Selection and Moral Hazard in the Reverse Mortgage Market

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August 23, 2004

Abstract

Reverse mortgages offer "house rich, cash poor" older homeowners the opportunity to transfer wealth from the wealthy period after their home is sold to the impoverished period before. The puzzlingly small degree of demand has been blamed in part on large up-front fees. These fees, in turn, are justified by concerns that adverse selection and moral hazard will operate such that borrowers will remain in their homes for so long and with such low appreciation that collateral value will fall below loan balances. We show theoretically that there is an ambiguous correlation between reverse mortgage take-up and discounted property value upon exit from a home. Based on reverse mortgage loan histories and the *American Housing Survey*, we find empirically that single women who have participated in the most popular US reverse mortgage program (HECM) depart from their homes at a rate almost 50 percent greater than observably similar non-participating homeowners. The results suggest that rising home prices have fed strongly advantageous selection in this market through a mechanism similar to the heterogeneity in risk aversion used by de Meza and Webb (2001) to rationalize advantageous selection in insurance markets. We find advantageous selection on observables, but not enough to explain the large gap in exit rates, suggesting significant roles for unobservables such as poor health status, risk aversion or heavy discounting. The prospect of weakened price appreciation in the near future may undermine the advantageous selection seen to date.

1 Introduction

Home equity is the dominant form of wealth for older Americans, particularly widows. Based on the 2001 *Survey of Consumer Finances*, Aizcorbe, Kennickell and Moore (2003) show that 76 percent of household heads 75 or over owned a home, with a median value of $92,500. Median net wealth among these households was $151,400. Just 11% of these households owed any mortgage debt. Among the majority of older single women in the 2000 *AHEAD* survey who own homes, the median ratio of home value to total assets was 79%.

Not only does home equity represent the majority of wealth for older Americans, but it is wealth that frequently goes unspent. Sheiner and Weil (1992) report an annual mobility rate of approximately 4% among older single women based on the Panel Study of Income Dynamics, and a similar number arises in the Survey of Income and Program Participation. Combined with mortality rates, this suggests that approximately 50% of recent retirees will die in their current home. This is consistent with the AARP survey finding, cited by Venti and Wise (2000) that 89% of surveyed Americans over 55 reported that they wanted to remain in their current residence as long as possible.

In a life-cycle model, the desire for a smooth consumption trajectory implies that a transfer of money from the wealthy period after a home is sold to the cash-poor period before increases welfare, absent extremely strong bequest motives.[1] In fact, low interest rates and rising home values have apparently led to an increase in the volume of home equity borrowing among the elderly.[2] Home equity loans with growing balances can serve the purpose of transferring money from after to before sale or death. However, such loans provide little liquidity for older homeowners unable to pledge much non-pension income towards repayment because of enforced minimum income to loan amount tests.[3]

Reverse mortgages are designed to allow borrowers to make only a single, "balloon" payment at the time of move out or death if they so wish. Figure 1 illustrates the workings of a reverse mortgage for an older consumer who is alive at present and may live zero or one additional periods. Conditional on living for one additional period, this consumer might move or remain in their home. M_1 denotes an initial reverse mortgage amount paid to a reverse mortgagor by a lender. If the borrower moves or dies, the borrower (or their estate) owes principal plus interest on M_1 plus a financed origination fee F. Should the borrower remain in the home and live in the second period, they

[1] Artle and Varaiya (1978) prove such a gain in a specialized setting with deterministic mobility and no bequest motive. Mayer (1994) and Kutty (1998) suggest that a large number of retirees could move out of poverty if they took on reverse mortgages.

[2] See, for example, Bayot (2004).

[3] Borrowers may simply not state income in loan contracts, but this involves steep increases in the interest rate, on the order of 2%.

borrow M_2. M_2 can be a negative number if the borrower wishes to prepay some portion of the loan balance. After the borrower's death, the estate owes accumulated principal and interest on M_1, F and M_2.

An important element of reverse mortgage design is that in no event does the borrower or their estate owe the lender more than the resale value of the home.[4] This design feature gives rise to concerns of adverse selection and moral hazard. The potential for adverse selection in the reverse mortgage industry is well illustrated by the case of famed Frenchwoman Jeanne Calmet who lived to the age of 121 and her reverse mortgagee Andre-Francois Raffray.[5] More generally, the rate of price appreciation (π in Figure 1) is likely to be smaller than the opporunity cost of funds for lenders. Depending on maximal loan amounts, borrowers who remain in their homes for a long time may thus enjoy a long effectively interest free period of default, in which the bank is, by construction, unable to evict. Adverse selection arises if consumers expecting an unusually long life or low mobility enter into reverse mortgages with strategic default in mind.

Reverse mortgage design might invite two dimensions of moral hazard. The first, mentioned by Caplin (2002) and modeled by Miceli and Sirmans (1994) and Shiller and Weiss (2000), is that a mortgagor facing default has no incentive to maintain property values. The second moral hazard issue is that by giving funds to an older homeowner, life in the home is made relatively more attractive than life after moving or death, and so the act of giving a borrower a reverse mortgage may extend the borrower's stay in the home beyond the optimal length for an otherwise identical non-mortgagor.

This paper explains that neither adverse selection nor moral hazard is guaranteed by the structure of the reverse mortgage industry. In fact, Figures 2 and 3 demonstrate that, to date, reverse mortgage borrowers in the US have moved out of their homes, whether due to death or voluntary mobility, at a rate that far exceeds the rate of demographically similar non-borrowers. These figures and supplementary hazard estimates are discussed in detail below.

Figure 1 shows that the reverse mortgage market can be thought of as akin to an insurance market, where the insured risk is the act of staying for a long time in a home that experiences weak or negative appreciation. The reverse mortgage is like insurance because, as in the standard case of insurance against misfortune, money is transferred from a low marginal utility state (after the gains from sale have been realized) to a high marginal utility state (before the gains have been realized and when liquid assets

[4]In an extreme version of a "shared appreciation" reverse mortgage, the lender gets the home when the borrower moves or dies.

[5]As reported by the Associated Press on August 5, 1997, Calmet sold her apartment forward to Raffray in her eighties, in what turned out to be a disastrous arrangement for Raffray and his heirs. The french word for the arrangement is "viager."

are typically small).

de Meza and Webb (2001) argue that when actuarially unfair pricing renders full coverage undesirable, insurance markets may feature advantageous, rather than adverse, selection. For example, they cite evidence that UK credit card holders who purchase insurance against lost cards are less likely to lose their credit cards. Finkelstein and McGarry (2003) find that older individuals who purchase long term medical care insurance are less likely to wind up in long term carre than non-purchasers. In both cases, the proposed rationale is that more risk averse consumers are likely both to seek insurance and to behave in a way that avoids the insured event. The relatively rapid exit from homes on the part of reverse mortgagors may be explained similarly. Reverse mortgage borrowers are likely, by revealed preference, to have a greater gap between marginal utility before moving and marginal utility after moving (or in death) than those who find reverse mortgages unattractive. The reallocation of wealth allowed by a reverse mortgage may be insufficient to fully reduce this marginal utility gap. Just as the insured can act to reduce the probability of accidents through careful behavior, so reverse mortgagors can act to reduce the length of the high marginal utility state by moving relatively quickly.

