Hacking Reverse Mortgages

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Abstract

Reverse mortgages hold the promise of unlocking home equity to help meet retirees' spending needs while allowing them to age in place. Despite the product's potential as significant source of liquidity and insurance, the reverse mortgage market has been slow to take off. In the U.S., the HECM--a product designed and administered by the federal government—dominates the market. We develop a valuation model for HECMs and use it to suggest an answer to the reverse mortgage puzzle: why is it that a seemingly useful and subsidized product is so unpopular? The analysis suggests a financial explanation may be an important component of the answer: The loans are expensive for borrowers. There is a government subsidy, but the benefits are largely captured by the guaranteed private lenders. Structural changes to the program are proposed that could lower cost and improve the product's functionality and appeal.

1. Introduction

Home equity represents a large share of wealth for many older households. Approximately 80% of households over the age of 62 own their homes in the U.S., and home equity makes up about half of their median net worth (Poterba et. al., 2011). As an asset class, it extends further down the income distribution than other forms of private retirement savings including private defined benefit and 401(k)-type plans (see Figure 1). As such, it is an important component of retirement savings.

A well-known disadvantage of home equity in the asset drawdown phase of the lifecycle is its illiquidity. Some people sell their homes sooner than they otherwise would in order to access those savings, or consume at sub-optimally low levels to be able to stay in their homes. Others draw on the equity by borrowing against it, for instance by taking out a Home Equity Line of Credit (HELOC) or using a cash-out refinancing. However, traditional lending products tend to postpone rather than solve retirees' liquidity problems because loan payments come due before the house is sold, perhaps accounting for why they are rarely used by the elderly.

Reverse mortgages offer older homeowners an alternative that allows them to access home equity while staying in their homes for as long as they choose to, thereby providing both liquidity and a form of longevity insurance. The funds can be put to any number of uses, including delaying Social Security to increase the value of the annuity it provides, buffering shortfalls in investment income when market returns are low, making bequests to beneficiaries at younger ages, and covering emergency expenditures (Hopkins, 2015).

The basic idea is that with a reverse mortgage the homeowner takes out a loan or line of credit in an amount capped at a portion of current home equity. No payments come due until the borrower

dies or moves permanently out of the house (henceforth referred to as an exit). The house serves as collateral and there is no other recourse to the borrower. If the loan balance is less than the house price upon exit, the homeowners or their heirs can repay the loan and capture the balance of the home's value. If the loan balance exceeds the house price, the house is goes the lender who recovers the value of the home net of transaction costs. In financial terms, reverse mortgage borrowers are short a loan or credit line, and long a put option on their house, both with a variable maturity equal to their tenure in their current home.

In the U.S., almost all reverse mortgages are Home Equity Conversion Mortgages (HECMs). HECMs are insured by the federal government through the Federal Housing Administration (FHA), but issued, funded and serviced by private lenders. FHA rules govern how the loans are structured, the amounts of certain borrower fees and insurance premiums, and implicitly, how risk will be shared between the public and private sectors. The FHA has taken substantial losses on HECMs in the years following the financial crisis.

Despite the potential appeal, the demand for reverse mortgages in the U.S. has been extremely limited. Originations of new loans against home equity by people age 62, through any mortgage product including reverse mortgages, have occurred at rates of less than 3% in recent years, and were also modest prior to that (Moulton, et. al, 2015).

This points to a reverse mortgage puzzle: Why is a subsidized financial product that appears to solve the problem of liquefying home equity for older households so unpopular? A growing number of studies have sought to illuminate the economics and demographics of reverse mortgage adoption, and to identify the main factors that influence usage. Potential contributors to low demand include distrust and lack of understanding exacerbated by the product's complexity;

substantial upfront costs; limited need because of Medicaid coverage; and reluctance to spend bequests.

In this paper we develop a stochastic model of the HECM program, and use it to evaluate the purely financial costs and benefits that accrue to borrowers, the government, and private lenders.[1] The approach differs from earlier analyses by incorporating the details of program rules into a formal valuation model, by distinguishing between the government's risk exposure and a lender's, and by generating fair value estimates of costs and benefits rather than actuarial estimates that neglect the market price of risk.

The results suggest a surprisingly simple explanation for the reverse mortgage puzzle that rests entirely on financial considerations. HECMs may be unpopular with borrowers because they are very expensive: The NPV of the typical HECM at origination is about -$27,000 under our base case assumptions and on a fair value basis. The NPV of the government subsidy, even with the recent tightening of program rules, averages $4,000 per loan. The winners are the private lenders, who realize an NPV of about $31,000 per loan. Normalizing by the size of the average line-of-credit at origination of $145,000, the NPVs expressed as cost rates are 18.6% of principal for borrowers and 2.8% of principal for the government. The profit rate for the lender is 21.4% of principal.

An examination of the HECM program suggests several structural reasons for the costs being higher than necessary for both borrowers and the government, and reasons for lenders capturing

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[1] This contrasts with a lifecycle modeling approach that takes a stand on specific preferences and constraints of households to assess demand, e.g., Cocco and Lopes (2015) and Nakajima and Telyukova (2014).

the rents. It also suggests programmatic changes that could reduce costs and thereby increase take-up rates and the number of people who are able to benefit from the program.

 This purely financial explanation for low reverse mortgage demand is best understood as a complement to the behavioral and other reasons that have been suggested for low demand, rather than as a substitute. For example, the costs to borrowers appear high enough so that it may be worthwhile for some adult children to help out their liquidity-constrained parents to preserve the value of bequests by avoiding the expense of the reverse mortgage. Worries about complexity and making mistakes are less likely to be put aside when a loan also appears to be quite expensive.

