generate additional income and liquid wealth for elderly homeowners while allowing them to continue living in their homes, may be welfare-improving for many households.

A number of studies have estimated the potential size of the reverse mortgage market. Venti and Wise (1991) analyze the 1984 Survey of Income and Program Participation (SIPP) data and find that a reverse mortgage in the form of annuity payments would substantially affect the income of the single elderly who are very old. Merrill et al. (1994) use the 1989 American Housing Survey (AHS) data to show that out of the 12 million elderly homeowners who own their homes free and clear, 800,000 could benefit substantially from reverse mortgages. Instead of looking only at the median household and focusing on the income-increasing aspect of reverse mortgages, Mayer and Simons (1994) examine the whole distribution of elderly households and consider both income increases and debt reductions as

[2]See Bayer and Harper (2000).

benefits of reverse mortgages. As a result, they find a much larger potential market for reverse mortgages than previous studies: over 6 million homeowners in the U.S. could increase their effective monthly income by at least 20%.

In practice, the reverse mortgage market is much smaller than expected. For example, the HECM program represent 90% of the U.S. reverse mortgage market. During the first ten years since its inception, less than 40,000 loans were originated through the HECM program. On the demand side, a number of factors could have prevented reverse mortgages from becoming more popular among elderly homeowners. First, elderly homeowners with strong bequest motives may not find reverse mortgages attractive because reverse mortgages reduce the amount of wealth they can leave to their estates. However, Mayer and Simons (1994) estimate that more than 1.3 million homeowners have no children. For these homeowners, bequest motives are less likely to explain the lack of demand for reverse mortgages. Second, the probability of shouldering large medical expenses increases over time for the elderly. In the absence of other forms of protections such as Long-Term Care Insurance (LTCI), many elderly homeowners use their housing equity to self-insure. Using a survey conducted on 2,673 homeowners aged 50-65, Munnell et al. (2007) report that nearly half of the respondents who claim not planning to tap their housing equity in retirement list "insurance against living and health expenses" as the reason. Davidoff (2008) present a model suggesting that such behaviors may even be optimal. This self-insurance mechanism may explain why the elderly do not want to purchase the annuity type of reverse mortgages, but it does not explain why they do not want to purchase the Line of Credit (LOC) type of reverse mortgages. Third, certain features of the HECM program and its interaction with other welfare programs may be undesirable. For example, a HECM loan usually requires large upfront costs, the amount of home equity against which one can borrow is capped by the FHA mortgage limit, and the additional income received from a HECM loan may disqualify one from public assistance such as Supplemental Security Income (SSI) or Medicaid.

Fourth, reverse mortgages are complex financial products and can be particularly challenging to elderly homeowners. Conversations with players in the industry suggest that many senior homeowners have misconceptions about reverse mortgages. Lastly, the elderly may value owning their homes free and clear so much that they are averse to the idea of borrowing against their homes.

On the supply side, lenders face various obstacles as well. First, reverse mortgages are significantly different from traditional "forward" mortgages. Lenders with little experience in the reverse mortgage market often confront unfamiliar documentation requirements. For example, lenders who are accustomed to forward mortgages have to prepare different documents for reverse mortgages to satisfy the Truth-in-Lending Act requirements. As a result, lenders must designate reverse mortgage specialists among their employees. Because the HECM program caps origination fees charged by lenders, such a move is only economical if there is a sufficient volume of HECM loan origination. Another consideration is that different states have different regulations with respect to reverse mortgages. To comply with such regulations, lenders who operate in multiple states have to bear additional costs. In addition, due to the unconventional cash-flow pattern, reverse mortgages are difficult to securitize and finance. In fact, according to Szymanoski et al. (2007), HECM loans were not securitized until August 2006. Finally, the Fair Housing Act prohibits pricing loans based on sex, despite the fact the males and females impose very different mortality risks.

Besides the factors discussed above, economists have also recognized that reverse mortgage markets may suffer from adverse selection and moral hazard problems. Because reverse mortgage loans are not due until the borrower dies, sells the house, or permanently moves out, people who know they are likely to stay in their homes for a long time will find reverse mortgages more attractive than others. However, Davidoff and Welke (2007) find advantageous selection in the HECM program. In other words, HECM borrowers appear to exit their homes at a faster pace than the general population. The authors suggest that higher discount rate among the borrowers combined with housing price appreciation may explain observed advantageous selection. Furthermore, economists are concerned that the moral hazard problem on home maintenance would make lenders think twice before entering the reverse mortgage market. Davidoff (2006) uses AHS data to show that homeowners over 75 spend less on routine maintenance than younger owners of similar homes. However, in practice, the moral hazard problem is mitigated because borrowers are the residual claimant of the house, and because lenders are insured against the risk that the proceeds from a home sale fall short of the loan balance.

Overall, most of the studies on reverse mortgages do not have loan-level data and therefore, have to rely on hypothetical borrowers (e.g. Venti and Wise (1991), Merrill et al. (1994), Mayer and Simons (1994), Sun et al. (2006), and Sinai and Souleles (2008)). Among the few studies that do look at loan-level data, Davidoff (2006) and Szymanoski et al. (2007) focus only on termination rates of HECM loans, and Case and Schnare (1994) and Rodda et al. (2000) analyze only the data from earlier years of the HECM program. Given that 88% of all HECM loans originated between 1989 and 2007 were taken out after 2000, the field calls for research using more recent data. This paper aims to fill the gap. It contributes to the existing literature in two ways. First, this paper performs comprehensive analysis on all HECM loans originated before the end of 2007. The evidence shown here provide useful information on how HECM borrowers are different from the general population and how the characteristics of these borrowers change over time. Second, we use numerical simulations to project outcomes of the loans taken out in 2007. Our simulation results demonstrate how insurance claims, HECM profitability and borrower costs depend on loan termination rates, housing price appreciation, and payment schedules. The high sensitivity of these outcomes to the underlying assumption advocate caution on the part of those design future HECM reforms.

2.2 Background on the HECM Program

Congress established the Home Equity Conversion Mortgage (HECM) program in 1987 and authorized the Department of Housing and Urban Development (HUD) to administer the program. The first HECM loan was made in 1989. Since then, the HECM program has been the dominant reverse mortgage product in the United States.[3]

A HECM loan is a reverse mortgage secured by the borrower's home equity. In a forward mortgage, the borrower's home equity increases over time and her mortgage debt decreases over time. In a reverse mortgage, on the other hand, the borrower's home equity declines over time and her mortgage debt grows over time. To be eligible for a HECM loan, first, borrowers have 62 years of age or older. Second, the prospective borrower's property must be a one-unit dwelling. Third, borrowers have to own their homes free and clear, or have liens not exceeding the HECM loan that they can receive. Unlike conventional home equity loans, a HECM loan does not have a fixed maturity date. The loan becomes due and payable only after the borrower dies or the borrower no longer occupies the property as a principal residence. Moreover, A HECM loan is a "non-recourse" loan. This means that the borrower and her estate will never owe more than the value of the property and no other assets can be seized to repay the loan. While traditional home equity loans often require borrowers to have sufficient income and credit worthiness, HECM loans do not have such requirements.[4] Therefore, house-rich but cash-poor elderly homeowners who cannot obtain home equity loans may find HECM loans particularly attractive.

The amount that the borrower can receive from a HECM loan is determined by the principal limit. To calculate the principal limit, the Maximum Claim Amount (MCA) needs to be determined first. The MCA is the lesser of the appraised value of the property

[3]Other reverse mortgage products in the U.S. include the Home Keeper program offered by Fannie Mae and jumbo reverse-mortgage loans offered by Financial Freedom Senior Funding Corporation.

[4]However, borrowers who have delinquent or defaulted federal debt may not be eligible for HECM loans.

or the FHA mortgage limit in that area for a one-family residence under Section 203 (b) of the National Housing Act. The limit for any given area is usually set at 95% of the median house value in that area. However, there exist both ceiling and floor caps, creating nationwide maximum and minimum values for the FHA mortgage limit. For example, the ceiling was $312,895 in 2005 and $362,790 in 2006 and 2007, and the floor was $172,632 in 2005 and $200,160 in 2006 and 2007. The FHA mortgage limit effectively reduces the amount of housing equity the borrower can use to purchase reverse mortgages. Figure 1 compares the MCA and the appraised housing value of HECM loans originated between 1989 and 2007. The solid line indicates the fraction of loans with housing values exceeding MCA. The vertical bars shows the median housing-value-to-MCA ratio among loans with the housing value exceeding MCA. For example, 28.6% of HECM loans made in 2007 have housing values greater than the area-specific FHA mortgage limit. Among these loans, the median housing-value-to-MCA ratio is 1.2, meaning that the housing value is 20% above the FHA mortgage limit.

Once the MCA is determined, the "Initial Principal Limit" can be calculated by multiplying the MCA with a factor that lies between zero and one. The magnitude of this factor depends on the age of the borrower and the "expected interest rate" at the time of loan closing. For married couples, only the age of the younger borrower that is taken into consideration. The expected interest rate, a proxy for future interest rate, equals the sum of the ten-year Treasury rate and the lender's margin. The lender's margin is typically between 1 and 2 percentage points. These principal limit factors are designed such that, under certain assumptions, the loan balance reaches the MCA at the time when the loan becomes due.[5] As a result, the factor increases with the borrower's age and decreases with the expected interest rate. For example, the factor equals 0.281 for a 65-year old at 10 percent expected

[5]See Szymanoski (1994) for detailed discussions on the assumptions that HUD makes to calculate the principal limit factors.

rate, and it equals 0.819 for a 85-year old at 5 percent expected rate. Figure 2 displays the median expected rate and the ten-year Treasury rate between 1989 and 2007. Over time, expected rates on HECM loans declined significantly, largely due to the decreases in the ten-year Treasury rate.

The "Net Principal Limit", which is the amount the borrower can take as a lump-sum at closing, is then calculated by subtracting from the initial principal limit the initial Mortgage Insurance Premium (MIP), closing costs, and a set-aside for monthly servicing fees. The initial MIP is set at 2% of the MCA. In addition to the initial MIP, HUD also charges a monthly MIP that equals to 1/12 of the annual rate of 0.5% of the outstanding balance. By charging MIP, HUD insures the borrower against the risk that the lender can no longer make the contracted payments. It also insures the lender against the risk that the loan balance exceeds the property value. Closing costs include origination fees and other third-party fees such as appraisal fees, credit report fees, and title insurance fees. Origination fees are set at $2,000 or 2% of the MCA, whichever is greater. A servicing-fee set-aside is the present value of the monthly servicing fees charged by the lender, assuming that the loan becomes due when the borrower turns 100. For example, if the lender charges $30 per month as servicing fees, the set-aside would be $4,467 at an expected interest rate of 6 percent for a 75-year old borrower. The initial MIP, closing costs, and the set-aside for servicing fees can all be financed rather than paid by the borrower out of pocket. Figure 3 summarizes the steps described above in calculating the net principal limit.