Section 2 of this paper outlines the structure of the dominant reverse mortgage product in the United States, the Home Equity Conversion Mortgage (HECM). Section 3 lays out a stylized model of the relationships among health status, optimal move date and reverse mortgage take up. The model does not deliver closed form results, but inspection of the first order condition for an optimal move suggests that advantageous selection of the type described by de Meza and Webb (2001) is likely to operate in the reverse mortgage market, at least when house price appreciation is as strong as it has been over the life of most reverse mortgages. Simulations suggest that both moral hazard and advantageous selection are likely to operate in this market.

Empirically, we find in Section (4 that selection on the observable characteristics of age, income, wealth, property value and historical price appreciation rates follow from theoretical considerations. However, advantageous selection on observables explains only a small part of the large difference in mobility rates between reverse mortgage borrowers and the rest of the population. Further, we find that in states with very low appreciation rates, such that default is more feasible, mobility among reverse mortgage borrowers has been considerably less than among non-borrowers. Finally, we find that younger mortgagors, who have retained a greater fraction of home equity than older borrowers due to price appreciation and the structure of credit limits have exhibited a much larger rate of mobility than young non-borrowers. Among older borrowers, the difference in mobility rates is less pronounced. These results suggest that advantageous selection to date has occurred, but largely on unobservable dimensions such as risk aversion, discounting or health status. The results also suggest that a likely slowdown

in appreciation rates may undo the advantageous selection observed to date.

This paper largely ignores moral hazard issues related to home maintenance. We allow borrowers to have private information concerning the rate of price appreciation, but do not consider the effects of reverse mortgage borrowing on maintenance. Neglect of maintenance moral hazard can be justified in three ways. First, home maintenance among the elderly is quite low on average, even in the near absence of debt.[6] Second, inspection of Figure 1 demonstrates that unless the borrower anticipates default, the presence of reverse mortgage debt should encourage, rather than discourage, home maintenance. A liquidity constrained mortgagor should be more, rather than less willing to make investments that are realized only after sale after borrowing money from the post-sale period. Third, data on realized appreciation is not readily available, and even if it were, it would be very difficult to demonstrate under-maintenance given the wide variation in home maintenance expenditures observed in the *American Housing Survey*, even conditional on demographics. A stochastic model of maintenance by a risk averse homeowner is the subject of ongoing research.

Strategic behavior on the part of suppliers is also not considered in this paper. To date, pricing in the home equity conversion market has been driven largely by federal regulations and potential losses to the actual issuers of reverse mortgages are small due to federal loan guarantees. As an illustration of the absence of strategic supply behavior, the actuarial model used by FHA to estimate income and payouts from its insurance of HECMs assumes a constant termination rate that is independent of interest rates or price appreciation.[7]. As such, we take the pricing and credit limits of reverse mortgages as exogenously given. Expansion of the home equity conversion industry beyond its currently small size would presumably affect housing prices, a consideration we also ignore.

2 The Home Equity Conversion Mortgage

The reverse mortgage industry dates to 1961 in the US and the early part of 20th Century in Europe. In the late 1980s, the US Department of Housing and Urban Development ("HUD") devised a Home Equity Conversion Mortgage ("HECM") program. HECM is currently the dominant reverse mortgage product in the US. The program works roughly as follows.[8]

Borrowers must be homeowners with very little or zero outstanding mortgage debt. HECMs are originated by banks, sometimes through mortgage brokers. The banks and

[6]Davidoff (2004) finds under-investment on the part of older homeowners as well as appreciation rates of three percent less per additional year of ownership by a household head over 75.

[7]See Rodda, Herbert and Lam (2000)

[8]Much of the discussion below comes from Rodda et al. (2000).

brokers earn upfront fees and the originators typically retain servicing rights. These lenders typically sell the cash flow rights associated with the loans to Fannie Mae, a for-profit mortgage company whose bond holders have an "implicit guarantee" of repayment from the federal government. The loan cash flows themselves are insured by the Federal Housing Agency (FHA) against default. In exchange for providing any difference between property value and accumulated loan balance, FHA receives 2 percent of the property value at the time of loan closing and assesses a charge of $\frac{1}{24}$ of one percent of the outstanding loan balance each month.

The borrowers are obliged to make property tax payments and to perform minimal maintenance but maintenance requirements are presumably enforceable only before closing.[9] Otherwise, no payments are due until all mortgagors (a borrower and a spouse if one exists) have moved out of the home, dead or alive. There is no recourse to the lender for payments outside of the value of the home in the event that the resale value is below the outstanding loan balance. Because interest rates are likely to exceed the rate of house price inflation, loan-to-value ratios are fairly small and increase with age. For example, an 80 year old single homeowner could obtain a loan-to-value of approximately two-thirds of property value as of August, 2004. A 65 year old single homeowner could obtain an actuarially reduced value of approximately one-half of property value.

Borrowers can receive payments in several forms. They may receive a single lump sum payment, a line of credit with an increasing maximum outstanding balance, monthly payments that last for a fixed period (term payments), or monthly payments that last as long as the borrower lives in the home (tenure payments). Borrowers may receive payments in a combination of any of these forms. The line of credit is by far the most popular option (and it includes lump sum payments as a subset). The amount that may be borrowed is decreasing in interest rates and increasing in borrower age.

The interest rate on HECM loans may be fixed or adjustable, but almost all existing loan rates are adjustable as Fannie Mae will only purchase adjustable rate mortgages under HECM. The spread over the one-year treasury rate is typically near 1.5 percent. Closing costs on the 77,007 loans issued to date vary considerably, and the size of the loan has minimal explanatory power.[10] The median ratio of closing cost to property value is 6.8 percent. These closing costs, which may be financed, are large relative to conventional loans, particularly relative to home equity lines of credit which feature closing costs of zero in some cases. No payments are due until the borrower moves or dies.

[9] One would expect considerable legal difficulty in evicting an elderly mortgagor for failing to make sufficient repairs to their home.

[10] The R^2 from a regression of closing cost on maximum loan amount is just .0008 and the coefficient on maximum loan amount has the wrong sign.

Weakness of demand has led to the exit of many originators,[11] but as discussed above, the potential size of the market is huge. Indeed, Mayer (1994) estimates that the HECM product should be welfare-enhancing attractive to at least six million older households, so that something like one percent of the potential market has taken on reverse mortgage debt. Simulations discussed below suggest that the potential market is, indeed, large.

The small size of the reverse mortgage market is blamed in part on the very large fees. A lower upfront fee combined with smaller loan amounts to render default highly unlikely seems like a natural way to encourage demand, but loan size appears anecdotally to be an important factor in consumer demand. Part, but not all, of the large fees are attributable to the 2 percent insurance fee charged by the FHA. This guarantee fee is more than ten times as large as the fees charged by Fannie Mae to insure repayment of conventional mortgages.[12] To date, FHA has been able to assemble a large reserve against future defaults because of rising asset values and rapid mobility of borrowers. However, there is uncertainty about what will happen if appreciation weakens so that it is not clear that for prevailing credit limit rules the 2 percent guaranty fee should be reduced. Providing the market with a better understanding of the nature of selection and moral hazard in the market may thus be critical to expansion.