A cursory look at the fees and interest rates on HECMs gives intuitive support to the idea that the loans may be expensive for borrowers and profitable for lenders. Depending on the house value, borrowers pay between $2,500 and $6,000 at origination to the lender. They also pay an annual insurance premium of 1.25% of the outstanding mortgage balance to the FHA, and incur other smaller upfront fees. Despite bearing almost none of the put option risk, lenders charge a spread over short-term LIBOR (on floating-rate loans) or over Treasury's (on fixed-rate loans) that reportedly falls between 1% to 3% and that usually is at the upper end of that range. Adding that all up, lenders receive LIBOR plus a substantial spread on outstanding balances for many years, in addition to high upfront origination fees, on loans that from their perspective are default-free, albeit of potentially long and uncertain duration.

The story that private lenders benefit at the expense of borrowers and the government is shown to be robust to many variations in parametric assumptions, although the dollar estimates differ considerably with assumed borrower behavior, house price volatility, whether exit rates are sensitive to house prices, and so forth.

Other factors that are not modeled also could affect the estimates, although they seem unlikely to change the broad conclusions. Most importantly, the estimates do not include actual administrative costs. Taking administrative costs into account would increase the estimate of government subsidies and lower estimated lender profits. We also do not incorporate risk premiums associated with longevity and prepayment, which would tend to increase the value of the program to borrowers and make it more costly for lenders and the government.

The conclusion that HECMs are unattractive to borrowers because they are expensive might at first seem at odds with Davidoff (2010), who shows that the HECM allows borrowers to profit by following a "ruthless" strategy that involves taking out a HECM line of credit, and then only drawing on it if the put option is in the money when the house will be sold. However, Davidoff and Wetzel (2014) find that very few borrowers appear to follow a ruthless strategy despite its profitability. In the model here, that ruthless strategy is also found to be very profitable for borrowers, yielding an average NPV of $53,000 at the expense of the government. However, in light of the finding that ruthless behavior appears to be rare, the overall cost is estimated under the assumption that only 10% of the borrower population takes advantage of that strategy. The majority of borrowers are assumed to draw down some or all of the available funds early in the life of the loan, consistent with a demand for liquidity and insurance and with observed behavior.

The program rules cause the government to bear essentially all of the put option risk. That is because lenders can and do sell the loans to the FHA as balances approach the insured limit, even if they haven't defaulted. The ability of lenders to sell the loans to FHA also reduces interest rate risk because it shortens the duration of the loans. Because most of the loans made in recent years carry a floating rate, interest rate risk is a lesser concern than on fixed rate mortgages, although

the presence of caps, floors and fixed spreads does suggest that rate volatility affects value. (The effects of interest rate volatility will be incorporated into a subsequent version of the model).

The risk that significantly more borrowers could adopt a ruthless strategy is a serious one for the government. A jump in ruthless behavior could be triggered, for instance, if financial counselors realize the large benefits of following that strategy and begin to publicize it. A policy option that could reduce government costs, and hence that could permit lower insurance premiums to be charged, would be to discourage or eliminate the ruthless strategy. That could be accomplished by charging more for an undrawn credit line, or by assessing a penalty fee on large withdrawals in the year in which the house is sold.

This analysis adds to a growing body of work that evaluates the cost of federal credit programs and government investments on a fair value basis (Lucas, 2012, surveys that literature). Here as for many other credit programs, taking into account the cost of the market risk that is borne by taxpayers considerably increases the government's cost of the program over what is reported in the Federal Budget. The analysis suggests that although the program looks profitable to the government when evaluated under the rules used for budgetary accounting (here estimated to be a net profit of $10,500 for the average loan), on a fair value basis it creates a net loss (-$4,000 for the average loan).

The finding that a federal guaranteed loan program provides greater benefits to guaranteed lenders than to the intended beneficiaries is unfortunately also not unique to HECMs. Related analyses of the now-discontinued Guaranteed Student Loan program (Lucas and Moore, 2010) and of the Small Business Administration's 7a program (de Andrade and Lucas, 2013), reach similar conclusions. In each case, although the government bears much or all of the default risk, lender fees and interest rate spreads are considerable, and competition between guaranteed lenders is

limited. Lenders would counter that the administrative costs of running federal lending programs are higher than what these analyses assume. However, in the past for guaranteed student loans and currently for HECMs, clearly some of those higher costs incurred by lenders are a consequence of the aggressive marketing that occurs because of competition to originate profitable loans. Those observations suggest that some guarantee programs, including the HECM program, could be restructured to shift the incidence of subsidies from lenders to borrowers—for instance by lowering mandated fees or by improving the competitive structure of the market.

The remainder of the paper is organized as follows: Section 2 describes the HECM product and program; Section 3 outlines the model and its calibration; Section 4 presents the results on costs and benefits under the base case assumptions and various alternatives; and Section 5 discusses policy options and concludes.

2. The HECM Program

About 95% of reverse mortgages in the U.S. are originated under the HECM program. HECMs are no-recourse loans, collateralized by the borrower's home and guaranteed against default by the government. The loans come due when the borrower dies or permanently moves.

The program, which is administered by the U.S. Federal Housing Administration (FHA), received permanent authorization from Congress in 1998. The Dodd-Frank Act subsequently mandated an oversight role for the Consumer Financial Protection Bureau.

HECM program rules have been modified repeatedly since its inception in response to market developments. For example, origination fees were increased early on to attract additional lenders, and requirements have been tightened repeatedly in recent years to reduce the high loss rates

experienced in the late 2000s, and to stem the growth of defaults caused by non-payment of property taxes and insurance.

The program description here is based on current (2015) program rules, which are used to calibrate model parameters in the base case.

Eligibility. HECM loans are available to borrowers aged 62 and older. A borrower's spouse may be younger than 62, but the loan terms then reflect the life expectancy of the youngest co-borrower. Any existing mortgage on the house must be paid off, which can be done using HECM funds. Borrowers are required to obtain advice from a certified counselor, either telephonically or in person.

