An Actuarial Analysis of FHA Home Equity Conversion Mortgage Loans in the Mutual Mortgage Insurance Fund: Fiscal Year 2011

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Executive Summary

The U.S. Department of Housing and Urban Development (HUD), Federal Housing Administration (FHA), provides reverse mortgage insurance through the Home Equity Conversion Mortgage (HECM) program. HECM enables senior homeowners to obtain additional income by accessing the equity in their homes. The program began as a pilot program in 1989 and became a permanent program in 1998. Between 2003 and 2008, the number of HECM endorsements steadily grew because of increasingly widespread product knowledge, lower interest rates, higher home values, and higher FHA loan limits. Prior to fiscal year (FY) 2009, the HECM program was part of the General Insurance Fund (GI). The Federal Housing Administration Modernization Act within the Housing and Economic Recovery Act of 2008 (HERA)[1] moved all new HECM program endorsements to the Mutual Mortgage Insurance (MMI) Fund effective in FY 2009.

The National Housing Act requires an independent annual actuarial study of FHA's MMI Fund.[2] Accordingly, an actuarial review must be conducted on HECM loans within the MMI Fund. This document reports the estimated economic values of the FY 2011 through FY 2018 MMI HECM portfolios. A fiscal year's MMI HECM portfolio is defined as the set of loans that survive to the end of the fiscal year and were endorsed in FY 2009 or later. In addition to the capital resource balance, the economic value of a portfolio depends on the discounted net present value of the future cash flows from the surviving portfolio of loans existing at the start of the valuation forecast (the end of the fiscal year under review). Our projections indicate that, as of the end of FY 2011, the HECM portion of the MMI fund has sufficient capital resources to meet its future liabilities and hence will not require support from the overall fund. Expected improvements in house price growth rates and recent increases in mortgage insurance premiums contribute to a steadily increasing economic value of the MMI HECM portfolio from FY 2011 through FY 2018.

A. Status of the MMI HECM Portfolio

In order to assess the adequacy of the current and future capital resources to meet estimated future net liabilities, we analyzed all HECM historical terminations and associated recoveries using loan-level HECM data reported by FHA through June 30, 2011. We developed loan level termination and recovery models to estimate the relationship between HECM terminations and recoveries using various economic and loan-specific factors. We then estimated the future loan performance of the FY 2011 to FY 2018 MMI HECM portfolios using various assumptions, including macroeconomic forecasts from Moody's Analytics and the expected HECM portfolio characteristics provided by FHA.

[1] HERA was passed by the United States Congress on July 24, 2008 and signed by President George W. Bush on July 30, 2008.
[2] HERA moved the requirement from the 1990 National Affordable Housing Act (NAHA) to the Federal Housing Administration operations within the National Housing Act, 12 USC 1708(a)(4).

Using the estimated loan performance of the HECM loans in the FY 2011 portfolio, we estimated the economic value of the HECM portion of the MMI fund to be positive $1.36 billion. We estimated that the economic value of the HECM portfolio will subsequently increase over time with the addition of new endorsements, the recent increase in annual insurance premiums, and improvements in forecasted economic conditions. The estimated economic value of the fund as of the end of FY 2018 is $10.03 billion.

The maximum claim amount (MCA) of a HECM loan serves as cap on the amount of insurance claims that FHA will pay the lender. The MCA is defined as the minimum of the appraised value and FHA's HECM loan limit at the time of origination. The insurance-in-force (IIF) is expressed as the sum total of MCAs over the active portfolio. As new endorsements are added to the portfolio, projected HECM IIF increases from $68.37 billion in FY 2011 to $208.69 billion in FY 2018. The economic value of the HECM portfolio in the MMI fund is projected to grow at a faster rate than the insurance-in-force, representing an increasing ratio of the program's economic value to its overall insurance risk over time. Exhibit ES-1 provides the economic value, IIF and endorsements for FY 2011 through FY 2018.

