Home Equity Conversion Mortgage Terminations: Information To Enhance the Developing Secondary Market

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Abstract

This article examines loan terminations under the U.S. Department of Housing and Urban Development's (HUD's) reverse mortgage *insurance program formally known as the Home Equity Conversion Mortgage (HECM). Demand for HECM loans is increasing and may continue to rise in the future as the baby boom generation enters its retirement years. An efficient secondary market would help the HECM program realize its full market potential to meet this growing demand. Information for investors to gauge the future performance of HECM loans has not been widely available but is critical to help the secondary market mature. This article addresses the need for information by analyzing HUD historical data on HECM loan terminations—a major risk factor in assessing loan performance. Reverse mortgage terminations are primarily driven by the timing of borrower deaths and voluntary loan payoffs associated with moving out of the mortgaged property. Thus, borrower age and type (specifically single female or male or couples) affect reverse mortgage termination rates. One unique feature of the HECM program (compared to other reverse mortgage products available in the market) is that it gives lenders the option to assign an active HECM loan to HUD in the event the loan balance reaches the maximum claim covered by FHA insurance. From an investor's perspective, the assignment of an active loan to HUD is the equivalent of a loan termination. The research described in this article generates annual hazard and survival rate tables for HECM loans grouped by age and borrower type and examines the impact assignments have on expected termination experiences for these groups. It finds that assignments begin to impact hazard and survival rates after policy year*

Abstract (continued)

six for all borrowers and as early as policy year four for older borrowers. Additional findings related to borrower age and borrower type are discussed.

Introduction

This article examines loan terminations for the U.S. Department of Housing and Urban Development's (HUD's) *reverse mortgage* insurance product formally known as the Home Equity Conversion Mortgage (HECM). Reverse mortgages enable homeowners to convert home equity into liquid assets. Older Americans who own their own homes and who have most of their wealth in their houses use HUD-insured HECMs and conventional (not government insured) reverse mortgages. Market interest in reverse mortgages is expanding both in the United States and internationally where rapidly aging populations are looking for alternative ways to access financial assets to raise or maintain the standard of living for the elderly.

The purpose of this article is to enhance the development of an efficient secondary market for HECM loans by providing the general public and mortgage market participants (particularly potential reverse mortgage investors) with analysis of 16 years of actual program experience on the timing of HECM loan terminations. Such detailed HECM termination experience has not been made public elsewhere. Specifically, this article provides information on discrete-time (annual) HECM loan termination and survival rates, focusing on the impacts on these rates of differing borrower ages and borrower types. The article also provides information on the impact on termination and survival rates associated with the unique assignment option feature of the HECM product that is not found in conventional reverse mortgages.

A reverse mortgage derives its name from the pattern of payments that is typically the reverse of a traditional mortgage loan used to buy a home. Specifically, with a home purchase mortgage, the lender advances funds to the borrower in a lump sum at the outset, while the borrower makes periodic repayments to the lender that eventually retire the debt. With a reverse mortgage, the pattern is the opposite: the lender advances funds periodically to the borrower, while the borrower makes no repayment to the lender until the end of the loan, when a lump sum repayment is due. HECM reverse mortgages do not require repayment as long as the borrower is alive and resides in the home. Because periodic advances to borrowers, interest on the debt, and other fees accrue, reverse mortgages such as HECMs are generally rising debt loans. Equity declines because the debt usually rises at a faster rate than property appreciation.

The HECM product, launched in 1989, has become the dominant reverse mortgage product in the U.S. market. HUD's Federal Housing Administration (FHA) provides mortgage insurance to private HECM lenders, protecting them against losses resulting from nonrepayment in full of the loans and making lenders more willing to make these loans. Nonrepayment losses would typically occur if the amount of the debt exceeds the net proceeds from the sale of the property when the loan becomes due. If a loss due to nonrepayment occurs, the lender files a claim to HUD for insurance benefits.

One feature that distinguishes the HECM product from conventional reverse mortgage products is an option that HUD gives its lenders to assign the loan to HUD when the total loan balance grows to equal 98 percent or more of the loan's *maximum claim amount.*[1] HUD offers this option (1) to increase the liquidity of these loans that have no stated term to maturity and (2) to provide lenders with full insurance coverage from losses due to nonrepayment.[2] When the balance of a HECM loan reaches 98 percent of the maximum claim, the lender may assign the loan to HUD, and HUD assumes all responsibilities for servicing the loan going forward. At the time of the assignment, HUD pays an insurance claim to the lender equal to the loan balance (up to the maximum claim). The timing of these assignments varies depending on the rates at which borrowers draw down their cash advances from the HECM loan and on the path that interest rates have followed, given that nearly all HECM loans accrue interest at adjustable rates. Loans made to older borrowers tend to get assigned sooner because older borrowers may receive larger loan advances (as a fraction of the property value) than younger borrowers.

When the initial 1989 pricing model for HUD's HECM insurance product was created, no actual program experience data existed for estimating the cashflows of reverse mortgages. The key risk factors affecting the cashflows and, consequently, the pricing of HECM insurance, are (1) borrower mortality rates and voluntary loan terminations, which together determine the timing of loan terminations and lump sum repayments; (2) interest rate changes, which affect the rate at which the debt rises; and (3) the uncertainty of future property values, which affects the net proceeds from a sale. Similar risk factors would also affect the pricing of securities backed by reverse mortgage assets. Szymanoski (1994) notes that absent actual program experience, HECM insurance was priced based on reasonable, but untested, assumptions relating to the previously mentioned factors. Regarding mortality and voluntary terminations, the original pricing assumption was that HECM loans made to borrowers of any given age would terminate in the future at a rate equal to 1.3 times the age-specific mortality rate for female borrowers.[3]

Since HUD's HECM product was launched, additional research on the risk factors affecting HECM cashflows has occurred. Some of this research on borrower mortality rates, loan termination rates, and house price appreciation for older homeowners suggests that the original HECM assumptions may need updating. DiVenti and Herzog (1992) simulated HECM pricing and cashflows using an alternative mortality model that forecasted improvements in survival rates over a 25-year period. Their findings suggest that the HECM program assumptions might have underestimated borrower survival rates. Nevertheless, Szymanoski, DiVenti, and Chow (2000) note that HUD does not collect complete data on borrowers' deaths; hence, actual HECM termination experience cannot distinguish between mortality and move-out. These authors found that for some HECM borrowers—especially for younger borrowers in their 60s at the time of loan origination—HUD's assumptions appeared to be underestimating total terminations and, therefore, overestimating loan (as opposed to borrower) survival rates. Szymanoski, DiVenti, and Chow (2000), McConaghy (2004), and Rodda, Lam, and Youn (2004) construct multivariate statistical models of HECM termination probabilities. These studies show that factors such as borrower type, house price appreciation at the metropolitan area level, and interest rates affect termination probabilities. More research into model specification may be necessary for multivariate statistical analysis to be useful in understanding HECM termination probabilities.[4]

The investment community has begun to issue securities backed by reverse mortgage assets, including the first-ever HECM-backed securities issued during August 2006. Potential exists for rapid growth in the volume of HECM securitizations in the future. On October 17, 2006, Ginnie Mae announced that it is in the process of creating a HECM mortgage-backed security (MBS) product. The first Ginnie Mae-guaranteed HECM securities are planned before the end of 2007.

According to Lehman Brothers, the investment banking firm that pioneered the first reverse mortgage security in the United States, reverse mortgages have two unique features that complicate the securitization process. First, reverse mortgages involve two-way flows of cash, unlike traditional home purchase mortgages from which cash flows only to investors. Specifically, purchase mortgage cash inflows to investors include scheduled monthly principal and interest payments plus prepayments from borrowers. Reverse mortgage cash outflows to borrowers include regular annuity payments or unscheduled line of credit draws, and cash inflows to investors include repayments of principal and accrued interest when the loan is repaid in a lump sum. Second, investors often prefer to hold current-pay securities, but reverse mortgages, unlike home purchase mortgages, provide cash inflows only when they terminate. A securitization of reverse mortgages must be structured to satisfy obligations to advance cash to borrowers as well as to investors "despite the unusual nature of reverse mortgage payments."[5]

The secondary market is still developing ways to meet the challenges of securitizing reverse mortgages. Some securitizations to date have structured the securitization trust with prefunded cash accounts to make necessary obligations to borrowers and investors if cash inflows from terminations do not provide sufficient cash to meet these obligations. An alternative reverse mortgage securitization structure under development is to allow for dividing each whole reverse mortgage loan used as collateral into participations (shares of the loan) and for placing only fully funded loan participations into a security so investors would have no obligation to advance funds to the borrower. In this alternative securitization model, a prefunded cash account to meet the borrower's obligations would not be needed because the issuer of the security would retain these obligations to make required cash advances to the borrower. Future cash advances, when met, could become additional fully funded loan participations that the issuer could place in a subsequent security.

Until the secondary market for reverse mortgages develops and becomes more efficient (reducing the costs of securitization), the HECM product may not be realizing its full market potential. As a result, the HECM has not fully benefited from the increased liquidity that the home purchase mortgage market has achieved. Increased liquidity could broaden the lender distribution channels for HECM loans and expand the investor base. These benefits could also lead to lower costs for borrowers and product innovations that are permitted under current product rules but not supplied by lenders (for example, zero-closing-cost and fixed-rate HECM loans).

An efficient secondary market for asset-backed securities requires information about the timing of terminations, or payoffs, for the underlying assets for investors to estimate the duration and price of these securities. To support the development of such a market for HECM loans, this article provides termination information in the form of discrete-time hazard and survival rate tables using historical HUD HECM data and standard life-table techniques. The tables show annual hazard and survival rates for selected initial borrower age categories and borrower types (single female, single male, couples, and all borrowers). The hazard and survival tables are presented in two ways. In the first set of tables, the hazard is defined in the traditional manner as the event of the loan being repaid upon the death or move-out of the borrower (including borrower payoffs for other reasons, such as refinancing). A second set of tables is presented in which the hazard definition is extended to include the assignment of an active loan to HUD by the lender as an additional termination event. The actual loan termination due to the borrower's death, move-out, or refinancing may occur many years after the assignment to HUD, but the assignment event is likely to be treated as a loan termination by investors in HECM securities. From an investor's perspective, the assignment of a HECM loan to HUD would result in the loan's purchase out of the mortgage pool.

The next section of this article provides background information on the HECM product and the recent developments in the secondary market for these loans. The section following background information describes the database used in the analysis, provides a theoretical overview of the discrete-time hazard model, and applies this theory to estimate annual HECM hazard and survival rates directly from the data. The final section discusses main findings from the estimated hazard and survival rates as presented.

Background on HECM

HUD-insured HECM loans, which have been available for more than 16 years, have come to dominate the primary reverse mortgage market; yet, for most of this time no secondary market has been available for these loans. The investment community and Ginnie Mae have recently shown increasing interest in developing a secondary market for reverse mortgages in general and for the HECM product specifically. This section provides a useful comparison of cashflow patterns of traditional "forward" mortgages and reverse mortgages, a brief history of the HUD HECM reverse mortgage program, and the investment community's increased interest in the securitization of these loans.

Forward and Reverse Mortgage Cashflow Patterns

A major difference between the cashflows of a traditional home purchase, or forward, mortgage and a reverse mortgage is in the pattern of equity and debt over time. For the forward mortgage, debt is largest at the beginning of the loan term than at any other time. As a borrower makes monthly principal and interest payments on the mortgage and the property appreciates in value, the borrower's debt declines and equity increases. In contrast, for a reverse mortgage, the borrower's debt is smallest at the beginning of the loan term than at any other time. As the lender makes periodic principal advances to borrowers and accrues interest and loan fees into the outstanding balance, the borrower's debt increases faster than the property value appreciates and equity decreases.