Note that HECM loans are priced on age, interest rate, and housing value. They are not priced on gender or marital status. Because females have longer life expectancy than males and because borrowers who are couples do not repay their mortgages until the last person dies or moves out, HECM loans may be worth more to couples and single females than to single males. Figure 4 shows the fraction of single male, single female, and couple borrowers by HECM loan origination year. It is perhaps unsurprising that couples and single females constitute the majority of HECM borrowers. However, the fraction of single male borrowers has been increasing over time and the fraction of single female borrowers has been declining.

After the net principal limit is determined, HECM borrowers choose from five payment plans to receive the mortgage proceeds. Under the *Tenure* plan, the borrower will receive equal monthly payments from the lender for as long as the borrower lives and continues to occupy the property as her principal residence. This payment plan is also called "reverse annuity mortgage" in the literature due to its resemblance to an annuity product. Under the *Term* plan, the borrower will receive equal monthly payments from the lender for a fixed period of months selected by the borrower. Note that even though payments stop at the end of the selected term, the loan is not due until the borrower dies or moves out of her home. Under the *Line of Credit* plan, the borrower will receive the mortgage proceeds in unscheduled payments or in installments, at times and in amounts of the borrower's choosing, until the line of credit is exhausted. This is the most popular payment plan among HECM borrowers. In addition, the *Modified Tenure* plan allows the borrower to combine a line of credit with monthly payments for as long as she is alive and continues to live in the house. The *Modified Term* plan allows the borrower to combine a line of credit with monthly payments for a fixed period of months. Moreover, borrowers may change their payment plan throughout the life of the loan at a small cost.[6] Among the HECM loans made in 2007, 3.7% borrowers chose tenure plans, 1.5% chose term plans, 87.0% chose line-of-credit plans, 4.5% chose modified-tenure plans, and 3.3% chose modified-term plans.

For term or tenure plans, monthly payments are determined by the future value of the net principal limit, the length of payment term in months, and the compounding rate.

[6] Anecdotal evidence suggests that most of the payment-plan changes are adding a line-of-credit option to existing term or tenure policies.

The length of payment term in months for term plans is simply the number of payment years multiplied by 12. For tenure plans, it is 100 minus the age of the borrower multiplied by 12. Borrowers of age above 95 are treated as if they were 95 for the purpose of calculation. The compounding rate is 1/12 of the sum of the expected rate and the annual rate of 0.5% for the monthly MIP. With the term length and the compounding rate, the future value of the net principal limit can be easily calculated. For term plans, a constant monthly payment is determined such that the outstanding balance will equal the future value of the net principal limit at the end of the term. For tenure plans, a constant monthly payment is determined such that the outstanding balance will equal to the future value of the net principle limit at the time when the borrower becomes 100 years of age. For a hypothetical borrower with an MCA of $200,000, table 1 shows her principal limit factor, net principal limit, the monthly payment under a tenure plan, and monthly payment under a ten-year term plan, given reasonable assumptions about closing costs and servicing fees. Everything else equal, the older the borrower is, the more payment she receives. Although the net principal limit decreases monotonically in expected interest rate, the relationship between expected interest rate and monthly payment is not necessarily monotonic because higher expected rate increases both loan balance and future value of the net principal limit at the end of the payment term.

Figure 5 plots the distribution of monthly payments for HECM loans made in 2007 that have a term or tenure component. The vertical lines indicate the median monthly payments for term and tenure policies respectively. Because tenure plans are relatively more back-loaded and payments stretch out over a longer period of time, monthly payments of term loans are typically higher than tenure loans. It is interesting to observe that monthly payments appear to bunch at round numbers such as $500 and $1,000, suggesting that some borrowers may have a "target" income level in mind when choosing payment plans and term length.

The HECM program insures both fixed-rate loans and adjustable-rate loans. In practice, virtually all HECM loans are adjustable-rate loans because Fannie Mae, the only agency that buys HECM loans from lenders, do not purchase fixed-rate loans. Adjustable-rate loans may be annually-adjusted or monthly-adjusted. During the earlier years of the HECM program, most loans were annually-adjusted. Since 1994, vast majority of HECM loans have been monthly-adjusted. For instance, 99.5% of the HECM loans originated in 2007 are monthly-adjusted. The "current interest rate" for monthly-adjusted loans is the sum of the treasury rate and the lender's margin. This current interest rate plus the on-going MIP charge of 0.5% is the rate at which loan balances actually grow over time. If realized current rates are lower than expected rates, then the net principal limit will grow faster than the loan balance, which means that borrowers who have chosen a line-of-credit option will be able to withdraw more equity out of their homes.

In the FHA insurance program, HUD allows lenders to choose between an "assignment option" and a "shared premium option". Under the assignment option, lenders remit to HUD both the initial MIP of 2% of the MCA and the monthly MIP of an annual rate of 0.5% of the loan balance. In exchange, lenders can assign loans to HUD when the loan balance reaches 98% of the MCA. Moreover, in the event that the proceeds from the sale of the property are not sufficient to pay the outstanding loan balance, lenders who have chosen the assignment option but have not assigned the mortgage to HUD can submit a claim for insurance benefits up to the MCA. Thus, the assignment option fully protects lenders from potential losses. Under the shared premium option, lenders retain a portion of the MIP but do not have the option to assign the mortgage to HUD. In practice, the shared premium option is not used because Fannie Mae does not purchase such loans. Other provisions designed to protect lenders include a mandatory appraisal that ensures the property meets minimum standard of maintenance, and borrowers are required to maintain flood insurance coverage if the property is subject to flood hazard.

The HECM program also has provisions designed to protect borrowers. Because reverse mortgages are a complex financial product that elderly homeowners may not be familiar with, HUD requires borrowers to receive mandatory counselling from an HUD-approved independent agency. Such counselling is provided regardless of whether a person is in contact with a lender, and counsellors are urged to invite the participation of the children and other advisors of the borrower. In the event that lenders can no longer make payments to borrowers, HUD will continue making the payments.

3 Data Description

The data that we analyze in this paper are the loan-level HECM data provided by HUD. We have all HECM loans made between 1989 and 2007, a total of 388,416 records, in the raw data. For each of these loan records, we have information on age of the borrower, age of the co-borrower when applicable, gender and marital status of the borrower, the appraised value of the property, location of the property (i.e. state and zip code), MCA, expected interest rate, initial principal limit, interest rate type (i.e. fixed-rate, annually-adjusted, or monthly-adjusted), choice of payment plan, monthly payment amount when applicable, loan termination date, loan assignment date, whether a claim was filed to HUD by the lender, and the nature of the claim.

Such administrative data are essential for studying the reverse mortgage market because reverse mortgage borrowers are a tiny fraction of the general population and they are unlikely to be captured by public surveys. Nevertheless, there are a number of caveats associated with our data. First, similar to many administrative datasets, we do not know very much about these borrowers beyond their characteristics that are used in the HECM pricing model. For example, we do not know the income and financial wealth of these borrowers, nor do we know their demographic characteristics such as race, eduction, and number of children. Second, according to the staff member at HUD who shared the data with us, our data come from a snapshot at the end of 2007. Because borrowers are allowed to change their payment plans at a small cost, it is possible that the payment plan we observe is not the original payment plan chosen by the borrower.

In the process of data cleaning, we dropped irregular observations such as loans with borrower age below 62, loans with expected interest rates of zero or above 20 percent, and one loan originated before 1989. We also dropped borrowers from places other than continental U.S. because the FHA mortgage limit for Alaska, Guam, Hawaii and the Virgin Islands is very different from the rest of the country. We have a final sample of 383,158 after data cleaning.

4 Analysis of HECM Borrowers and Loans

In this section, we analyze the loan-level HECM data provided by HUD. We first present evidence on trends in loan origination, age of borrowers, house value of borrowers, and initial-principal-limit to house value ratios. Then we compare characteristics of HECM borrowers with the other elderly homeowners. Lastly, we use a proportional hazard model to study the termination pattern of these loans.

4.1 Changes in HECM Borrower and Loan Characteristics

Figure 6 shows the number of HECM loans originated each year between 1989 and 2007. In early years of the program, only a small number of elderly homeowners purchased HECM mortgages. In contrast, loan originations have grown substantially in recent years. For instance, the number of loans made in 2007 is ten times the number in 2001. One of the potential explanations for such significant growth is that elderly homeowners have become more comfortable taking equity out of their homes and taking on debt in general. To test the plausibility of this explanation, we use the 1989-2004 Survey of Consumer Finances (SCF) data and plot the fraction of homeowners aged 62 or above who have credit card debt, debt secured by primary residence, or any type of debt in figure 7. The fraction of elderly homeowners with credit card debt trended slightly up over the 15-year sample period. The fraction of elderly homeowners with mortgages, home equity loans, or home equity lines of credit increased steadily from 22% in 1989 to 34% in 2004. The fraction with any type of debt rose from 44% to 56%. Overall, the SCF data suggest that a increasing number of elderly homeowners feel comfortable taking on debt secured by their homes. However, such a shift in financial attitude is unlikely to fully explain the unusually large increase in reverse mortgage origination. Other factors may also contribute to the growth of the HECM program, including the 2000-2005 housing market boom, lower interest rates in recent years, and elderly homeowners becoming more aware of the reverse mortgage product.

In figure 8, we show how the distribution of HECM borrower age evolves between 1989 and 2007.[7] Two time trends shown in this figure are worth mentioning. First, the distribution of borrower age shifts to the left over time, meaning that recent borrowers are younger than early borrowers. Second, the spike at age 62 becomes more prominent over time, suggesting that there may be homeowners of ages less than 62 who would want to take HECM loans if allowed. Such patterns imply that the reverse mortgage market has been growing most rapidly among younger elderly homeowners.