Loan types. Borrowers can choose to receive payments in one or a combination of ways including lump-sum withdrawals, annuities that end when the borrower exits the house, term annuities, and a line of credit. Because lenders have the discretion to set the terms on the various options, e.g., the annuity amounts, the annuities are assumed to be fairly priced and hence equivalent from a valuation perspective to lump-sum withdrawals.[2]

Borrowing limits. The initial Principal Limit, which caps the amount borrowed in the first year, is based on the assessed value of the house at origination multiplied by a Principal Limit Factor (PLF). The PLF is based on youngest borrower's age and projected future interest rates. The Principal Limit adjusts upward annually to accommodate the accrual of interest payments and mortgage insurance premiums. The increase occurs whether or not the costs are actually incurred.

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[2] An interesting question that remains for future investigation is how the pricing of the term annuities by reverse mortgage lenders compares to those of life insurers.

The 2014 Actuarial Report shows sample PLFs that range from a low of 4.2% for a 25-year old (younger spouse) in an 8.5% interest rate environment, to 64.4% for an 85-year old in a 5.5% interest rate environment. A more typical PLF currently, e.g., for a 65-year old with interest rates projected to be 5.5%, is 47.8%. The lower limits for younger borrowers and in high-rate environments reflect the greater risk of the loan balance exceeding the future house price because of longer tenures and a more rapidly increasing Principal Limit.

Fees and interest charges. Lenders receive origination fees set to 2% of the first $200,000 of assessed house value plus 1% of home value above that, with a floor of $2,500 and a cap of $6,000. Lenders may also receive $360 annually to cover servicing costs, which can be prepaid and rolled into the loan balance. Additional closing costs are paid to third parties to cover appraisals, title search and insurance, surveys, inspections, recording fees, mortgage taxes credit checks and other fees. FHA charges an initial mortgage insurance premium of 0.5% of the home value, and an annual premium of 1.25% on outstanding balances thereafter.

Borrowers choose a fixed or floating rate from the menu of rate options offered by their lender. Floating rate loans have mandatory caps and floors. Currently most borrowers choose loans with a floating rate tied to 1-month LIBOR. Reportedly, offered rate spreads tend to fall between 1% and 3% and are typically at the higher end of that range.

Consistent with its purpose as a source of liquidity, most fees, interest and insurance charges can be rolled into the loan balance, avoiding the need for the borrower to come up with cash at origination or at any time prior to selling the house.

Risk-sharing with private lenders. HECM lenders are almost entirely shielded from default risk by the FHA guarantee. The guarantee covers a maximum claim equal to the Mortgage Claim Amount

(MCA), which is based on the lesser of the appraised house value at origination and $625,000. Because the loan accrues interest and insurance premiums over time, the balance can eventually grow to exceed the MCA. However, lenders have the option of selling a loan to the FHA when its balance reaches 98% of the MCA or when a draw on the line of credit exceeds this amount, which they typically exercise.

3. Valuation Model

We are interested in calculating the NPV of a HECM loan at origination from the perspective of borrowers, lenders and the government, and exploring how different program rules and assumptions affect those valuations. Projected cash flows depend on assumptions about program rules, loan characteristics, borrower behavior, house price dynamics, mortality and moving rates, and other economic variables. In this draft, the volatility of house price appreciation is assumed to be the only priced risk; we plan to add interest rate risk to future versions of the model but expect it to be of second order. The market premium for house price risk is incorporated into discount rates using a risk-neutral pricing approach.

NPVs are calculated on a fair value basis to represent the true economic costs and benefits to the various parties. Because the government calculates the cost of loan guarantees using Treasury rates for discounting, NPV calculations are also shown on that basis.

3.1 Borrower behavior types

Five different borrower types are considered in order to understand the implications of a range of observed and possible behaviors.

Type 1: Ruthless borrowers. Ruthless borrowers do not draw on the credit line (beyond covering fees and interest on those fees) until they move, at which point they take out the maximum amount allowed if that amount exceeds the house value.

Type 2: Full early drawdown. These borrowers extract the maximum amount available in the year after taking out the mortgage. No cost or behavioral distinction is made between their choosing a tenure or term annuity and taking a lump sum; all three withdrawal options have the same value under the assumption that the annuities are priced fairly. This group is assumed to constitute 80% of all borrowers in the base case, consistent with the high drawdown rates shown in the Actuarial Report. In practice, drawdowns may be spread over additional years, but as long as they occur in the first few years the estimated values are similar (as can be seen by comparing the results for Type 1 and Type 3).

Type 3: 50% year 1, balance year 3. These borrowers take longer to draw on the loan, extracting half of the available amount in the first year and the rest in year 3 if they are still in the house. If they exit early they are assumed to be ruthless, but that event is rare and has a minimal effect on value.

Type 4: 50% year 1. These borrowers take out half the available funds immediately, but then never draw on the line again before exit. The idea is to capture the likelihood that some people keep a precautionary balance that never turns out to be needed.

Type 5: Never draw. These borrowers wind up opening a credit line and never using it. They are not included in the population averages as this behavior seems likely to be rare, but the possibility is considered in order to understand the cost of a line of credit that is never drawn upon.

We do not attempt to identify what would constitute theoretically optimal behavior for two main reasons. First, market interest rates and fees depend on expected behavior rather than theoretically optimal behavior. If borrowers are expected to make mistakes, competition between lenders tends to drive down prices below what would prevail at the theoretically optimizing. Furthermore, because the demand for liquidity and insurance is not modeled or observable, what would constitute optimal behavior in this case is not well defined.