Exhibits 1 and 2 illustrate the different equity and debt patterns associated with forward and reverse mortgages, respectively. Exhibit 1 shows a typical pattern of changes in the equity and debt for a 30-year fixed-rate mortgage over the full loan term. Exhibit 2 shows the changes in the equity and debt for a reverse mortgage for which the borrower draws down cash advances in the typical pattern observed in the HECM program. This typical pattern of cash paid out for a HECM (expressed as average percentages of the initial principal limit by policy year) is provided in exhibit 3.[6]

Exhibit 1

Debt and Equity for a Traditional 30-Year Fixed-Rate Mortgage by Age of Loan in Years

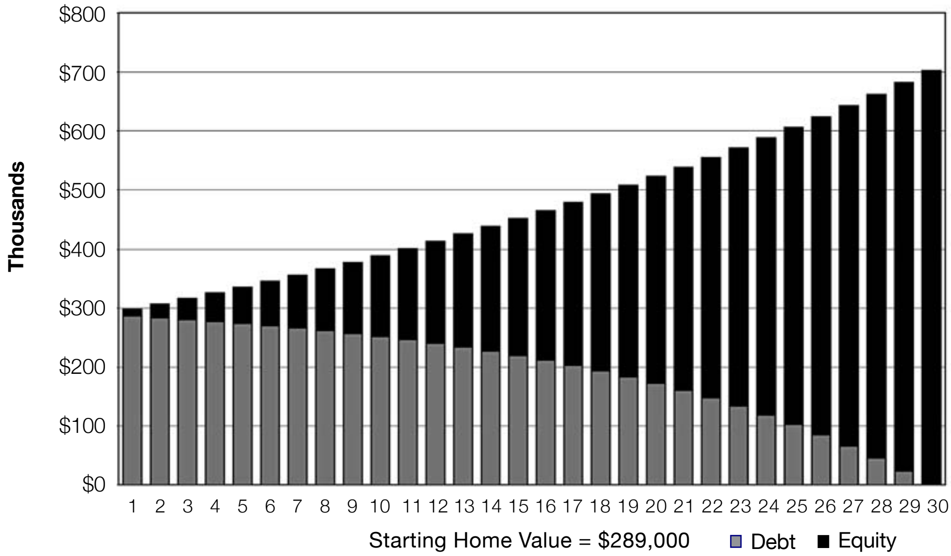
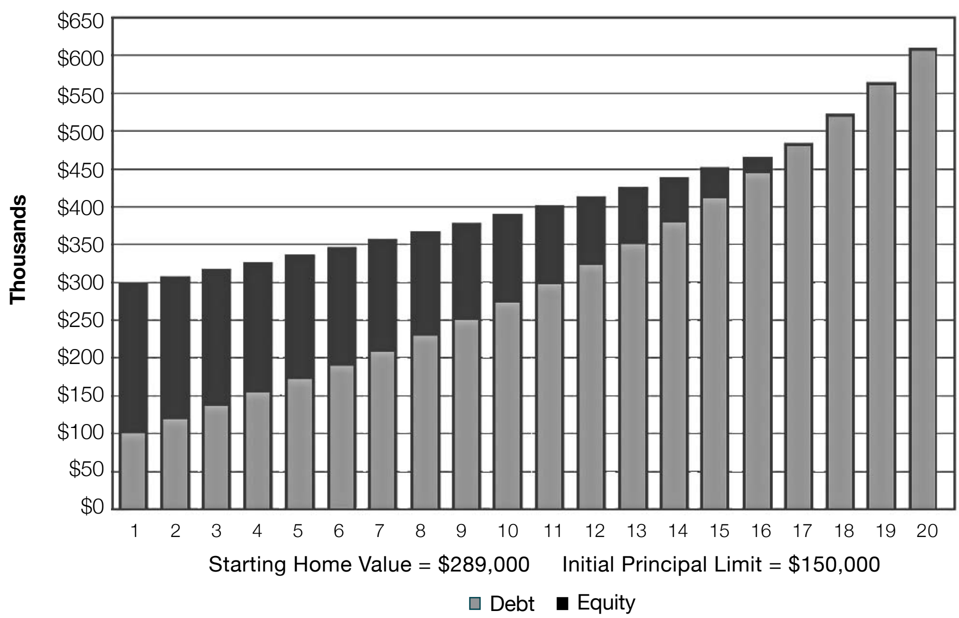


Exhibit 2

Debt and Equity for a HECM Reverse Mortgage by Age of Loan in Years



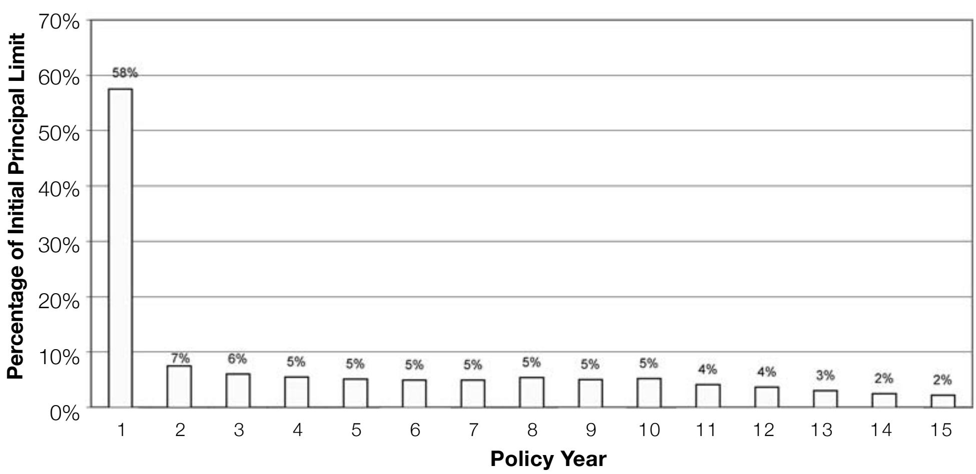
HECM = Home Equity Conversion Mortgage.

For a single reverse mortgage loan, cash flows from the lender to the borrower in periodic payments, which typically decline over time. Cash flows in the other direction, from the borrower to the lender (or investor), only one time—as a lump sum repayment when the loan terminates.

Nevertheless, for a large pool of reverse mortgages, the pattern of cashflows is very different. If the pool is large enough, some loans are expected to terminate in each discrete-time period. Hence, the expected net cashflows for the pool quickly switch from a net outflow to a net inflow as lump sum repayments exceed aggregate cash advances paid to the remaining borrowers. The expected cashflows on a pool of HECM loans are illustrated in exhibit 4 using average termination rates for a 75-year-old borrower and the typical cash payouts shown in exhibit 3. These net cashflows from a pool of reverse mortgages represent the cash passthroughs on a reverse mortgage security. If the security is formed with loans that have been seasoned past the first year, then the net cash inflows in most cases will be adequate to create current pay securities for investors and meet additional borrower cash drawdown obligations. In case the net cash inflows fall short, however, the trust created for a reverse mortgage security often includes a cash funding account to ensure that all obligations will be met. The appendix at the end of this article illustrates the structure of a stylized reverse mortgage security.

Exhibit 3

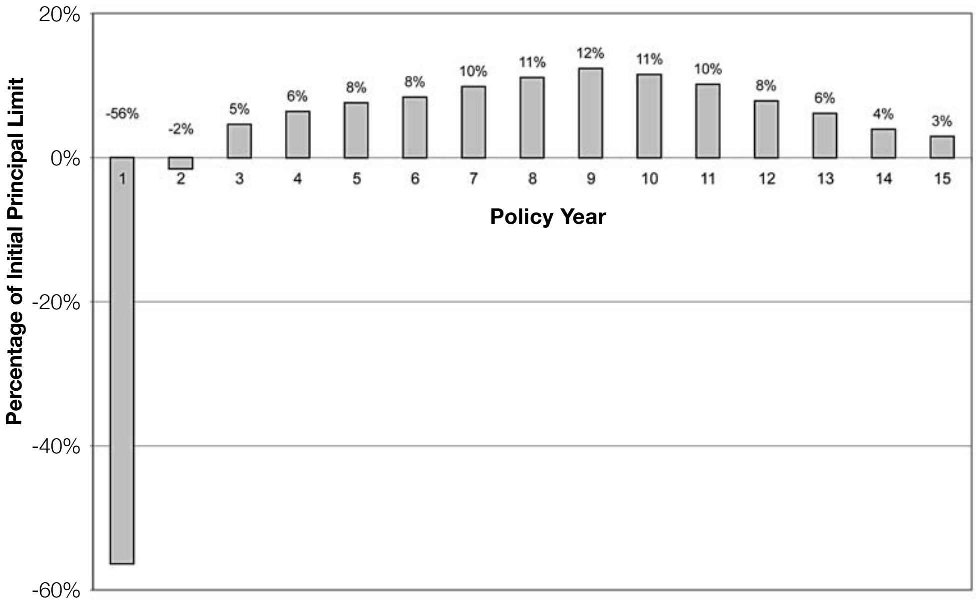
Cash Paid Out to Borrowers on a Typical HECM Loan by Policy Year as Percentage of Initial Principal Limit



HECM = Home Equity Conversion Mortgage.
Source: Preliminary analysis of HUD's Single Family Data Warehouse and Single Family Mortgage Asset Recovery Technology databases

Exhibit 4

Net Cash Flows to Investors on a Pool of HECM Loans by Policy Year as Percentage of Initial Principal Limit



History of the HUD HECM Program

A demonstration program for home equity conversion was authorized by the Housing and Community Development Act of 1987 (Public Law 100-242) and was initially limited to 2,500 total mortgages, although that limit was soon raised. The first HECM loan was made in September 1989. HUD designed the HECM product in response to the statute, and it has become the dominant reverse mortgage product in the U.S. market. The HUD Appropriation Act of 1998 made HECM a permanent program of HUD and the FHA.

The history of the HECM program is documented in five reports to Congress prepared by HUD. The first, submitted in 1990, described the HECM product's features and explained why various design decisions were made, including the actuarial assumptions of the HUD pricing model. The second HUD report, submitted to Congress in 1992, provided initial findings on borrower, loan, property, and lender characteristics and on outstanding legal and programmatic issues. The third report to Congress, submitted in 1995, updated the findings of the 1992 report and conducted an initial actuarial review of the program's insurance fund. The fourth report, submitted to Congress in May 2000, updated the 1995 actuarial review and presented the latest available borrower, loan, and property characteristics. The 2000 report also included borrower feedback on satisfaction with the program. The fifth and most recent report to Congress, submitted in 2003, was mandated by Congress to update the actuarial analysis presented in the 2000 HECM report and to examine the potential impact of three legislative proposals affecting the HECM program: (1) replacing FHA's local loan limits with a single, national loan limit for HECM; (2) reducing the premium for HECM refinancing; and (3) waiving the upfront premium for HECMs used exclusively for the payment of long-term care insurance policies.[7]

The HUD reports show that HECM borrowers tend to be older than the general population of homeowners age 62 and older and are more likely to be single females. According to the 2000 report, which was the last report to contain detailed borrower and loan characteristics, the median age of a HECM borrower was 75 compared with a median age of 72 among all elderly homeowners. Of the HECM borrowers, 56 percent were single females, compared with 28 percent of elderly homeowners in the general population. Single males accounted for 14 percent of HECM loans and couples accounted for 30 percent, compared with 8 and 65 percent, respectively, among the general population. The properties of HECM borrowers tended to be more valuable than those of the general population of homeowners age 62 and older: the median value was $107,000 for HECM borrowers compared with $87,000 for elderly homeowners in the general population. The typical HECM loan, as of the 2000 study, had an initial principal limit of $54,890, the maximum amount that can be borrowed under the terms of the HECM loan (either taken as a lump sum at closing or as the present value of an annuity or credit line).

Current HUD data on HECMs show that the previously mentioned borrower and loan characteristics have changed since the 2000 report to Congress. Specifically, among HECM loans insured in fiscal year (FY) 2006, the median borrower's age is now 74; single females still represent the largest share of borrower types, although their share has fallen to 44 percent compared with 17 percent for single males; 39 percent of borrowers are couples; average property values have grown to $289,000; and the average principal limit is now about $159,000.

The HUD reports to Congress also show that HECM loans have been primarily purchased by a single investor, Fannie Mae, and held as whole loans in Fannie Mae's portfolio. Originating lenders rarely hold HECM loans in portfolio, even though the loans nearly always carry adjustable interest rates, choosing instead to sell these loans to an investor as quickly as possible.

As noted previously, HUD's HECM product does not require any repayment as long as the borrower remains in the home. This feature increases the demand for HECM loans among elderly homeowners (the minimum qualifying age is 62) because they can borrow without the fear of involuntary displacement or foreclosure due to failure to make monthly payments or a lump sum repayment by a specified date. Nonrepayment on a HECM loan can occur only after the borrower's death or a voluntary move-out, at which time the loan becomes due and payable.[8] In the case of death or move-out, the property is sold to pay off the debt. If the sales proceeds are sufficient to pay the debt, including interest, the remaining cash usually belongs to the borrower or his or her estate. If the sales proceeds are insufficient, the lender (or investor) must absorb the loss, releasing the mortgage upon receipt of the net sales proceeds, and then must file a claim with HUD for insurance benefits that fully reimburse the lender for the deficiency.