Figure 9 displays histograms of appraised house values at the time of loan origination. All dollar amounts are converted to 2007 constant dollars. Over time, the distribution of

[7] We break down the sample into four time periods, 1989-1999, 2000-2003, 2004-2006, and 2007, so that each time period has enough observations to plot a stable distribution.

house values shifts to the right and becomes more dispersed. Such changes may be due to the overall housing price appreciation in the early 2000s. To determine whether housing price appreciation alone can explain the time trend of the histograms, we take the 1989-1999 house value distribution and inflate it with national-level OFHEO housing price indexes. We then impose the kernel density of these inflated 1989-1999 distributions on the histograms of actual HECM loan house values. If housing price appreciation accounts for all the change in the distribution of HECM loan house values, then the kernel density curves should exactly match the histograms. We find that by and large, the histograms and the kernel density curves mirror each other, although the histograms in later years have fatter tails than the kernel density curves. This suggests that more homeowners at the top and bottom of the housing value distribution are acquiring HECM loans.

It has been argued in the literature that the HECM program may not be attractive to potential borrowers because of limitations on the fraction of housing equity one can borrow. In figure 10, we plot the distribution of the Initial Principal Limit (IPL) to house value ratio for HECM loans. Recall that the IPL is the product of MCA and a factor that increases in age and decreases in expected interest rate. It represents the present value of all payments that may be received by the borrower plus costs associated with providing such payments. Before 2000, the IPL on average was about 50-60% of the house value. Since then, IPL to house value ratios have increased to between 0.6 and 0.7, presumably due to low interest rates in the 2000s. Higher IPL to house value ratios mean that borrowers are able to transform a larger fraction of their illiquid housing equity into income and liquid assets.

4.2 Comparison of HECM Borrowers with the Population of Elderly Homeowners

Elderly homeowners choosing HECM loans account for a very small fraction of the eligible population. How are borrowers different from the rest of elderly homeowners? To address this question, we compare HECM borrowers in our data with homeowners of age 62 or older in the 1989-2004 SCF. Table 2 illustrates differences in median age and median house value between the HECM sample and the SCF sample. In general, HECM borrowers tend to be older than non-borrowers, but the gap narrowed in recent years. For example, the median age of the 1989 HECM sample is 77.2 and the median age of the 1989 SCF sample is 71. Over time, the HECM program attracts younger borrowers, and the median elderly homeowner becomes older in the general population. In the 2004 samples, the median HECM borrower age decreased to 73.7 while the median SCF respondent age increased to 73. Moreover, HECM borrowers appear to own more expensive houses than non-borrowers, reflecting that house-rich but cash-poor homeowners may benefit most from reverse mortgages. While the median house value of the SCF sample increased steadily from 1989 to 2004, the median house value in the HECM sample declined in the 1990s before rising considerably since 1998.

To identify geographic areas with HECM borrowers, we exploit the zip code information in our HECM dataset to merge 2000 Census demographic statistics at the zip code level. Approximately 40% of all zip codes in the U.S. have HECM loans originated between 1989 and 2007. Table 3 compares the characteristics of the zip codes with and without HECM loans. Areas with HECM loans appear to have more minority residents than areas with no HECM loans originated. For instance, zip codes with HECM loans are 8.5% black on average and zip codes without HECM loans are 5.6% black. Second, HECM borrowers are from areas with a better-educated population. For example, 14.2% of the people in zip codes with HECM loans have college or post-graduate degrees, but only 8.7% of the people in zip codes without HECM loans have such degrees. Lastly, HECM borrowers live in places with higher median household income and house value. The median house value is only $65,624 in zip codes without HECM loans, while it is almost twice as much in zip codes with HECM loans. These differences are consistent with the findings of Case and Schnare (1994) and Rodda et al. (2000) that HECM borrowers are mostly from metropolitan areas. Table 4 displays the twenty MSAs that originated the most HECM loans. For instance, 20,249 loans were made in Los Angeles-Long Beach-Glendale, CA, approximately 5% of all HECM loans originated between 1989 and 2007.

4.3 Termination Outcomes of HECM Loans

A HECM loan is terminated when the borrower dies or permanently moves out the house. Understanding termination outcomes of HECM loans is essential for the FHA insurance program and the long-term viability of the HECM program. As mentioned earlier in this paper, HECM loans are not priced on gender or marital status. Because couples and single females have longer life expectancy, we may observe different termination outcomes for different groups. Figure 11 plots the loan survival curves for single male, single female, and couple borrowers respectively. The survival curve of couple borrowers lies above that of single females which in turn lies above that of single males. This pattern suggests that couples have the longest loan life and single males have the shortest loan life. Figure 12 shows the termination hazard rates corresponding to the survival curves plotted in Figure 11. These hazard rates appear to have an inverse-U shape. In other words, termination hazard is low in years immediately after origination and then increases with time. However, for loans that have not been terminated within 10 years, termination hazard declines with time, suggesting that borrowers who have not died or moved out after 10 years may stay for a very long time.

The above analysis does not control for age and origination year. To separate the gender and marital status effect from the age and year effect, we estimate the following proportional hazard model:

$$\lambda_t = \lambda_0 * exp(\beta_1 SingleFemale_i + \beta_2 Couple_i + \delta_{it} + \theta_t) \tag{1}$$

where λ_0 is the baseline hazard, δ_{it} are age fixed effects, and θ_t are year fixed effects. If single females and couples have lower termination hazard than single males conditional on age and origination year, we would expect β_1 and β_2 to be negative. Table 5 displays our estimation results. Estimates of β_1 and β_2 are both negative and statistically significant, suggesting that single males indeed have the highest termination risk and couples have the lowest. To help interpret the magnitude of our estimates, we also show the hazard ratios implied by our estimates. On average, the termination hazard for single females is 75.2% of that for single males. The termination hazard for couples is even lower, 57.1% of that for single males. These results highlight the significant differences in termination risks across different groups.

5 Simulation of HECM Program Profits

5.1 HUD Insurance Pricing Model

In establishing a pricing scheme for HECM loans, HUD faces imperatives both to establish a self-financing system and to keep prices low so as to maximize market participation and avoid overcharging elderly homeowners in difficult financial circumstances. However, when the program was first established in 1987, there was of course no past experience with

HECM loans upon which to base cash-flow estimates. As explained in Szymanoski (1994), designers of the HECM program made modeling assumptions to address uncertainty about the inflows and outflows associated with an insured loan, and then set program parameters to satisfy a zero-profit condition. To address interest rate uncertainty, the original HUD model uses the ten-year Treasury rate plus the lender's margin as a risk-adjusted expected interest rate for the life of the loan. Future house prices are expected to follow a geometric Brownian motion process, with average nominal increases of 4% and a standard deviation of 10%. Loan termination rates are crudely approximated by multiplying age-specific female mortality rates by a factor of 1.3.[8] This model determined the age and interest-rate specific principal limit factors, or the fraction of the MCA available at origination, for all HECM loans in the FHA insurance program.

Recent comparisons of empirical loan outcomes to the model suggest that the original assumptions about loan termination and HECM profits may be too conservative. The 2003 HUD evaluation of the HECM program estimates net expected profits as $1,039 per HECM loan.[9] Similarly, Szymanoski et al (2007) shows that actual loan terminations have occurred at a significantly faster rate than the HUD model anticipated. Further, an AARP survey found that large up-front costs contributed to many homeowners' decisions to forego taking out a HECM loan.[10] The conception that the HECM program has produced positive profits thus far has resulted in pressure to reduce the costs of HECM insurance, as reflected in the Housing and Economic Recovery Act of 2008's mandate to lower FHA premiums for HECM loans. However, the available HECM data on both profits and terminations come from a period of generally rising home values and relatively low and stable interest rates. In addition, changes in the composition of the pool of HECM borrowers suggest that extrapolating from

[8]Mortality rates come from the 1979-1981 decennial life tables published by the U.S. National Center for Health Statistics.

[9]See Rodda et al (2003).

[10]See Redfoot et al (2007).

past outcomes may not be appropriate in forecasting the long-term financial health of the HECM program. Our simulations attempt to better understand how different assumptions about house price appreciation, HECM loan termination, and payment schedules affect long-term profitability.

5.2 Simulation Model

Instead of calculating a principal limit factor that results in zero profits for a given age and expected interest rate, our simulation model takes all program parameters as given and calculates numerous expected outcomes for the sample of HECM loans originated in 2007 with stochastic interest rates, house values, and loan terminations. We simulate 1000 paths of future interest rates and house values over a period of 44 years. This allows the youngest borrowers in the sample reach age 105, the upper bound for loan termination in our model. Then for each household in our sample and each interest rate path, we calculate borrower payments, loan balances, and MIP premiums in each year of the simulation. We use a matrix of age- and group-specific loan termination rates to randomly draw a termination year for each loan. We then are able to generate termination-year outcomes for each borrower in our sample. For each of these calculations, we compute averages across all simulations and within three groups of borrowers: males, females, and couples. The HECM outcomes we calculate include whether or not a loan results in an FHA insurance claim because the final loan balance exceeds the final house value, the amount of the claim, the present discounted value of MIP paid to HUD, and the profit or loss to the HECM program associated with the loan. We also make two calculations from the point of view of the borrower: first, the present discounted value of all loan costs, including MIP premiums, closing costs, and loan servicing fees. Second, we calculate the ratio of these costs to the net principal limit, which is the maximum lump sum payment that could be received by the borrower at the time of closing.

In calculating insurance claims, our simulation model focuses on actual losses to the HECM program, rather than technical claims. Historical FHA claim rates for HECM loans are reported in Table 6. Note that claims result from one of three events: a foreclosure on the property that does not cover the outstanding loan balance,[11] a sale that does not cover the outstanding loan balance, or the balance on an active loan reaching 98% of the MCA and prompting the lender to assign the loan to HUD. In the first two cases, the claim amount is the difference between the sale value and the outstanding balance. However, in the last case, the claim is for the total loan balance, and HUD will later recover much or all of the value of the claim when the house is sold. Our simulated claim rate omits loans assigned to HUD that later experience a full recovery. We only consider a loan to result in a claim if the loan balance exceeds the house value in the year the loan is terminated. As a simplification, our model also ignores the possibility of foreclosure, except in its contribution to historical termination rates.

Like any simulation model, our calculations reflect assumptions about payment schedules, loan termination rates, and future interest rates and house prices. Our benchmark models assume an initial lump-sum distribution of maximum size and annual interest rates drawn from the historical distribution of treasury bill rates from 1926 to 2007,[12] plus the lender's margin. In our sample of 2007 HECM loans, the lender's margin is typically very close to 1%. In light of the recent concern that existing models used to forecast future house prices are inadequate,[13] our benchmark assumption for house price appreciation is simple – we assume that real house prices are constant over time. Each year the nominal house

[11]Most HECM foreclosures are due to nonpayment of home-owner's insurance or property taxes.

