

Welfare Gains and Positive Selection in the US Reverse Mortgage Industry

Thomas Davidoff and Gerd Welke

Haas School of Business UC Berkeley

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Abstract

Reverse mortgage products have the flavor of insurance because they transfer money from states featuring high wealth and plausibly low marginal utility (homes are typically sold when the homeowner is dead or in ill health) to states with low wealth and plausibly high marginal utility. Despite the intuitive appeal of reverse mortgage products, there has been little demand in the US, where only 77,000 have been issued under the program with terms most favorable to most older homeowners (HUD's HECM program). This paper explores the demand issue by identifying conditions under which this most extensively marketed reverse mortgage product improves welfare for a 75 year old single woman homeowner. Numerical solution to utility maximization problems suggest economic losses of \$750 under extremely adverse conditions for reverse mortgages; gains of \$15,000 to \$25,000 with less adverse financial conditions or a weaker bequest motive and \$67,500 for a plausibly representative older women with no bequest motive. These gains are large relative to those that would arise for a similar retiree in a standard model of annuities. We also explore the histories of the existing HECM loans to estimate the extent to which adverse selection affects the reverse mortgage industry. Confirming earlier studies, we find that adverse selection is not a concern in this market. Indeed on the dimensions of mobility and regional price appreciation we find positive selection. Hence the smallness of the reverse mortgage market represents an important puzzle in the literature on aging. The positive selection effects seem to be consistent with increasing benefits of both reverse mortgage take up and sale of the home with rising housing prices.

Housing is the most important asset for many American families, including older Americans.¹ Older homeowners are not highly mobile; Sheiner and Weil (1992) report based on the Panel Survey of Income Dynamics that a 75 year old widow homeowner will move out of her home in the next year with a probability of approximately 4%. This figure is consistent with results from panel analysis of the American Housing Survey and implies a probability of roughly 50% that such a woman will die while she still owns her home. Hence many older households hold a large amount of unliquidated wealth for a long period.² As long as the bequest motive is not too strong, the logic of Artle and Varaiya (1977) suggests that there should be considerable value to a product which allows such households to transfer wealth from the date at which their home is sold to earlier dates. In particular, Artle and Varaiya show that households should be willing to pay a premium over the interest rate at which they save to borrow against their home if they are allowed to defer payment until they leave the home.³

Most older homeowners are likely unfamiliar with the workings of the life cycle model but are in contact with the popular press. A Google search revealed 671 web pages where “reverse mortgage” and “unscrupulous” are both mentioned, so it is presumably not common knowledge in the population that reverse mortgages enhance welfare.

To our knowledge, there is no normative economic model of the gains to reverse mortgages that adds the realistic complications relative to Artle and Varaiya (1977) of stochastic dates of both death and departure from the home. The analysis is similar to the analysis of the effect of annuities on individual welfare in that both reverse mortgages and annuities transfer money to states in which the individual is alive from states in which the individual is dead. There are, however, two important differences. First, reverse mortgages require repayment when the borrower exits their home, so there are states in which the borrower is alive but the reverse mortgage program has made her worse off. Second, the value of annuitization is diminished by liquidity needs. By contrast, reverse mortgages serve the purpose of meeting liquidity needs. Below we will incorporate the stochastic date of departure, although we retain the assumption that this date is exogenously given and incorporate only a particularly simple form of liquidity shocks.

The importance of understanding how older households treat housing wealth is difficult to overstate. Davidoff (2003) shows evidence that home maintenance behavior among the elderly combined with the absence of reverse mortgage demand sits well with neither a model with no bequests nor a model with strong bequest motives (nor

¹See, e.g. Kennickel, Starr-McCluer and Surette (2000) and Sheiner and Weil (1992)

²Mortgage debt is low among older homeowners.

³Artle and Varaiya assume a deterministic date at which the individual moves out of the home so the analysis is not identical.

any standard model in between). Whether or not older homeowners have the intention of cashing out housing wealth should have a direct effect on the level of housing prices and should determine the macroeconomic consequences of rising housing prices, such as have been experienced in the US in recent decades (exactly counter to the standard intuition mapped out in Mankiw and Weil (1989)).