Even with the risk of loss due to nonrepayment borne by the government, private lenders may have additional reasons for not holding reverse mortgage loans in their portfolios. Specifically, regulated depository institutions may find it difficult to manage portfolio capital requirements if they hold illiquid whole loan assets such as HECMs. In addition, some lenders may not want to accrue taxable interest income on reverse mortgage assets because this income will not actually be received until the loan is paid off—potentially many years in the future.

Although Fannie Mae's participation as the principal investor for HECM loans has been a major factor in the early success of HECM as a niche product, the long-term success of HECM as a more mainstream loan product may require the eventual development of a more efficient secondary market for these loans. If an efficient secondary market in HECM loans does develop, then the liquidity and taxation problems could be shifted to investors who may value these assets more highly than portfolio lenders do. Furthermore, increased liquidity from an efficient secondary market could broaden the lenders' distribution channels for HECM loans and expand the investor base. Broader distribution channels and increased investor demand could also lead to lower costs for borrowers and product innovations, including some that are permitted under current product rules but not currently supplied by lenders (for example, zero-closing-cost and fixed-rate HECM loans).[9]

The Secondary Market for HECMs

The investment community's interest in developing a secondary market for reverse mortgages dates back to the late 1990s. In 1999, for example, Lehman Brothers led the first U.S. securitization of reverse MBSs with a $317 million structured financing by the Structured Asset Securities Corporation (SASCO) using conventional reverse mortgages as assets. At that time, Standard & Poor's (S&P), a public ratings agency, published its ratings criteria for reverse mortgage backed securities.[10] The S&P criteria state that, from a cashflow perspective, "the repayment rate [due to move-out and mortality] is the most important [cashflow] variable of the security." For reverse mortgage securities backed by HECM assets, the underlying termination rate of the loans is by far the most critical cashflow risk factor because the HECM mortgage insurance mitigates cashflow risks arising from interest rate and property value uncertainties.

More recently, the investment community's interest in the reverse mortgage market (both for FHA-insured HECM loans and conventional reverse mortgages) has accelerated. Whether fueled by the low interest rates and robust house price growth of the past 5 years, the rapid growth of HECM and conventional reverse mortgage volumes over this same period, growth in the number of lenders with experience in lending and servicing these loans, or a combination of all these factors, the market for reverse mortgage securities, including those backed by both conventional and HECM reverse mortgages, is poised for considerable growth.

In August 2006, the Mortgage Equity Conversion Asset Corporation issued $221 million in Class A notes backed by a pool of HECM loans. This issuance, which received a rating of "AAA" by Fitch Ratings, represented the first ever asset-backed security using HECM loans as assets. The trust in this securitization consisted of a mortgage pool of HECM loans with a cutoff aggregate balance of $135.5 million, plus an $85.45 million funding account comprising cash and securities to provide assurance that borrowers would be advanced funds even if pool cash inflows from terminated cases fell short.[11]

The following month, Fitch rated another $598.3 million reverse mortgage pool trust, which was a structured financing backed by conventional reverse mortgages with a cutoff date balance of $522.3 million. Because the assets in the pool, unlike HECM loans, have no federal insurance to cover nonrepayment risk, the securities were structured (as was the 1999 SASCO deal) with multiple risk classes, in which the lower rated classes absorbed some of the nonrepayment risks of the highest rated classes. Thus, the security's Class A-IO and Class A-1 notes, with a combined balance of $490 million, received Fitch's highest rating of "AAA" because they were structured with sufficient protection from nonrepayment risk. The security's $83.3 million Class M-1 notes, structured with less protection from nonrepayment risk, received a lower rating of "AA," and the security's $25.0 million Class M-1 notes, which assumed the most nonrepayment risk, received the lowest rating of "A."

The potential exists for continued HECM securitizations in the future. On October 17, 2006, Ginnie Mae announced that it is in the process of creating a new product to securitize HECMs. Ginnie Mae, an arm of HUD, has a mission to promote an efficient government-guaranteed secondary mortgage market linking the global capital markets with federally insured housing markets.[12] The first of these Ginnie Mae-guaranteed HECM securities will likely be issued before the end of 2007.

Clearly, a growing supply of HECM loans available for securitization exists. FHA has insured about 236,000 HECM loans since the program's inception in 1989.[13] Of these loans, FHA insured more than 74,000 cases during FY 2006 (October 1, 2005, through September 30, 2006), which represents nearly 32 percent of the cases ever insured and a 73-percent increase over the 43,000 cases FHA insured in FY 2005. As of September 30, 2006, more than 175,000 of the ever-insured HECM loans were still actively insured—that is, the loans were active and had not been assigned to HUD—with an average outstanding loan balance of $103,000 and an aggregate outstanding loan balance of $18.1 billion. Both FHA and Ginnie Mae believe that HECM volume will continue to rise in the future as the baby boom generation enters its retirement years and the demand for reverse mortgages, in general, is expected to increase.

The previously mentioned reverse mortgage ratings criteria from Wall Street public ratings agencies reflect the market's desire to gain a better understanding of HECM cashflows. For a secondary market for HECM loans to thrive, it will need specific information on HECM cashflow factors—especially information about the timing of loan terminations due to mortality, move-out, and refinancing.

Constructing Discrete-Time Hazard and Survival Rates Using HUD's HECM Data

This section provides a discussion of HUD HECM data. It emphasizes the impact of assignments, unique to HUD's program, on expected terminations. Discrete-time hazard and survival models are constructed for borrowers of different types and ages. Hazard and survival rates are recomputed taking into consideration the impact of loan assignment on termination experience.

HUD's HECM Data

The analyses are based primarily on a database containing 235,993 loan-level records representing all loans that HUD had endorsed for HECM insurance as of September 30, 2006.[14] The data come from two sources: the HUD Single Family Data Warehouse and FHA's Single Family Mortgage Asset Recovery Technology (SMART) database. HUD's Single Family Data Warehouse compiles its HECM data from the primary program source systems: the Computerized Housing Underwriting Management System and the Insurance Accounting Collection System. The SMART database contains information about HECM cases which have been assigned to HUD. The post-assignment case data in SMART are not currently captured in the Single Family Data Warehouse.

Each loan-level record obtained for analysis contains fields for the loan origination or funding date and borrower and co-borrower (if applicable) characteristics, including date of birth and gender, date of termination (if applicable), date of assignment (if applicable), and loan status codes, all as of the cutoff date of September 30, 2006. The borrower's age at loan origination was calculated using the loan origination date and the borrower's date-of-birth information. Also, where a co-borrower is present on the loan, the date-of-birth information for the younger of the couples was used to represent the borrower's age.[15]

Lack of data in some fields resulted in a small number of termination dates being estimated and a small number of loans being dropped from the analysis. For 385 cases with termination status codes indicating claims were paid but the cases were missing termination dates, the claim payment dates were obtained from the Single Family Data Warehouse to approximate the loan termination dates. A total of 531 records with bad data for the borrower's date-of-birth could not be proxied using other data; these records were discarded, leaving 235,993 valid cases for analysis.

Exhibits 5A and 5B summarize the numbers of loans among the 235,993 valid records originated by calendar year and by termination status; that is, terminated or censored.[16] In exhibit 5A, these data are presented using the loan termination status as it appeared through September 30, 2006, in the Single Family Data Warehouse for cases not assigned to HUD. Exhibit 5A uses similar data on termination status from the SMART database for assigned cases. In exhibit 5A, loans that are assigned to HUD are not shown as terminations until the borrower dies or pays off the loan.

Exhibit 5A

HECM-Insured Cases by Termination Status as of September 30, 2006
Terminations Exclude Assignment to HUD

Origination Year	Terminated		Censored		Total Originations	
	Count	Percentage of Row	Count	Percentage of Row	Count	Percentage of Row
1989	11	100.0	0	0.0	11	100.0
1990	362	91.0	36	9.0	398	100.0
1991	579	88.1	78	11.9	657	100.0
1992	1,597	84.5	293	15.5	1,890	100.0
1993	2,277	80.1	567	19.9	2,844	100.0
1994	3,333	81.5	757	18.5	4,090	100.0
1995	3,025	77.7	870	22.3	3,895	100.0
1996	3,626	72.7	1,364	27.3	4,990	100.0
1997	4,197	72.2	1,617	27.8	5,814	100.0
1998	4,299	64.1	2,411	35.9	6,710	100.0

HECM = Home Equity Conversion Mortgage.
Note: Excludes 531 cases with missing data.

Exhibit 5A

HECM-Insured Cases by Termination Status as of September 30, 2006
Terminations Exclude Assignment to HUD (continued)

Origination Year	Terminated		Censored		Total Originations	
	Count	Percentage of Row	Count	Percentage of Row	Count	Percentage of Row
1999	4,682	61.5	2,934	38.5	7,616	100.0
2000	3,665	58.3	2,617	41.7	6,282	100.0
2001	4,507	46.0	5,287	54.0	9,794	100.0
2002	5,161	38.0	8,406	62.0	13,567	100.0
2003	7,214	25.3	21,249	74.7	28,463	100.0
2004	5,971	16.0	31,389	84.0	37,360	100.0
2005	2,415	4.2	54,886	95.8	57,301	100.0
2006	166	0.4	44,145	99.6	44,311	100.0
Total	**57,087**	**24.2**	**178,906**	**75.8**	**235,993**	**100.0**

HECM = Home Equity Conversion Mortgage.
Note: Excludes 531 cases with missing data.

Exhibit 5B

HECM-Insured Cases by Termination Status as of September 30, 2006
Terminations Include Assignment to HUD

Origination Year	Terminated		Censored		Total Originations	
	Count	Percentage of Row	Count	Percentage of Row	Count	Percentage of Row
1989	11	100.0	0	0.0	11	100.0
1990	389	97.7	9	2.3	398	100.0
1991	649	98.8	8	1.2	657	100.0
1992	1,833	97.0	57	3.0	1,890	100.0
1993	2,733	96.1	111	3.9	2,844	100.0
1994	3,761	92.0	329	8.0	4,090	100.0
1995	3,493	89.7	402	10.3	3,895	100.0
1996	4,134	82.8	856	17.2	4,990	100.0
1997	4,456	76.6	1,358	23.4	5,814	100.0
1998	4,642	69.2	2,068	30.8	6,710	100.0
1999	4,833	63.5	2,783	36.5	7,616	100.0
2000	3,693	58.8	2,589	41.2	6,282	100.0
2001	4,543	46.4	5,251	53.6	9,794	100.0
2002	5,183	38.2	8,384	61.8	13,567	100.0
2003	7,277	25.6	21,186	74.4	28,463	100.0
2004	5,983	16.0	31,377	84.0	37,360	100.0
2005	2,416	4.2	54,885	95.8	57,301	100.0
2006	166	0.4	44,145	99.6	44,311	100.0
Total	**60,195**	**25.5**	**175,798**	**74.5**	**235,993**	**100.0**

HECM = Home Equity Conversion Mortgage.
Note: Excludes 531 cases with missing data.

In exhibit 5B, the data are presented using termination status as it appears in the Single Family Data Warehouse, including the date that a case was assigned to HUD as a termination event. That is, in exhibit 5B, those cases that are assigned to HUD are considered to be terminated even if the borrower continues to live in the mortgaged property. From an investor's perspective, an assignment to HUD is equivalent to a loan termination because the assigned loan is bought out of the securitization pool by HUD's payment of the claim.

Discrete-Time Hazard Model

Discrete-time hazard models use regularly defined time periods (such as years, months, or other units of time) to describe the likelihood of events occurring at various points in time among a group of individuals. These events can include loan terminations among a group of mortgages such as HECMs.

A central concept in the discrete-time hazard model is that of the *hazard rate*. The discrete-time hazard rate is the probability that an event will occur during a particular time period to a particular individual, given that the individual is at risk at the beginning of the period. In this article, the event of interest is the act of terminating a HECM loan. Based on this definition, the discrete-time hazard rate is sometimes referred to as the *conditional probability* of the event occurring during a given time period, with the condition being that the individual was at risk at the start of the time period.[17] A second key concept is that of the *risk set*, which is the set of individuals (in our case, HECM loans) who are at risk of some event occurring at the start of each discrete point in time. The risk set is also called the risk *exposure*.

