Hacking Reverse Mortgages

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Abstract

Reverse mortgages allow retirees to access a portion of their home equity to meet spending needs while insuring that they can age in place. In the U.S., almost all reverse mortgages are in the form of a Home Equity Conversion Mortgage (HECM)--a product designed and administered by the federal government. Despite the potential liquidity and insurance benefits, and the presence of a government subsidy, the take-up rate among eligible borrowers is very low. I develop and calibrate a valuation model for HECMs that suggests a purely financial reasons for why the current product remains so unpopular: the cost to borrowers is extremely high relative to estimated fair market value. Rents go to the guaranteed private lenders that originate the loans but bear little of the risk and face limited competition. I consider structural changes to the HECM program that could lower costs to borrowers and improve the product's functionality without increasing taxpayer cost, and discuss some general lessons for the design of government credit programs.

1. Introduction

Home equity represents a large share of wealth for many older households. In the U.S., approximately 80% of households over the age of 62 own their homes, and home equity makes up about half of their median net worth (Poterba et. al., 2011). As an asset class, home equity 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 whose significance is likely to increase with the aging of the population.

A well-known disadvantage of home equity in the asset drawdown phase of the lifecycle is that it is illiquid. Some people feel compelled to sell their homes sooner than they would like to in order to access those savings, while others reduce non-housing consumption to sub-optimally low levels to be able to retain their homes. A small number of retirees draw on their home equity by borrowing against it using traditional lending products, for instance by taking out a Home Equity Line of Credit (HELOC) or refinancing with a cash-out mortgage. However, traditional products tend to postpone rather than solve retirees' liquidity problems because loan payments come due before the house is sold.

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, thereby providing both liquidity and a form of longevity insurance. The funds can be put to any number of uses, including covering emergency expenditures, providing a supplemental annuity, delaying Social Security to increase the value of the annuity it provides, buffering shortfalls in investment income when market returns are low, and making bequests to beneficiaries at younger ages (Hopkins, 2015).

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. Importantly, no payments come due until the borrower dies or permanently moves out of the house (henceforth referred to as an exit). Interest and other fees accrue prior to exit. The house serves as collateral for the loan and there is no other recourse. If the loan balance is less than the house price at exit, the homeowners or their heirs can repay the loan and capture the balance of the home's value. Otherwise the lender recovers the value of the home net of transaction costs and the borrower has no liability. In financial terms, reverse mortgage borrowers are short a loan and long a put option on their house. Both the loan and the option have a variable maturity equal to their tenure in the house.

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 guaranteed lenders. FHA rules govern the competitive structure of the market, the design of the loans, certain borrower fees and insurance premiums, and implicitly how costs and risks will be shared between the public and private sectors.

Despite the product's potential appeal and government backing, the demand for reverse mortgages has been extremely limited. Originations of new loans against home equity by people age 62 or older, 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 time (Moulton, et. al, 2015).

This points to a reverse mortgage puzzle: Why is a government-subsidized financial product that appears to solve the problem of liquefying home equity for many 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 take-up rates. (See Warshawsky and Zohrabyan, 2016, for a comprehensive survey of the literature.) Potential factors that have been identified as contributing to low demand include: distrust and lack of understanding exacerbated by the product's complexity; substantial upfront fees; limited need because of Medicaid coverage; and reluctance to spend savings mentally set aside for bequests.

To better understand the costs and benefits of HECMs, and to create a tool to examine the effects of programmatic changes on valuations, in this paper I develop and calibrate a stochastic model that values HECMs as contingent claims. The model is used to estimate how financial costs and benefits are allocated between borrowers, the government, and the private guaranteed lenders, and how those costs might be affected by changes in the structure of the HECM program.[1]

The analysis suggest a surprisingly simple explanation for the reverse mortgage puzzle: HECMs are extremely expensive relative to the value they deliver to borrowers. Currently the net present value (NPV) cost to a borrower at origination of a typical HECM is about $27,000 on a fair value basis.[2] The NPV of the government subsidy is about $4,000 per loan. The winners are the private guaranteed lenders, who realize a positive NPV of about $31,000 per loan at origination. Normalizing by the size of the average line-of-credit at origination of $145,000, the cost rate is about 18.6% for borrowers and 2.8% for the government. The profit rate for the lender is 21.4%.