Nevertheless, the ruthless type's behavior probably comes close to maximizing the NPV of the HECM loan for the borrower. A fully strategic borrower would also take the value of the put option into account in deciding whether to move, with moves occurring at a higher rate when the house value is higher and the put option is further out of the money. However, moving has high transactions costs and it is unlikely that moving decisions will be significantly altered by consideration of the put option. Empirically house price appreciation and move rates are positively correlated, which means that even if moving behavior isn't strategic, its timing can increase costs to the government. The effect of linking exit rates to house values is examined in the sensitivity analysis.

3.2 Model logic

The valuation model embeds the program rules, lender choices, and fee structure described in Section 2 and the behavior of borrowers described in Section 3.2 into a Monte Carlo simulation. Model parameters are calibrated as described in Section 3.3. The code is available upon request. The basic logic is this:

- For each possible borrower type, borrower age at origination, and borrower's initial home value, the model computes the NPV of the HECM to that borrower, to the government, and

to the lender. The population averages are found by taking a weighted average across all of those types. Other statistics are calculated by changing the weighting matrix to cover the subgroup of interest, e.g., only ruthless borrowers.

- At origination, the principal limit is determined as a function of borrower age and the initial house value using the PLF factors. Upfront fees, including origination, servicing, initial mortgage insurance premium, and miscellaneous, are paid to the government or lender as per program rules. Those fees are added to the loan balance. The loan balance at the end of the first year varies across borrower types (e.g., it is zero for ruthless borrowers and the maximum allowable amount for type 2 borrowers that draw 100%).

- At the beginning of each subsequent year, the house price is updated to account for drift and a random normal shock. Draws from a uniform distribution determine whether the borrower dies or moves.

- If the borrow exits and is ruthless, the loan balance is maximized if the put is in the money. For all types that exit, the loan holder is repaid the minimum of the balance due and the house value. When the lender holds the loan, insurance covers the difference between the balance due and the house value.

- If the borrower does not exit, then the balance is updated for any additional draws, accruals of interest, insurance premiums, and servicing fees. The principal limit is also increased as per program rules. The loan is sold to the FHA if the balance then exceeds 98% of the maximum claim amount.

- There are no future cash flows following an exit. At that point, the NPV of cash flows for the borrower, lender and government are calculated based on the cash flows on the completed Monte Carlo path and the discount rate.

3.3 Calibration

The parameter choices for the base case calibration are described here. Variations are discussed in Section 4.

3.3.1 House values

The modal house value of $262,000 is taken from the 2014 Actuarial Report. The distribution of values around that and their assumed frequencies is shown in Table 3.3.1.The upper bound of $625,000 is the maximum insured amount. (The distribution of values is a guestimate, but the NPV results are close to linear in house values.)

Table 3.3.1 Distribution of House Values at Origination				
House Value	$100,000	$200,000	$262,000	$443,500	$625,000
Frequency	.05	.3	.4	.2	.05

3.3.2 Principal limit factors

The PLFs are taken from the 2014 Actuarial Report and listed in Table 3.3.2. Consistent with current interest rate conditions and spreads, the projected rate is set to 5.5%. For ages between those shown, PLFs are interpolated or extrapolated.

Table 3.3.2 Principal Limit Factors by Projected Rate and Age							
Rate/Age	25	35	45	55	65	75	85
5.5%	0.302	0.341	0.381	0.419	0.478	0.553	0.644
7%	0.146	0.187	0.228	0.270	0.332	0.410	0.513
8.5%	0.042	0.087	0.133	0.171	0.227	0.304	0.414

3.3.3 Demographics

Mortality rates by age are taken from the static IRS unisex estimates for 2014-15. Moving rates by age are based on data from the Current Population Survey of the U.S. Census Bureau for

homeowners. In the base case, moving rates are assumed to be unaffected by house price movements. The distribution of borrower age at origination is interpolated from information in the 2014 Actuarial Report. Borrower age ranges from 62 to 90, with an average age at origination of 72.2. Any remaining borrowers that reach age 98 are assumed to exit in that year.

3.3.4 Borrower types

The assumed base case distribution of borrower types in the population is shown in Table 3.3.4. The high concentration of early withdrawals is consistent with the summary statistics in the Actuarial Report; the share that behave ruthlessly is a guestimate.

Table 3.3.4 Distribution of Borrower Types (population weights)	
1. Ruthless	.1
2. Draw 100% year 1	.8
3. Draw 50% year 1, 50% year 3	.05
4. Draw 50% year 1	.05
5. Never draw	0

3.3.5 Economic variables

Interest rates. Recently most HECM borrowers have chosen the option of borrowing at a floating rate indexed to 1-month LIBOR. There are also other floating and fixed rate options available, with pricing that varies across lenders. The current short-term rate is set to 1% and the current long-term rate is set to 2%. In this draft, both rates are assumed to be constant over time. The interest rate spread on HECMs is assumed to be 2.75%, which is roughly consistent with rates reported by several websites that provide consumer information on the program. Therefore in the base case, lenders receive a rate of 3.75%, the short-term rate plus the spread.

For the purposes of discounting, both in the risk-neutral and government accounting implementations, the risk-free rate is set to the long-term rate of 2%. An interpretation of setting the risk-free rate higher than the short-term rate in the risk-neutral exercise is that the additional 1% spread proxies for the illiquidity of HECMs and the risk premiums on other risks that are not explicitly modeled.

House prices. House prices are assumed to follow a geometric random walk with drift. The drift, which represents average house price appreciation, is assumed to be 2.5% annually, consistent with Actuarial Report assumptions (which in turn are based on rating agency projections). The volatility is set to 16%. The volatility represents that of individual houses, not of the overall housing market, because the options are written on individual houses.

House price risk premium. The house price risk premium is set to 1% per annum, consistent with the rate assumed in other analyses of FHA mortgage programs and elsewhere (citations to be added).

3.3.6 Model parameters

Results are based on 5,000 Monte Carlo runs of house price paths over a maximum of 50 years. Draws from a uniform distribution determine mortality and move outcomes. Draws from a standard normal distribution determine the evolution of house prices.