By grouping together individuals with similar characteristics (such as those having the same initial borrower age), we find that the hazard rate varies over discrete-time periods but can be considered the same for all individuals in the group at each period. We estimate the hazard rate for the group at each time period by dividing the number of events observed during the period by the number of individuals at risk during the period.

Another concept in the discrete-time hazard model is that of the *survival rate*. Survivors are those individuals from the original group that have not experienced the event through a given time period. The number of survivors expected at the end of a time period equals the expected number of survivors from the start of the period minus the expected number of events that occur during the period. The expected number of events in a period is the estimated hazard rate for that period multiplied by the number of individuals at risk at the start of the period. Absent censoring, the number of individuals at risk is equal to the number of survivors at the start of the period. The survival rates for the group are the proportions of the initial group that have not experienced the event of interest as of the start of each time period. Note that the introduction of censoring in the data will require some adjustments to these calculations. See Allison (1984, 1995).

Constructing Discrete-Time HECM Hazard and Survival Rates

We construct discrete-time HECM hazard and survival rates from the data using the *life-table* method to account for censoring of some of the data.[18] The hazard being considered is HECM loan termination defined either with or without loan assignments to HUD as termination events. The data are right-censored because actual termination dates for loans that did not terminate as of the cutoff date of the study (September 30, 2006) are censored from further observation. The timing of the termination and censoring events is based on each loan's policy year. *Policy year* is the age of the loan in years beginning with the date the loan was originated and insured by HUD. All loans, regardless of calendar year of origination, begin in the first policy year. The number of policy years observed varies for each loan record.[19] The files contain a loan origination date for each loan and a termination date if the loan is terminated. If there is no termination date, the loan is considered to have survived at least through September 30, 2006.

The hazard rate in policy year *i* is estimated by dividing the number of loans that terminated in the i-th policy, d(i), by the number of loans at risk, or exposed to the hazard of interest, E(i), at the start of that policy year

$$h(i) = d(i) / E(i).^{20} \tag{1}$$

The survival rates in policy year i are computed as follows:

$$S(0) = 1.0000 \tag{2}$$

$$S(1) = S(0) \times (1 - h(1)), \text{ and in general} \tag{3}$$

$$S(i) = S(i\text{-}1) \times (1 - h(i)) \tag{4}$$

$$= \prod_{j=1}^{i} (1 - h(j)). \tag{5}$$

The discrete-time survival rates constructed from the discrete-time hazard rates as noted previously are analogous to continuous-time hazard and survival probabilities in a continuous-time hazard model.[21] See Allison (1984).

Exhibits 6 through 9 present HECM hazard and survival rates that have been constructed from the HUD database of 235,993 loan-level records. The tables are split into parts A and B. In exhibits 6A through 9A, the hazard is defined as mortality, move-out, or other voluntary payoff of the loan (including refinancing) but excluding assignment of the loan to HUD. In exhibits 6B through 9B, the hazard definition is expanded to include assignment of the loan to HUD along with mortality, move-out, and voluntary payoff. Three selected age groupings are presented in exhibits 6A through 8A and repeated for exhibits 6B through 8B: younger borrowers (defined as those ages 64 to 66 at closing), typical borrowers (defined as those ages 74 to 76 at closing), and older borrowers (defined as those ages 84 to 86 at closing).[22] Exhibits 9A and 9B pool all the HECM data to show aggregate hazard and survival rates for all ages. Within each exhibit, hazard and survivor information is broken out for selected borrower types (all borrowers, couples, single females, and single males). The exhibits also show the effective sample size for each policy year along with standard errors for the estimated hazard rates. Finally, the exhibits show the 2006 general population mortality rates for females as determined by the National Center for Health Statistics (based on the age corresponding to the midpoint of the age interval illustrated in the exhibit at origination) and the ratios of the observed hazard rates to the corresponding U.S. Department of Health and Human Services female mortality rates. This ratio is given for illustrative purposes only because the underlying mortality rates for each group of borrowers are unknown and will vary by group composition. The mortality rate comparison is not presented for exhibits 9A and 9B because these exhibits aggregate all ages.

Exhibit 6A

Younger Borrowers (Ages 64 to 66 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other but Excludes Loan Assignment to HUD (1 of 2)

		1. All Borrowers					2. Couples With Younger Borrower in Age Group				
Policy Year	Female Mortality Rate *m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	14288.0	0.0000	—	0.0000	1.0000	5569.0	0.0000	—
1	0.0122	0.0142	0.9858	11830.0	0.0011	1.2	0.0092	0.9908	4584.0	0.0014	0.7
2	0.0134	0.0658	0.9209	7841.0	0.0028	4.9	0.0483	0.9430	3002.0	0.0039	3.6
3	0.0147	0.1143	0.8157	4944.5	0.0045	7.8	0.0936	0.8547	1902.0	0.0067	6.4
4	0.0160	0.1297	0.7099	2929.0	0.0062	8.1	0.1133	0.7579	1156.5	0.0093	7.1
5	0.0174	0.1361	0.6133	1925.0	0.0078	7.8	0.1076	0.6763	771.5	0.0112	6.2
6	0.0190	0.1295	0.5338	1375.0	0.0091	6.8	0.1064	0.6044	564.0	0.0130	5.6
7	0.0208	0.1326	0.4631	1041.0	0.0105	6.4	0.1047	0.5411	439.5	0.0146	5.0
8	0.0227	0.1328	0.4016	753.0	0.0124	5.9	0.1325	0.4694	332.0	0.0186	5.8
9	0.0246	0.1816	0.3286	490.0	0.0174	7.4	0.1618	0.3934	222.5	0.0247	6.6
10	0.0266	0.1742	0.2714	298.5	0.0220	6.5	0.1773	0.3237	141.0	0.0322	6.7
11	0.0290	0.1224	0.2382	196.0	0.0234	4.2	0.0782	0.2984	89.5	0.0284	2.7
12	0.0318	0.1255	0.2083	135.5	0.0285	3.9	0.0945	0.2702	63.5	0.0367	3.0
13	0.0349	0.2222	0.1620	76.5	0.0475	6.4	0.2162	0.2118	37.0	0.0677	6.2
14	0.0381	0.1250	0.1418	24.0	0.0675	3.3	0.1739	0.1749	11.5	0.1118	4.6
15	0.0417	0.1538	0.1200	6.5	0.1415	3.7	0.3333	0.1166	3.0	0.2722	8.0

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 65 females.
Source: National Center for Health Statistics, 2006

Exhibit 6A

Younger Borrowers (Ages 64 to 66 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other but Excludes Loan Assignment to HUD (2 of 2)

		3. Single Female Borrowers					4. Single Male Borrowers				
Policy Year	Female Mortality Rate *m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	6150.0	0.0000	—	0.0000	1.0000	2512.0	0.0000	—
1	0.0122	0.0166	0.9834	5169.5	0.0018	1.4	0.0192	0.9808	2035.0	0.0030	1.6
2	0.0134	0.0718	0.9128	3536.0	0.0043	5.4	0.0897	0.8928	1282.5	0.0080	6.7
3	0.0147	0.1288	0.7952	2275.5	0.0070	8.8	0.1233	0.7827	754.0	0.0120	8.4
4	0.0160	0.1334	0.6891	1349.5	0.0093	8.4	0.1602	0.6573	412.0	0.0181	10.0
5	0.0174	0.1507	0.5853	896.0	0.0120	8.7	0.1723	0.5441	249.5	0.0239	9.9
6	0.0190	0.1352	0.5062	636.0	0.0136	7.1	0.1845	0.4437	168.0	0.0299	9.7
7	0.0208	0.1637	0.4233	476.5	0.0169	7.9	0.1176	0.3915	119.0	0.0295	5.7
8	0.0227	0.1225	0.3714	326.5	0.0181	5.4	0.1582	0.3296	88.5	0.0388	7.0
9	0.0246	0.2019	0.2965	213.0	0.0275	8.2	0.1980	0.2643	50.5	0.0561	8.1
10	0.0266	0.1569	0.2499	127.5	0.0322	5.9	0.1923	0.2135	26.0	0.0773	7.2
11	0.0290	0.1600	0.2099	87.5	0.0392	5.5	0.1176	0.1884	17.0	0.0781	4.1
12	0.0318	0.1368	0.1812	58.5	0.0449	4.3	0.2400	0.1432	12.5	0.1208	7.5
13	0.0349	0.2462	0.1366	32.5	0.0756	7.1	0.1538	0.1212	6.5	0.1415	4.4
14	0.0381	0.0000	0.1366	10.0	0.0000	0.0					
15	0.0417	0.0000	0.1366	3.5	0.0000	0.0					

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 65 females.
Source: National Center for Health Statistics, 2006

Exhibit 6B

Younger Borrowers (Ages 64 to 66 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other and Includes Loan Assignment to HUD (1 of 2)

		1. All Borrowers					2. Couples With Younger Borrower in Age Group				
Policy Year	Female Mortality Rate *m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	14288.0	0.0000	—	0.0000	1.0000	5569.0	0.0000	—
1	0.0122	0.0142	0.9858	11830.0	0.0011	1.2	0.0092	0.9908	4584.0	0.0014	0.7
2	0.0134	0.0659	0.9208	7841.5	0.0028	4.9	0.0483	0.9430	3002.0	0.0039	3.6
3	0.0147	0.1143	0.8156	4944.5	0.0045	7.8	0.0936	0.8547	1902.0	0.0067	6.4
4	0.0160	0.1297	0.7098	2929.0	0.0062	8.1	0.1133	0.7579	1156.5	0.0093	7.1
5	0.0174	0.1361	0.6132	1925.0	0.0078	7.8	0.1076	0.6763	771.5	0.0112	6.2
6	0.0190	0.1302	0.5334	1375.0	0.0091	6.9	0.1064	0.6044	564.0	0.0130	5.6
7	0.0208	0.1327	0.4626	1040.0	0.0105	6.4	0.1047	0.5411	439.5	0.0146	5.0
8	0.0227	0.1329	0.4011	752.5	0.0124	5.9	0.1325	0.4694	332.0	0.0186	5.8
9	0.0246	0.1837	0.3274	490.0	0.0175	7.5	0.1663	0.3913	222.5	0.0250	6.8
10	0.0266	0.1946	0.2637	298.0	0.0229	7.3	0.2071	0.3103	140.0	0.0343	7.8
11	0.0290	0.2474	0.1985	194.0	0.0310	8.5	0.2171	0.2429	87.5	0.0441	7.5
12	0.0318	0.2773	0.1434	119.0	0.0410	8.7	0.2456	0.1833	57.0	0.0570	7.7
13	0.0349	0.4553	0.0781	61.5	0.0635	13.1	0.4776	0.0957	33.5	0.0863	13.7
14	0.0381	0.2000	0.0625	15.0	0.1033	5.2	0.1333	0.0830	7.5	0.1241	3.5
15	0.0417	0.5455	0.0284	5.5	0.2123	13.1	0.8000	0.0166	2.5	0.2530	19.2

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 65 females.
Source: National Center for Health Statistics, 2006

Exhibit 6B

Younger Borrowers (Ages 64 to 66 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other and Includes Loan Assignment to HUD (2 of 2)