The conclusion that private lenders benefit at the expense of borrowers and the government is shown to be robust to wide variations in parametric assumptions. However as to be expected, the estimates vary considerably with assumed borrower behavior, house price volatility, whether exit

[1] This contrasts with a lifecycle modeling approach that takes a stand on the preferences and constraints of households to assess demand, e.g., Cocco and Lopes (2015) and Nakajima and Telyukova (2014).
[2] All reported NPVs are on a fair value basis that approximate market values unless otherwise stated.

rates are sensitive to house price changes, and so forth. Other factors that are not included in the base case model also would affect the estimated values. Most importantly, taking into account administrative costs would increase the estimated size of government subsidies and lower estimated lender profits. Accounting for premiums associated with longevity and prepayment risk would tend to increase the value of the program to borrowers and make it more costly for lenders and the government. An examination of the likely magnitude of these additional factors suggest that they are very unlikely to change the broad conclusions about winners and losers.

The purely financial explanation for low reverse mortgage demand suggested here is best understood as a complement to the behavioral and other reasons that have been suggested in the literature. For example, the high cost of HECMs may make it worthwhile for some adult children to help out their liquidity-constrained parents, thereby preserving the value of bequests by avoiding the high cost of a reverse mortgage. Worries about complexity and making mistakes also are more likely to surface when a loan appears to be expensive.

A natural question is, why doesn't competition between guaranteed lenders cause prices to fall? An examination of the structure and rules of the HECM program suggests that there are significant structural barriers that limit competition and support high prices. I consider programmatic changes that could increase competition, reduce borrower costs, and thereby increase take-up rates and the number of people who are able to benefit from the program without increasing government subsidies.

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, with the aim of improving the information about cost that is available to policymakers and the public (Lucas, 2012, surveys that literature). Taking into account the cost of market risk borne by taxpayers significantly increases the estimated cost of the HECM program over what is reported in the Federal Budget. As for many other federal credit programs, the HECM program looks profitable to the government when evaluated under the rules used for budgetary accounting (a net profit of $10,500 for the average loan), but entails a cost to the government when it is evaluated on a more comprehensive fair value basis (-$4,000 for the average loan).

The finding that a HECMs provides greater benefits to guaranteed lenders than to borrowers has also been found to be true for other larger federal guaranteed loan programs. 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), found that although the government bears much or all of the default risk, lender fees and interest rate spreads are high and competition between guaranteed lenders is limited.[3] Drawing on these examples, I discuss some basic principles for the design of government credit programs that could reduce administrative costs and shift the incidence of subsidies from lenders to borrowers.

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; Section 5 discusses possible structural reasons for the findings and policy options; and Section 6 concludes.

[3] Guaranteed lenders might counter that the administrative costs of running federal lending programs are higher than what these analyses assume. However, the costs are to some extent endogenous. For example, lenders may incur high costs due to aggressive marketing to compete to originate profitable loans.

2. The HECM Program

About 95% of reverse mortgages in the U.S. are originated under the U.S. Federal Housing Administration's (FHA) HECM program. The program received permanent authorization from Congress in 1998. The Dodd-Frank Act subsequently mandated an oversight role for the Consumer Financial Protection Bureau, which has commented on certain aspects of the program but not on pricing which is the focus here.

HECM program rules have been modified over time in response to market developments. Origination fees were increased early on to attract additional lenders. In recent years loan terms have been tightened repeatedly to avoid a repeat of the high loss rates experienced in the wake of the 2007 financial crisis, and to prevent defaults caused by non-payment of property taxes and insurance. The government sets guarantee fees to cover prospective losses as measured under its rules for credit accounting, but as discussed below, on a fair value basis HECMs continue to carry a subsidy.

A fairly detailed description of the 2015 HECM program is included here because the computational model is structured and calibrated to capture these programmatic features, and because they bear on the competitive structure of the market. Much of this information is drawn from Integrated Financial Engineering (2014), henceforth referred to as the "2014 Actuarial Report," an HFA-commissioned report on the program.

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. Lenders have the discretion to set the terms on the various options (e.g., the size of annuity payments offered). For simplicity, the annuities are assumed to be fairly priced and equivalent from a valuation perspective to the cost of lump-sum withdrawals.[4]

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.

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, 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.

[4] An interesting question is how the pricing of the term annuities by reverse mortgage lenders compares to those of life insurers. Warshawsky and Zohrabyan (2016) provide some information on this issue but do not come to a conclusion about whether the pricing on HECM annuities is more or less favorable.

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, and credit checks. 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 the sale of the house.