3 A Model of Mobility, Mortality and Reverse Mortgage Take Up

In this section we ask under what conditions reverse mortgage borrowers are likely move more or less rapidly than non-borrowers, taking the details of the HECM program described above as given. Holding the evolution of asset prices constant and assuming that fees are greater than or equal to fixed loan costs, selection is advantageous from an actuarial perspective if mobility is greater among borrowers. However, due to the convexity of bank losses, to the extent that borrower mobility rates are positively correlated with price growth, adverse selection is more likely. Given the program details, we consider "mobility" to include moves to different private homes, moves to

[11] Other problems have plagued the industry. Some reverse mortgages were designed with shared appreciation features. Some reverse mortgagors under such "SAM" arrangements died within one or two years of origination but enjoyed large capital gains, so that the payments received relative to the debt owed were very small. This has led to legal conflicts. Perhaps for this reason, Fannie Mae does not purchase shared appreciation mortgages. There appears to be some belief in the industry that a vicious cycle of absence of demand leading to difficulty in establishing actuarial estimates, leading to high borrowing costs leading to absence of demand.

[12] In 2000, Fannie Mae reported an average guaranty fee of .2 percent, but this is on mortgage size, not home value.

assisted living or with relatives, moves to nursing homes and also death.

While a complete actuarial model of the reverse mortgage market is beyond our present scope, it is clear that mobility and appreciation rates are critical determinants of market viability. To see this, denote initial home value H, loan amount L, risk adjusted discount rate r and constant and deterministic net appreciation g. Assume that the entire allowable loan balance at date 0 is withdrawn immediately and that FHA charges no fixed fee in exchange for its guarantee of full HECM repayment. The FHA would then lose money through its guaranty program if the borrower moves past the date t such that $He^{gt} = Le^{rt}$, or $t = \frac{ln(H)-ln(L)}{r-g}$.

If net appreciation exceeds the interest rate, loss to FHA is impossible. Averaged across all owners, appreciation has exceeded the interest rate by a wide margin in many markets in recent years. However, appreciation rates among the elderly are lower than among the young within markets and a negative expected user cost of housing would be a peculiar long term equilibrium. For a single woman mortgagor at age 80, given a loan to value ratio of two-thirds, and with g just one percent less than r, default could not occur unless the mortgagor lived, like Mme. Calmet to the almost unheard of age of 120. By contrast, if the interest rate were five percent greater than the net appreciation rate, default would occur within 8.1 years. The expected loss if a move occurred only at death would be close to 50 percent of property value.[13] At a mobility rate of 8 percent per year above the mortality rate, the expected loss would be six percent of property value. Consistent with FHA pricing and actuarial assumptions, at a 3.25 percent gap between appreciation and the discount rate and a mobility rate set equal to 1.3 times the mortality rate, expected losses would be 2 percent of property value.

To determine whether mobility among HECM borrowers should exceed population mobility, we consider the lifetime utility maximization problem for a retired homeowner, observed at age a. We ask whether the retiree will find it optimal to move at some date T prior to the date of death A and whether the retiree will consider reverse mortgage debt attractive. Clear analytical predictions concerning the correlation between mobility and the utility gain arising from reverse mortgage take-up are not available even in a rather simplified setting. Some parameterized simulations are thus presented as well.

For simplicity, we consider single retirees both in modelling and estimation of relative mobility among borrowers and non-borrowers. In practice, approximately 60% of HECM borrowers are single, and most of these are single females. To focus on asymmetric information and given the complexity and unexplored nature of the problem,

[13]This calculation is based on the Berkeley mortality database. The fraction of housing value by which the accumulated mortgage balance exceeds inflated property value is multiplied by the probability that death occurs each year up to 110.

we assume that the borrower knows the date of death A for sure and that she also knows the constant rates of interest r and net house price appreciation g. The interest rate assumption is not too severe of an approximation in the sense that HECM debt is adjustable, so that refinancing strategies are not salient to the analysis. The reverse mortgage debt grows at the constant rate r_M in addition to draws from the line of credit.

In the absence of mortgage debt, moving generates a large and immediate positive cash flow. If the homeowner had been unwilling or unable to treat home equity as liquid wealth, this windfall allows the rate of consumption of other goods to increase, as discussed in Artle and Varaiya (1978). We denote consumption of a composite non-housing good by c.

Waiting to move when there is no mortgage debt has three financial effects. First, there is an additional period of capital gain or loss prior to sale, discounted by the interest rate. Second, the price of housing consumed (either purchased or rented) after the move increases or decreases by the rate of growth. Assuming housing demand is price inelastic, this will tend to reduce marginal utility after the move. Third, the purchase (or rental) of post-move housing is deferred, generating an interest savings.[14]

Moving generates direct changes to utility as well as the financial effects listed above. First, it is clear from observation that moving involves a considerable and possibly time dependent psychic disruption cost, which we denote $\mu_0(t)$. Second, after the move, the act of having moved may generate utility gains or costs through moving perhaps closer to family or medical attention and improved maintenance conditions, but out of a familiar environment. We denote such costs or benefits $\mu_1(t)$. Moving also allows a consumer to reoptimize housing consumption, from the level before the move H_a to the optimal subsequent level H_T. For house rich - asset poor elderly widows, this reoptimization should in theory generate considerable gains. Theoretically, concavity of the utility function should also imply that asset rich - house poor widows should find immediate reoptimization through trade-up in housing attractive (e.g. moving to Palm Beach upon retirement).

The existence of reverse mortgage debt affects the analysis of the optimal move date. If, at the optimal move date, the borrower is in default on the reverse mortgage, then the only financial effect of waiting to move is to save the user cost of the new housing unit for some time. The first two financial effects alluded to above disappear, because the entire proceeds from the home, and no more, go to the lender. If the loan is not in default at the optimal move date, then waiting to move generates both the price and interest rate related effects discussed above as well as an additional period

[14]We ignore maintenance as discussed above, and subsume selling costs into the growth rate of housing prices.

of interest paid on the reverse mortgage.

An older homeowner must compare taking on reverse mortgage debt both to taking on no debt and to taking on a home equity line of credit. Home equity lines feature higher interest rates than the reverse mortgage, but we assume zero fixed fee. In the absence of a reverse mortgage, the interest rate on savings r is thus greater than r_M for negative savings and infinite above some limit on allowable debt under a home equity line. A home equity loan is likely to be relatively more attractive to retirees with large income, since the maximum loan amount available under a home equity loan is an increasing function of non-annuitized income. This ranking is complicated by the possibility that increased income will lead to a lengthened stay in the home, rendering the HECM's high fee and low interest rate more attractive.