		3. Single Female Borrowers					4. Single Male Borrowers				
Policy Year	Female Mortality Rate *m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	6150.0	0.0000	—	0.0000	1.0000	2512.0	0.0000	—
1	0.0122	0.0166	0.9834	5169.5	0.0018	1.4	0.0192	0.9808	2035.0	0.0030	1.6
2	0.0134	0.0721	0.9125	3536.5	0.0044	5.4	0.0897	0.8928	1282.5	0.0080	6.7
3	0.0147	0.1288	0.7950	2275.5	0.0070	8.8	0.1233	0.7827	754.0	0.0120	8.4
4	0.0160	0.1334	0.6889	1349.5	0.0093	8.4	0.1602	0.6573	412.0	0.0181	10.0
5	0.0174	0.1507	0.5851	896.0	0.0120	8.7	0.1723	0.5441	249.5	0.0239	9.9
6	0.0190	0.1368	0.5051	636.0	0.0136	7.2	0.1845	0.4437	168.0	0.0299	9.7
7	0.0208	0.1640	0.4222	475.5	0.0170	7.9	0.1176	0.3915	119.0	0.0295	5.7
8	0.0227	0.1227	0.3704	326.0	0.0182	5.4	0.1582	0.3296	88.5	0.0388	7.0
9	0.0246	0.2019	0.2956	213.0	0.0275	8.2	0.1980	0.2643	50.5	0.0561	8.1
10	0.0266	0.1719	0.2448	128.0	0.0333	6.5	0.1923	0.2135	26.0	0.0773	7.2
11	0.0290	0.2400	0.1861	87.5	0.0457	8.3	0.3529	0.1382	17.0	0.1159	12.2
12	0.0318	0.2991	0.1304	53.5	0.0626	9.4	0.3529	0.0894	8.5	0.1639	11.1
13	0.0349	0.4082	0.0772	24.5	0.0993	11.7	0.5714	0.0383	3.5	0.2645	16.4
14	0.0381	0.1538	0.0653	6.5	0.1415	4.0					
15	0.0417	0.3333	0.0435	3.0	0.2722	8.0					

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 65 females.
Source: National Center for Health Statistics, 2006

Exhibit 7A

Typical Borrowers (Ages 74 to 76 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other but Excludes Loan Assignment to HUD (1 of 2)

		1. All Borrowers					2. Couples With Younger Borrower in Age Group				
Policy Year	Female Mortality Rate *m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	24295.0	0.0000	—	0.0000	1.0000	9614.0	0.0000	—
1	0.0306	0.0144	0.9856	20621.0	0.0008	0.5	0.0070	0.9931	8059.5	0.0009	0.2
2	0.0337	0.0659	0.9206	14707.0	0.0021	2.0	0.0464	0.9470	5642.0	0.0028	1.4
3	0.0371	0.1151	0.8147	10253.5	0.0032	3.1	0.1031	0.8493	3938.0	0.0049	2.8
4	0.0408	0.1204	0.7166	6838.0	0.0039	2.9	0.1170	0.7500	2607.0	0.0063	2.9
5	0.0450	0.1266	0.6259	4889.5	0.0048	2.8	0.1206	0.6595	1832.0	0.0076	2.7
6	0.0498	0.1407	0.5378	3611.5	0.0058	2.8	0.1438	0.5647	1342.0	0.0096	2.9
7	0.0552	0.1452	0.4597	2707.5	0.0068	2.6	0.1426	0.4842	989.0	0.0111	2.6
8	0.0613	0.1622	0.3852	1960.0	0.0083	2.6	0.1520	0.4106	710.5	0.0135	2.5
9	0.0680	0.1846	0.3141	1295.0	0.0108	2.7	0.1822	0.3358	477.5	0.0177	2.7
10	0.0756	0.1794	0.2577	791.5	0.0136	2.4	0.1465	0.2866	293.5	0.0206	1.9
11	0.0842	0.1770	0.2121	491.5	0.0172	2.1	0.1762	0.2361	193.0	0.0274	2.1
12	0.0940	0.1681	0.1764	297.5	0.0217	1.8	0.1494	0.2008	120.5	0.0325	1.6
13	0.1048	0.1776	0.1451	152.0	0.0310	1.7	0.1760	0.1655	62.5	0.0482	1.7
14	0.1168	0.0847	0.1328	59.0	0.0363	0.7	0.1739	0.1367	23.0	0.0790	1.5
15	0.1299	0.1364	0.1147	22.0	0.0732	1.1	0.1333	0.1185	7.5	0.1241	1.0

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 75 females.
Source: National Center for Health Statistics, 2006

Exhibit 7A

Typical Borrowers (Ages 74 to 76 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other but Excludes Loan Assignment to HUD (2 of 2)

Policy Year	Female Mortality Rate *m(t)*	3. Single Female Borrowers					4. Single Male Borrowers				
		Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	11279.0	0.0000	—	0.0000	1.0000	3329.0	0.0000	—
1	0.0306	0.0184	0.9816	9729.5	0.0014	0.6	0.0216	0.9784	2782.5	0.0028	0.7
2	0.0337	0.0709	0.9120	7137.0	0.0030	2.1	0.1049	0.8758	1906.5	0.0070	3.1
3	0.0371	0.1142	0.8079	5062.5	0.0045	3.1	0.1574	0.7379	1238.5	0.0103	4.2
4	0.0408	0.1179	0.7126	3451.0	0.0055	2.9	0.1443	0.6314	769.0	0.0127	3.5
5	0.0450	0.1240	0.6242	2509.0	0.0066	2.8	0.1581	0.5316	537.5	0.0157	3.5
6	0.0498	0.1358	0.5395	1877.5	0.0079	2.7	0.1567	0.4483	383.0	0.0186	3.1
7	0.0552	0.1448	0.4614	1429.5	0.0093	2.6	0.1607	0.3763	280.0	0.0219	2.9
8	0.0613	0.1650	0.3852	1042.5	0.0115	2.7	0.1818	0.3079	198.0	0.0274	3.0
9	0.0680	0.1797	0.3160	679.0	0.0147	2.6	0.2281	0.2376	131.5	0.0366	3.4
10	0.0756	0.1825	0.2583	411.0	0.0191	2.4	0.2875	0.1693	80.0	0.0506	3.8
11	0.0842	0.1694	0.2146	248.0	0.0238	2.0	0.2022	0.1351	44.5	0.0602	2.4
12	0.0940	0.1608	0.1801	143.0	0.0307	1.7	0.2000	0.1081	30.0	0.0730	2.1
13	0.1048	0.2113	0.1420	71.0	0.0484	2.0	0.0571	0.1019	17.5	0.0555	0.5
14	0.1168	0.0000	0.1420	26.5	0.0000	0.0	0.1111	0.0906	9.0	0.1048	1.0
15	0.1299	0.0909	0.1291	11.0	0.0867	0.7	0.2857	0.0647	3.5	0.2415	2.2

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 75 females.
Source: National Center for Health Statistics, 2006

Exhibit 7B

Typical Borrowers (Ages 74 to 76 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other and Includes Loan Assignment to HUD (1 of 2)

		1. All Borrowers					2. Couples With Younger Borrower in Age Group				
Policy Year	**Female Mortality Rate** *m(t)*	**Observed Hazard Rate** *h(t)*	**End Year Survival Rate** *S(t)*	**Effective Sample Size**	**Std Error of h(t)**	**Ratio of Hazard to Female Mortality** *h(t)/m(t)*	**Observed Hazard Rate** *h(t)*	**End Year Survival Rate** *S(t)*	**Effective Sample Size**	**Std Error of h(t)**	**Ratio of Hazard to Female Mortality** *h(t)/m(t)*
0	—	0.0000	1.0000	24295.0	0.0000	—	0.0000	1.0000	9614.0	0.0000	—
1	0.0306	0.0144	0.9856	20621.0	0.0008	0.5	0.0071	0.9929	8059.5	0.0009	0.2
2	0.0337	0.0659	0.9206	14706.0	0.0021	2.0	0.0464	0.9469	5641.0	0.0028	1.4
3	0.0371	0.1151	0.8147	10252.5	0.0032	3.1	0.1031	0.8492	3937.0	0.0049	2.8
4	0.0408	0.1205	0.7165	6837.0	0.0039	3.0	0.1170	0.7499	2606.0	0.0063	2.9
5	0.0450	0.1271	0.6254	4887.5	0.0048	2.8	0.1212	0.6590	1831.0	0.0076	2.7
6	0.0498	0.1430	0.5360	3607.5	0.0058	2.9	0.1448	0.5636	1340.0	0.0096	2.9
7	0.0552	0.1620	0.4492	2697.5	0.0071	2.9	0.1550	0.4762	987.0	0.0115	2.8
8	0.0613	0.2286	0.3465	1924.5	0.0096	3.7	0.2121	0.3752	702.5	0.0154	3.5
9	0.0680	0.3238	0.2343	1167.5	0.0137	4.8	0.3193	0.2554	438.5	0.0223	4.7
10	0.0756	0.3516	0.1519	583.0	0.0198	4.6	0.3304	0.1710	227.0	0.0312	4.4
11	0.0842	0.3904	0.0926	292.0	0.0285	4.6	0.3775	0.1065	124.5	0.0434	4.5
12	0.0940	0.4138	0.0543	130.5	0.0431	4.4	0.4167	0.0621	60.0	0.0636	4.4
13	0.1048	0.4894	0.0277	47.0	0.0729	4.7	0.5116	0.0303	21.5	0.1078	4.9
14	0.1168	0.2222	0.0216	13.5	0.1132	1.9	0.2222	0.0236	4.5	0.1960	1.9
15	0.1299	0.5333	0.0101	7.5	0.1822	4.1	0.6667	0.0079	3.0	0.2722	5.1

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 75 females.
Source: National Center for Health Statistics, 2006

Exhibit 7B

Typical Borrowers (Ages 74 to 76 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other and Includes Loan Assignment to HUD (2 of 2)

Policy Year	Female Mortality Rate *m(t)*	3. Single Female Borrowers					4. Single Male Borrowers				
		Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	11279.0	0.0000	—	0.0000	1.0000	3329.0	0.0000	—
1	0.0306	0.0184	0.9816	9729.5	0.0014	0.6	0.0216	0.9784	2782.5	0.0028	0.7
2	0.0337	0.0709	0.9120	7137.0	0.0030	2.1	0.1049	0.8758	1906.5	0.0070	3.1
3	0.0371	0.1142	0.8079	5062.5	0.0045	3.1	0.1574	0.7379	1238.5	0.0103	4.2
4	0.0408	0.1182	0.7124	3451.0	0.0055	2.9	0.1443	0.6314	769.0	0.0127	3.5
5	0.0450	0.1240	0.6240	2508.0	0.0066	2.8	0.1600	0.5304	537.5	0.0158	3.6
6	0.0498	0.1386	0.5375	1876.5	0.0079	2.8	0.1623	0.4443	382.0	0.0189	3.3
7	0.0552	0.1629	0.4500	1424.0	0.0098	3.0	0.1874	0.3611	277.5	0.0234	3.4
8	0.0613	0.2320	0.3456	1021.5	0.0132	3.8	0.2715	0.2630	191.5	0.0321	4.4
9	0.0680	0.3164	0.2362	610.0	0.0188	4.7	0.3661	0.1667	112.0	0.0455	5.4
10	0.0756	0.3494	0.1537	300.5	0.0275	4.6	0.4571	0.0905	52.5	0.0688	6.0
11	0.0842	0.3918	0.0935	145.5	0.0405	4.7	0.4500	0.0498	20.0	0.1112	5.3
12	0.0940	0.3934	0.0567	61.0	0.0625	4.2	0.4706	0.0264	8.5	0.1712	5.0
13	0.1048	0.4889	0.0290	22.5	0.1054	4.7	0.3333	0.0176	3.0	0.2722	3.2
14	0.1168	0.1429	0.0248	7.0	0.1323	1.2	0.5000	0.0088	2.0	0.3536	4.3
15	0.1299	0.2857	0.0177	3.5	0.2415	2.2					

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 75 females.
Source: National Center for Health Statistics, 2006

Exhibit 8A

Older Borrowers (Ages 84 to 86 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other but Excludes Loan Assignment to HUD (1 of 2)

Policy Year	Female Mortality Rate *m(t)*	1. All Borrowers					2. Couples With Younger Borrower in Age Group				
		Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	9217.0	0.0000	—	0.0000	1.0000	2339.0	0.0000	—
1	0.0874	0.0326	0.9674	7728.5	0.0020	0.4	0.0217	0.9783	1890.5	0.0034	0.2
2	0.0976	0.1321	0.8396	5270.0	0.0047	1.4	0.1083	0.8724	1200.0	0.0090	1.1
3	0.1091	0.1904	0.6797	3345.5	0.0068	1.7	0.1785	0.7166	734.0	0.0141	1.6
4	0.1218	0.2079	0.5384	2005.5	0.0091	1.7	0.1758	0.5907	421.0	0.0186	1.4
5	0.1358	0.2018	0.4298	1283.5	0.0112	1.5	0.2243	0.4582	272.0	0.0253	1.7
6	0.1509	0.2390	0.3271	866.0	0.0145	1.6	0.2126	0.3608	174.0	0.0310	1.4
7	0.1672	0.2444	0.2471	577.0	0.0179	1.5	0.2131	0.2839	122.0	0.0371	1.3
8	0.1847	0.2654	0.1815	365.5	0.0231	1.4	0.2317	0.2181	82.0	0.0466	1.3
9	0.2031	0.2333	0.1392	210.0	0.0292	1.1	0.1957	0.1754	46.0	0.0585	1.0
10	0.2226	0.3033	0.0970	122.0	0.0416	1.4	0.2083	0.1389	24.0	0.0829	0.9
11	0.2420	0.2581	0.0719	62.0	0.0556	1.1	0.1538	0.1175	13.0	0.1001	0.6
12	0.2612	0.3125	0.0495	32.0	0.0819	1.2	0.2667	0.0862	7.5	0.1615	1.0
13	0.2797	0.1739	0.0409	11.5	0.1118	0.6					
14	0.2968	0.4444	0.0227	4.5	0.2342	1.5					