[12]The Treasury rate associated with each year is the annualized return on Treasury securities for that year, as reported in Ibbotson Associates (2008). Inflation rates come from the same source. Between 1926 and 2007, Treasury rates average 3.8%, and inflation rates average 3.1%.

[13]See Wheaton and Nechayev (2008), for example

value appreciation rate equals the inflation rate experienced in the year corresponding to the interest rate drawn from the historical distribution. In future extensions of this paper, we hope to consider the effects of more complex assumptions about house price appreciation, including area and borrower level variation. We offer both high and low benchmark assumptions for age-specific loan termination rates, each measured separately for the three groups of borrowers. For the high termination mode, we use the historical termination rates for HECM loans originated between 1989 and 2006.[14] Because these termination rates may be endogenously related to the house-price appreciation of that period, as suggested by Davidoff and Welke (2007), we also calculate results using age-specific mortality rates from the 2004 life tables produced by the National Center for Health Statistics.[15] Because of the possibility of adverse selection, mortality rates are not a lower bound on age-specific termination rates in general, but Davidoff and Welke's (2007) results suggest that they may be considered as such in the context of some models. For all three groups of borrowers, the termination rates used in the original HUD model lie between the empirical termination rate and the 2004 mortality rate except at very old ages.[16] Graphs of the group-specific historic termination rates and mortality rates appear in Figure 13. Note that the graph of historical termination rates is not a standard survival function because loans originate at different ages. For example, households appearing in the pool of age 75 borrowers might not be in the pool of age 62 borrowers.

We also provide results based on various alternatives to our benchmark assumptions. First, to facilitate comparison with the HUD model, we let nominal house prices increase by a

[14]Calculation of empirical termination rates requires grouping all observations beyond a certain age because of small sample sizes. Thus the male termination rates are constant after age 98, female rates after 99, and couple rates after 94. In our simulations, we ensure that all loans have a termination year by setting the age 105 termination rate to 100% in both the empirical and mortality termination conditions.

[15]See Arias (2007).

[16]For females, the HUD model termination rate falls below the empirical rate at ages 94 and above. In addition, because the empirical rate becomes a constant after some age, the HUD model termination rate eventually exceeds this rate for males and couples.

constant 4% each year and also calculate results for the sub-sample of 2007 loans with initial house values below the area-specific FHA mortgage limits. Second, to measure potential HECM losses resulting from a bursting of the housing bubble, we implement an assumption that half of the MSA-specific real house price appreciation between 1998 and 2007 is lost in the first year, with house prices remaining at a constant real value thereafter.[17] Lastly, to consider the profits that result when households do not initially withdraw the maximum lump sum, we present results assuming that households elect instead to receive equal monthly payments under the tenure plan.

5.3 Simulation Results

The top panel of Table 7 shows the FHA insurance claim rate in our simulation models. The claim rate predicted by our benchmark model using empirical termination rates, 12.6%, is about one-third lower than the historic non-foreclosure related claim rate for loans that originated by 1997 of 18.6%. This is likely due both to the difference in definitions and to demographic differences between the sample of 2007 borrowers and earlier borrowers. The low termination benchmark, which corresponds to longer average loan duration, predicts much higher claim rates than the high termination benchmark. This occurs because in our model, the interest rate paid on loan balances is higher on average than the rate of house price appreciation.[18] Thus the longer the duration of the loan, the more likely it is that the loan balance surpasses the house value. This intuition also explains why claim rates are higher for loans issued to couples and to females than for loans issued to males. Panel B shows the average claim amount, which also is increasing in the expected duration of the

[17] The real increase in house prices is calculated using MSA-level OFHEO housing price indexes for 1998 and 2007, adjusted for inflation as measured by the CPI.

[18] The effective interest rate for the borrower is the Treasury rate, averaging 3.8%, plus a lender's margin of around 1%, plus the 0.5% MIP paid to HUD. The average rate of house price appreciation is simply the average inflation rate of 3.1%.

loan. Note that this is an empirical result; theoretically, the effect on average claim size is indeterminate. The marginal effect of longer loan duration will depend on the magnitude of the increase in claim size for existing claims, as well as the relative density of marginal claims. In the high (low) termination mode, the average claim is 9.3% (12.3%)of the median house value in the 2007 HECM sample of $222,000.

Table 8 shows the average profits per HECM loan in our simulated models. The profit on a loan is the present discounted value of the difference between premiums paid and the loss at termination, if any. HECM profits are large and positive for our benchmark models, though these results may change after implementing more complex assumptions about house price appreciation. For similar reasons, we refrain from commenting about cross-subsidization across groups. Our results demonstrate that profitability is not necessarily monotone in expected loan duration, as average profits on loans issued to female borrowers are less than profits on loans issued to either males or couples in both our high and low termination simulations. This occurs because increasing loan duration increases both MIP payments and the probability of a claim. Thus calls for MIP decreases because of high historic termination rates may be premature, as the effect of higher termination rates on expected profits is an empirical question.

In Table 9, we calculate the average costs faced by households that take out HECM loans, including closing costs, MIPs, and monthly servicing fees. These costs do not depend on house price appreciation rates and are increasing in the expected loan duration. In both the high and low termination modes, as expected, borrower costs are high relative to the costs of a conventional forward mortgage. According to information provided in the Federal Reserve Board's Consumer Guide to Mortgage Settlement Costs, closing costs related to a mortgage on a house purchase for $222,000 with a down payment of twenty percent are expected to total between \$4,700 and \$10,200.[19] Our calculation of borrower costs on HECM loans are much higher, \$18,340 (\$24,670)in the high (low) termination mode. Ratios of borrower costs to the net principal limit at origination, which is the maximum lump sum that could be immediately withdrawn, are similarly much higher than ratios of closing costs to loan values for forward mortgages: 13.5% (18.4%) in the high (low) termination mode for reverse mortgages compared to no more than 6% for forward mortgages. The most important factor contributing to the difference in costs between reverse mortgages and forward mortgages is the need to purchase FHA insurance.

At this point, the reader may wonder why our simulations produce positive profits from parameters chosen to satisfy zero-profit conditions. Our simulations differ from the original HUD assumptions in several ways. First, we use different termination rates, though this is unlikely to be the only factor because our simulations generate large positive profits using two different sets of assumptions about termination rates. Second, our assumption of constant real housing values allows for less variance in housing price appreciation than the original HUD model. Because profits depend on house price appreciation in a non-linear way, increasing the variance could either increase or decrease our calculations of expected profits. We hope to investigate this effect in future extensions of this paper. Furthermore, our distribution of house price appreciation has a lower mean than in the HUD model. The second model listed in Tables 7 and 8 shows the impact of raising the mean value of nominal house price appreciation from 3.1% to 4% to match the HUD model, while reducing variance to zero. This lowers claim rates by 71 to 81% and increases profits at least 20%, even doubling them in some cases of the low termination mode. The large size of this effect illustrates the importance of the choice of expected house price appreciation and the need for better understanding of house price dynamics. Finally, our simulations differ from the

[19] Authors' calculations based on information provided in the Federal Reserve Board's online publication, available at `http://www.federalreserve.gov/pubs/settlement/default.htm`

HUD model as a result of the presence of borrowers with appraised house values that exceed the maximum claim amount. The HUD model implicitly ignores such borrowers in setting principal limit factors, so these borrowers enter the HECM pool with a cushion of expected profits resulting from their extra equity. Results for simulations of our benchmark model on the sample of 2007 HECM borrowers with appraised house values less than the local MCA are reported in the third line of the tables. This sample produces claim rates that are approximately 20% (16%) higher than in the full sample under high (low) termination rates. Profits decline by about a quarter (45%). Thus, the extra profits generated by the sample including borrowers with high house values suggest that the current HECM program is likely to produce positive profits in the long run under most assumptions.

In the short run, the recent decline in housing prices across the country raises the question of how the HECM program might be affected. Might the bursting of the housing bubble wipe out the expected profits from earlier cohorts? We address this question by simulating a model in which initial house values drop sharply before maintaining a constant real value. This has the effect of calculating net principal limits based on a value that is higher than the long term real value of the house, as is likely to have occurred for HECM borrowers that took out loans near the peak in national housing prices. We calibrate the house price drop to equal half of the real increase in house prices since 1998, specific to each MSA. Results of this simulation appear in the fourth rows of Tables 7 and 8: insurance claims soar and the program loses money on the cohort of loans experiencing the drop in housing prices, regardless of which termination profile is used. The per loan losses are larger than the projected profits in the 2003 HECM evaluation. Because recent cohorts of loans are so large in comparison to the existing stock, the current housing decline may lead to cash flow shortfalls, even if the long-term financial health of the program is sound.

Our final alternative model examines the effects of the borrower's choice of payment schedules. The HUD model is formulated to calculate the maximum lump sum payment associated with a zero profit condition, and then stipulates that borrowers may choose any payment schedule that has a present value less than or equal to this lump sum. Though such a rule may seem reasonable on its face, it neglects to recognize that changing a payment schedule affects the stream of premiums paid for FHA insurance, making it possible to devise a payment stream that conforms to HECM rules, but results in negative expected profits. For example, instead of taking the maximum lump sum immediately, a borrower could wait five years and then take the the original sum plus interest. Thus the borrower has the same balance after five years, but has avoiding paying monthly premiums throughout that time. We illustrate this effect by simulating a model in which the borrower chooses to take tenure payments rather than a lump sum withdrawal, such that the borrower receives a monthly payment determined by HECM rules until the loan is terminated. Table 9 shows that the lower monthly insurance premiums cause borrower costs to be lower by about 18% on average.[20]. Although tenure payments reduce MIP payments, the full effect of this change on HECM profits depends also on how it affects insurance claims. As can be seen in Table 7, insurance claim rates are uniformly lower under tenure payments, but average claim amounts are substantially larger.[21] The net effect on profits appears in Table 8: across the board, average profits-per-loan are much lower for the model of tenure payments. This empirical outcome is important because early explanations of the HECM pricing model surmised that borrowers taking less than the maximum payment would generate long-term profits to the program Szymanoski (1994).

[20] Note that all other components of our cost measure–closing costs, the initial MIP, and monthly servicing fees–are unaffected by the change in payment schedule.