Exhibit ES-1: Economic Value, Insurance-in-Force, and Endorsements for FY 2011-FY 2018 ($ m)

Fiscal Year[(1)]	Economic Value	Insurance in Force[(2)]	Volume of New Endorsements	Economic Value of Each New Book of Business	Investment Earnings on Fund Balance
2011	$1,358	$68,373	$18,792	-$159	
2012	2,107	85,077	17,981	742	8
2013	3,102	102,333	22,592	951	44
2014	4,212	121,274	26,425	1,027	83
2015	5,458	142,542	31,889	1,125	120
2016	6,824	164,957	36,243	1,205	162
2017	8,355	187,086	40,027	1,288	243
2018	10,033	208,691	43,451	1,325	353

1. All values, except the volume of new endorsements, are expressed as of the end of the fiscal year.
2. Insurance-in-force is estimated as the sum of the MCAs of the remaining insured loans.

The economic value of the HECM portfolio in the MMI fund increased by $1.86 billion from the economic value of negative $503 million estimated in the FY 2010 review. This change was primarily driven by three factors:

- This year's Review used lower near-term house price growth rates but higher long-term growth rates compared to last year's Review. The HECM portfolio is more concentrated in states with larger long-term forecasted home value increases. Higher home values translate into higher recovery on HECM loans at their termination. This change in house price growth rates added $1,383 million to FY 2011 economic value. Our decomposition analysis also indicated that this year's base-line interest rate path generated over a $300 million increase in value relative to last year.
- In FY 2011, $535 million was transferred from the MMI capital reserve to the HECM financing account given the annual budget re-estimation process and the lack of dedicated capital reserves for HECM loans in the MMI Fund.

- This year's Review re-estimated the HECM base termination model and added newly built models of tax and insurance defaults and of projected volumes. All updated and new models were implemented in the IFE Group's forecasting software platform. These changes resulted in a reduction of $949 million in the FY 2011 economic value.

B. Impact of Economic and Loan Factors

The projected economic value of the HECM portion of the MMI Fund depends on various economic and loan-specific factors. These include the following:

- House Price Appreciation: Impacts the recovery FHA receives on terminations and the rate at which borrowers will refinance or move out of the property. House price appreciation projections are based on Moody's July 2011 forecast.
- One-year and ten-year Treasury interest rates and one-year and ten-year LIBOR rates: Interest rates impact the growth rate of the loan balances and the amount of equity available to the borrower at origination. Interest rate projections used are also based on Moody's July 2011 forecast.
- Mortality Rates: Mortality rates impact loan terminations due to the borrower's death. Mortality rates are obtained from the U.S. Decennial Life Table for 1999-2001 published by the Centers for Disease Control and Prevention (CDC) in 2004.
- Cash Draw Down Rates: Represent the speed at which borrowers access the equity in their homes over time, which impacts the growth rate of the loan balance. Borrower cash draw rates are derived from past HECM program experience with adjustments to account for the expected borrower characteristics of future books-of-business.

The realized economic value will vary from the Review's baseline estimates if the actual drivers of loan performance deviate from the projections used. Therefore, we conducted a sensitivity analysis to assess the impact of changes in the economic factors on the economic value of the HECM portfolio. We examined the following scenarios that were published by Moody's Analytics in July 2011:

- S1: Stronger Near-Term Rebound Scenario
- S2: Mild Second Recession Scenario
- S3: Deeper Second Recession Scenario
- S4: Protracted Slump Scenario

In August 2011 the Federal Reserve Board issued a press release indicating the intention of keeping interest rates low for two years. Thus, we also added a low interest rate scenario "S5" where rates remain at their 2011:Q2 values for two years and then linearly increase to converge to the base-case interest rate scenario two years after the two years of flat-lining. Scenario S5 retains the base-case assumption for house price growth rates for all periods.

Exhibit ES-2 presents the economic value under the base-case scenario and the five alternative scenarios. The economic values under S5 are remarkably similar to the base-case; this result indicates that lower interest rates create a tradeoff between the benefits of more HECM

endorsement volume (and more upfront premiums) and delayed assignments versus the opportunity costs of lower annual premiums generated by slower accruals of the unpaid loan balances. The rank-ordering of economic values has the expected relationship in that the economic values for S1 > base-case > S2 > S3 > S4 and the relationship holds for every fiscal year 2011-2018. Said differently, the economic values under a strong economic rebound exceed every other case and the economic values under the protracted slump are lower than every other case.