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life table method. Mortality rates are for age 85 females.
Source: National Center for Health Statistics, 2006

Exhibit 8A

Older Borrowers (Ages 84 to 86 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other but Excludes Loan Assignment to HUD (2 of 2)

		3. Single Female Borrowers					4. Single Male Borrowers				
Policy Year	Female Mortality Rate *m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	5277.0	0.0000	—	0.0000	1.0000	1564.0	0.0000	—
1	0.0874	0.0364	0.9636	4510.0	0.0028	0.4	0.0353	0.9647	1302.5	0.0051	0.4
2	0.0976	0.1341	0.8344	3192.0	0.0060	1.4	0.1525	0.8176	865.5	0.0122	1.6
3	0.1091	0.1848	0.6802	2088.5	0.0085	1.7	0.2263	0.6326	517.0	0.0184	2.1
4	0.1218	0.2030	0.5421	1295.5	0.0112	1.7	0.2762	0.4578	286.0	0.0264	2.3
5	0.1358	0.1903	0.4389	846.0	0.0135	1.4	0.2202	0.3570	163.5	0.0324	1.6
6	0.1509	0.2479	0.3301	585.0	0.0179	1.6	0.2358	0.2728	106.0	0.0412	1.6
7	0.1672	0.2474	0.2485	380.0	0.0221	1.5	0.2838	0.1954	74.0	0.0524	1.7
8	0.1847	0.2900	0.1764	234.5	0.0296	1.6	0.2083	0.1547	48.0	0.0586	1.1
9	0.2031	0.2471	0.1328	129.5	0.0379	1.2	0.2388	0.1178	33.5	0.0737	1.2
10	0.2226	0.3624	0.0847	74.5	0.0557	1.6	0.1778	0.0968	22.5	0.0806	0.8
11	0.2420	0.3333	0.0565	33.0	0.0821	1.4	0.1875	0.0787	16.0	0.0976	0.8
12	0.2612	0.3448	0.0370	14.5	0.1248	1.3	0.3000	0.0551	10.0	0.1449	1.1
13	0.2797	0.2000	0.0296	5.0	0.1789	0.7	0.0000	0.0551	4.0	0.0000	0.0
14	0.2968	0.0000	0.0296	2.0	0.0000	0.0					

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life table method. Mortality rates are for age 85 females.
Source: National Center for Health Statistics, 2006

Exhibit 8B

Older Borrowers (Ages 84 to 86 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other and Includes Loan Assignment to HUD (1 of 2)

		1. All Borrowers					2. Couples With Younger Borrower in Age Group				
Policy Year	Female Mortality Rate *m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	9217.0	0.0000	—	0.0000	1.0000	2339.0	0.0000	—
1	0.0874	0.0326	0.9674	7728.5	0.0020	0.4	0.0217	0.9783	1890.5	0.0034	0.2
2	0.0976	0.1322	0.8395	5270.5	0.0047	1.4	0.1083	0.8724	1200.0	0.0090	1.1
3	0.1091	0.1910	0.6792	3345.5	0.0068	1.8	0.1798	0.7155	734.0	0.0142	1.6
4	0.1218	0.2141	0.5338	2004.0	0.0092	1.8	0.1786	0.5877	420.0	0.0187	1.5
5	0.1358	0.2283	0.4119	1270.5	0.0118	1.7	0.2370	0.4484	270.0	0.0259	1.7
6	0.1509	0.3183	0.2808	823.0	0.0162	2.1	0.2604	0.3317	169.0	0.0338	1.7
7	0.1672	0.3395	0.1855	483.0	0.0215	2.0	0.2715	0.2416	110.5	0.0423	1.6
8	0.1847	0.4000	0.1113	262.5	0.0302	2.2	0.4286	0.1381	70.0	0.0591	2.3
9	0.2031	0.4180	0.0648	122.0	0.0447	2.1	0.3333	0.0920	30.0	0.0861	1.6
10	0.2226	0.5818	0.0271	55.0	0.0665	2.6	0.4286	0.0526	14.0	0.1323	1.9
11	0.2420	0.4706	0.0143	17.0	0.1211	1.9	0.1818	0.0430	5.5	0.1645	0.8
12	0.2612	0.4615	0.0077	6.5	0.1955	1.8	0.6667	0.0143	3.0	0.2722	2.6
13	0.2797	0.4000	0.0046	2.5	0.3098	1.4					

HECM = Home Equity Conversion Mortgage.
Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 85 females.
Source: National Center for Health Statistics, 2006

Exhibit 8B

Older Borrowers (Ages 84 to 86 at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year

Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other and Includes Loan Assignment to HUD (2 of 2)

		3. Single Female Borrowers					4. Single Male Borrowers				
Policy Year	Female Mortality Rate *m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Ratio of Hazard to Female Mortality *h(t)/m(t)*
0	—	0.0000	1.0000	5277.0	0.0000	—	0.0000	1.0000	1564.0	0.0000	—
1	0.0874	0.0364	0.9636	4510.0	0.0028	0.4	0.0353	0.9647	1302.5	0.0051	0.4
2	0.0976	0.1344	0.8341	3192.5	0.0060	1.4	0.1525	0.8176	865.5	0.0122	1.6
3	0.1091	0.1853	0.6795	2088.5	0.0085	1.7	0.2263	0.6326	517.0	0.0184	2.1
4	0.1218	0.2108	0.5363	1295.0	0.0113	1.7	0.2797	0.4556	286.0	0.0265	2.3
5	0.1358	0.2177	0.4195	836.0	0.0143	1.6	0.2646	0.3351	162.5	0.0346	1.9
6	0.1509	0.3351	0.2790	555.0	0.0200	2.2	0.3265	0.2257	98.0	0.0474	2.2
7	0.1672	0.3392	0.1843	312.5	0.0268	2.0	0.4576	0.1224	59.0	0.0649	2.7
8	0.1847	0.3951	0.1115	164.5	0.0381	2.1	0.3571	0.0787	28.0	0.0906	1.9
9	0.2031	0.4706	0.0590	76.5	0.0571	2.3	0.3226	0.0533	15.5	0.1187	1.6
10	0.2226	0.7302	0.0159	31.5	0.0791	3.3	0.3158	0.0365	9.5	0.1508	1.4
11	0.2420	0.6667	0.0053	6.0	0.1925	2.8	0.5455	0.0166	5.5	0.2123	2.3
12	0.2612	0.0000	0.0053	1.5	0.0000	0.0	0.5000	0.0083	2.0	0.3536	1.9

HECM = Home Equity Conversion Mortgage.

Notes: Hazard and mortality rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method. Mortality rates are for age 85 females.

Source: National Center for Health Statistics, 2006

Exhibit 9A

All Borrowers (Ages 62 and Older at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other but Excludes Loan Assignment to HUD (1 of 2)

Policy Year	1. All Borrowers				2. Couples With Younger Borrower in Age Group			
	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)
0	0.0000	1.0000	235993.0	0.0000	0.0000	1.0000	85067.0	0.0000
1	0.0203	0.9797	199200.5	0.0003	0.0105	0.9895	70786.0	0.0004
2	0.0860	0.8954	138690.0	0.0008	0.0567	0.9334	48081.5	0.0011
3	0.1351	0.7745	92192.5	0.0011	0.1047	0.8357	32011.0	0.0017
4	0.1426	0.6640	58398.5	0.0015	0.1184	0.7367	20390.0	0.0023
5	0.1504	0.5642	39822.5	0.0018	0.1316	0.6398	13912.0	0.0029
6	0.1514	0.4787	28237.0	0.0021	0.1309	0.5560	9936.0	0.0034
7	0.1634	0.4005	20814.0	0.0026	0.1468	0.4744	7481.5	0.0041
8	0.1735	0.3310	14601.0	0.0031	0.1572	0.3998	5370.5	0.0050
9	0.1863	0.2694	9399.0	0.0040	0.1722	0.3310	3537.0	0.0064
10	0.1804	0.2208	5766.5	0.0051	0.1599	0.2781	2201.0	0.0078
11	0.1830	0.1804	3649.5	0.0064	0.1490	0.2366	1416.0	0.0095
12	0.1681	0.1500	2225.5	0.0079	0.1452	0.2023	888.5	0.0118
13	0.1666	0.1250	1128.5	0.0111	0.1478	0.1724	446.5	0.0168
14	0.1321	0.1085	439.0	0.0162	0.1493	0.1466	167.5	0.0275
15	0.1220	0.0953	147.5	0.0270	0.1176	0.1294	51.0	0.0451

HECM = Home Equity Conversion Mortgage.
Notes: Hazard rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method.

Exhibit 9A

All Borrowers (Ages 62 and Older at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other but Excludes Loan Assignment to HUD (2 of 2)

Policy Year	3. Single Female Borrowers				4. Single Male Borrowers			
	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)
0	0.0000	1.0000	113985.0	0.0000	0.0000	1.0000	36083.0	0.0000
1	0.0243	0.9757	97769.0	0.0005	0.0302	0.9698	30057.5	0.0010
2	0.0948	0.8832	70221.0	0.0011	0.1258	0.8478	20104.0	0.0023
3	0.1439	0.7561	47511.0	0.0016	0.1800	0.6952	12492.0	0.0034
4	0.1512	0.6418	30518.0	0.0021	0.1740	0.5742	7363.5	0.0044
5	0.1554	0.5421	20977.0	0.0025	0.1840	0.4686	4825.5	0.0056
6	0.1582	0.4563	14904.0	0.0030	0.1827	0.3830	3301.0	0.0067
7	0.1710	0.3783	10882.5	0.0036	0.1821	0.3132	2367.0	0.0079
8	0.1793	0.3104	7527.5	0.0044	0.1999	0.2506	1631.0	0.0099
9	0.1901	0.2514	4798.0	0.0057	0.2189	0.1958	1005.0	0.0130
10	0.1869	0.2044	2921.0	0.0072	0.2183	0.1530	595.5	0.0169
11	0.1998	0.1636	1821.5	0.0094	0.2187	0.1196	375.0	0.0213
12	0.1847	0.1334	1083.0	0.0118	0.1798	0.0981	228.0	0.0254
13	0.1788	0.1095	542.5	0.0165	0.1841	0.0800	119.5	0.0355
14	0.1106	0.0974	217.0	0.0213	0.1720	0.0662	46.5	0.0553
15	0.1205	0.0857	83.0	0.0357	0.1481	0.0564	13.5	0.0967

HECM = Home Equity Conversion Mortgage.
Notes: Hazard rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method.

Exhibit 9B

All Borrowers (Ages 62 and Older at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other and Includes Loan Assignment to HUD (1 of 2)

Policy Year	1. All Borrowers				2. Couples With Younger Borrower in Age Group			
	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)
0	0.0000	1.0000	235993.0	0.0000	0.0000	1.0000	85067.0	0.0000
1	0.0203	0.9797	199200.5	0.0003	0.0106	0.9894	70786.0	0.0004
2	0.0862	0.8952	138683.5	0.0008	0.0567	0.9333	48077.5	0.0011
3	0.1365	0.7730	92191.0	0.0011	0.1050	0.8353	32007.5	0.0017
4	0.1458	0.6603	58311.5	0.0015	0.1192	0.7357	20378.5	0.0023
5	0.1548	0.5581	39605.5	0.0018	0.1331	0.6378	13887.5	0.0029
6	0.1640	0.4666	27909.0	0.0022	0.1375	0.5501	9896.5	0.0035
7	0.1907	0.3776	20233.5	0.0028	0.1636	0.4601	7390.0	0.0043
8	0.2272	0.2918	13780.0	0.0036	0.2024	0.3670	5222.5	0.0056
9	0.2779	0.2107	8328.0	0.0049	0.2538	0.2738	3274.5	0.0076
10	0.3147	0.1444	4541.5	0.0069	0.2877	0.1951	1852.5	0.0105
11	0.3537	0.0933	2460.0	0.0096	0.3093	0.1347	1041.0	0.0143
12	0.3810	0.0578	1233.5	0.0138	0.3607	0.0861	554.5	0.0204
13	0.4286	0.0330	504.0	0.0220	0.3850	0.0530	226.0	0.0324
14	0.4000	0.0198	160.0	0.0387	0.3803	0.0328	71.0	0.0576
15	0.4694	0.0105	49.0	0.0713	0.5263	0.0155	19.0	0.1145

HECM = home equity conversion mortgage.
Notes: Hazard rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method.