3.4 Risk adjustment

To estimate fair values (i.e., to find the best approximation to market values), we replace the physical house price drift of 2.5% with a proxy for the risk-free drift, which is taken to be the physical drift minus the assumed risk premium of 1%. The resulting specification, which has house price drift rate of 1.5% and other parameters as under the physical measure, is interpreted as a risk

neutral model of the house price process. This is analogous to replacing the expected return on stocks with the risk-free rate to price stock options using a risk-neutral approach. The lower average growth in house prices increases the frequency that the put option is in the money when an exit occurs, which increases the value of the option. Intuitively, the insurance is more valuable because of the systematic risk in house prices: There is a higher probability of lower house prices in economic downturns when resources are scarce and hence the payouts on the put options are highly valued.

4. Estimated Costs

Costs are reported both on a fair value basis and under the rules of the Federal Credit Reform Act of 1990 (FCRA), which dictates how the government accounts for its program costs.

4.1 Fair value estimates

Table 4.1 summarizes the NPV on a fair value basis of a HECM loan for various groups: the overall population of borrower types; each individual type; for the government for each type; and for lenders for each type; each under the base case assumptions, and for several variants on key parameters. The results are shown in dollar terms and also as a percentage of the average line of credit at origination.

For the overall population, and for all borrower types other than ruthless borrowers, the loans have a negative NPV. This indicates that the rate spreads and fees are high relative to the economic value of the risk transfer.

The default risk is absorbed by the government, but the insurance premiums cover most of the cost of that risk transfer. On net, the government loses about $4,000 on each loan. Lenders benefit from the receipt of the origination fees and from the rate spread over the life of the loan, while bearing none of the default risk. That results in an average gain to lenders of $31,000 per loan. Taking into account lenders' realized administrative costs would reduce but presumably not eliminate those profits.

Table 4.1
Panel 1: Risk adjusted NPV ($)

	Borrowers	Government	Lenders
Base case			
population-weighted average	-27,415	-3,970	31,075
ruthless	53,149	-55,287	1,838
full draw in year 1	-36,412	1,319	34,793
50% draw in year 1, rest in year 3	-32,539	-313	32,330
50% draw in year 1	-39,480	10,381	28,798
never draw	-10,503	3,311	6,892
< =age 75	-30,353	-4,048	34,097
> age 75	-20,290	-3,783	23,742
Variants			
vol = .3 overall	15,295	-46,664	31,013
vol = .3 ruthless	96,997	-98,522	1,225
vol = .1 overall	-45,669	14,279	31,089
vol = .1 ruthless	34,384	-36,669	1,986
<=age 75 ruthless	64,872	-66,472	1,300
>75 ruthless	24,713	-28,155	3,142
flat 10% odds of moving	-18,286	-642	18,601
moving odds up with HPA	-20,007	-10,024	29,721
.5% lower HPA	-19,875	-11,477	31,040

Table 4.1 Panel 2
Risk adjusted NPV as percentage of initial LOC

	Borrowers	Government	Lenders
Base case			
population-weighted average	-18.9	-2.7	21.4
ruthless	36.7	-38.1	1.3
full draw in year 1	-25.1	0.9	24.0
50% draw in year 1, rest in year 3	-22.4	-0.2	22.3
50% draw in year 1	-27.2	7.2	19.9
never draw	-7.2	2.3	4.8
< =age 75	-20.9	-2.8	23.5
> age 75	-14.0	-2.6	16.4
Variants			
vol = .3 overall	10.5	-32.2	21.4
vol = .3 ruthless	66.9	-67.9	0.8
vol = .1 overall	-31.5	9.8	21.4
vol = .1 ruthless	23.7	-25.3	1.4
<=age 75 ruthless	44.7	-45.8	0.9
>75 ruthless	17.0	-19.4	2.2
flat 10% odds of moving	-12.6	-0.4	12.8
moving odds up with HPA	-13.8	-6.9	20.5
.5% lower HPA	-13.7	-7.9	21.4

The results of the sensitivity analysis, also reported in Table 4.1, show the effects of increasing or decreasing the average age at origination, house price volatility, house price appreciation, and the probability of moving. The direction of the changes in each case can be explained intuitively:

- Anything that increases the loan balance early on or that increases the average life of the loan makes it more expensive for the borrower. That is because the annual fees and rate spread are high relative to the value of the risk transfer. The larger the annual accumulation of fees and interest, and the longer payments last, the greater the present value cost. This explains the relatively high costs for Type 2 and Type 3 borrowers, and the higher costs for younger versus older borrowers.

- Apart from taking fuller advantage of the house price insurance from the put option, the ruthless strategy is so profitable to borrowers because it avoids most of the annual costs because balances only become large right before they are partially paid back.

- In the usual way, higher house price volatility increases the value of the put option, making the contract more valuable to borrowers and more costly to writer of the option which is the government. Lender cash flows are largely unaffected by house price risk in the base case because it does not affect exit rates or annual payments.

- Several authors have emphasized the incentive to under-maintain ones house created by the put option. The variant with the slower rate of house price appreciation can be thought of as a proxy for the poorer condition of homes with lower equity due to the moral hazard of reduced maintenance. As expected the effect is to increase the cost of insurance for the government and to make the guarantee more valuable for the borrower.

- Borrowers that take out a line of credit but never draw on it (Type 5) have costs that exceed the first year upfront expenses. That is because interest and mortgage insurance premiums accrue on the initial borrowing used to cover the upfront expenses.

- Faster unconditional move-out rates benefit the borrower largely at the expense of the lender. When the average annual move-out rate is increased to 10% (from about 2.5% in the base case), rate premiums are paid for a shorter average period of time. It has less effect on the government's position because the insurance premiums are close to being breakeven with the value of the risk transfer.