According to Moody's, there is about 75 percent probability that the actual economy will be better than the S2 scenario. Since the economic value of FY 2011 was positive in the base-case scenario and negative in the S2 scenario, based on simple linear interpolation we can conclude that there is about a 65 percent chance that the HECM MMI portfolio will be self-sustaining and will not need additional support from the general MMI capital reserve account or other sources.

Exhibit ES-2: Economic Values for FY 2011-FY 2018 under Various Economic Scenarios ($ millions)

	Economic Value					
Fiscal Year[(1)]	**Base Case**	**S1: Stronger Near-Term Rebound Scenario**	**S2: Mild Second Recession Scenario**	**S3:Deeper Second Recession Scenario**	**S4: Protracted Slump Scenario**	**S5: Low Interest Rates Scenario**
2011	$1,358	$1,727	-$878	-$2,614	-$3,913	$1,594
2012	2,107	2,538	-390	-2,252	-3,637	2,107
2013	3,102	3,680	212	-1,882	-3,404	2,772
2014	4,212	4,943	905	-1,439	-3,128	3,782
2015	5,458	6,355	1,704	-898	-2,763	5,200
2016	6,824	7,890	2,601	-276	-2,323	6,799
2017	8,355	9,606	3,618	429	-1,817	8,565
2018	10,033	11,479	4,742	1,211	-1,261	10,474

1. All values are expressed as of the end of the fiscal year.

Section I. Introduction

Actuarial Reviews of the FHA Mutual Mortgage Insurance Fund

The National Housing Act requires an annual independent actuarial review of the Federal Housing Administration's (FHA) Mutual Mortgage Insurance (MMI) Fund.[1] FHA has conducted an actuarial review of the MMI Fund since 1990.

The FHA Modernization Act within the Housing and Economic Recovery Act of 2008 (HERA)[2] moved all new endorsements for FHA's Home Equity Conversion Mortgage (HECM) program from the General Insurance Fund to the MMI Fund starting in fiscal year (FY) 2009. Therefore, an actuarial review must also be conducted on the HECM portfolio within the MMI Fund. This document reports the estimated economic value of the FY 2011 through FY 2018 HECM MMI portfolios. This review also provides the HECM portion of the economic value and insurance-in-force (IIF) used to assess the overall MMI Fund capital ratio.

HECM Program Overview

The U.S. Department of Housing and Urban Development (HUD), Federal Housing Administration (FHA), provides reverse mortgage insurance through the HECM program, which enables senior homeowners to obtain additional income by accessing the equity in their homes. Since the inception of the HECM program in 1989, FHA has insured more than 727,000 reverse mortgages. To be eligible for a HECM, at least one of the homeowners must be 62 years of age or older; if they have a mortgage, the outstanding balance must be paid off with the HECM proceeds; and they must have received FHA-approved reverse mortgage counseling to learn about the program. HECM loans are available from FHA-approved lending institutions. They provide homeowners with cash payments or credit lines secured by their home's equity, and require no repayment as long as the borrowers continue to live in the home and meet the HUD guidelines on property taxes, homeowners insurance, and property maintenance. Borrowers use reverse mortgages to access cash for various reasons, including home improvements, medical bills, paying off balances on existing traditional mortgages, or for everyday living. A HECM terminates for reasons described in Section 5; having negative equity, however, does not force the borrowers to pay it off and does not limit any payments to them as per their HECM contract.

The reverse mortgage insurance provided by FHA through the HECM program protects lenders from losses due to non-repayment. When a loan terminates and the loan balance is greater than the value of the home, the lender can file a claim for the amount of loss up to the maximum claim amount (MCA), which is defined as the minimum of the home's appraised value and the FHA HECM loan limit, both measured at origination. A lender can also assign the mortgage note to FHA when the loan balance reaches 98 percent of the MCA and be reimbursed for the balance of the loan. When note assignment occurs, FHA switches from being the insurer to the

[1] HERA moved the requirement from the 1990 National Affordable Housing Act (NAHA) to the Federal Housing Administration operations within the National Housing Act, 12 USC 1708(a)(4).
[2] HERA was passed by the United States Congress on July 24, 2008 and signed by President George W. Bush on July 30, 2008.

holder of the note and services the loan until termination. At loan termination (post-assignment), FHA can attempt to recover the loan balance including any interest accrued. Without the loss protection provided by FHA insurance, lenders would need to increase interest rates or reduce the amount of equity borrowers can access in order to cover the financial risks posed by reverse mortgages. Furthermore, FHA insurance protects borrowers from lenders' failure to advance contracted-for funds.