1 The HECM Product

The theoretical willingness of older homeowners to pay a spread above the riskless rate to borrow against future housing sale proceeds underlies the reverse mortgage industry, which 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 which is currently the dominant reverse mortgage product in the US. The program works roughly as follows, based on a program evaluation done for HUD by Abt Associates in 2000.

Borrowers must be homeowners with very little or zero outstanding mortgage debt. Banks or mortgage brokers find borrowers, thereby earning upfront fees and the originators typically retain servicing rights. These lenders typically sell the cash flow rights associated with the loans to Fannie Mae. The loan cash flows are insured by the Federal Housing Agency against default. In exchange for the guarantee, 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.⁴ 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.

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 interest rate on HECM loans may be fixed or adjustable, but almost all are

⁴One would expect considerable legal difficulty in evicting an elderly mortgagor for failing to make sufficient repairs to their home.

adjustable as Fannie Mae will only purchase ARMs 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.⁵ The median ratio of closing cost to property value is 6.8 percent.

Absence of demand has led to the exit of many originators.⁶ The potential size of the market is huge. The 2000 US Census reports that there are approximately 17.5 million homes owned by households with heads over age 65. Hence the total originations of 77,000 to date in the decade of HECM operation represents a very small market share. Indeed, Mayer (1994) suggests that the HECM product should be attractive to at least six million older households. From the American Housing Survey, homeowners aged over 65 had homes that averaged values of \$170,000 in 2001. If 10 percent of the value of these homes were subject to reverse mortgages, the outstanding balance would be approximately \$300 billion. The next section explores the extent to which an increase in demand is warranted by life cycle considerations.

2 Modeling The Effects of HECM on Borrower Welfare

The lack of demand for annuity products is presented as a puzzle because the introduction of annuities yields gains to consumer welfare. In particular, several authors have shown that a consumer with standard preferences would be indifferent between a world in which annuities are available and one in which annuities are not available but a significant fraction of wealth (akin to a compensating or equivalent variation) is granted in return.⁷ To estimate a similar value for the right (and obligation) to undertake a particular HECM mortgage, some assumptions on the utility function and its arguments are required.

We consider a 75 year old single woman homeowner. We endow this woman with assets and income that make a reverse mortgage appear moderately attractive on the surface. This seems natural given that we would like to know if there is a substantial fraction of the population that would benefit from a reverse mortgage, not whether all older households would gain. Thus she has a house valued at the 75th percentile

⁵The 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.

⁶Other 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.

⁷See for example (Mitchell, Poterba, Warshawsky and Brown 1999).

among 75 year old women in the fifth Health and Retirement Survey (HRS) wave, or 140,000. She has income (which I assume is constant across time) and assets at the 25th percentile of women 75 or over with houses worth over 90,000. This yields an annual income of 15,000 and net non-housing wealth of 17,000.

The woman maximizes lifetime utility which is a sum of subutilities over annual consumption and the terminal bequest subject to a budget constraint which forbids negative wealth. Savings earn a real interest rate of 3 percent and as a baseline there is no inflation. Interest accrues on the reverse mortgage balance at the real rate plus a typical spread of 1.5 percent. To facilitate computation, I assume that the entire loan balance is withdrawn at age 75. Given positive assets and the 1.5 percent spread, this assumes a greater loan balance due than would be the case under optimal behavior where liquid assets are run down to zero before a reverse mortgage line of credit is tapped. Thus welfare gains here will be understated. I assume that annuities beyond those which provides annual income are unavailable (the tenure payments option is like an annuity, but payments end when the owner moves out of the home).

In the absence of a bequest motive and any possibility of moving out of the home, the value of taking on a reverse mortgage is equal to the loan amount. This is because repayment occurs only in states of the world (death) which someone with no bequest motive does not care about. Valuing the reverse mortgage is more complicated when, as in the real world, the individual may move out of the home and thus be required to repay the balance due before death. The balance due exceeds the loan amount in present value because of the interest rate spread and the upfront fee (assumed to be 6.8% of the loan value). Thus if frontloading consumption is not sufficiently important and if the probability of a move is relatively high the reverse mortgage can be unattractive even in the absence of a bequest motive. A bequest motive can be expected to detract further from the value of a reverse mortgage to the borrower because even absent a move, repayment occurs in a state of the world where money is valued.