- When higher move-out rates are correlated with higher house prices the option becomes more valuable because there is a greater chance the house will be worth less when it is exercised. This is costly to the government and beneficial to borrowers.

The model can be used to answer "what if" questions about changes in program structure that could lower borrower costs. One question is by how much lender interest rate spreads and insurance premiums could be lowered and still leave lenders and the government with sufficient revenues to cover moderate administrative expenses. Reducing the annual mortgage insurance premium to 1% (from 1.25%), and the lender interest rate spread to 1% (from 2.75%) leaves the government with an NPV of $1500 and lenders with $4200 to cover costs on an average loan. Another question is how much further the government insurance premium could be reduced if ruthless strategies were eliminated through changes in program rules. Assuming that the assumed 10% share of ruthless volume is shifted to Type 2 borrowers, and that lender spreads are again reduced to 1% so as to cover administrative expenses of about $4500, the answer is that the mortgage insurance premium could be reduced to 0.85% from its current level of 1.25%.

4.2 FCRA cost estimates

FCRA is a statute that directs how the budgetary costs of federal loan programs are to be calculated. Those cost estimates use the same assumed cash flows as for the fair value estimates, but the cash flows are discounted at Treasury rates, and hence without risk adjustment. The effect is to leave out the cost of market and other priced risks from the reported budgetary cost of the government's loan guarantees.

In the case of the HECM program, the switch to FCRA accounting causes the government guarantees to appear to make money for the government (rather than to cost money as it does on a fair value basis) in all of the variations considered except under the assumption that ruthless behavior is the norm. Table 4.2 summarizes the NPV on a FCRA basis of a HECM loan for the same groupings as in Table 4.1. The ordering of costs and benefits is similar in both tables.

Leaving out the cost of risk makes the government guarantee appear to be less valuable than at market prices, and hence the product also appears to be less valuable to borrowers. The estimated lender profit is similar in both cases because it is unaffected by the valuation of the risk transfer. As discussed in Lucas (2012) and citations therein, this practice results in the systematic understatement of the cost of federal credit programs. Leaving out the cost of market risk for credit programs distorts the price signals facing policymakers and the public. Hence it distorts policymakers' decisions about whether a program is worthwhile and how federal credit support should be priced.

Table 4.2
Panel 1: FCRA (gov't accounting) NPV ($)

	Borrowers	Government	Lenders
Base case			
population-weighted average	-41,983	10,520	31,154
ruthless	38,063	-40,991	2,627
full draw in year 1	-51,527	16,434	34,793
50% draw in year 1, rest in year 3	-47,598	14,787	32,330
50% draw in year 1	-43,747	14,648	28,798
never draw	-10,507	3,315	6,892
< =age 75	-47,943	13,448	34,193
> age 75	-27,525	3,418	23,781
Variants			
vol = .3 overall	5,238	-36,638	31,048
vol = .3 ruthless	86,583	-88,459	1,576
vol = .1 overall	-62,302	30,784	31,217
vol = .1 ruthless	17,054	-20,617	3,263
<=age 75 ruthless	46,676	-49,228	2,252
>75 ruthless	17,170	-21,007	3,537
flat 10% odds of moving	-22,698	3,755	18,620
moving odds up with HPA	-31,184	1,784	29,092
.5% lower HPA			

Table 4.2 Panel 2
FCRA (gov't accounting) NPV as percentage of initial LOC

	Borrowers	Government	Lenders
Base case			
population-weighted average	-29.0	7.3	21.5
ruthless	26.3	-28.3	1.8
full draw in year 1	-35.5	11.3	24.0
50% draw in year 1, rest in year 3	-32.8	10.2	22.3
50% draw in year 1	-30.2	10.1	19.9
never draw	-7.2	2.3	4.8
< =age 75	-33.1	9.3	23.6
> age 75	-19.0	2.4	16.4
Variants			
vol = .3 overall	3.6	-25.3	21.4
vol = .3 ruthless	59.7	-61.0	1.1
vol = .1 overall	-43.0	21.2	21.5
vol = .1 ruthless	11.8	-14.2	2.3
<=age 75 ruthless	32.2	-34.0	1.6
>75 ruthless	11.8	-14.5	2.4
flat 10% odds of moving	-15.7	2.6	12.8
moving odds up with HPA	-21.5	1.2	20.1

5. Discussion, Policy Options and Conclusions

The above findings raise questions as to why costs are high and what types of programmatic changes might lower them. Possible answers are briefly discussed here, but further research is needed to establish fuller explanations. Some broader lessons for government credit programs are also discussed.

5.1 Why are the costs so high?

A natural reaction to the claim that lenders are making large profits is, why don't competitive forces reduce or eliminate those gains? Although lenders have to be approved to participate, there appear to be sufficient numbers for competitive forces to operate. For example, a lender could try to increase market share by lowering loan spreads. A financial institution could hope to profit by offering a better-designed product. For instance, introducing a reverse mortgage product with less optionality and intrinsically lower cost could attract additional borrowers.

A partial explanation for limited competition is that the market is opaque and comparison shopping is difficult. For example, consumer groups point out that competition on loan spreads appears to be inhibited by lenders not publicizing what those spreads are.[3] Furthermore, many potential borrowers may not have the know-how to comparison shop for financial products. Reverse mortgage lending is fairly concentrated among the top lenders. Reverse Mortgage Insights (2014) reports that for 2014, out of the 52,754 reverse mortgages made that year about 30,000 were originated by the top 5 lenders. All this begs the question however, of why competitive pressures don't cause practices to change.

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[3] http://reversemortgagealert.org/reverse-mortgage-rates/

There is also the question of why the FHA hasn't put more restrictions on interest rate spreads or required more transparency. One possibility is that lenders have convinced officials that the current fee structure is necessary to cover their costs. A possible disincentive to tighten regulations in this regard is that the FHA earns the spread set by private lenders on the high balance loans that it purchases, which backstops the program's solvency and reduces pressures to increase insurance premiums.