In 2010, FHA introduced the "Saver" alternative to the Standard HECM product. The HECM Saver program charges a far lower upfront mortgage insurance premium but also lowers the amount of housing equity a borrower can access. Thus, the Saver's upfront mortgage insurance premium of one basis point is expected to attract borrowers who require fewer funds as an alternative to a Standard HECM that has a two percent upfront mortgage insurance premium. Appendix B provides insights on the impact of the Saver initiative on HECM product demand and hence future HECM endorsement compositions.

The following provides details on the features of HECMs.

1. Maximum Claim Amount (MCA)

The MCA is the minimum of the appraised value of the home and the FHA HECM loan limit at the time of origination. It is the maximum HECM insurance claim the lender can receive. The MCA is also used together with the Principal Limit Factor (explained next) to calculate the maximum amount of initial equity available to the borrower. The MCA is determined at origination and does not change over the life of the loan. However, as a home appreciates over time, borrowers can access additional equity by refinancing. In the event of termination, the entire net sales proceeds[3] can be used to pay off the outstanding loan balance, regardless of whether the maximum claim amount was capped by the FHA HECM loan limit at origination.

2. Principal Limit and Principal Limit Factors (PLF)

FHA manages its insurance risk by limiting the percentage of the initial equity available to HECM borrowers by use of a Principal Limit Factor (PLF). Conceptually, the PLF is similar to the loan-to-value ratio applied to a traditional mortgage. Exhibit I-1 illustrates a selected number of PLFs published in October 2010. For a given HECM applicant, a PLF is multiplied by the MCA that applies to that applicant. The result is the maximum HECM principal limit available to the applicant. The PLF increases with the borrower's age at origination[4] and decreases with the expected mortgage interest rate (with a floor of 5.0 percent).[5] The PLFs for the Saver program are lower than the Standard program, quantifying for borrowers the tradeoff between the amount of accessible home equity and the rate of the upfront mortgage insurance premium. Over the course of the loan, the principal limit grows at a rate equal to the mortgage interest rate, mortgage insurance premium and service fees. Once the HECM unpaid loan balance reaches the

[3] Net sales proceeds are the proceeds from selling the home minus transaction costs.
[4] For couples, the age of the younger borrower is used to determine the corresponding PLF.
[5] For adjustable rate mortgages, "expected" interest rates are calculated by the lender as the sum of an index rate (10-year LIBOR or Treasury) and the lender's index margin. The index margin is what will actually be charged on the loan as a mark-up over the index rate used for the loan (LIBOR or Constant-Maturity Treasury, either 1-month or 1-year). For fixed-rate loans, the "expected" rate is the note rate on the mortgage.

principal limit, no more cash advances are available to the borrower (except for the tenure plan which acts as an annuity).

Exhibit I-1: Selected Principal Limit Factors[6]

Expected Mortgage Interest Rate	Borrower Age at Origination					
	65		75		85	
	Standard	Saver	Standard	Saver	Standard	Saver
5.50%	0.569	0.468	0.636	0.508	0.703	0.554
7.00%	0.428	0.316	0.516	0.376	0.606	0.443
8.50%	0.326	0.192	0.425	0.264	0.531	0.341

3. Payment Plans

HECM borrowers access the equity available to them according to the payment plan they select. Borrowers can change their payment plan at any time during the course of the loan as long as they have not exhausted their principal limit. The payment plans are:

- Tenure plan: a fixed monthly cash payment as long as the borrowers stay in their home;
- Term plan: a fixed monthly cash payment over a specified number of years;
- Line of credit: the ability to draw on allowable funds at any time;
- Combinations of all of the above.