For modeling purposes, at least two important assumptions must be made regarding what occurs after a move: changes to the subutility function and changes to the probability of survival. We might think that marginal utility (holding wealth constant) increases after a move because moves might be occasioned by increased medical and hence financial needs. Indeed, Heiss, Hurd and Borsch-Supan (2003) show that a common transition from one's own home is to a nursing home. A move generally will require new financial burden in that housing payments must be made relative to the assumption that there was no mortgage debt on the existing home. However, there may be a negative complementarity between consumption and the state of being in ill health. We thus assume a constant utility function while alive, regardless of where one lives, but we allow for the possibility of required expenditures up to \$30,000 per year.⁸

⁸In this version, medicaid is ignored. The consequences of the presence of medicaid for the attractiveness

A second assumption concerns the probability of death conditional on being alive. We borrow mortality probabilities for ages 75 to 105 year old from Berkeley’s mortality database. To speed computation I assume death occurs with 100 percent probability at the end of the year if the woman lives to be 105. However, I multiply these probabilities by 1.5 (up to a maximum of 100 percent probability) in states of nature where the woman has moved out of her home. This is consistent with the correlations among ill health, mortality and moving out of one’s home found by Sheiner and Weil (1992) and Heiss et al. (2003).

As is commonly done, we assume that utility is additively separable across time and that utility over consumption c in any period has the constant relative risk aversion form of $\frac{c^{1-\gamma}}{1-\gamma}$. In particular, we assume that γ is equal to 2 so that utility is given by $\frac{-1}{c}$. This seems moderately risk averse given the responses to questions in the Health and Retirement Survey concerning willingness to gamble different fractions of something that could be interpreted as either income or wealth. We assume that the bequest motive has the same curvature as the periodic utility function and is multiplied by some number κ . Discounting arises only from mortality probabilities. Hence, lifetime utility can be written as:

$$U = \sum_{t=75}^{105} q_t \left(\frac{c_t^{1-\gamma}}{1-\gamma} + m_t \kappa \frac{w_{t+1}^{1-\gamma}}{1-\gamma} \right). \quad (1)$$

Here q_t is the probability as of age 75 that the individual will be alive. m_t is the probability that the individual dies at age t conditional on surviving to date $t - 1$. We assume that there is no discounting of future utility over consumption or bequests, other than a weighting of future utility by survival probabilities. It is clear that an increased discount rate will increase the value of a reverse mortgage because the reverse mortgage involves the transfer of funds from later to earlier periods.

w_t , wealth available at time t is constrained to be positive. w_t ’s value is given by:

$$w_t = (w_{t-1} + RM_{t-1} - c_t + H_{t-1} - X_t)(1 + r), \quad (2)$$

RM_{t-1} represents transfers arising from the reverse mortgage program at date $t - 1$ and H_{t-1} represents the sale price of the home if the widow moves out of her home at the end of period $t - 1$. I assume that there is no real house price appreciation; relaxation of this assumption would predictably increase the value of the reverse mortgage to the borrower. X_t represents required medical or housing expenditures that do not arise while the widow lives in the home she owns but do arise after she moves out.

of a reverse mortgage are unclear and depend on medicaid’s treatment of housing wealth. For a permanent move out of one’s home and into a nursing home, most states would capture home equity before paying for the nursing home from medicaid funds. This suggests that the presence of medicaid makes HECM more, not less attractive in that the disutility of zero wealth is bounded.

Reverse mortgage transfers RM are equal to the maximum loan amount of 100,000 (based on interest rates of November, 2003 and the results of AARP's Reverse Mortgage Calculator software) at age 75 and equal to the outstanding loan amount (the future value of RM plus fees of 6.8 percent, with interest accruing at the real interest rate plus the interest rate spread). I vary κ between 0 and 50. At a value of 50, the bequest motive is extremely strong. In the last year of life, an individual with such a large value for κ with \$60,000 in wealth would consume \$1500 and bequeath the remainder.