Risk-sharing with guaranteed 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, an option lenders 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. The volatility of house price appreciation is the largest risk, and here it is assumed to be the only priced risk. The market premium for house price risk is incorporated into discount rates using a risk-neutral pricing approach. Prepayment, interest rate, and longevity risk could also affect the market risk premium, but those effects are expected to be of second order. That is because the base rate is a usually a floating rate, and it is unclear because of the high rate spreads whether lenders are better or worse off if the loan is slower to pay off.

NPVs are calculated on a fair value basis to represent the full economic costs and benefits to the various parties. (See Lucas, 2012, for an explanation of why the cost of government credit programs should be evaluated on a fair value basis.) Because the government calculates the budgetary cost of loan guarantees using Treasury rates for discounting, for comparison 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 future behaviors.

Type 1: Ruthless borrowers. Ruthless borrowers maximize the value of the put option on the house, a strategy first suggested as potentially value-maximizing by Davidoff (2010). Those borrowers never 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 take these types as given rather than attempting 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 (which they appear to do), fair value prices are lower than what would prevail at the theoretically optimizing behavior. Furthermore, because the complicated factors driving the demand for liquidity and insurance is not modeled or observable, what would constitute optimal behavior is not well defined.[5]

As suggested by Davidoff (2010), the ruthless type's behavior probably comes close to maximizing the NPV of the HECM loan from a purely financial perspective. However, 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 lower rate when the house value is lower and the put option is further into the money. Because moving involves high transactions costs, 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 the choice to move isn't made strategically, typical moving behavior tends to 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 assumed 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

[5] Optimizing models such as Nakajima and Telyukova (2014) and Cocco and Lopes (2015) provide insights on the possible benefits of reverse mortgages, but do not fully explain observed behavior.

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 reported 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% of the available credit line).
- 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 a ruthless borrow exits, then the entire credit line is drawn down in that year if the put is in the money. For all types that exit, the loan holder (a guaranteed lender or the government) is repaid the minimum of the balance due and the house value; no further draws are made. When the lender holds the loan, insurance covers any 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. Loans held by guaranteed lenders are sold to the FHA if the resulting balance 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 depend 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 house values around the modal amount is a guestimate. However, estimated NPVs 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 interest rate is set to 5.5%. For ages not 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 borrower who reaches age 98 in the simulation 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 full immediate withdrawals is consistent with the summary statistics in the Actuarial Report; the share that behave ruthlessly is set to a fairly low value because that behavior is reportedly rare (although that could change as knowledge about its value spreads).

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%. 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 an annual return of 3.75%, the short-term rate plus the spread.

For the purpose of discounting cash flows in both in the risk-neutral and government accounting implementations, the risk-free rate is set to the long-term rate of 2%. The risk-free rate is assumed to be higher than the observed short-term rate to account for the illiquidity of HECMs, and to proxy for any omitted risk premiums.

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 is for 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 (Castelli et. al., 2014).

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 best approximate what market value would be in a competitive, well-functioning market), 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 U.S. federal government accounts for the costs of credit programs.

4.1 Fair value estimates

Table 4.1 summarizes the NPV of a HECM loan on a fair value basis for: the overall population of borrower types; each individual borrower type; for the government for each borrower type; and for lenders for each borrower type; all under the base case assumptions, and then 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 borrower population, and for all individual borrower types except for 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 cash flows received and the risk transfer.

Recall that the default risk arising from the loan balance exceeding the house value at exit is absorbed by the government. The insurance premiums charged cover most of the cost of that risk transfer; on net, the government loses about $4,000 on each loan. Guaranteed lenders, who receive the origination fees and the rate spread over the life of the loan while bearing none of the default risk, realize an average gain of $31,000 per loan. Consideration of 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

Table 4.1 also shows the results of the sensitivity analysis, which includes varying the average age at origination, house price volatility, house price appreciation, and the likelihood of moving. Cases labeled "ruthless" assume all borrowers follow the ruthless strategy; the rest use the overall population weights. The direction of the changes in each case can be explained intuitively:

- Anything that causes the loan balance to increase 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.

- The ruthless strategy is extremely profitable because it takes almost full advantage of the house price insurance from the put option, and it avoids most of the high annual costs because the loan balance remains small until right before the loan is 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 government, which is the writer of the option. Lender cash flows are largely unaffected by changes in house price risk because it does not affect exit rates or annual payments.
- Some commentators have emphasized the incentive to skimp on home maintenance because of the put option. The variant with a 0.5% slower rate of house price appreciation (HPA) can be thought of as a proxy for the poorer condition of homes due to moral hazard. 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 amount borrowed in order 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), the above-market 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.