4. Unpaid Principal Balance (UPB) and Loan Costs

HECM differs from other mortgage products as it requires no repayment as long as the borrowers continue to live in the home and follow the FHA guidelines on property maintenance and real estate taxes and insurance. In general, the loan balance continues to grow with borrower cash draws, interest, premiums, and service fees until the loan terminates.[7] Borrowers can choose between a fixed or adjustable interest rate, and the adjustable rate can be adjusted annually or monthly.

The cost of a HECM can be financed by adding it to the loan balance instead of paying out-of-pocket, which reduces the remaining principal limit available to draw by the borrower. These costs include origination fees, closing costs, mortgage insurance premiums, and annual servicing fees. For all loans endorsed prior to October 4, 2010, the insurance premium comprises an upfront premium of two percent of the MCA and an annual premium of half a percent of the unpaid principal balance. On or after October 4, 2010, the upfront premium remained at two percent for the Standard program but was set as one basis point of the MCA for the Saver program, whereas the annual insurance premium increased from 0.5 to 1.25 percent of the unpaid principal balance for both the Standard and Saver programs.

[6] The PLFs shown here are based on the 10/4/2010 values provided at: http://portal.hud.gov/hudportal/HUD?src=/program_offices/housing/sfh/hecm/hecmhomelenders

[7] Loan balance can also decrease or stay the same as the borrowers have the option to make a partial or full repayment at any time.

5. Loan Terminations

HECM loans typically terminate because the borrowers die, their primary residence changes, the HECM is refinanced, or the house is sold. Loans can also terminate under foreclosure when the borrowers fail to pay property taxes or homeowner's insurance. For this year's Review, the IFE Group built an econometric model of tax and insurance defaults. Appendix D provides the details.

When the HECM loan terminates, borrowers are required to pay back the current loan balance. If the net sale proceeds from the home sale exceed the loan balance, the borrowers or their estate is entitled to the difference. If the net proceeds from the home sale are insufficient to pay off the entire outstanding loan balance and the lender has not assigned the note, the lender can file a claim for the shortfall, capped by the MCA. The property is the only collateral for the loan, so that no other assets of the borrowers can be accessed to cover any shortfall. In other words, HECM loans are non-recourse.

6. Assignments and Recoveries

The assignment option is a unique feature of the HECM program. When the balance of a HECM reaches 98 percent of the MCA, the lender can choose to terminate the FHA insurance by selling the mortgage note to HUD at face value, a transaction referred to as loan assignment. HUD will pay an assignment claim in the full amount of the loan balance (up to the MCA) and will continue to hold and service the note until termination. During the note holding period, the loan balance will continue to grow by accruing interest, premiums, and service fees. Borrowers can continue to draw cash as long as the loan balance is below the current principal limit. The only exception is that borrowers on the tenure plan are not constrained by the principal limit. At loan termination, the borrowers or their estates are required to repay HUD the minimum of the loan balance and the net sales proceeds of the home. These repayments are referred to as (post-assignment) recoveries.

FHA Policy Changes

FHA periodically implements policy changes to the HECM program, including changes in insurance premiums, changes in principal limit factors, changes in FHA loan limits for HECMs and related program features. (These changes do not affect outstanding HECM contracts.) FHA publishes the policy changes in Mortgagee Letters with several examples listed in the references.

Exhibit I-2 indicates that the principal limit factors have become more conservative since FY 2009. The percentage decrease in the PLFs varies based on the borrower's age at origination and expected interest rate. The reduction in PLFs reduces the amount of equity available to borrowers. This policy lowers the likelihood and size of claims and reduces FHA's financial risk accordingly, as it reduces the likelihood that the unpaid principal balance will exceed the net proceeds from a house sale.

Exhibit I-2 Selected Principal Limit Factor Changes since FY 2009: Standard HECMs

Borrower Age at Origination	Expected Mortgage Interest Rate	PLFs		
		FY 2009 and Pior	FY 2010	FY 2011 and onward
65	5.5%	0.649	0.584	0.569
65	7.0%	0.489	0.440	0.428
65	8.5%	0.369	0.332	0.326
75	5.5%	0.732	0.659	0.636
75	7.0%	0.609	0.548	0.516
75	8.5%	0.503	0.453	0.425
85	5.5%	0.819	0.737	0.703
85	7.0%	0.738	0.664	0.606
85	8.5%	0.660	0.594	0.531

In early 2009, the United States Congress passed the American Recovery and Reinvestment Act of 2009 (ARRA)[8] which mandated a temporary increase in the HECM loan limit to $625,500 nationwide, effective February 17, 2009 through December 31, 2009. The temporary loan limit increase was later extended to December 31, 2010 in the Department of the Interior, Environment, and Related Agencies Appropriations Act 2010.[9] Mortgage Letter 2011-29 further extended the $625,500 loan limit through December 31, 2011.