With these considerations in mind, denoting lifetime utility by U, denoting the choice of reverse mortgage debt to take on in each period, assuming that a single level of housing H_T is chosen after any move, and assuming that utility is intertemporally separable and consistent, the utility maximization problem can be written:[15]

$$\max_{\{m(t)\},\{c(t)\},T,H_T} U = \int_a^T u(c(t),H_a)e^{-\delta t}dt - \mu_0(T) + \int_T^A (u(c(t),H_T)e^{-\delta t} + \mu_1(t))dt. \quad (1)$$

The optimization over mortgage draws, consumption, move date and housing after moving are subject to the following constraints:

$$M(a) = F(\bar{M}); \quad s(a) = s_a; \quad (2)$$

$$M(t) \leq \bar{M}e^{t-a}. \quad (3)$$

The first equation in (2) states that the initial mortgage balance is either zero or the size of the fee required to open a reverse mortgage line of credit with upper limit $\bar{M}$. F is difficult to estimate as there has been considerable heterogeneity in reverse mortgage fees to date. As discussed above, this is a large amount and may be increasing in the value of the home as well as in $\bar{M}$; there is, however, a considerable fixed component. Equation 3) recognizes the bound on draws out of the allowable reverse mortgage balance.

The laws of motion for savings and reverse mortgage debt are given in equations (4) through (7). These laws reflect the jump in cash savings at the time the home is sold and the assumption there is no collateral to allow for reverse mortgage borrowing after the move. We assume that savings must be weakly positive at death whether or not there is a bequest motive. f represents the rental cost per unit of housing price, $m(t)$ is the withdrawal from a reverse mortgage line of credit and $M(t)$ the reverse

[15]This form of a utility function assumes away a bequest motive. The presence and functional form of bequest motives are matters of empirical controversy. Assuming that bequest size is a superior good, we would expect the desirability of reverse mortgages to decrease all the more in wealth and income.

mortgage balance at time t.

$$\dot{s}(t) = r(s(t) - M(t), y(t), HP(t))s(t) + y + m(t) - c(t); \tag{4}$$

$$\dot{M}(t) = m(t) + r_M M(t) \ \forall t < T; \tag{5}$$

$$\dot{s}(T) = \max(0, H_a P_a e^{g(T-a)} - M(T)); \tag{6}$$

$$\dot{s}(t) = r(s(t) - M(t), y(t), H_T P(t))s(t) + y(t) + m(t) - c(t) - H_T f P_a e^{g(t-a)} \ \forall t > T. \tag{7}$$

The functional form for the interest rate in equations (4) and (7) acknowledge the role of home equity borrowing. $y(t)$ is exogenous income at date t.

An optimal move at date T must therefore satisfy the following first order condition:[16]

$$\begin{aligned} \frac{\partial U}{\partial T} &= -\mu_0'(T) - \mu_1(T) + u(c(T-), H_a) - u(c(T+), H_T) \\ &+\pi_s(T+) I_{H_a P_a e^{g(T-a)} > M(T)}((g-r)H_a P_a e^{g(T-a)} - (r_M - r)M(T)) \\ &+\pi_s(T-)\dot{s}(T-) - \pi_s(T+)\dot{s}(T+) = 0. \end{aligned} \tag{8}$$

Here u is an instantaneous felicity function, $\pi_s(t)$ represents the shadow value of an additional dollar of savings s at date t, $T-$ denotes the moment before the move and $T+$ the moment after. M_T is the amount of reverse mortgage debt owed at time T.

The first order condition can be interpreted by considering the three lines separately. The first line represents the change in the level of utility induced by waiting an additional moment to move. If housing consumption is unchanged and if the homeowner were not liquidity constrained at T, then the only consideration is the effect of the "psychic" costs and benefits of moving μ_0 and μ_1.

The second line of first order condition (8) represents the capital gains and mortgage interest effects of waiting to move. As discussed above, these effects are operative only if any reverse mortgage debt owed is not in default. Note that the shadow value of an extra dollar of reverse mortgage debt at time T is either $-\pi_s(T+)$ or, if the loan is in default, zero.

The third line of (8) represents the possibility that scarce resources are stretched thinner before or after the move. Absent substantial mortgage debt, we would expect the shadow value of savings to be greater before moving and the rate of dissavings

[16]The functional form below could be made more flexible by assuming that the initial level of housing shapes utility after the move. The optimality condition is discussed in, among other places, Léonard and Van Long (1992).

greater. This might not be the case if the felicity function were non-separable between housing and other consumption. The effect of rising prices on rental and other expenditures after moving is subsumed in the expression $-\pi_s(T+)\dot{s}(T+)$.

There is no guarantee that an optimal move date exists. This fact is seen empirically in the large number of retirees who die without moving. Further, it is possible that an extremum of utility in T could reflect a minimum rather than a maximum.

3.1 Simulated Welfare Effects

In the Appendix, we detail parameterized solutions to the control problem stated above. We focus on two formulations for the utility function. In the first, housing is simply discarded from the felicity function u. Hence all consumers would move immediately if not for the direct utility costs of moving. As parameterized, the optimal move would occur when $\mu_1 - \mu_0'$ equals zero, if a move were ever worth incurring the cost. In a second simulation, we allow housing to enter the felicity function such that there is additive separability between housing and other consumption.

In both cases, we find considerable welfare gains for a broad swath of consumers. For a retiree with \$2,000 in wealth and ... we find that the presence of the right to take on a reverse mortgage is equivalent to being given \$XXX in a world where reverse mortgages are unavailable. The gains to high wealth and high income consumers likely would not translate to demand among such consumers in the cross section. Our simulations assume that the retiree has a take-it-or-leave it option to take on a reverse mortgage. Realistically, a consumer would spend down financial wealth before taking on the interest obligation of the reverse mortgage if there is any probability of moving before retirement. We only observe assets among mortgagors at the time of loan closing, so that we do not know if individuals spent down significant wealth before taking on the HECM. The low incomes among borrowers suggest otherwise. Earlier simulations that allowed for stochastic health shocks that provided a basis for exogenous moves demonstrated that gains were considerably larger for lower wealth and lower income retirees.

3.2 Moral Hazard

With large fixed fees and a rate of price appreciation less than the interest rate, lenders might worry that issuing reverse mortgage debt will impel borrowers to extend their stays at home so long as to ensure default. This is analogous to moral hazard in insurance markets in that a very long stay in the home is like an insured event that the lender hopes is not incited by the financial transaction. Given that $\frac{\partial^2 U}{\partial T^2}$ must be negative if T is an internal optimum between a and A, the existence of moral hazard

can be defined as the condition that reverse mortgage debt increases the derivative $\frac{\partial U}{\partial T}$, rendering a later move more attractive.[17]

Simulations reported below justify the intuitive fear of moral hazard. Indeed, part of the public justification for federal involvement in the HECM program is to enable older homeowners to remain in their homes longer than they would be able to otherwise (see Blacker (1998)). We have not identified a tractable way to identify analytically the effect of reverse mortgage debt on move date, but inspection of the first order condition is revealing. Assuming that the reverse mortgage is not prepaid (empirically, almost none are fully prepaid), the presence of reverse mortgage debt increases the first and last lines of equation (8). This is because an infusion of cash before the move and the attendant outflow after increase the level of utility before moving and reduce the level after. By concavity, the marginal value of cash before the move must weakly fall relative to the value after by concavity of indirect utility in wealth.