[21] Under the rules that determine the size of tenure payments, it is possible for the loan balance to grow larger than the balance for the equivalent lump sum if the borrower lives beyond age 100. Thus under low termination rates, it is theoretically possible for tenure payment assignment rates to exceed the benchmark rates.

6 Conclusion

The HUD-sponsored HECM program accounts for most reverse mortgages originated in the United States. Over the past decade, the number of HECM loans made each year has been growing substantially. In this paper, we perform analysis on all HECM loans originated between 1989 and 2007. We find that borrowers in the HECM program become younger over time. The recent housing market boom may have induced house values to increase among HECM loans. The IPL to house value ratio, which indicates the fraction of housing equity a borrower can use to purchase a HECM loan, is also increasing over time. HECM borrowers appear to be from areas with higher income and house values, a better-educated population, and more minority residents. Additionally, we find that single males in the HECM program have the highest termination hazard and couples have the lowest.

We also conduct numerical simulations to show how termination risks, housing price appreciation, and choices of payment schedules may affect the profitability of the HECM program. Our results suggest that profits are sensitive to assumptions made about termination rates and housing price appreciation rates. In addition, we find that profits fluctuate with payment schedules chosen by borrowers, even when changes in payment schedules do not affect the present value of all future payments. Furthermore, even though the HECM program has positive expected profits in the long run, our simulations show that a significant drop in housing prices for the recent borrower cohort may cause considerable losses in the short run. Therefore, it may be premature to call for reductions in HECM insurance premiums before assessing the impact of such reductions.

There have been various misconceptions about how the HECM program works among researchers and potential borrowers. For example, some people think once a borrower enters the HECM program, she relinquishes her house entirely to the lender. In fact, the borrower pays back the lesser of the loan balance or proceeds from the property sale. Hence, the borrower remains the residual claimant on the value of the property and the moral hazard problem on home maintenance may not be as severe as many people believe. Another common misconception about the HECM program is that the tenure payment plan, which gives borrowers equal monthly payments for as long as they are alive and continue living in their homes, is equivalent to an annuity. For immediate life annuities, insurance against outliving one's assets is provided by pooling mortality risks across a group of people. However, the tenure plan of HECM loans involves little risk-pooling: if a borrower dies shortly after her HECM loan is originated, she pays back only the loan balance, which presumably is small. HUD does not inherit this borrower's entire housing equity to pay another borrower who lives to be over 100 years old. Thus, the longevity insurance aspect of a tenure HECM loan is very limited. Furthermore, many people believe the high costs associated with HECM loans indicate that these loans are a bad deal for elderly homeowners. One reason why a reverse mortgage costs more than a regular forward mortgage is the MIP charged by HUD to insure both the lender and the borrower. Precisely because there is little risk-pooling in the HECM program, insurance premiums have to be high for HUD to break even. As a result, one may have to change the fundamental structure of the HECM program in order to cut the MIP significantly. We hope that the descriptions and analysis presented in this paper help correct these misconceptions.

Although we take the first step to investigate how the characteristics of HECM loans and borrowers have evolved over time and how the profitability of HECM loans respond to stochastic risks, numerous questions remain unanswered and more studies are called for. For example, how might the HECM program be modified to involve more risk-pooling? What is the optimal division of the HECM insurance premium between initial and monthly payments? How much demand will there be once the market for reverse mortgages matures? How does the reverse mortgage market interact with the annuity market, the Long-Term

Care Insurance market, and government redistribution programs? We plan to address these questions in future work.

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Figure 1: Comparing MCA with Appraised Housing Value

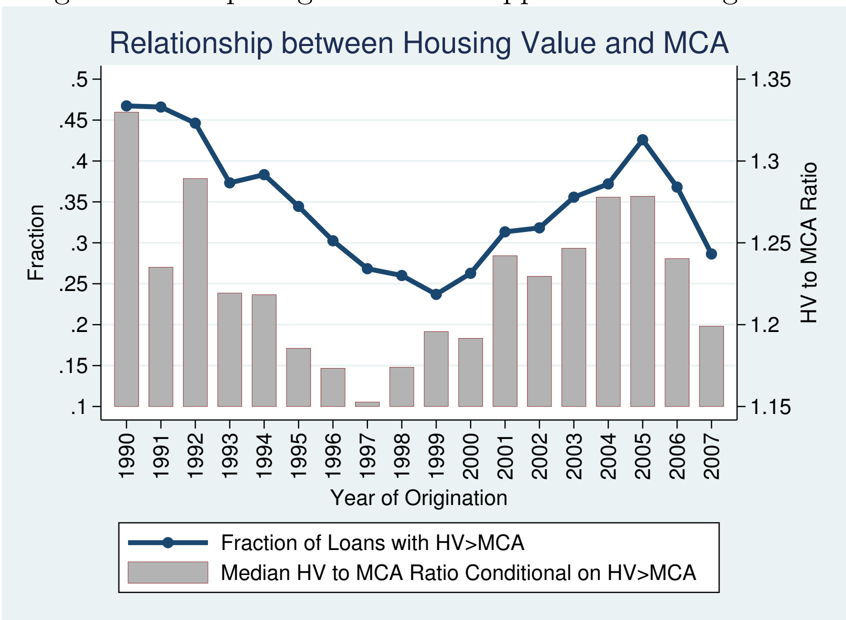


Figure 2: Compare Median Expected Interest Rate Charged on HECM Loans to Ten-Year Treasury Rates

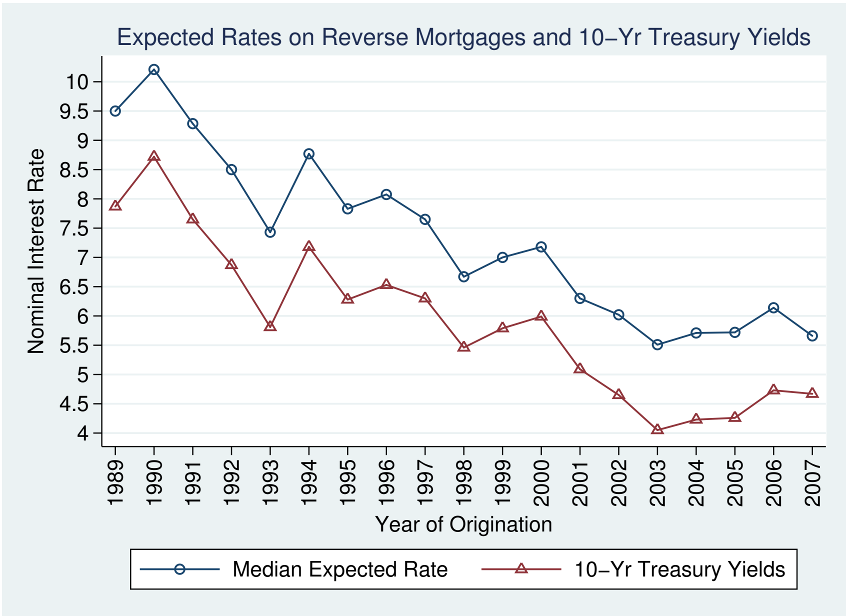


Figure 3: Calculating the Principal Limit

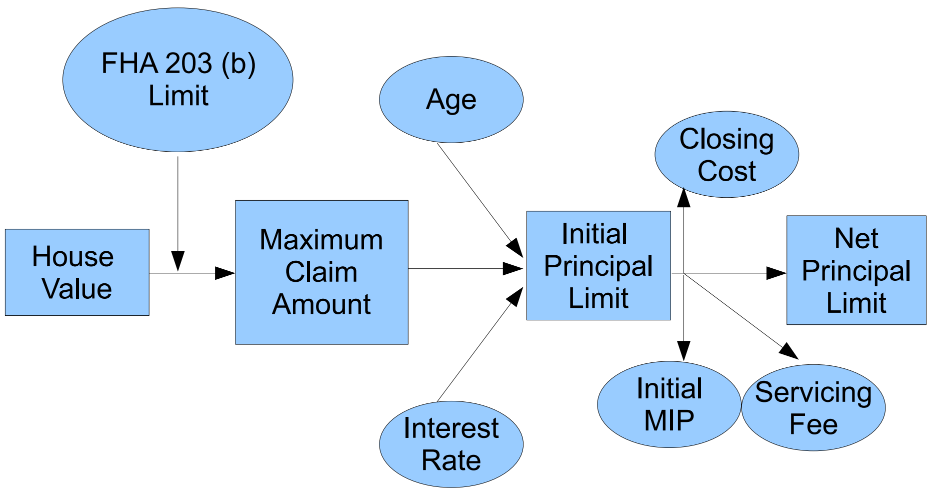


Figure 4: Distribution of HECM Borrower Gender and Marital Status by Loan Origination Year

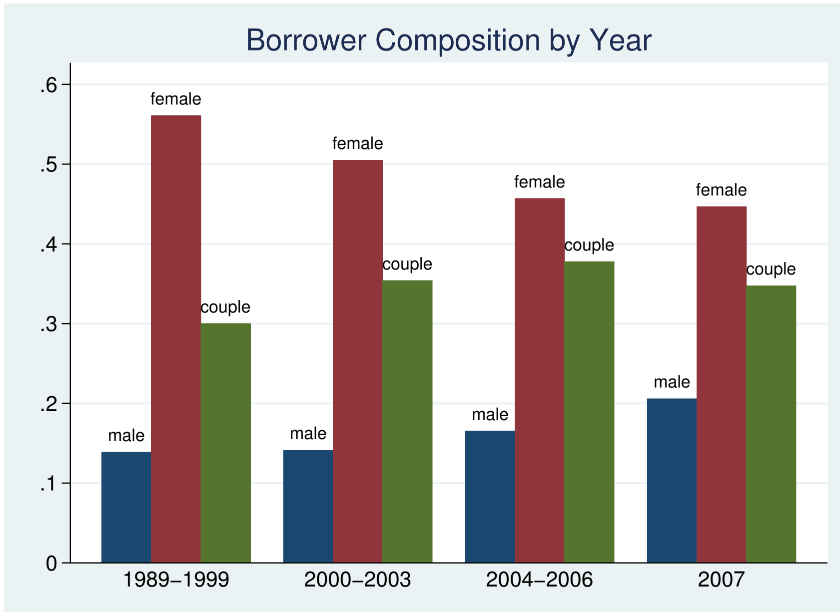


Figure 5: Distribution of Monthly Payments for HECM Loans Originated in 2007 that Have a Term or Tenure Component