With regard to offering new and better-structured alternatives, it may be particularly difficult for private lenders to gain traction when competing with a government product. There could be significant liability if the new offering is found to be unsuitable, and an endorsement effect and incumbency both favor the government-backed product.

Another possibility is that lenders may in fact have a high cost structure. High costs could arise from the way HECMs are marketed (e.g., large expenditures on television advertising and one-on-one selling) or financing the loans could be more costly than we assume. According to Reverse Mortgage Insights (2014), most of the lenders below the top 10 made fewer than 200 loans that year, and low volume could contribute to high transactions costs.

With regard to funding costs, a fundamental question is whether under the current market structure the risks are borne by the types of investors with the most capacity to absorb them, such as hedge funds. Although default risk is absorbed by the government, longevity, interest rate, and other risks may be driving up funding costs. Most HECMs are sold to Ginnie Mae, a government entity that securitizes other government-insured mortgages as well. Analyzing the cost and ownership structure of those Ginnie Mae securities could provide important information on this issue.

5.2 Other structural reasons for low demand

The requirement that a borrower's existing mortgage be repaid before taking out a HECM protects the government by giving it a first lien on the property. However, the rule could inhibit demand, particularly in the recent low mortgage rate environment. When the HECM rate exceeds the existing mortgage rate, the spread between the two rates is an additional annual cost of accessing home equity that in some cases could be substantial. Older households are less likely to reach retirement having paid off their mortgages than in the past, suggesting that this will continue to be a potential issue for some borrowers.

Whether the existing menu of interest rate choices is optimal is another open question. Having those choices may appeal to some consumers and cause confusion for others. Greater choice contributes to the difficulty of comparison shopping. Most borrowers also may not understand that their choice between a fixed and floating rate has consequences for investors' cost of hedging, and hence for the price they ultimately pay. Reverse mortgages have potentially long and uncertain lifetimes. From an investor perspective, a variable rate reduces interest rate and prepayment risk, thereby reducing hedging costs. The risk to the borrower of taking out a floating rate loan is far less than on a traditional mortgage because rate changes are absorbed in the loan balance rather than affecting required monthly payments. For this reason, it is possible that the mandatory caps and floors set by FHA, presumably to protect consumers, may actually make the product harder to price and hedge and therefore contribute to its high cost.

5.3 Lessons for government guarantee programs

Government credit support has an economic justification when the social and private benefits of overcoming a credit market imperfection exceeds the costs of doing so. Program structure can

significantly affect how efficiently it achieves its goals. The structure of the HECM program has a number of features that seem likely to detract from its efficiency, both from first principles and in light of the experiences of other federal credit programs.

Governments can provide credit support through direct lending or by providing loan guarantees. The U.S. government uses both approaches. As a first approximation, the all-in cost (funding, risk-bearing and administration) of a government-backed loan is similar whether the government makes it directly or whether it guarantees it (Lucas, 2012). All credit extension involves the same basic administrative functions (origination, servicing and collection), and all risks must be absorbed by a combination of investors and taxpayers. However, the efficiency with which those functions are performed is influenced by a program's structure.

Program structure affects costs and efficiency when the government or the private sector has a relative advantage at certain functions. Guaranteed lending tends to improve efficiency over direct lending when (1) there is substantive a credit decision to be made, or (2) when monitoring is important. Although governments could and sometimes do perform screening and monitoring functions, the private sector may be better at making those decision because they have a stronger profit incentive and a lower likelihood of political capture. Private lenders may also provide better customer service, albeit at a cost.

When there is little screening or monitoring to be done because of the design of the program (e.g., it is a categorical entitlement as for student loans), it can be less expensive for the government to make loans directly. On direct loans, it generally subcontracts out servicing, collection, and certain other administration functions where incentives matter. Direct lending avoids the risk of political capture by guaranteed lenders, who may persuade the government to set compensation at excessive levels. Marketing costs also are lower with direct lending because

the government does not need to advertise to compete with other lenders. Although it is sometimes argued that a further advantage of direct lending is that governments have an intrinsically lower funding cost, that logic neglects the role of taxpayers is equity holders. A more careful analysis suggests that the government's funding costs are similar to those of private lenders (Lucas, 2012).

Turning back to HECMs, the program structure violates the principles just described. Specifically, the program appears susceptible to the disadvantages of guaranteed lending without reaping its advantages:

- Lenders perform almost no screening or monitoring functions for HECMs although program rules impose age, credit score and other restrictions on eligibility that must be verified.[4] Hence, a HECM is essentially a categorical entitlement. This is in contrast to loan programs serving small businesses or agriculture, where a credit decision is important and program rules leave skin-in-the-game for private lenders, who bear a portion of default losses.

- Lenders bear no credit risk. The government buys loans when or before they default, and therefore handles the collection function as it would for its direct loan programs.

- Compensation for lenders' administrative costs is set formulaically and there is no competitive mechanism to lower those fees when they are excessive or to raise them when they are inadequate. Historically there was concern about too few lenders participating, which led to changes to attract more entrants. However, without a

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[4] Consultation with an outside counselor is required to determine product suitability.

mechanism to control fees, officials may be reluctant to propose fee reductions because of lender pressure and fear of disrupting supply.

- With the government absorbing the default risk, there is little justification for allowing lenders to set interest rate spreads without limits. A justification for allowing some pricing discretion is that the other risks, particularly longevity risk, is expensive and its price could vary over time. However, the opacity and complexity of the current pricing structure suggests that the current level of discretion could be excessive.