Because repayment of the reverse mortgage is triggered by a move out of the home, the state space is fairly simple. At the age of 76, the individual may die, move or live in the same home. If the individual has moved, she may remain out of the home or she may die at age 77. If the individual has stayed through age 76, she may again stay, move or die. If she has died at age 77, she remains dead. These transition possibilities are repeated up to age 105. The probability of moving, based on the results of Sheiner and Weil (1992) and panel analysis of the American Housing Survey, is equal to 4.5 percent through age 85 and 8.5 percent per year thereafter.

3 Optimization Procedure and Results

To solve the utility maximization problem subject to a positive wealth constraint, I solve the problem backwards. I allow wealth and consumption values between \$1,500 and \$300,000 in each period. We solve for the optimal level of consumption conditional on wealth at the maximum possible age of 105 under the assumption that the individual no longer lives in their home (this amount depends on the strength of the bequest motive). This yields a value function mapping wealth at age 105 to a terminal utility and allows an estimate of optimal consumption and attained utility conditional on wealth at age 104. We solve backwards to age 76 under the assumption that the individual no longer lives in her home.

The above procedure provides a mapping from wealth to indirect utility based on transiting from alive and in one's home to alive and out of one's home for every age from 76 to 105. We then solve backwards for optimal consumption conditional on being alive and in one's home for every age from 75 to 105. The woman weighs utility over consumption in each period against the probability weighted indirect utilities of (1) being alive and in one's home, (2) being alive and moving and (3) being dead (if there is a bequest motive). Exiting any period with negative wealth generates practically infinitely negative utility.

We find that there are large gains to the reverse mortgage but that these gains vary considerably depending on assumptions regarding the utility function and annual required expenditures as a result of moving out of one's home. Table 1 presents the

equivalent variation associated with the introduction or elimination of reverse mortgage contracts under different assumptions. With no bequest motive and no additional spending required (scenario 1), the opportunity to participate in the HECM program has a value of 67,500 to our hypothetical widow. Introduction of a bequest motive reduces the value of the program to 15,000 or 9,000, depending on the relative weight put on bequests. It should be noted that weights of 25 and 50 imply very large bequest motives: in the last year of life consumption expenditures based on a wealth of \$60,000 would be \$60,000 with no bequest motive but only \$10,500 with $\kappa = 25$ and \$7,500 with $\kappa = 50$.

A large level of required expenditures after moving out of the home reduces the value to 15,000 with no bequest motive. The logic is that the required expenditure increases marginal utility in states where the individual has already lost money due to the presence of the reverse mortgage. \$30,000 seems like an extremely large negative financial shock relative to resources and the presence of medicaid, but the purpose is to consider the welfare consequences of a reverse mortgage under a broad set of circumstances for a more targeted type of consumer. A slightly negative valuation of the reverse mortgage arises when there is a very strong bequest motive and large expenditures are required when the homeowner has exited the home. The negativity of this last number may not be robust to a realistically timed drawdown of a home equity line of credit because smaller loan amounts in early years of the loan's life would reduce interest spread expenses.

The natural conclusion is that it is difficult to come up with preferences and post-mobility conditions such that the reverse mortgage harms a house rich and cash poor older household. It is easy to come up with assumptions whereby the gain is very large relative to wealth.

As discussed in the conclusion, the value of the reverse mortgage falls when the ratio of liquid wealth to housing wealth rises. Presumably the desire to move out of one's home decreases when this ratio rises. In combination, these facts may explain the positive selection effects discussed below. Future work will extend the model to endogenize the date at which homeowners leave their houses with stochastic house prices. This is a complicated matter because it requires strong assumptions on complementarities between housing consumption and other consumption in the period subutility function.

4 Adverse Selection in the HECM History

While the results above suggest that a reverse mortgage is likely to be attractive to households with few assets other than their home, demand alone does not necessarily

Table 1: Utility Gains from a HECM Reverse Mortgage of 100,000 on a 140,000 home for a 75 year old woman with 15,000 in nonhousing financial wealth and an annuitized income of 15,000.