That reverse mortgage debt could fail to induce a longer stay follows from the interest rate spread $r_M - r$. This spread implies that reverse mortgage debt engenders an added financial cost to waiting to move that increases in the loan balance, itself increasing with time. If the liquidity constraint before moving is weak or non-existent, then there is likely no effect of the reverse mortgage on relative utility and marginal utility, so the only effect is to induce an earlier move. Of course, if there is no liquidity constraint prior to any planned move, the reverse mortgage is welfare destructive unless either default is planned or the consumer does not plan to move prior to death. If the direct welfare cost of remaining at home $\mu_1 - \mu_0$ becomes sufficiently negative, failing to move may be quite burdensome.

3.2.1 Simulated Moral Hazard

Our simulations generate a prediction of moral hazard... The appendix discusses a simulation which specifies and parameterizes the optimization problem utility function. This simulation allows us to ask whether individuals with different characteristics including initial income, wealth, home value, price appreciation rates and utility function remain in their homes longer in the presence of reverse mortgage debt. As shown in figure ... ...

3.3 Selection

Selection into reverse mortgages may be adverse or advantageous. The direction of selection is determined by whether characteristics that render a reverse mortgage at-

[17] That utility is concave in the move date is not guaranteed. Empirically, we see many corner solutions in the form of moves near retirement, moves induced by health shocks or no move before death - see for example Venti and Wise (2000).

tractive also render long stays attractive, conditional on reverse mortgage status.

In the absence of a bequest motive, any individual who is certain to remain in their home until death even, with no reverse mortgage, will find reverse mortgage debt attractive. Indeed, the value of the reverse mortgage to such an individual is identical to the present value of optimal loan withdrawals. This calculation follows because home equity has no value to such an individual. Because the value of the opportunity to take on reverse mortgage debt must be weakly less the present value of maximum allowable proceeds, no one can value the reverse mortgage more than individuals who are certain to remain in their homes up to death. This consideration implies that adverse selection is possible. More generally, individuals who choose to move earlier, all else equal, should have a smaller marginal utility of money before moving relative to after moving (as indicated in the third line of equation (8). This should lead again to a positive correlation between reverse mortgage demand and length of stay, since the direction of cash transfers implied by reverse mortgages appeal to individuals with large marginal utilities before moving relative to after moving.

The considerations above that lead to adverse selection take the optimal move date T as exogenous. Advantageous selection is plausible because the same forces that render an early move attractive may tend to render reverse mortgage debt attractive. Consider the factors that contribute to mobility holding the direct utility costs and benefits of moving μ_0 and μ_1 as well as the schedule of mortgage debt outstanding in t constant. Individuals who wish to move earlier have a larger difference between at least one of (a) utility after moving and utility before moving, and (b) marginal utility before moving and marginal utility after moving.[18] Individuals with a higher marginal utility of wealth before moving relative to after moving should find reverse mortgage debt more attractive, again because reverse mortgages transfer wealth from the period after moving to the period before.[19]

A number of characteristics, both observable and unobservable, should lead both to high marginal utility before moving and after moving and mobility. Low wealth, low income, high home value and old age should all contribute to relatively high utility before moving and are empirically observable. A high discount rate should lead at any time t to a low weight on the relatively distant post-move period and hence high

[18]The differences (a) and (b) can be ranked differently between individuals because the level of housing before moving is not chosen optimally and because there may be complementarities between housing and the consumption good).

[19]It is not obvious how to define the concept of "reverse mortgage debt is attractive." The effect on maximized utility of a small amount of reverse mortgage debt is negative if a move is ever optimal due to the large fixed cost. One might consider evaluating the effect of the shadow value of the constraint that reverse mortgage debt not exceed some positive amount on mobility to estimate adverse selection, but we have not found a way to capture this shadow value in an analytically useful expression.

marginal utility of wealth before. Likewise, a utility function that is more concave over non-housing consumption should increase marginal utility in the period before home equity is fully cashed out.

Realistically, the growth of the income stream $y(t)$ is likely correlated with health status. Hence individuals likely to move for health reasons are likely also to face dwindling resources. Health-induced mobility should lead to adverse selection if it is forecastable, since this would be a reason for mobility unrelated to marginal utility. However, the connection with reduced income would generate a relationship to high marginal utility before moving and hence it is not at all clear what the effect of variation in health status should be on the sign of selection.

3.3.1 Simulated Selection

As the discussion above makes clear, the nature of selection is likely to depend on complex interactions among characteristics. This is what we find in simulations...

3.4 Appreciation, Moral Hazard and Selection

The strength and direction of moral hazard and selection effects are likely to depend on the rate of price appreciation. Strong price appreciation makes selling later attractive through a "substitution effect," assuming that future housing consumption H_T is not too much larger than present housing H_a. However, strong appreciation also increases the value of the home and hence reduces marginal utility after sale, rendering an early move optimal. Hence there is an ambiguous effect of appreciation on optimal move date, holding reverse mortgage debt constant. Holding move date constant, appreciation increases the appeal of reverse mortgage debt again by reducing post-move marginal utility.

Very weak price appreciation should enhance the moral hazard effect. If it is possible to remain in the home for a long period of default on the reverse mortgage, then the second line of the derivative (8) may disappear for most candidate move dates, so that remaining at home is costless to a reverse mortgagor. By contrast, non-mortgagors experience capital losses when they wait to move, regardless of the date.

Similar considerations suggest that weak or negative price appreciation may push the direction of selection to adversity. To the extent that a long stay in the home is planned under default, the reverse becomes less of a transfer from the period after the move and more of a transfer from the bank. Hence, the appeal of a reverse mortgage likely has more to do with planned stay and less to do with relative marginal utilities in a low appreciation environment. As we saw above, this renders adverse selection more likely.

3.5 The Role of Price Appreciation in Simulations

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4 Empirical Mobility Among Reverse Mortgage Borrowers and Non-Borrowers

To date, HECM reverse mortgagors have exited homes at a strikingly rapid rate, as illustrated in Figures 2 and 3. In this section, we ask to what extent available data support the theoretical discussion in Section 3. In particular, we ask if the data are consistent with the simultaneous presence of moral hazard and advantageous selection. We ask further if the intuition that sufficiently weak price appreciation undermines the effect of advantageous selection is borne out in the data. Single women only are selected to avoid intra-family dynamics in interpretation.[20]

To determine whether advantageous selection appears to have a role in the relative mobility rates, we extend the comparison of survival and hazard rates between single women reverse mortgage borrowers and single women homeowners in the *American Housing Survey* (AHS) to include covariates. To do this, we ask first whether the observable variables that predict participation in the HECM program also predict rapid mobility out of homes, noting that other than age, there is almost no systematic attempt in the program to screen in or out individuals likely to move quickly. To obtain an idea of the importance of selection on observable characteristics, we ask whether any observed advantageous selection explains away a large fraction of the difference in observed mobility rates among borrowers and non-borrowers. In particular, we estimate the effect of HECM participation on a hazard rate out of homeownership by merging all single women homeowners in a proprietary HECM data set with all single women homeowners in the AHS. We then ask whether the estimated coefficient on having come from the HECM data set falls in the presence of observable covariates.