Exhibit 9B

All Borrowers (Ages 62 and Older at Origination) Observed HECM Loan Survivorship and Hazard Rates by Policy Year
Hazard Defined as Loan Payoff Due to Death, Move-Out, or Other and Includes Loan Assignment to HUD (2 of 2)

Policy Year	3. Single Female Borrowers				4. Single Male Borrowers			
	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)	Observed Hazard Rate *h(t)*	End Year Survival Rate *S(t)*	Effective Sample Size	Std Error of h(t)
0	0.0000	1.0000	113985.0	0.0000	0.0000	1.0000	36083.0	0.0000
1	0.0243	0.9757	97769.0	0.0005	0.0302	0.9698	30057.5	0.0010
2	0.0949	0.8831	70219.0	0.0011	0.1260	0.8476	20103.5	0.0023
3	0.1459	0.7543	47512.5	0.0016	0.1819	0.6934	12492.5	0.0035
4	0.1558	0.6367	30458.0	0.0021	0.1776	0.5703	7348.0	0.0045
5	0.1613	0.5340	20817.0	0.0026	0.1901	0.4619	4793.0	0.0057
6	0.1749	0.4406	14667.5	0.0031	0.1954	0.3716	3249.0	0.0070
7	0.2033	0.3511	10472.5	0.0039	0.2206	0.2896	2289.0	0.0087
8	0.2370	0.2679	6980.0	0.0051	0.2635	0.2133	1510.5	0.0113
9	0.2887	0.1905	4150.0	0.0070	0.3098	0.1472	858.5	0.0158
10	0.3284	0.1280	2216.5	0.0100	0.3539	0.0951	446.5	0.0226
11	0.3791	0.0794	1166.0	0.0142	0.4051	0.0566	237.0	0.0319
12	0.4025	0.0475	559.0	0.0207	0.3772	0.0352	114.0	0.0454
13	0.4602	0.0256	226.0	0.0332	0.4792	0.0184	48.0	0.0721
14	0.3946	0.0155	73.5	0.0570	0.5000	0.0092	14.0	0.1336
15	0.4231	0.0089	26.0	0.0969	0.5000	0.0046	4.0	0.2500

HECM = home equity conversion mortgage.
Notes: Hazard rates apply to beginning-of-year survivors. Effective sample sizes (risk sets) for calculation of h(t) using life-table method.

Exhibits 10 through 12 illustrate the impact of assignments to HUD on loan survival rates for all borrowers within the three age groups (younger, typical, and older). The policy year for which the assignments begin to affect the hazard and survival rates varies with the initial age of the borrowers. Exhibit 13 extends this illustration to borrowers of all ages by pooling all the HECM data. Assignments begin to impact hazard and survival rates after policy year six for all borrowers and as early as policy year four for older borrowers.

Exhibit 10

HECM Survival Rates—Ages 64 to 66

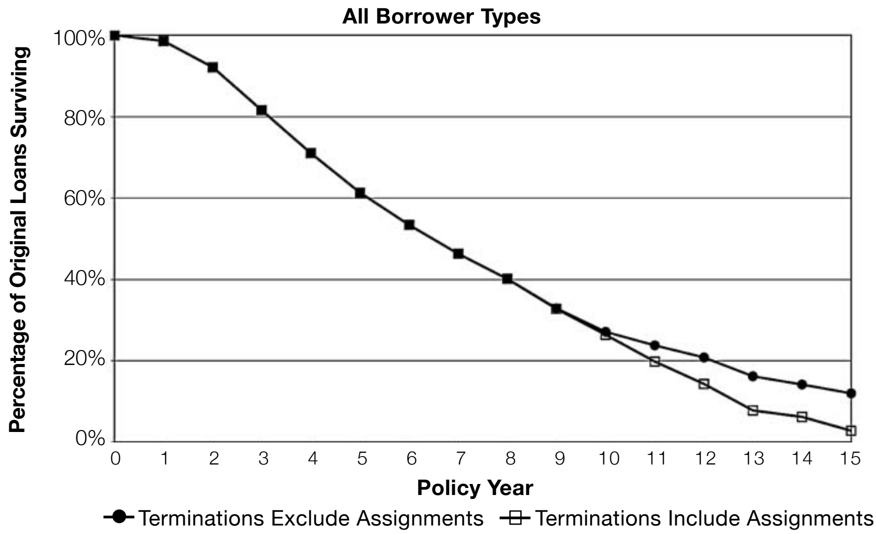


Exhibit 11

HECM Survival Rates—Ages 74 to 76

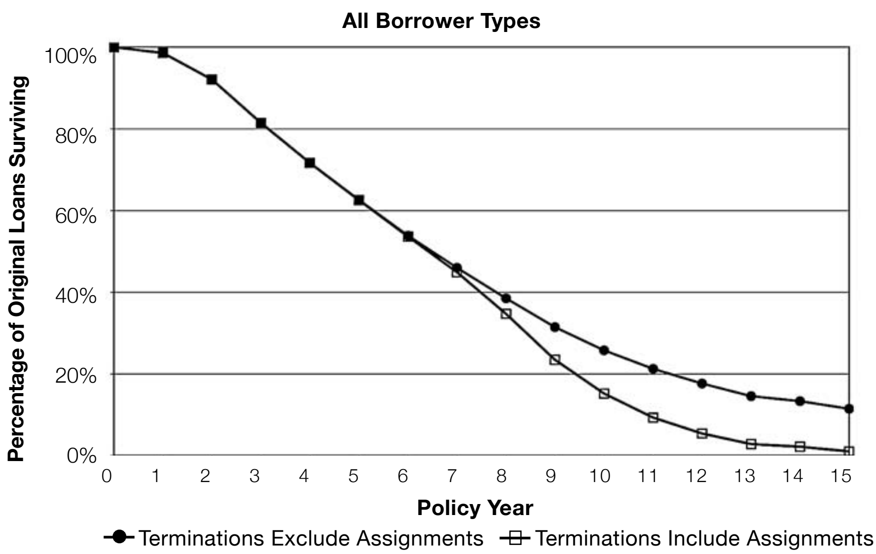


Exhibit 12

HECM Survival Rates—Ages 84 to 86

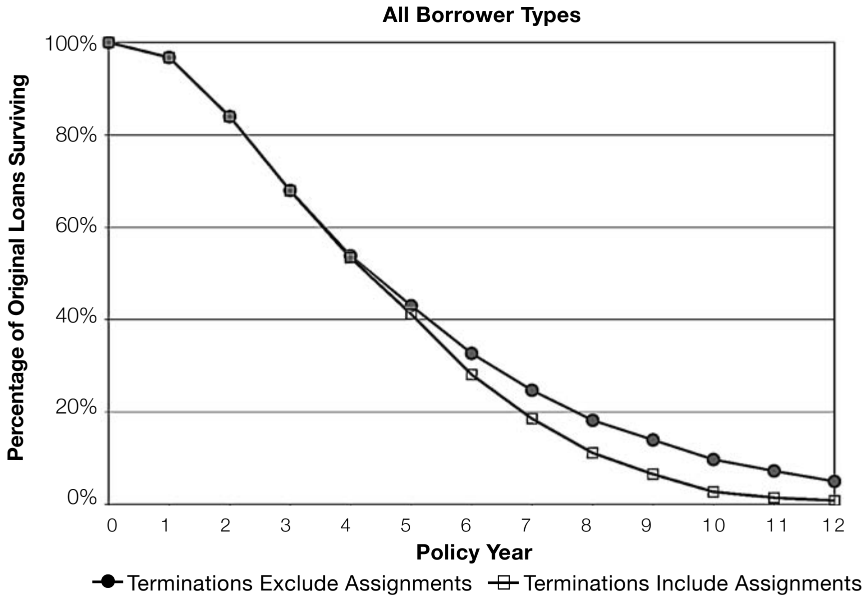
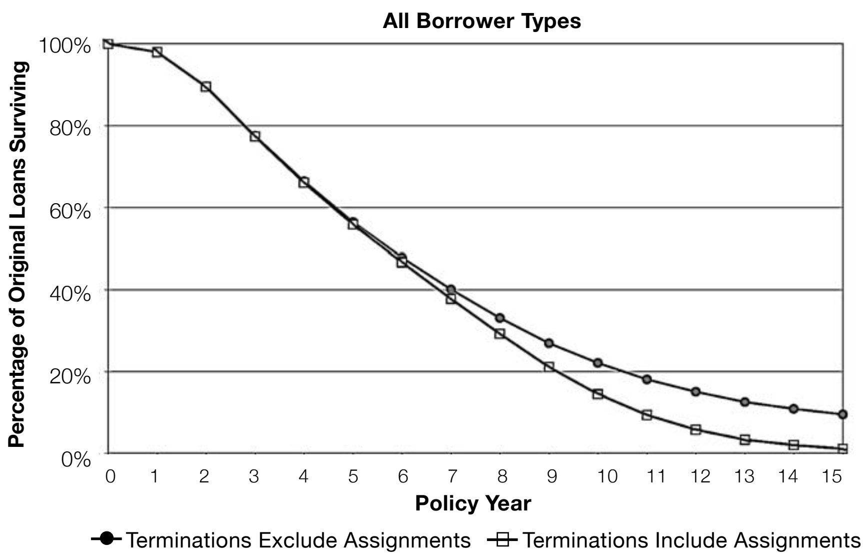


Exhibit 13

HECM Survival Rates—All Ages



Findings

The main findings from the data presented in exhibits 6 through 9 are as follows. First, the exhibits make clear that borrower age and type, as well as the timing of loan assignments to HUD, all affect the hazard and survival rates for HECM loans. Investors in particular need to be aware of the impact of loan assignments, because conventional reverse mortgage products do not have a similar feature.

Borrower Age

If the termination event of a HECM loan is defined in the traditional manner as a loan payoff due to borrower death, move-out, or other voluntary payoff such as refinancing, then—

- Exhibit 6A presents discrete-time hazard and survival rates that show younger borrowers (those in their mid-60s at loan origination) are paying off their HECM loans much faster than the underlying general population mortality rates for females. Specifically, for all borrower types in this age group, payoffs are occurring at approximately 6 to 8 times the female mortality rate.
- Exhibit 7A shows that typical HECM borrowers (those in their mid-70s at loan origination) are paying off their loans faster than the underlying general population mortality rates for females but at much smaller multiples (about 2 to 3 times the female mortality rates) than those observed for the younger borrowers.
- Despite the wide observed difference in the payoff rates for younger borrowers compared with typical borrowers when expressed as multiples of the underlying female mortality rates, the actual observed hazard rates for these two groups of borrowers are relatively similar. This similarity results, for example, in the 10-year survival rate of a HECM loan to younger borrowers being 27 percent and the 10-year loan survival rate for typical borrowers being nearly the same, at 26 percent.
- Exhibit 8A shows that older borrowers (those in their mid-80s at loan origination) are paying off their loans at much smaller multiples of the underlying general population mortality rates for females (about 1.5 times the female mortality rates).
- Despite observed payoff rates at much lower multiples of the underlying female mortality rates, older borrowers are paying off their loans faster than younger or typical borrowers are due to the higher mortality rates. This faster payoff results in the 10-year loan survival rate for older borrowers being observed at only 10 percent.
- Exhibit 9A, which includes all borrower ages, shows a 10-year loan survival rate of 22 percent.