Scenario	Parameter	Assumed Value	Value to Consumer of HECM
1	κ (increasing weight on bequest)	0	67,500
	X (required annual spending after selling home)	0	
2	κ	25	15,000
	X	0	
3	κ	50	9,000
	X	0	
4	κ	0	25,500
	X	30,000	
5	κ	50	-750
	X	30,000	

Notes: Values are based on numerical simulation of a consumption problem starting at age 75. The woman's subjective discount rate is zero and her coefficient of relative risk aversion (in a CRRA utility function) is 2.

lead to growth of the reverse mortgage industry. Adverse selection and moral hazard threaten the viability of the reverse mortgage business as they do the conventional mortgage business. A particularly salient threat is adverse selection on health status, which has been demonstrated to affect the market for annuities (see Finkelstein and Poterba (2003)). Indeed, the famed Frenchwoman Jeanne Calmet, who lived to be 121 sold her apartment forward in her late eighties in what must have been a disastrous arrangement for reverse mortgagee Andre-Francois Raffray.⁹

It is not obvious that reverse mortgagors should be expected to remain longer in their homes than their non-mortgagor homeowner counterparts. Reverse mortgages should be attractive to people with larger subjective discount rates who may die sooner or be forced by financial or health reasons to leave their homes sooner than others.

A second potential source of adverse selection is with respect to the regions from which mortgagors can be expected to come. The HECM program provides identical loan to value ratios and interest rates across the nation. Naturally, one expects greater housing price appreciation in urban coastal areas with positive projected population growth (e.g. coastal California) and less appreciation where population growth is negative and land is abundant (e.g. rural Kansas). A homeowner who is certain that

⁹This was reported by the AP on August 5, 1997.

her house will depreciate rapidly should be more likely to take up a reverse mortgage because the default option is likely to be deep in the money.

That regional adverse selection will arise is not obvious, either. Analysis of home maintenance behavior of younger and older homeowners reveals that older homeowners spend considerably less on home maintenance than younger homeowners. This suggests that older homeowners may be taking home equity out of their homes via deferred maintenance.¹⁰ If this reduction in home equity is a matter of conscious choice, then paying any lump sum required to bring a home up to HECM requirements may render the loan unattractive if the repair work is large relative to the home's value. This would suggest that the reverse mortgage should be attractive in markets where value per square foot of housing is large, so that deferred maintenance is small relative to the wealth that can be gained from taking on a reverse mortgage. Large values per square foot should be associated with large lot size. Hence rural areas would be natural candidates for reverse mortgages but more so with areas with high population densities and with large expected growth in prices. The ability of older homeowners to destroy value through deferred maintenance could affect the profitability and the pricing of the reverse mortgage product, an issue raised in Shiller and Weiss (2000). The empirical applicability of that analysis will be incorporated in future work. A further consideration is that increases in house prices have been serially correlated in the post-war era, so people who face low expected appreciation are likely people with low housing to wealth ratios such that reverse mortgages become relatively unattractive.

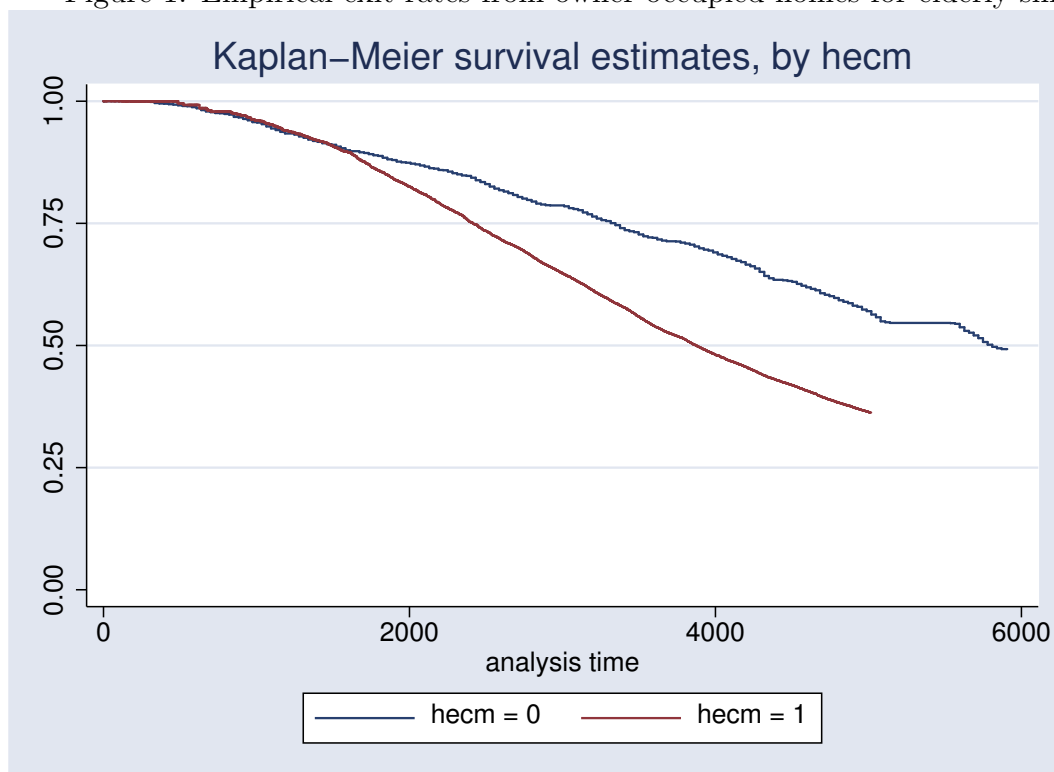
4.1 Length of Tenure With and Without HECM