Current and Future Market Environment

This section discusses the recent and projected market environment and the implications for the HECM program.

1. House Price Growth Rate

The house price growth rate forecasts for the national, state and MSA averages were obtained from Moody's July 2011 forecast. Moody's state and MSA house price forecasts take into consideration local area economic environment forecasts including unemployment rates. The July 2011 forecast provides estimates from FY 2011 Q2 to the end of FY 2041. We used the forecasts for FY 2041 as the basis for forecasts beyond that year as needed by the HECM cash flow model.

Using Moody's base-case economic scenario, this year's Review is based on projections of slower national house price growth rates compared to last year's Review. According to this year's forecast, the annualized national house price growth rate during the remainder of calendar year 2011 will be negative 5 percent. National house prices will begin to experience positive

[8] ARRA was passed by the United States Congress on February 13, 2009 and signed by President Barack Obama on February 17, 2009.

[9] Department of the Interior, Environment, and Related Agencies Appropriations Act (H.R. 2996) was passed by the United States Congress on October 29, 2009 and signed by President Barrack Obama on October 30, 2009.

growth starting in the second half of FY 2012. The forecast suggests house price growth will rebound to positive 5 percent by the end of FY 2014 and will return to a long-run average of around 3.4 percent thereafter.

The house price projections at the state level are different from the national level. The HECM portfolio active at the end of FY 2011 is concentrated in California, Florida, New York and Texas. The near-term decline is forecasted to be more severe for California and Florida, while it is forecasted to be less severe for Texas and New York. However, the long-term trend of house price growth for these four states is better than in last year's forecast. The differences compared to last year's Review are shown below in Exhibit I-3 for these states and nationally.

Exhibit I-3: Comparison of House Price Forecasts in Three States

State	Percent of FY 2011 Active Portfolio	House Price Growth		
		FY2011 Change from 2010	Long Term Trend 2011	Long Term Trend 2010
California	13.8%	-11.3%	3.7%	3.0%
Texas	7.7%	-2.3%	2.9%	2.2%
Florida	10.5%	-12.8%	4.0%	3.4%
New York	5.6%	-4.5%	3.4%	2.9%
National Average		-5.7%	3.4%	3.4%

The continued deterioration in 2011 followed by a longer-term recovery in house price growth affect the HECM portfolio in several ways. First, recoveries on terminations will be lower in a weak house price growth environment. However, as early HECM terminations are relatively rare, the impact of near-term house price declines on the FY 2011 HECM portfolio (the active loans at fiscal year-end) is expected to be limited. Because house price growth is forecasted to improve by the time the majority of the terminations are expected to occur, HECM insurance losses should fall within a normal range. Second, a near-term weak house price forecast reduces the additional equity available to a borrower through refinancing. This lowers the likelihood of refinance terminations in the near term. See Appendix A for a detailed discussion on HECM termination patterns.

For future HECM endorsements under the baseline scenario, the eventual return to positive home price growth will increase HECM loan demand, increase the available equity for borrowing, and improve recoveries at termination.

2. Interest Rates

According to Federal Reserve Board statistics, the one-year U. S. Treasury rate reached its lowest point since the 1950s in 2009 and remained low throughout 2011 as shown in Exhibit I-4. Similarly, the London Interbank Offered Rate (LIBOR) rates reached historic lows in early 2009. The ten-year LIBOR swap rate fluctuated around three percent in FY 2011 and the one-year LIBOR rate has remained below one percent.