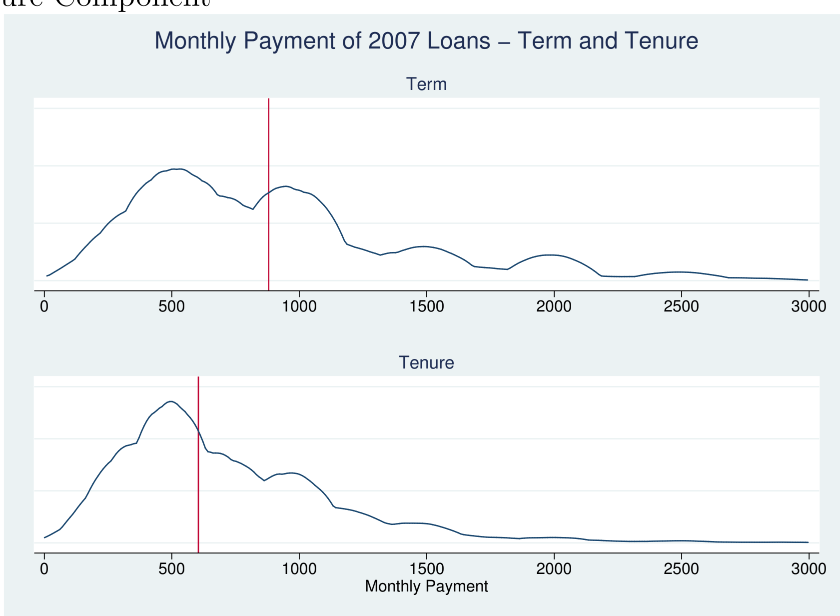


Figure 6: Growth in HECM Loans 1989-2007

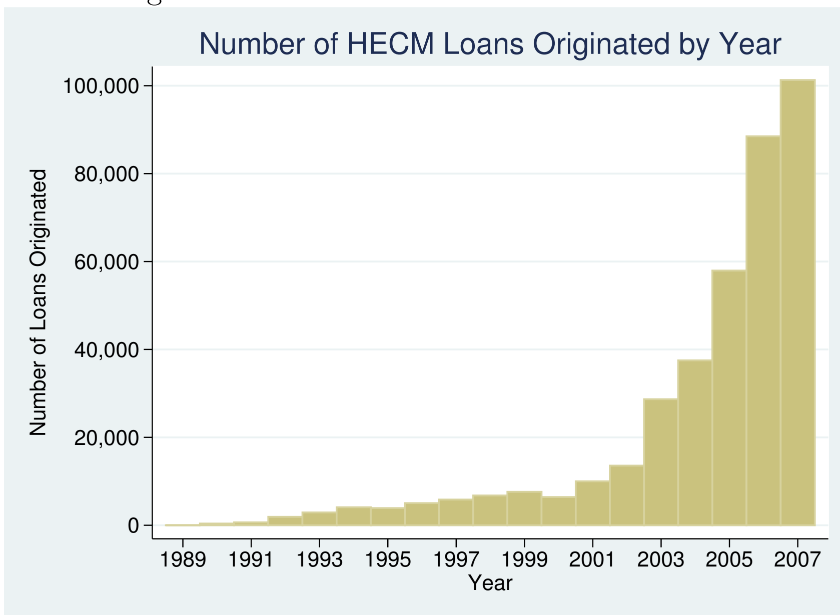
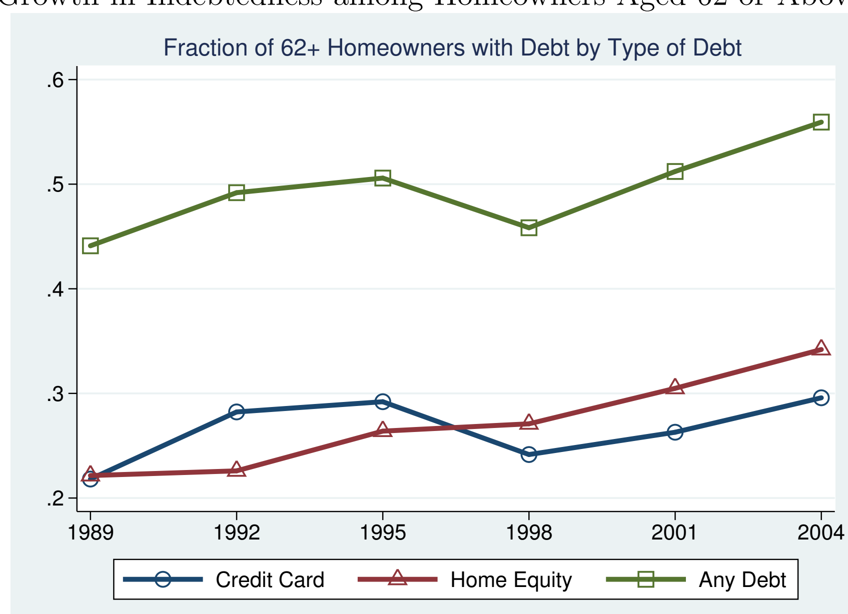


Figure 7: Growth in Indebtedness among Homeowners Aged 62 or Above 1989-2004



Note: Data are from 1989, 1992, 1995, 1998, 2001, and 2004 Survey of Consumer Finances.

Figure 8: Distribution of HECM Borrower Age by Loan Origination Year

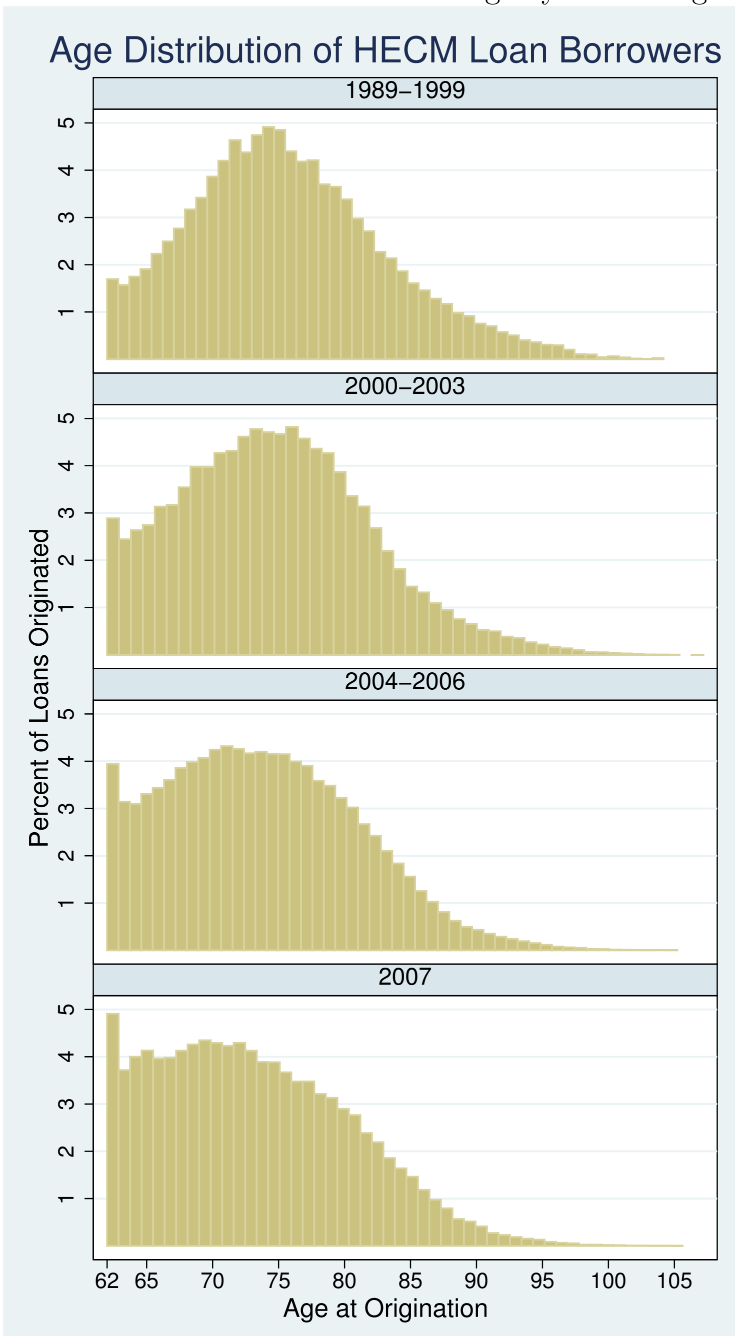
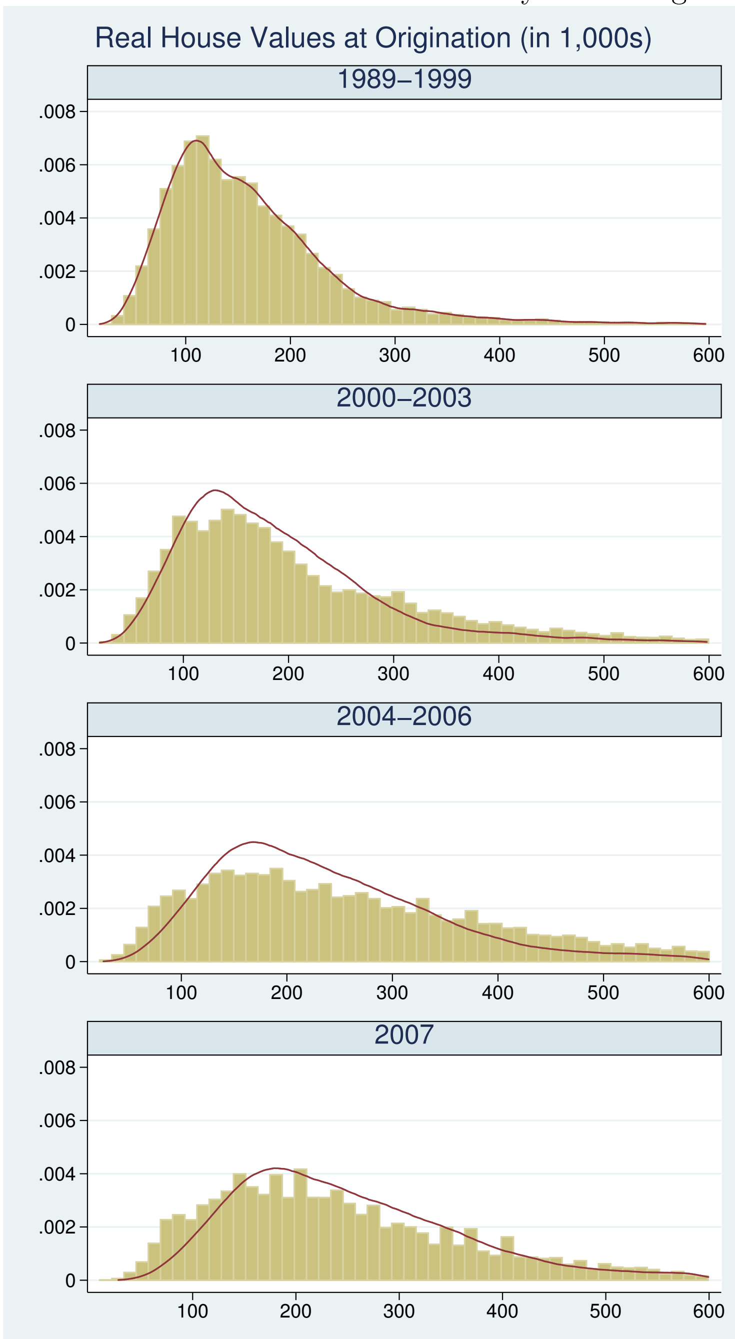
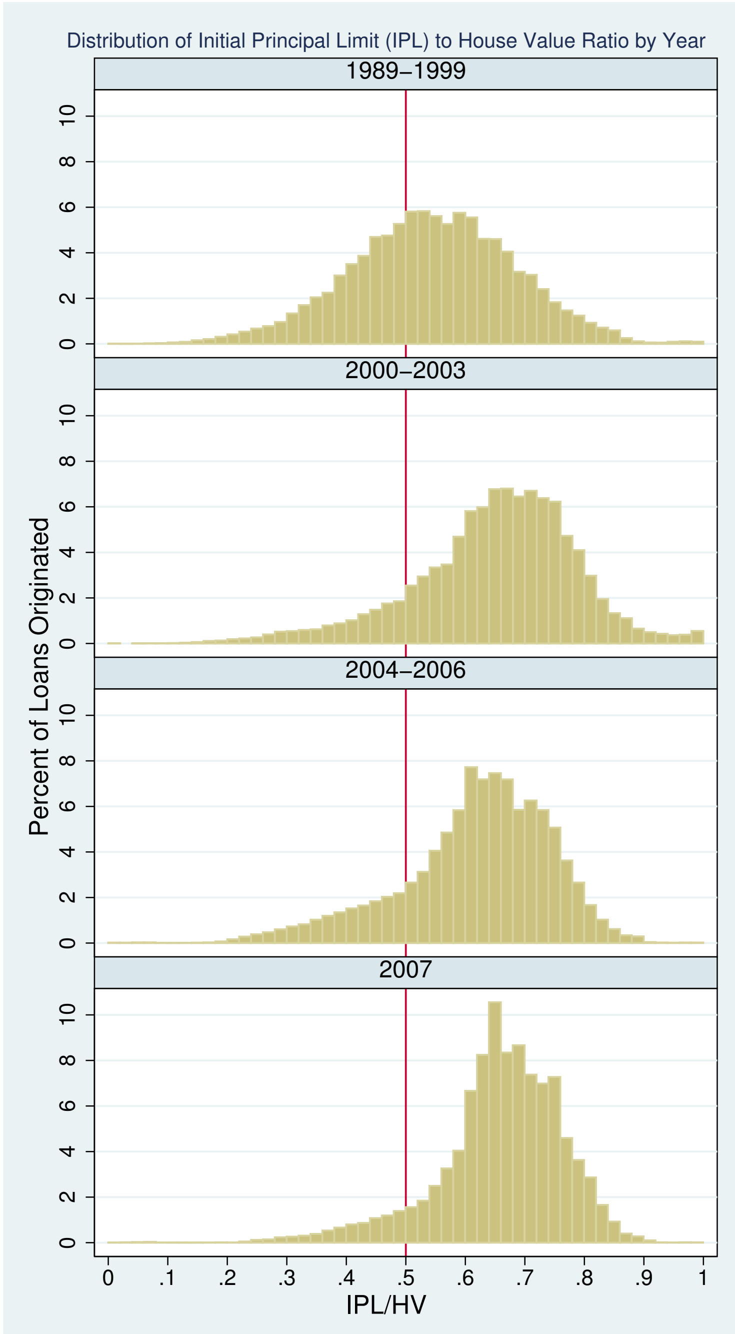