Using American Housing Survey panel data on particular homes we can estimate the rate at which older homeowners exit their homes. Similar hazard rates can be observed in HECM loan performance data from HUD. Figure 1 displays Kaplan-Meier survival estimates from the two datasets. Visual inspection shows that there is favorable selection rather than adverse selection, at least through twelve years from reverse mortgage take-up. The figure displays data only for households with a single woman at the start of each panel.

A more formal way to determine the nature of selection in the HECM program is to estimate a proportional hazard regression, pooling the observed mobility or lack thereof in the AHS and HECM samples. A proportional hazard model is rejected by visual inspection. I thus present results in Table 2 for the Weibull distribution which implies a proportional hazard, and the lognormal and log-logistic hazard which do not imply

¹⁰Davidoff (2003) shows that older homeowners spend roughly 1,000 less per year on home maintenance than older households and that this undermaintenance is associated with capital losses of 2 to 10 percent of house prices per year.

Figure 1: Empirical exit rates from owner occupied homes for elderly single women



Notes: Data are from the American Housing Survey 1985-2001 and from loan performance data from HUD on the Home Equity Conversion Mortgage. The sample is confined to 41,179 single women over age 62 in 1985 in the AHS and 2,177 women from the HECM sample with loan origination dates from 1992 to 2003. Failure time in this context is the date at which the women leave the homes in which they start the sample. Units of time are days since either entry into the AHS sample or HECM loan funding date.

proportionality. The log likelihoods are similar for both distributions. In all cases, with or without controls for the age of the woman at the time at which the sample starts, we find a significant difference between the HECM and non-HECM group, with the HECM group departing their homes at a date 25 to 35 percent earlier than the AHS group.

In sum, we find the opposite of adverse selection in these data. An important caveat is that we do not know the departure behavior at the right tail of the data. However, it appears from Figure 1 that in the first year or two after takeup, the HECM group is less mobile, and that the difference in mobility rates switches and becomes more pronounced over time, not less pronounced.

Table 2: Estimates of the relationship between HECM participation and exit rate from homes.

	Weibull	lognormal	log-logistic
HECM Participation	-0.359 (14.62)**	-0.252 (11.06)**	-0.262 (12.54)**
Constant	8.343 (282.81)**	7.760 (178.27)**	7.866 (161.06)**
Observations	43,321	43,321	43,321
Log likelihood	-14,567	-14,677	-14,644

Notes: Data are from the American Housing Survey 1985-2001 and from loan performance data from HUD on the Home Equity Conversion Mortgage. The sample is confined to 41,179 single women over age 62 in 1985 in the AHS and 2,177 women from the HECM sample with loan origination dates from 1992 to 2003. Failure time in this context is the date at which the women leave the homes in which they start the sample. Units of time are days since either entry into the AHS sample or HECM loan funding date. Absolute value of z statistics are in parentheses, * significant at 1%.