We now turn to using the model to answer "what if" questions about the amount of borrower savings that might be achieved by the sorts of structural changes discussed in Section 5 below. 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. 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 government's 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 that would be the basis for a fair value estimate, but discounting is mandated to be done at maturity-matched Treasury rates, and hence without risk adjustment. The effect is to leave out the cost of market risk and other priced risks from the reported budgetary cost of the government's loan guarantees.

The model for HECM program described above can be easily modified to implement FCRA accounting by replacing the risk-neutral house price drift with the physical drift. The switch to FCRA accounting causes the government guarantees to appear to make money for the government in all of the variations considered except under the assumption that ruthless behavior is the norm. Table 4.2 summarizes the NPVs on a FCRA basis of a HECM loan for the same cases 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 and Policy Options

The above findings raise the questions of why the costs to HECM borrowers are so high, and what types of programmatic changes might help to lower them. Developing a model to more fully explore these issues is beyond the scope of this paper, but here I suggest possible answers based on observations about market structure and the experiences of other federal credit programs. Some lessons for the design of government credit programs more generally are also discussed.

5.1 Why are costs to borrowers 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 HECM lenders for competitive forces to operate at least in large urban areas. Those lenders could compete for market share by offering lower interest rate spreads or higher annuity payments. Alternatively, if there are flaws in the design of HECMs that discourage higher participation rates, financial institution could hope to profit by offering a better-designed product. For example, a financial institution could introduce a reverse mortgage product with less optionality and hence intrinsically lower costs.

It appears that one factor limiting 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.[6] 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. However, the question remains of why competitive pressures don't cause these practices to change.

[6] 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 improves the program's solvency and reduces pressures to increase insurance premiums.

Barriers also exist 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 HECM over private alternatives.

Another possibility is that lenders may in fact incur large costs because of the way HECMs are marketed (e.g., large expenditures on television advertising and one-on-one selling). According to Reverse Mortgage Insights (2014), most of the lenders below the top 10 made fewer than 200 loans that year, which could make fixed costs a significant factor in pricing.

With regard to funding costs, a fundamental question is whether under the current market structure the risks are being borne by those investors with the most capacity to absorb them. Although default risk is absorbed by the government, investors bear longevity, interest rate, and house price risk. Although HECMs are classified as mortgages, those risks make them more akin to illiquid equity investments, and entities such as hedge funds may be the natural holders. Most HECMs are sold to Ginnie Mae, a government entity that repackages the loans into structured securities that are sold to private investors. Analyzing the cost and ownership structure of those Ginnie Mae securities could provide important information on the efficiency of how HECMs are funded.

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 and payout 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. The annuities offered are non-standard and so cannot be easily compared with more traditional insurance products. 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. Notably, the risk to the borrower of taking out a floating rate loan is considerably lower 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 Broader lessons

Government credit support improves welfare when the social benefits of overcoming a credit market imperfection exceed the cost of the subsidies provided. But because credit programs are created through a political process rather than by market forces, there is no reason to presume that a particular program will be structured to most efficiently achieve its stated goals. Examination of the HECM program suggests that it has serious structural flaws that impede its effectiveness and discourage demand. That conclusion is supported both from first principles and in light of the experiences of other federal credit programs.

A fundamental choice in setting up a government credit program is whether to provide loans directly, or whether to provide loan guarantees and outsource most other credit functions to private lenders. 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 should be 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 the various credit functions are performed can be significantly affected by a program's structure.

When either the government or the private sector has a relative advantage at performing a certain function, costs are reduced by assigning that task to the more efficient provider. Guaranteed lending tends to be relatively efficient when (1) there is substantive a credit decision to be made, or (2) when monitoring is important. Although governments can 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 risk of political capture. Private lenders may also provide better customer service, albeit at a cost.

It can be less expensive for the government to make loans directly when there is little screening or monitoring required, for example because the program is designed to non-selective (e.g. the student loan program is a categorical entitlement independent of credit quality). In its direct loan programs, the government often subcontracts out servicing, collection, and certain other administration functions where performance incentives matter. Direct lending avoids political capture by guaranteed lenders, who may persuade the government to set their compensation at excessive levels or to protect them from competition. Marketing costs also are lower with direct lending because the government doesn't 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, a more complete analysis that takes into account risk-bearing by taxpayers suggests that the government's funding costs are similar to those of private lenders (Lucas, 2012).