Exhibit I-4: Comparison of Interest Rates

Rate type	Interest rate	
	July-2010	**July-2011**
1yr CMT	0.29%	0.26%
10yr CMT	3.01%	3.18%
1yr LIBOR	0.60%	0.79%
10yr LIBOR	3.01%	3.38%

The expected mortgage interest rate, which is calculated as the sum of the ten-year rate and the lender's margin for a variable rate HECM, affects the percentage of equity available to borrowers. The PLF increases as the expected rate declines for a given borrower age. Moody's has forecasted the ten-year Treasury rate to rise steadily to 5.86 percent by FY 2013 and stabilize at around 5.0 percent by FY 2016.[10] The ten-year Treasury rate forecast implies a continued low interest rate environment, which enables borrowers to access a larger percentage of their home equity. However, even though the ten-year Treasury rates remain at low levels, lender margins have increased from an average of 1.5 percent for FY 2008 and prior to 2.5 percent from FY 2009 to FY 2011. This increase may partially offset the impact of low interest rates and limit the increase in equity available to borrowers.

Approximately 33 percent of loans in the FY 2011 book of business are monthly adjustable rate loans (see Section IV for a detailed breakdown). The mortgage interest rate for adjustable-rate HECMs is equal to the sum of the base rate and the lender's margin. Moody's has forecasted the one-year Treasury rate to rise steadily and stabilize around 3.9 percent by FY 2015.

3. HECM Demand

HECM started as a pilot program in 1989 and became a permanent program in 1998. Between 2003 and 2008, the number of HECM loans grew steadily because of increased product knowledge on the part of potential applicants, lower interest rates, higher home values, and higher loan limits. Demand remained steady during the financial crisis with about 115,000 endorsements in FY 2009, similar to the level in FY 2008. The Principal Limit Factor reductions listed in Exhibit I-2 and recent house price depreciation have contributed to a reduction in HECM demand growth since FY 2009. Exhibit I-5 shows the actual number and dollars of endorsements in FY 2009 and FY 2010 as well as the annualized values for FY 2011 (based on data as of June 30, 2011). The Exhibit also contains the baseline volume projections for FY 2012 through FY 2018 based on our newly developed HECM demand model described in Appendix E.

[10] At the time of the review, Moody does not forecast the LIBOR ten-year SWAP rate. For modeling purposes, we leveraged the FHA estimated relationship between the U. S. Treasury and the LIBOR ten-year rates, and accordingly estimated the future LIBOR ten-year rate using the Moody's Treasury rate forecast.

Exhibit I-5: Actual and Forecasted FY 2009 to FY 2018 Endorsements

Fiscal Year	Number of Endorsements	Average MCA per Endorsement	Total Endorsements ($millions)
2009	114,656	$ 263,114	$ 30,168
2010	78,773	$ 266,313	$ 20,978
2011	74,935	$ 250,779	$ 18,792
2012	71,420	$ 251,759	$ 17,981
2013	87,834	$ 257,209	$ 22,592
2014	97,949	$ 269,788	$ 26,425
2015	111,561	$ 285,847	$ 31,889
2016	121,058	$ 299,386	$ 36,243
2017	128,169	$ 312,299	$ 40,027
2018	134,494	$ 323,070	$ 43,451

HECM borrowers represent about 0.9 percent of households with at least one member aged 62 years or older (according to AARP). If this ratio is maintained, the number of reverse mortgages will continue to increase with the expected growth in the senior population. In 2010, 16 percent of the population (approximately 50 million) was 62 or older. According to the U.S. Census Bureau's projection, 20 percent of the population (approximately 67 million) will be 62 or older in 2020 and this will grow to 22 percent of the population (approximately 84 million) by 2030. Furthermore, as longevity improves, more seniors may have insufficient savings to sustain their financial needs in retirement, potentially increasing the demand for HECM.

Besides HECM, there are several non-government reverse mortgage products. Typically, non-government products have higher loan limits but offer a lower percentage of home equity to borrowers. Their market share is less than 10 percent and will likely continue to shrink until the current stresses on lending institutions wane.

4. HECM Secondary Market

The HECM secondary market increases liquidity by providing capital market funding to primary market HECM lenders, broadening distribution channels for HECM loans, and expanding the investor base for the HECM product. Fannie Mae has been the largest portfolio purchaser of HECM loans. As of 2011 Q1, Fannie Mae held for investment $51 billion in HECM loans representing about 75 percent of the HECM insurance in force.