5 Location of HECM Loans and House Price Appreciateion

To determine whether HECM borrowers come from areas with large expected price appreciation, we determine the concentration of borrowers by state in the HECM loan histories and in the US Census, based on the 1990 1% microsample. We compare the fraction of homeowners by state in HECM to the Census fraction of homeowners over age 62 by state. Not surprisingly, the two fractions are highly correlated. A state's share of the HECM population has a correlation coefficient of .8 with the state's share of older homeowners in the Census.

A next test is to determine whether high concentrations of HECM borrowers are found in states with low expected returns. Expected returns are difficult to measure.¹¹ We proxy for expected returns at the date of HECM loan closing by simply estimating the nominal percentage increase in the Office of Federal Housing Enterprise Oversight's House Price Index between 1975 and 2003. The OFHEO index is a repeated sale index of housing prices by geographic area. As was the case with respect to mobility, I find positive selection. In a regression with the difference between a state's share of all HECM borrower's as a dependent variable and the state's historical change in the OFHEO index on the right hand side, I find that a unit increase in the OFHEO index change is associated with an increase of .0037 in HECM over-representation.

¹¹We use states as the unit of observation because this is the geographic detail I was able to obtain in the HECM sample. Metropolitan area would be preferable.

This effect is significant at a 1% level of confidence despite a sample size of just 50 states. This is relative to a standard deviation of .015 in the difference in shares and a standard deviation of 1.5 in the return series. So a one standard deviation increase in the historical return is associated with a one-half standard deviation increase in HECM representation.

As noted above, the historical component of returns may drive expected appreciation. Indeed, the increased rate of reverse mortgage takeup in recent years - more than half of the HECM originations since 1989 have occurred since 2000 - is presumably attributable in large part to the recent runup in housing prices. In any event, there is no evidence that housing returns are negatively correlated with reverse mortgage takeup. Indeed, examining returns subsequent to reverse mortgage takeup we find a significantly positive correlation of .46 between the excess HECM share and housing appreciation subsequent to the year of takeup.

6 Conclusions

Reverse mortgage originators have bemoaned the absence of demand for their product. The analysis in Section 2 suggests that demand should indeed be substantial. Even in the presence of a very strong bequest motive, unless the marginal utility of consumption is dramatically greater after homeowners move out of their homes than before, the gains from a reverse mortgage are the equivalent of free cash of \$20,000 for a retired homeowner with a moderately large housing to financial wealth ratio. In the absence of a bequest motive, the gain is considerably larger and very large relative to the comparable gain from annuitization.

Originators may need to be concerned about moral hazard related to maintenance - good quality data is not available on the level of maintenance performed on individual homes or even on resale prices. The volume of claims has been small due to rising prices for whatever quality of housing remains after the mortgagor leaves. However, there is considerable evidence that under-maintenance would occur even in the absence of a reverse mortgage, and the welfare gains found for mortgagors would evidently survive contracted maintenance visits.

Selection appears to be a benefit rather than a cost to reverse mortgage lenders. While it appears that reverse mortgagors are somewhat less likely to move in the first year of the contract, in subsequent years their hazard rates are significantly greater, implying shorter expected stays in their homes so that upfront fees are amortized over a short period and the difference between the real rate of interest and the presumably generally smaller rate of house price appreciation does not have time to drive default options into the money. There also appears to be positive selection on the dimension

of appreciation rates.

The positive selection on appreciation rates seems easily explained by serial correlation in housing returns and the increasing benefit of the HECM program in the housing to financial wealth ratio. Future work will seek to determine the causes of the observed positive selection along the dimension of mobility in the context of endogenizing the date at which older people leave their housing, presently modeled as stochastic and exogenous. Surveys of reverse mortgagors might indicate differences in maintenance needs or discount rates. More prosaically, it seems likely that mobility out of homeownership is engendered by the same rising housing wealth that leads to reverse mortgage takeup. We find that with no bequest motive and no added expenditures after moving out of one's home that the value of a reverse mortgage is \$67,500 to a woman with \$140,000 in housing wealth and \$15,000 in liquid financial assets. Halving the housing to financial asset ratio by increasing financial assets to \$30,000 reduces the value of the reverse mortgage opportunity by more than 50 percent to \$30,000. As suggested above, this would also likely reduce the incentive to move. Survey research on reasons for the failure to take up reverse mortgages should also prove interesting in the context of modeling the role of housing in a life cycle consumer's portfolio.

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