If moral hazard is a concern in the reverse mortgage market, it appears from Section 3 that mobility rates in HECM should be lower where default is a possibility. For most HECM borrowers (the median in our data set enrolled in 1999), regional price appreciation has been large enough to render default unlikely in the foreseeable future. However, home price appreciation has varied considerably by region. Since 1999, OFHEO repeat sales data show that state-level annual price appreciation has varied from a low of two percent per year in Utah to a high of 14 percent per year in Washington, DC. We thus test the condition on moral hazard by asking whether the effect of HECM participation is weaker in markets with extremely low average price

[20]The rapidity of tenure termination among HECM borrowers extends to couples and single men.

appreciation.

If it is true that the high rate of exit from homeownership on the part of reverse mortgagors is attributable to advantageous selection effects swamping moral hazard effects of take up, then we might expect to observe greater differences in mobility rates where it is more plausible that advantageous selection could outweigh moral hazard and smaller differences where this condition is less plausible. Older borrowers are allowed larger initial loan to value amounts than younger borrowers, so that marginal utility before moving should become quite small relative to marginal utility after moving. For younger borrowers, it is true that the available loan balance rises with time spent in the home, so that upon reaching a given age, they will have the same principal limit as a borrower at that age has. However, if prices are rising, home equity as a function of age among younger borrowers dominates home equity as a function of age among older borrowers in a given region. In sum, if moral hazard and advantageous selection are operative, we should see a greater difference between HECM and non-HECM borrowers at relatively young ages than at older ages. Further, this difference in differences should be more pronounced in high appreciation environments.

4.1 Data

Estimation is undertaken using two distinct data sets. The first is from the US Department of Housing and Urban Development (HUD) and contains loan information on all 77,007 HECM loans originated since the program's inception. We observe the date of loan closing and the date of loan termination, either through death or voluntary mobility. We also observe income, financial assets, home equity, appraised property value and outstanding debt on the home if any. The income data appears to be of poor quality and likely excludes pension and social security income, given the large number of zero (distinct from missing) values assigned. Borrower's age is also known. For the most part, the reason for loan termination is not reported. Among the loans for which the reason for termination is reported, the large majority are either death or moving. Only approximately 2% of loans report prepayment without a move. This is not surprising given the very little financial wealth reported by borrowers. Unfortunately, while we know the observe the maximal credit limit at the time of loan closing, we do not know the extent to which credit has been used.

A comparison group of single women homeowners is found in the AHS, a bienniel panel survey of over 55,000 homes. Since 1985, the same set of homes has been surveyed, with occasional additions. We observe mobility through 2001. In this data set, we can consider the start of a spell to be the year and month of a first interview with a single woman homeowner. As in the HECM data set, income, age, property value (the owner's estimate) and an indicator for financial assets in excess of $20,000 are available.

Termination of a spell of homeownership is identified by noting the first date, if any, at which the home is occupied by a different household or individual. The AHS identifies metropolitan area, from which a state can be imputed.[21]

Combining the HECM and AHS data, we can compare truncated lengths of stay between borrowers and non-borrowers, under the assumption that HECM participation rates are so low (less than one-tenth of one percent nationally) that the AHS women are all non-borrowers. That is, we observe the length of completed states and a lower bound on length of not yet completed stays in both data sets.

A natural concern in comparing mobility rates between two different data sets is that the AHS data might under- or over-report the rate at which older women exit from homeownership due to imperfect data collection.[22] To address this concern, we estimate mortality and mobility rates in three different data sets to see if AHS appears consistent with other data sets populated almost entirely by non-reverse mortgagees. Table 1 compares mobility and mortality rates over two year periods across these data sets. The AHEAD survey of older women is an outlier for its low imputed mobility rates among single women homeowners. The AHS features a combined mortality plus mobility rate that is slightly higher than the implied mortality plus mobility from the Berkeley Mortality Database and the SIPP mobility survey of 1996. The AHS combined termination rate is overstated yet more if we consider that mortality rates are typically lower among homeowners than renters, as suggested by comparing the AHEAD mortality rates from 1993 to 1995 to those in the general population (mortality is nonlinear, so the comparison is imperfect). It appears that, if anything, the AHS overstates the speed of implicit loan termination.

Some more data from the AHEAD survey is in agreement with our conclusion

[21]State is assigned as the state in which the central city of a metropolitan area is located.

[22]HECM terminations may also be defined differently from AHS terminations.

Table 1: Two-Year Mobility and Mortality Rates among Single Women Homeowners Aged 62 + in Several US Population Surveys

Data	Mortality	Mobility	Mortality + Mobility	Mean Age
AHS 1985-2001			14.2%	73.6
Berkeley Mortality 1993-1995	5.5%			74
SIPP mobility survey 1996		8.0%		76
AHEAD 1993-1995	7.4%			78.8
AHEAD (Venti and Wise (2000))		3.8%		
Berkeley Mortality 1993-1995	7.9%			78

Notes: Berkeley data is for women aged 73 or 77 in 1993 only. Venti and Wise use the entire AHEAD panel.

concerning the role of income in mobility and suggests that the μ_0 and μ_1 terms, the changes in which reflect health status, are critical factors in determining mobility. Results are presented in Table 2. This table presents results from a probit estimate of the probability that a household moves out or dies between 1993 and 1998. These estimates are based on a survey of 2,317 households headed by an individual over age 70 in 1993. We find that income is associated with a lower probability of moving but that the interviewee-assessed probability of leaving $10,000 to heirs has no effect, nor do non-housing financial assets.

4.2 Move Out Date and Reverse Mortgage Take Up

Figures 2 and 3 show Kaplan - Meyer survival time and hazard rate estimates based on the AHS and HECM data. A failure date in the AHS data is listed as the earliest date at which a respondent who is not the original single woman occupant reports moving into a home, if this occurs at all.[23] A failure in the HECM data is the date at which the loan terminates, if the loan has terminated as of mid-2003. As noted above, HECM loans appear to terminate only very rarely for reasons other than a move or death We see that single women participating in HECM terminate the loans at a rate far in excess of the combined mobility and mortality rates in the AHS. This is consistent with the preliminary results in Rodda et al. (2000), but inconsistent with fears of moral hazard or adverse selection.

Table 3 adds to the hazard analysis some covariates that, based on the discussion above, might be expected to affect the date at which loans terminate or at which move out or death occurs. Here HECM is an indicator for participation in the HECM program. Age reflects age at entry into observation (a in the notation above), so there is an implicit assumption that changes in mobility rates follow the change in the baseline hazard. Table 4 provides summary statistics. Separate means are provided for each data set. Unfortunately, measures of health status are available in neither the AHS nor the HECM data set. The AHEAD results suggest that these are critically important factors. A plausible advantageous selection story would be that HECM proceeds are used to pay medical expenses which eventually lead to death or departure from the home.