Borrower Type

The hazard and survival rates in exhibits 6A through 8A also show, as one might expect due to differences in gender-specific mortality rates, that single females generally terminate their HECM loans more slowly than do single males of comparable age, but not as fast as couples (where the younger of the two is of comparable age). For example, the 10-year loan survival rates for typical borrowers (those in their mid-70s at loan origination) are 26 percent for single females, 17 percent for single males, and 29 percent for couples.

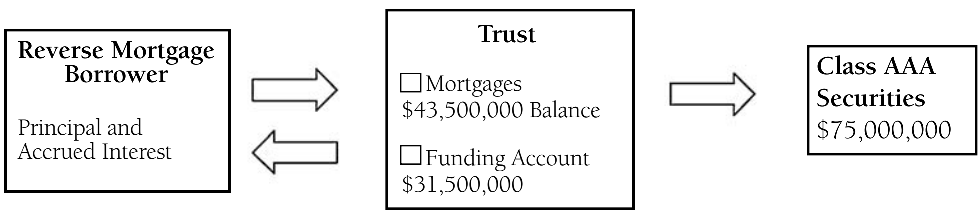
HECM Assignments

Because HUD pays the lender an insurance claim equal to the unpaid loan balance when an active HECM loan is assigned to HUD, investors in mortgage securities backed by HECM loans should consider assignments as termination events. Therefore, investors should define HECM terminations as loan payoffs due to death, move-out, other voluntary payoff, or by lender assignment of the loan to HUD. HECM termination experience changes in the following ways.

- First, hazard rates rise and loan survivor probabilities fall due to the loan assignments observed by policy year.
- Second, the first policy year for which assignments begin to affect the hazard and survival rates varies with the initial age of the borrowers. As shown in exhibits 6B through 8B, hazard and survival rates begin to change in policy year nine for younger borrowers, in policy year six for typical borrowers, and in policy year four for older borrowers. Before these policy years, very few loan assignments are observed.

Appendix

Stylized Reverse Mortgage Trust



A Stylized Trust

This stylized trust is based on 1,500 identical reverse mortgages. The borrowers are 75 years old with homes valued at $100,000. We assume the loans accrue interest at a variable rate that is indexed to the 1-year constant maturity Treasury rate if they are Home Equity Conversion Mortgage (HECM) loans, or to alternative interest rate indices, such as the London Interbank Offered Rate, if they are conventional reverse mortgages. The funding account consists of cash and/or liquid assets that accrue interest at a lower adjustable rate than the mortgages do. The securities, which are collateralized by both the mortgages and the funding account, are current-pay with coupon rates that are also lower than the mortgage interest rates.

The loans all have a 50-percent loan-to-value ratio (principal limit) and are structured as line-of-credit reverse mortgages. The borrowers take out 58 percent of the available balance on the first day. Subsequent withdrawals follow the pattern in exhibit 3 where an additional 7 percent is withdrawn in the second year of the loan, an additional 5 percent is withdrawn in the third year, and so on.

In this example, the aggregated collateral is $150 million of which $75 million is the initial principal limit. The aggregate initial loan balance is $43.5 million (based on the 58-percent draw on the principal limit) with a remaining $31.5 million of additional credit that the borrowers can draw. This additional credit makes up the funding account.

The securities are rated by a public ratings agency based on a specified stress scenario determined by the agency. Because reverse mortgages may not generate enough cashflow under stressful house price and interest rate scenarios to support timely interest and ultimate principal payments on the securities, the ratings agency will apply ratings criteria corresponding to the severity of the stress that the security can withstand.

If the reverse mortgages are HECM loans that are insured against losses from house price declines or rising mortgage accrual rates, then the securities will have considerable protection from stressful economics. The flowchart in this appendix corresponds to a HECM security in which there is a single class of AAA-rated securities. Conventional reverse mortgages, on the other hand, will have much less protection from stressful economics, and the trust may be structured with multiple classes of securities, with subordinated classes absorbing sufficient losses to enable senior classes to withstand higher stress levels and thereby achieve higher ratings from the ratings agency.

We note that a reverse mortgage security and a traditional forward mortgage-backed security (MBS) have similar structures. Nevertheless, MBSs do not have funding accounts because there is not a two-way flow of cash between the trust and the borrowers. We also note that alternative reverse mortgage securitization structures are under development that would divide each whole reverse mortgage loan used as collateral into participations (shares of the loan) and place only fully funded participations into the trust so that the trust would have no obligation to advance funds to borrowers. In this alternative securitization model, there would be no need for a funding account to meet borrower obligations because the issuer of the security would retain these obligations to make required cash advances to borrowers.

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Notes

1. The maximum claim amount is defined as the lesser of the original appraised value of the property securing the Home Equity Conversion Mortgage (HECM) loan or the maximum insurable mortgage under the Federal Housing Administration's (FHA's) Section 203(b) Program. The latter varies by locality and is set to equal 95 percent of the local median sales price for a single-family home, subject to a minimum of 48 percent of the Fannie Mae and Freddie Mac conforming loan limit in low-cost areas, to a maximum of 87 percent of the conforming loan limit in the highest cost markets. Thus, HECM maximum claim amounts are currently capped by Section 203(b) limits that range from $200,160 to $362,790.

2. When loan balances grow above the maximum claim that the U.S. Department of Housing and Urban Development will pay, lenders would become exposed to nonrepayment risk.

3. The HECM pricing assumptions use the age of the youngest of multiple borrowers and the 1979-through-1981 U.S. general population life tables published by the U.S. Department of Health and Human Services.

4. The literature also includes work on other reverse mortgage risk factors. For example, Rodda and Patrabansh (2005) estimate that the house values of elderly owners (age 75 and older) appreciate at real rates that are 1.0 to 1.2 percent less per year than the houses of middle-aged owners (ages 50 to 74). Similarly, Davidoff (2004) found evidence of real house price growth about 3.6 percent lower for homeowners age 75 and older compared with real house price growth for younger homeowners.

5. Lehman Brothers (2000: 19).

6. The average payout that HECM borrowers take in the first year is about 58 percent of the maximum payment (principal limit) followed by considerably smaller declining payments in all subsequent years.

7. U.S. Department of Housing and Urban Development (HUD) (2003, 2000, 1995, 1992, and 1990). These reports may be obtained from HUD's research dissemination service at www.huduser.org.

8. Refinancing a HECM loan is also a voluntary termination. In this case, the debt is paid in full from the proceeds of the new loan. In practice, borrowers have had little incentive to refinance a HECM, and the data confirm that few HECM refinances occurred during the 1990s. In 2004 HUD implemented a policy that reduced the upfront mortgage insurance premium on HECM cases that were refinanced after the effective date. This policy appears to have increased the incidence of refinance cases, particularly because, in addition to the reduced premium, robust house price appreciation in many parts of the country has increased HECM borrower incentives to refinance. Specifically, for the period from fiscal year (FY) 1990 through FY 2004, we identified only 2,256 refinanced cases in the data, which represented 2.0 percent of the total 115,472 cases insured through FY 2004. In FY 2005 and FY 2006, during which the reduced premium refinance policy was fully in effect, the number of refinanced cases was 6,338, bringing the total number of refinanced cases to 8,554, or 3.7 percent of the 236,500 cases ever insured.

9. A detailed discussion of the potential secondary market impacts on the overall HECM market can be heard in the audio transcript of an educational session of the National Reverse Mortgage Lenders' Association 2006 Annual Meeting and Expo in San Francisco, September 28 through 30, 2006. To access this audio file, "Developing a Secondary Market for Reverse Mortgages," use the link http://media.nrmlaonline.org/2006AM/SecondaryMarket.mp3.

10. "Structured Finance: Reverse Mortgage Criteria" by Standard & Poors' Ratings Services, New York, 1999. Similar reverse mortgage securities ratings criteria have subsequently been published by other public rating agencies: "Reverse Mortgage Securitizations: Understanding and Gauging the Risks" by Moody's Investors Service in 2000 and "Repay My Mortgage? Over My Dead Body! – Fitch's Reverse Mortgage Criteria" by Fitch Ratings in 2005.

11. On November 2, 2006, Fitch announced a AAA rating for another HECM security issued by the Mortgage Equity Conversion Asset Corporation consisting of $456 million in Class A notes.

12. Ginnie Mae does not buy or sell loans or issue mortgage-backed securities (MBSs). Rather, Ginnie Mae guarantees investors the timely payment of principal and interest on MBSs that are issued by private intermediaries and that are backed by federally insured or guaranteed loans—mainly loans insured by the Federal Housing Administration or guaranteed by the U.S. Department of Veterans Affairs. Ginnie Mae securities carry the full faith and credit guaranty of the U.S. government.

13. As of September 30, 2006.

14. The study did not capture any cases originated before September 30, 2006, but not endorsed for insurance by that date because reasons for the nonendorsement are unknown.

15. "Couples" does not necessarily refer to married couples; the term applies to all HECM loans with two co-borrowers, irrespective of gender.

16. "Censored" means the loan did not terminate as of the cutoff date of the analysis (September 30, 2006). The timing of the termination event for a censored loan is thereby not observed.

17. To illustrate the difference between a conditional probability and an unconditional one, consider the probability of someone dying exactly at age 95. The unconditional probability of dying at age 95 is very low (the vast majority of people die at other, mostly younger, ages). Nevertheless, if a person is already 94 years old, the probability of dying in the next year is quite large. The latter is a conditional probability of dying at age 95, given one has survived to age 94.

18. For example, the life-table method reduces the number of individuals at risk at the start of the period by one-half of the observations that were censored during the period to correct for individuals who were exposed to the hazard for less than the full period. A brief summary of the life-table method can be found in *SAS/STAT® User's Guide, Vol. 2, Version 6, Fourth Edition*, Chapter 26, "The LIFETEST Procedure," p. 1044, SAS Institute, Cary, NC.

19. For example, a loan that was originated on September 30, 2003, and that had not terminated as of the September 30, 2006, censoring or cutoff date would receive a policy year of

3.0, meaning that the loan was observed for exactly 3 policy years before it was censored from further observation. If a loan originated on September 30, 2003, had terminated on September 30, 2005, it would be given a policy year of 2.0, meaning it had been observed for exactly 2 policy years before it terminated. Most loans have fractional values for policy years, which means they have been observed for some whole number of policy years plus a fraction of another.

20. The following equations illustrate the life-table method's handling of censored observations. Let

    A = the total number of loan records in the database (or a defined subset of the database, such as all loans made to borrowers of a given age),

    d(i) = the number of loans that terminate in the i-th policy year,

    C(i) = the number of loans censored in the i-th policy year (that is, the cutoff date occurred during policy year i for these loans), and

    E(i) = the number of loans at risk at the *start* of the i-th policy year.

The life-table method treats all loans that are censored during the i-th policy year as if they all occurred at the midpoint of the year. This treatment assumes that censoring is randomly distributed throughout the year, and, as such, the average censored loan is exposed to risk for half of the policy year in which the censoring occurs. Thus, the *risk exposure*, E(i), also called the *effective sample size*, at the start of any year should be reduced by half of the censored cases during the year. Specifically:

$$E(1) = A - \tfrac{1}{2}\, C(1).$$

Similarly,

$$E(2) = E(1) - d(1) - \tfrac{1}{2}\, C(1) - \tfrac{1}{2}\, C(2)$$

$$= A - d(1) - C(1) - \tfrac{1}{2}\, C(2).$$

In general,

$$E(i+1) = E(i) - d(i) - \tfrac{1}{2}\, C(i) - \tfrac{1}{2}\, C(i+1)$$

$$= A - \Sigma\, d(j) - \Sigma\, C(j) - \tfrac{1}{2}\, C(i+1),$$

where the summations are taken over j = (1, ... , i).

21. In continuous time, the probability that an event occurs at *exactly* time t is infinitesimal. Instead, the hazard rate in the continuous model is the limit as s approaches 0 of the conditional probability of an event occurring during the interval from t to t + s:

$$h(t) = \lim_{s \to 0} P(t \le T < t+s \mid T \ge t) / s\ ,$$

where T represents the time at which the event occurs, and the condition $T \geq t$ implies that the individual is at risk at time t. If the hazard function h(t) thus defined is continuous, then the survival probability S(t) can be expressed by

$$S(t) = \exp\left(-\int_0^t h(y)\ dy \right).$$

22. To keep effective sample sizes higher, each age group presented in exhibits 6 through 8 includes borrowers who were 1 year older and 1 year younger at origination. For example, the exhibit for age 65 includes borrowers who were ages 64 through 66 at origination.

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