Turning back to HECMs, the program's structure violates the efficiency principles just described. Specifically, the program appears to suffer from 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.[7] Hence, a HECM is essentially a categorical entitlement. This is in contrast to loan programs such as those serving small businesses or agriculture, where a credit

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

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 and have little incentive to discourage participation by high-risk borrowers. 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 hence 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 that led to changes to attract more entrants. Even in the face of evidence that fees are now excessive, 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 limit. A justification for allowing some pricing discretion is that the price of other risks that affect costs, such as longevity and prepayment risk, vary over time and with market conditions. However, the opacity and complexity of the current pricing structure suggests that the current level of discretion in rate-setting is probably excessive.
- The tail of longevity risk is an undiversifiable risk that some view as best managed by government because of its ability to spread costs across generations as well as across taxpayers at a point in time. 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.

Earlier studies of other guaranteed lending programs suggest these sorts of structural 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. Largely 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).

6. Further Discussion and Conclusions

This analysis made possible by the valuation model developed in this paper suggests a simple financial explanation may be an important 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 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 technical approach differs from earlier analyses by incorporating the details of program rules into a formal valuation model and incorporating the value of the options embedded in the contracts, by distinguishing between the government's risk exposure and that of private lenders, and by generating fair value estimates of costs and benefits which differ from the government's own actuarial cost estimates by incorporating the price of market risk.

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.

Although the conclusion that costs are high rests on a valuation model that takes into account the complex optionality associated with this product, 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 no house price 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 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.

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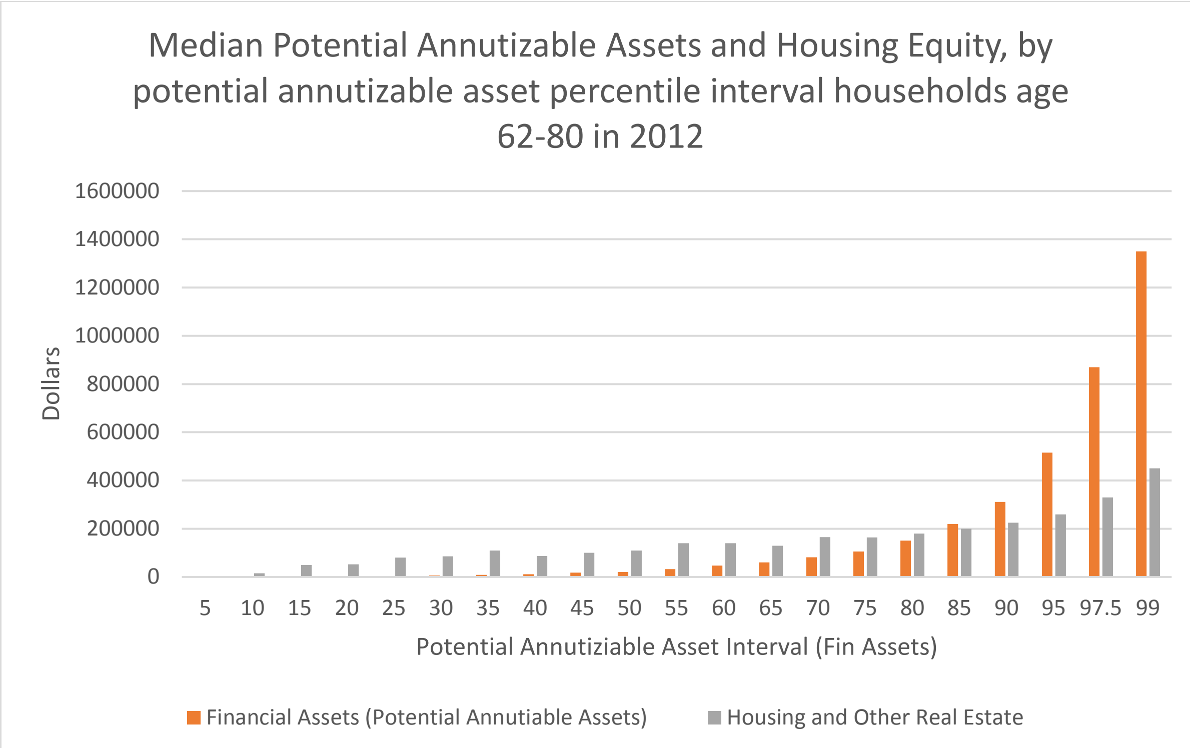
Figure 1:



Source: HRS data; tabulations by Mark Warshawsky.