Columns (1) and (3) of Table 3 demonstrate that the presence of covariates does not alter the conclusion that older women participating in HECM leave their homes much more rapidly than do similar women who are not participants. Older single women HECM borrowers move out at a rate approximately 50 percent greater than the rate for older single women in AHS, and this number is diminished only slightly by the

[23] On average, this date is earlier than the date at which the respondent reports having purchased the home, biasing mobility rates up, not down in AHS.

presence of covariates.

The (unreported) effect of age is predicted by the model; advanced age (and hence a shorter remaining lifetime) renders moving more attractive (and death more likely). The shorter horizon has an ambiguous effect on reverse mortgage demand, but the reverse mortgage borrowers are older than average. HECM borrowers are typically in the sample for a shorter period than the AHS comparison group, hence identification requires that age dependence α not depend on age.[24] This is an element of advantageous selection; as reported in Table 4 shows that HECM borrowers are somewhat older than their AHS counterparts.

Columns (2) and (4) of Table 3 shows that there is no significant effect of log income on mobility in the full sample. However, we find in column (3) that among those not taking on a HECM, there is a nearly significantly negative effect. Unfortunately, many HECM borrowers are listed as having no income; this presumably reflects a legal restriction on using social security income to support loan payments. This lack of effect does not run counter to the model, which predicted an ambiguous effect of income on length of stay. Table 4 reports dramatically lower incomes in the HECM sample, but this again could reflect definition. Nevertheless, the negative effect of income on mobility among non-mortgagors and the selection of evidently low income widows into HECM suggests advantageous selection.

As predicted by the model, we find a consistently positive effect of home value on the hazard out of homeownership. Again suggesting positive selection, we find in Table 4 that the HECM borrowers have dramatically more expensive homes than non-mortgagors. This difference overstates the true difference because the HECM data set is on average newer than AHS and the bulk of originations have been made since the price boom starting in the mid- to late- 1990s.

A clearer picture of housing value relates to wealth. We see that despite much larger housing prices and a run-up in the stock market, HECM borrowers are much less likely than AHS older woman homeowners to have \$20,000 in savings (the discrete figure is all that is available in the AHS data set). Figure 4 and shows the distribution of non-housing assets and the ratio of housing assets to these other assets in the HECM data set and the AHEAD data set, respectively. We see both less wealth and much more concentration of wealth in housing among HECM borrowers. This is hardly surprising given the program details which guarantee that it is a poor idea to take up the reverse mortgage when liquid assets are available.

[24]The time dependence paramter decreases only insignificantly when the sample is restricted to women over 80.

5 Conclusion

There appears to be substantial advantageous selection (or the opposite of moral hazard) in the US reverse mortgage market to date, at least among the plurality of borrowers who are older women participating in HECM. There is clear selection on observables such as house value, age and price appreciation. However, even controlling for these observables, we find a significant positive correlation between HECM participation and the rate of departure from homes. The model presented in Section 3 makes it hard to believe that this relationship is causal in the sense that a HECM loan enables early move out. Rather, it appears that some borrower characteristics, such as health status, access to unreported assets, bequest motives, localized price conditions or an attachment to home equity (perhaps due to some precautionary concerns), are both unobservable and important determinants of reverse mortgage demand that are associated with early move out. At least in recent years, we might reason that reverse mortgages enable longer stays at home, but that the kind of people who want to cash out their housing wealth turn first to a reverse mortgage and relatively soon thereafter to disposal of the entire asset.

A consequence of the evident advantageous selection has been that there have been very few losses paid out of the comparatively large reserves collected by the FHA as insurance against insufficient collateral. Interestingly, the large fixed fee and low interest rate that characterize the HECM program would seem to guarantee long stays among borrowers, since a home equity line of credit (with almost no fixed fee and a higher interest rate) seems to dominate HECM unless the planned stay is very long. In this way, it seems that reducing the large fees would be justified both by more rapid move outs than expected to date and by likely falling move outs with reduction of the fee. The analysis presented above suggests, however, that a reduced fee might invite participation by homeowners less eager to take out home equity and thus perhaps less likely to move out conditional on a less than 100% loan to value ratio. Given the tendency for the model's predictions concerning selection to flip to adversity when loans are more likely to go under water, this result may hinge on continued conditions in which there is no need for insurance in the first place.

It will be interesting to observe whether the favorable selection observed to date continues in any periods during which interest rates far exceed price appreciation. Some speculate that such a regime is imminent. When default is likely to occur in the sense that loan balance exceeds amount due, a longer stay becomes more attractive with falling prices. Already, we find that HECM borrowers living in states with low historical appreciation are dramatically slower to move out of their homes than HECM borrowers living in other states, and that this phenomenon does not occur among non-borrowers.

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Figure 1: Reverse mortgage design. Loan balance is repaid by the borrower as late as the date of move out of the home or death. F denotes financed closing costs.

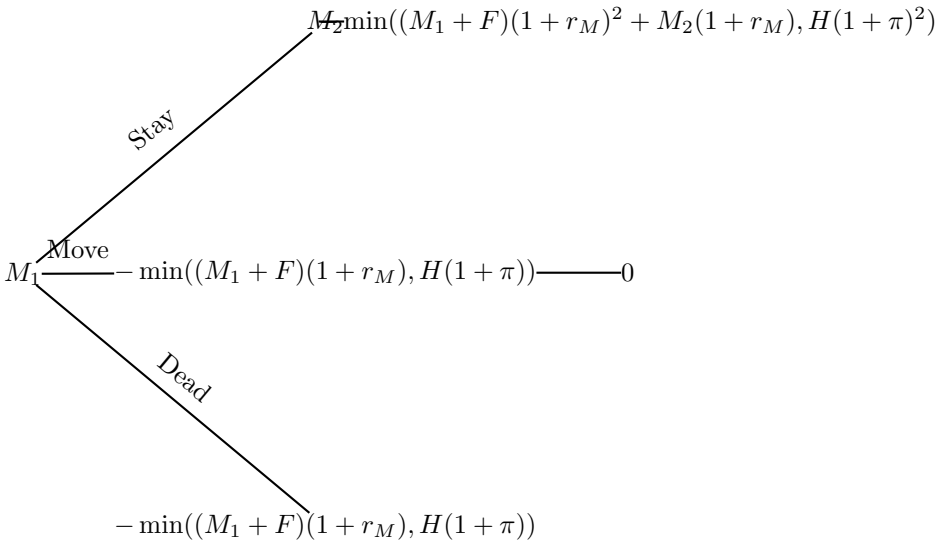
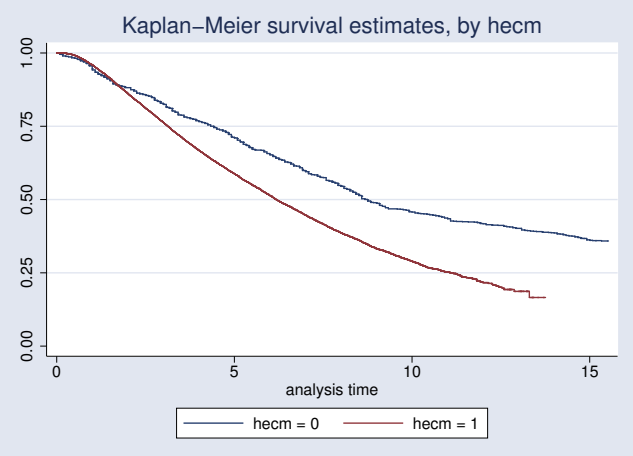
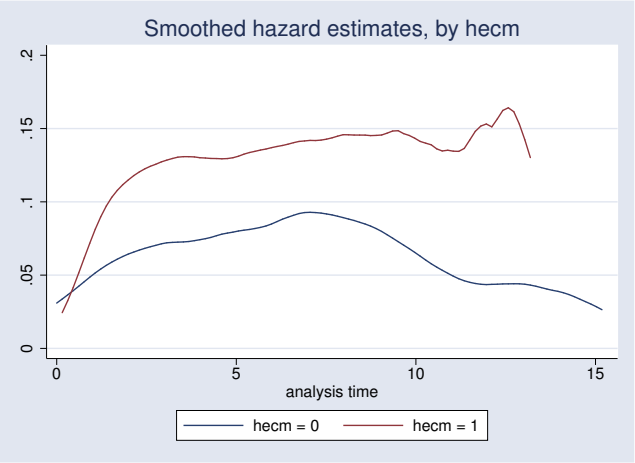