Figure 9: Distribution of Real House Values by Loan Origination Year



Note: The histograms are the actual house values of HECM borrowers at the time of loan origination. The kernel density curves refer to what the house values of 1989-1999 HECM borrowers would be in later years projected by OFHEO housing price indexes.

Figure 10: Distribution of the Initial Principal Limit (IPL) to House Value Ratio by Loan Origination Year



Note: The vertical lines mark the 0.5 IPL to House Value Ratio.

Figure 11: Survival Curves of HECM Loans for Single Males, Single Females, and Couples

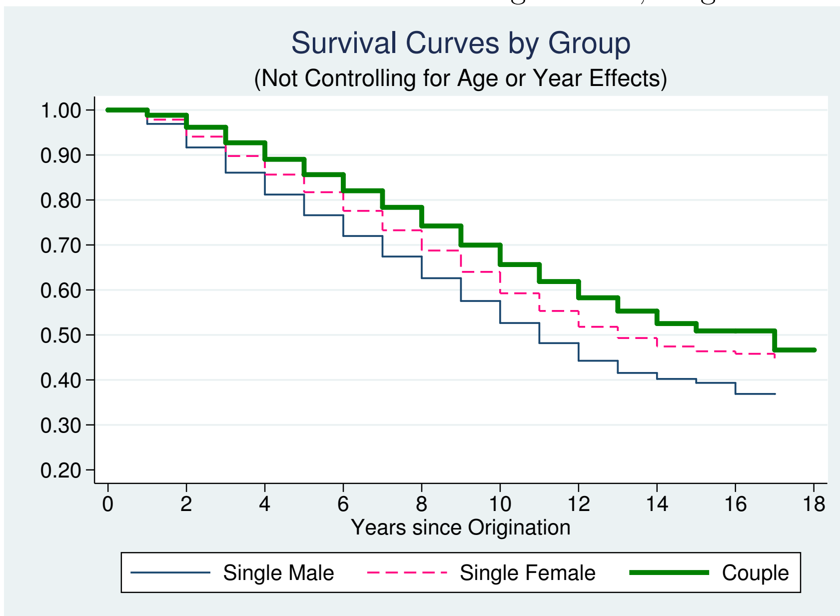


Figure 12: Termination Hazard Rates of HECM Loans for Single Males, Single Females, and Couples

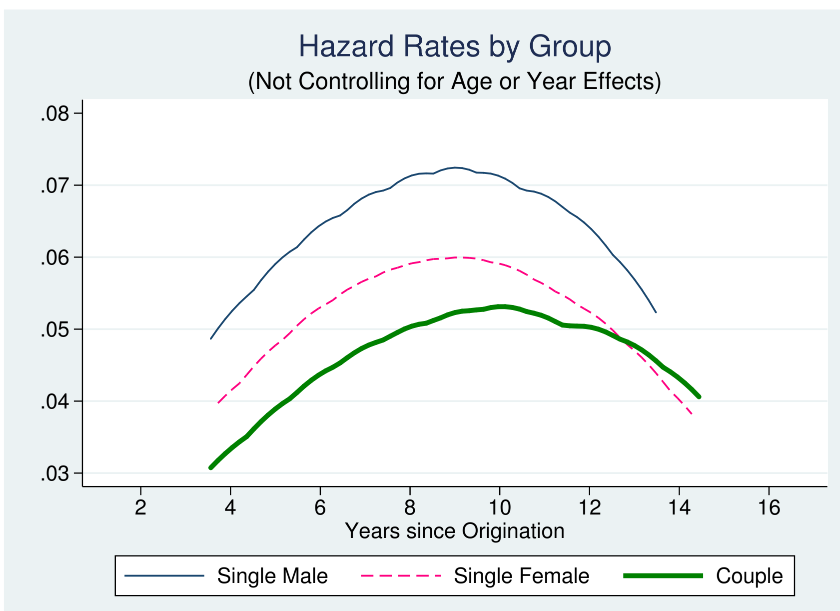
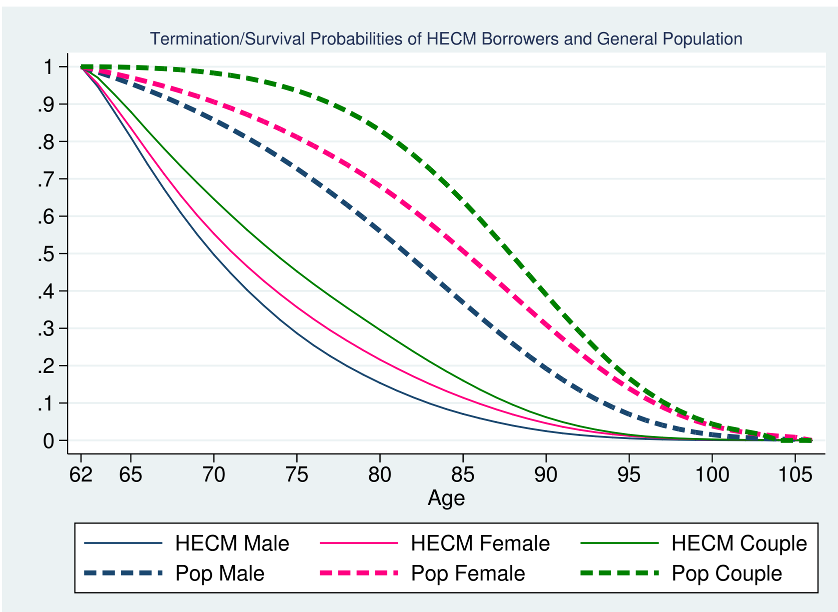


Figure 13: Termination Rates of HECM Borrowers and Survival Probabilities of the General Population



Note: Termination rates of HECM borrowers are based on 1989-2007 loan level data. Survival probabilities of the general population are based on 2004 National Center for Health Statistics (NCHS) mortality tables.