- The tail end of longevity risk is an undiversifiable risk that some view as best managed by government because of its ability to spread the effects across generations as well as across taxpayers. If lenders charge high spreads for reasons linked to longevity risk, it might be preferable for the government to insure more of that risk (which now falls primarily on lenders) and adjust premium rates and lender payments accordingly.

Comparisons with other guaranteed lending programs suggest these problems are not limited to HECMs. The guaranteed student loan program was similar to the HECM program in that lenders were not required to do judgmental screening, lenders bore almost no default risk, and that statutory fees paid to lenders appeared to considerably exceed their costs (Lucas and Moore, 2010). Notably, although lenders were exposed to interest rate and prepayment risk, unlike under the HECM program they had no pricing discretion. In part because of its high costs, the guaranteed student loan program was discontinued in 2010 and replaced with an expansion of the less costly direct student loan program. Another example is the SBA 7a program, which guarantees bank loans to small businesses. As with HECMs, limited competition between lenders appears to limit the benefits of the guarantee for borrowers (de Andrade and Lucas, 2012).

5.4 Conclusions

This analysis suggests a simple financial explanation may be part of the answer to the puzzle of why reverse mortgages are not more popular with older households: The FHA's HECM program, which originates about 95% of the reverse mortgages taken out in the U.S., offers a product that is very expensive for borrowers. It is also costly to the federal government, which guarantees the loans against default. The apparent winners are the private lenders that earn returns that are too high to be easily explained.

Notably, this financial explanation for low demand doesn't assume that borrowers behave rationally in the usual sense of maximizing utility subject to budget and wealth constraints. In fact, most borrowers are assumed to take very limited advantage of the optionality available to them through the contract. However, the low adoption rates suggest a kind of generalized rationality, in that people avoid products where they know there is a high chance that they will lose money on them.

Reverse mortgages are complicated to value, either as an academic exercise or for market participants, and the cost estimates presented are subject to considerably uncertainty. Nevertheless, the sensitivity analysis suggests that the main conclusions are robust to a range of plausible assumptions about many of the key drivers of cost and consumer behavior.

The analysis suggests that possible changes to the current program that could reduce complexity and costs and encourage greater borrower demand. Those include making it harder for borrowers to follow a ruthless strategy, putting some restrictions on lender rate spreads, eliminating interest rate caps and floors, and requiring rates to be posted to make comparison shopping easier for
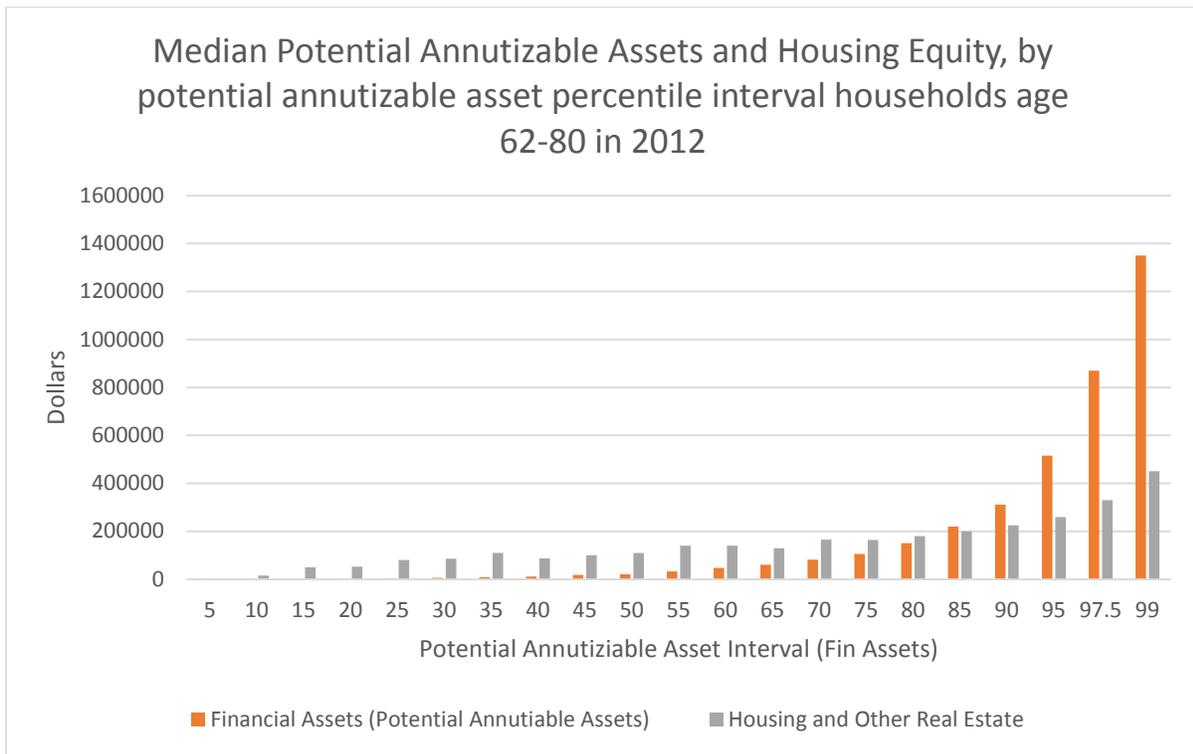
borrowers. Our estimates suggest that precluding the ruthless strategy and increasing competition between lenders could reduce the NPV cost of loans to borrowers by about $20,000.

Much remains to be done, including better understanding and incorporating into the model the effects on cost of longevity and interest rate risk, perhaps using data on the secondary market pricing of HECM securitizations. Other open issues include whether the annuity pricing is competitive with that offered by insurance companies, and whether the industrial organization of the industry is an impediment to more competitive pricing.

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Figure 1:

Median Potential Annutizable Assets and Housing Equity, by potential annutizable asset percentile interval households age 62-80 in 2012

Source: HRS data; tabulations by Mark Warshawsky.