Figure 2: Kaplan-Meyer survival time estimates: Older Single Women Home Equity Conversion Mortgagors versus American Housing Survey



Note: The blue (top) line is estimated time to move or die for single women homeowners over age 62 in the *American Housing Survey*. The red (bottom) line is estimated time to loan termination for single women homeowners participating in the HECM program.

Figure 3: Empirical Hazard out of homeownership: Older Single Women Home Equity Conversion Mortgagors versus American Housing Survey



Note: The blue (bottom) line is estimated time to move or die for single women homeowners over age 62 in the *American Housing Survey*. The red (top) line is estimated time to loan termination for single women homeowners participating in the HECM program.

Table 2: Probit estimates for moving or dying between 1993 and 1998 based on 2,317 AHEAD households

	Coef.	Std. Err.	z	$P > \|z\|$
price growth	-.0003569	.0004823	-0.74	0.459
bequest10k	-.0001967	.0009021	-0.22	0.827
Medical Exp.	.0000136	1.97e-06	6.91	0.000
healthprobs	.0936794	.0358571	2.61	0.009
income	-.0741869	.0422975	-1.75	0.079
houseval	-.0642961	.0420285	-1.53	0.126
fin.wealth	-.0020503	.0069724	-0.29	0.769
woman?	.196514	.0806384	2.44	0.015
married?	-.1956254	.079148	-2.47	0.013
Num.children	-.0025585	.0167843	-0.15	0.879
constant	78.45095	49.78365	1.58	0.115

Notes: A fifth order polynomial in mean age among household members is included by not reported. bequest10k asks the probability that the household will leave $10,000 to their children (this estimated probability is typically strikingly low given housing and other assets). healthprobs ranks the severity of any health problems, averaged across household members. Num.children is the number of children (not necessarily living with the household. Price growth is estimated from OFHEO based on Census region. Medixal Exp. is out of pocket medical expenditures over the past year.

Table 3: Regressions of Hazard Rates on HECM Participation and Covariates. Dependent variable is the estimated time-varying hazard rate under the Weibull distribution

	(1)	(2)	(3)	(4)	(5)	(6)
HECM	1.51**	1.47**		0**	0**	
	(.074)	(.104)		(0)	(0)	
ln Value	1.19**	1.12**	1.14	1.12**	1.21**	.98
	(.019)	(.014)	(.095)	(.034)	(.022)	(.057)
ln Income		1.04	.93	1.05		
		(.027)	(.132)	(.027)		
INV20K	.87**	.95	.746	.947	.866**	.83**
	(.03)	(.042)	(.114)	(.042)	(.036)	(.086)
ln Price		1.08	.373**	.381	.322**	
		(.091)	(.184)	(.184)	(.155)	
RETURN		.96**	1.14	1.13	1.16	
		(.014)	(.095)	(.092)	(.094)	
LOWRETURN		.698	5.36	6.93	8.57**	
		(.189)	(5.83)	(7.00)	(8.64)	
HECM*ln Price				2.93**	3.92**	
				(1.44)	(1.90)	
HECM*RETURN				.84**	.82**	
				(.070)	(.067)	
HECM*LOWRETURN				.095**	.11**	
				(.01)	(.116)	
TENURE					.99*	
					(.003)	
Excludes HECM?	No	No	Yes	No	No	Yes
Age polynomial	Yes	Yes	Yes	Yes	Yes	Yes
Time dependence α	1.45**	1.46**	1.47**	1.38**	1.49**	1.11**
	(.009)	*(.009)	(.010)	(.016)	*.010)	(.043)
Observations	41,608	7,748	374	7,748	40,932	772

Notes: Z-statistics reported in parentheses - subtract one from the coefficient estimates and divide by the standard error to get something akin in magnitude to a t-ratio. These estimates come from a merge of the cross section of HECM loan performance with the American Housing Survey Panel from 1985 to 2001. State fixed effects are approximated in the sense that the state of residence in AHS is identified through the location of the central city of a metropolitan area. The polynomial in age (at the time of first observation) contains five terms. INV20K denotes non housing assets are worth at least $20,000. ln Price is the log of mean price in the state in which an individual lives. HECM*ln Price interacts an indicator for HECM status with the mean price measure. RETURN measures the total percentage change in the OFHEO state price index from 1976-2003. LOWRETURN indicates that the log total return is less than 3. TENURE is how long prior to the first observation the individual lived in their home.

Table 4: Summary Statistics for Hazard Regression Covariates

Variable	Obs. HECM	Mean HECM	Obs. AHS	Mean AHS
AGE	41,004	76.2	1,301	72.7
House Value	41,004	144,807	1,301	58,370
Income	41,004	2,841	1,299	12,047
$\frac{\text{House Value}}{\text{Total Assets}}$	40,608	.95	0	.
$\frac{\text{House Value}}{\text{Income}}$	7,416	24.64	1,280	11.66
INV20K	41,004	.02	786	.28
PRICE (state mean)	40,793	148,165	684	142,550
RETURN (state mean)	40,924	5.55	684	2.05
LOWRETURN	41,004	.005	685	.0015

Figure 4: Distribution of non-housing assets (horizontal axis) and ratio of housing to non-housing assets (vertical) in the HECM (top panel) and AHEAD (bottom panel) data sets [Figure on next page]

Figure 5: Distribution of non-housing assets (horizontal axis) and ratio of housing to non-housing assets (vertical) in the HECM (top panel) and AHEAD (bottom panel) data sets