Table 1: HECM Payments for a Hypothetical Borrower

A. Principal Limit Factor

Expected Rate	Age=65	Age=75	Age=85
0.05	0.649	0.732	0.819
0.06	0.591	0.689	0.792
0.07	0.489	0.609	0.738

B. Net Principal Limit

Expected Rate	Age=65	Age=75	Age=85
0.05	$114,188	$131,492	$150,112
0.06	$103,207	$123,333	$144,937
0.07	$83,323	$107,715	$134,344

C. Tenure Plan Monthly Payment

Expected Rate	Age=65	Age=75	Age=85
0.05	$610	$804	$1,221
0.06	$620	$828	$1,256
0.07	$558	$791	$1,238

D. 10-Year Term Plan Monthly Payment

Expected Rate	Age=65	Age=75	Age=85
0.05	$1,234	$1,421	$1,622
0.06	$1,166	$1,393	$1,637
0.07	$983	$1,271	$1,585

Note: MCA=$200,000, closing costs = $6,000, monthly servicing fee = $30

Table 2: Compare the Median Age and Median House Value of HECM Borrowers and Elderly Homeowners in Survey of Consumer Finances

Year	Median Age		Median House Value	
	HECM	SCF	HECM	SCF
1989	77.2	71	$110,337	$100,307
1992	75.4	71	$158,098	$103,428
1995	75.1	72	$144,185	$108,819
1998	74.8	72	$137,352	$114,460
2001	75.0	72	$166,215	$140,463
2004	73.7	73	$208,507	$164,611

Note: Median house values are in 2007 dollars.

Table 3: Compare Characteristics of Zip Codes with HECM Loans and Zip Codes without HECM Loans

	Zip Code w/ HECM Loans	Zip Code w/o HECM Loans
Race/Ethnicity		
White	83.5%	87.1%
Black	8.5%	5.6%
Other	8.0%	7.3%
Hispanic	7.7%	4.9%
Education		
Less Than High School	12.7%	16.2%
High School Graduates	21.5%	25.5%
Some College	18.0%	16.3%
College Graduates or More	14.2%	8.7%
Income/House Value		
Median Income	$43,164	$30,991
Median House Value	$123,427	$65,624

Note: Characteristics are based on 2000 Census data.

Table 4: MSAs that Have the Most HECM Loans Originated between 1989 and 2007

MSA Name	N
Los Angeles-Long Beach-Glendale, CA	20,249
Riverside-San Bernardino-Ontario, CA	15,753
Chicago-Naperville-Joliet, IL	9,560
New York-White Plains-Wayne, NY-NJ	8,911
Phoenix-Mesa-Scottsdale, AZ	8,171
San Diego-Carlsbad-San Marcos, CA	7,262
Denver-Aurora, CO	7,231
Sacramento–Arden-Arcade–Roseville, CA	7,082
Nassau-Suffolk, NY	6,951
Washington-Arlington-Alexandria, DC-VA-MD-WV	6,604
Philadelphia, PA	5,909
Baltimore-Towson, MD	5,822
Detroit-Livonia-Dearborn, MI	5,564
Miami-Miami Beach-Kendall, FL	5,421
Fort Lauderdale-Pompano Beach-Deerfield Beach, FL	5,368
Oakland-Fremont-Hayward, CA	5,144
Tampa-St. Petersburg-Clearwater, FL	5,111
Seattle-Bellevue-Everett, WA	4,906
Houston-Sugar Land-Baytown, TX	4,813
Las Vegas-Paradise, NV	4,692

Table 5: Proportional Hazard Model Estimation Results

	Single Females	Couples
Coefficient	-0.285	-0.561
	(0.014)	(0.015)
Hazard Ratio	0.752	0.571
N	778,252	778,252

Note: Other controls include age fixed effects and year fixed effects. Standard errors are in parentheses. Hazard ratios shown above are relative to the termination hazard of single males.

Table 6: Fraction of Loans Resulted in Claims due to Foreclosure, Assignment, and Lower-than-Expected Sale Price

Claim Reasons	Loans Originated between 1989 and 1997	Loans Originated between 1998 and 2002
Foreclosure	3.59%	1.50%
Assigned to HUD by Lenders	18.38%	3.36%
Sale Price Less Than Loan Balance	0.26%	0.14%
Total	22.22%	5.01%

Note: All HECM loans in our data are censored at the end of 2007.

Table 7: Simulation Results on HECM Loans Originated in 2007:
Probability of HUD Insurance Claim and Average Claim Amount

A. Probability of HUD Insurance Claim

High Termination	All	Males	Females	Couples
Benchmark	12.6%	9.7%	12.9%	13.7%
4% Nominal Housing Appreciation	2.7%	2.0%	3.0%	2.6%
Sample with House Values ≤ MCA	15.1%	11.5%	15.3%	16.9%
Decline in House Values	43.2%	40.6%	44.9%	42.3%
Tenure Payment	6.8%	4.6%	6.9%	8.0%
Low Termination				
Benchmark	32.4%	24.6%	31.0%	38.5%
4% Nominal Housing Appreciation	8.9%	6.3%	9.0%	10.2%
Sample with House Values ≤ MCA	37.5%	28.2%	35.7%	45.8%
Decline in House Values	65.4%	59.3%	64.2%	70.2%
Tenure Payment	25.8%	17.3%	24.2%	32.5%

B. Average Claim Amount

High Termination	All	Males	Females	Couples
Benchmark	\$20,728	\$19,110	\$19,829	\$22,481
4% Nominal Housing Appreciation	\$14,219	\$13,429	\$13,675	\$15,375
Sample with House Values ≤ MCA	\$19,312	\$17,864	\$18,532	\$20,955
Decline in House Values	\$29,352	\$27,112	\$28,714	\$31,421
Tenure Payment	\$29,586	\$27,734	\$29,818	\$29,899
Low Termination				
Benchmark	\$27,366	\$24,699	\$26,112	\$29,633
4% Nominal Housing Appreciation	\$17,110	\$16,000	\$16,368	\$18,349
Sample with House Values ≤ MCA	\$25,361	\$22,935	\$24,235	\$27,562
Decline in House Values	\$40,420	\$36,059	\$38,698	\$44,521
Tenure Payment	\$37,578	\$34,118	\$36,861	\$39,290

Note: In our model, we stipulate that a HUD insurance claim occurs when the loan balance exceeds the house value at the time of termination. "High Termination" refers to termination rates observed in the 1989-2006 HECM loan data. "Low Termination" refers to mortality rates in the 2004 NCHS mortality tables. "Benchmark" results assume a lump sum payment with house values constant in real terms. "4% Nominal Housing Appreciation" assumes house values increase by 4% per year in nominal terms. "Sample with House Values ≤ MCA" uses the benchmark assumptions on the sub-sample of HECM loans originated in 2007 with appraised house values less than or equal to the local Maximum Claim Amount. "Decline in House Values" assumes house values drop to the average of 1998 and 2007 prices in the first year and remain constant in real terms after that. (MSA-level OFHEO housing price indices are used to calculate the average of 1998 and 2007 prices.) "Tenure Payment" assumes a constant nominal payment each year of the largest size possible under HECM rules. Claim amounts are reported in 2007 dollars. N=84,662 for the full samples and 60,020 for the sub-sample. 1000 simulations are performed on each HECM borrower.

Table 8: Simulation Results on HECM Loans Originated in 2007:
Average Profits-per-Loan for HUD

High Termination	All	Males	Females	Couples
Benchmark	\$8,682	\$8,297	\$8,091	\$9,675
4% Nominal Housing Appreciation	\$10,909	\$9,880	\$10,247	\$12,346
Sample with House Values $\leq$ MCA	\$6,497	\$6,500	\$6,038	\$7170
Decline in House Values	(\$1,377)	(\$841)	(\$2,232)	(\$540)
Tenure Payment	\$5,856	\$5,833	\$5,410	\$6,459
Low Termination				
Benchmark	\$7,445	\$7,929	\$6,785	\$8,051
4% Nominal Housing Appreciation	\$14,784	\$13,004	\$13,400	\$17,586
Sample with House Values $\leq$ MCA	\$4,091	\$5,364	\$3,811	\$3,730
Decline in House Values	(\$10,116)	(\$7,385)	(\$9,988)	(\$11,779)
Tenure Payment	\$2,064	\$4,006	\$1,807	\$1,340

Note: Numbers in parenthesis are losses to HUD. "High Termination" refers to termination rates observed in the 1989-2006 HECM loan data. "Low Termination" refers to mortality rates in the 2004 NCHS mortality tables. "Benchmark" results assume a lump sum payment with house values constant in real terms. "4% Nominal Housing Appreciation" assumes house values increase by 4% per year in nominal terms. "Sample with House Values $\leq$ MCA" uses the benchmark assumptions on the sub-sample of HECM loans originated in 2007 with appraised house values less than or equal to the local Maximum Claim Amount. "Decline in House Values" assumes house values drop to the average of 1998 and 2007 prices in the first year and remain constant in real terms after that. (MSA-level OFHEO housing price indices are used to calculate the average of 1998 and 2007 prices.) "Tenure Payment" assumes a constant nominal payment each year of the largest size possible under HECM rules. Profits are reported in 2007 dollars. N=84,662 for the full samples and 60,020 for the sub-sample. 1000 simulations are performed on each HECM borrower.

Table 9: Simulation Results on HECM Loans Originated in 2007:Costs to Borrowers

A. Costs to Borrowers

	All	Males	Females	Couples
High Termination, Lump Sum Payment	\$18,340	\$16,847	\$17,460	\$20,320
High Termination, Tenure Payment	\$14,933	\$13,795	\$14,272	\$16,428
Low Termination, Lump Sum Payment	\$24,670	\$21,787	\$22,833	\$28,673
Low Termination, Tenure Payment	\$20,114	\$17,700	\$18,673	\$23,338

B. Ratio of Costs to Net Principal Limit at Origination

	All	Males	Females	Couples
High Termination, Lump Sum Payment	0.135	0.126	0.131	0.145
High Termination, Tenure Payment	0.111	0.104	0.108	0.118
Low Termination, Lump Sum Payment	0.184	0.165	0.174	0.206
Low Termination, Tenure Payment	0.151	0.136	0.144	0.169

Note: Cost to borrowers includes the present discounted value of FHA premiums, origination fees, closing costs, and loan servicing fees. The net principal limit at origination is the maximum lump sum that could be immediately withdrawn. "High Termination" refers to termination rates observed in the 1989-2006 HECM loan data. "Low Termination" refers to mortality rates in the 2004 NCHS mortality tables. These calculations are independent of assumptions about future house price behavior. N=84,662 and 1000 simulations are performed on each HECM borrower.