Ginnie Mae implemented a HECM Mortgage Backed Security (HMBS) product in 2007. Under this program, Ginnie Mae-approved issuers can pool and securitize newly originated HECMs. During FY 2010, Ginnie Mae had issued nearly $12 billion in HMBS compared to $5.1 billion in FY 2009. The FY 2011 issuance level has been tracking similar to FY 2010's level of $12 billion.

The secondary market activities do not directly affect our actuarial projections, but a change in secondary market liquidity could impact the volume of future endorsements.

Data Sources and Future Projections

This review focuses on the economic value of HECM loans in the MMI Fund, which consists of the loans from FY 2009-2011 endorsement cohorts that were active at the end of FY 2011. The estimate of the economic value of the HECM program in the MMI fund is based on various assumptions. Since these assumptions may turn out to be inaccurate, the actual performance of the FY 2011 HECM portfolio may differ from our projections.

All historical HECM data were used to analyze and better understand the performance of the program and to develop the termination model specifications. This data include loans that were endorsed under the General Insurance (GI) Fund between FY 1990 and FY 2008, as well as the loans endorsed under the MMI Fund since the start of FY 2009. Since the MMI fund was charged with covering the losses accruing in loans endorsed after FY 2008, the HECM "MMI portfolio" is defined to include only those more recent endorsements.

Borrower characteristics and loan features are based on loan-level data as of June 30, 2011. Actual endorsement volume is annualized for the remaining three months of the fiscal year. Historical economic data is obtained from Moody's economy.com website. These data include the one-year and ten-year Treasury rates, one-year and ten-year LIBOR rates, and the house price appreciation rates for the Federal Housing Finance Agency (FHFA) Conventional and Conforming loans. FHA provided estimates of borrower characteristics for future endorsements. FHA also provided the house price appreciation adjustment factors reflecting the home-maintenance risk for HECM borrowers. The cash flow model used to estimate the present value of future cash flows on outstanding insurance tracks cash flows on a fiscal year basis.

Structure of this Report

The remainder of this report consists of the following sections:

- Section II. Summary of Findings -- presents the estimated economic value and insurance-in-force for the FY 2011 through FY 2018 MMI portfolios. It also provides a step-by-step description of changes from last year's Review.
- Section III. Current Status of the HECM Program -- analyzes the estimated economic values in further detail.
- Section IV. Characteristics of MMI HECMs -- presents various characteristics of HECM endorsements for fiscal years 2009, 2010 and 2011.
- Section V. Sensitivity Analysis -- presents sensitivity analyses of the HECM portfolio valuations using various economic and borrower assumptions.
- Section VI. Summary of Methodology -- presents the loan performance and cash flow models used to estimate the economic values included in this report.
- Section VII. Qualifications and Limitations -- describes the main assumptions and the limitations of the data and models relevant to the results presented in this Review.

- Appendix A. HECM Base Termination Model -- provides a technical description of the loan performance model for the causes of loan termination excluding Tax and Insurance defaults (which is described separately in Appendix D).
- Appendix B. HECM Loan Performance Projections -- provides a technical description of the loan termination projection methodology and the characteristics of the future endorsement cohorts modeled in this Review. It also gives an overview of Moody's economic forecasts for interest rates and home prices under the base-case scenario as well as for five alternative scenarios.
- Appendix C. HECM Cash Flow Analysis -- provides a technical description of the cash flow model covering the various sources of cash inflows and cash outflows that HECM loans generate.
- Appendix D. Tax and Insurance Default Analysis -- presents a technical description of the IFE Group's new tax and insurance default model development. It also explains how the tax and insurance default model is implemented in the cash flow projection.
- Appendix E. HECM Demand Model-- presents a technical description of the HECM demand forecasting model development and its implementation.

Section II. Summary of Findings

This section presents the economic value of the FY 2011 to FY 2018 HECM MMI portfolio. An MMI-designated fiscal year's portfolio is defined as the set of loans that survive to the end of the fiscal year and were endorsed in FY 2009 or later, when the MMI fund was responsible for losses. In addition to initial capital resources and net earnings through the year, the economic value of the HECM MMI portfolio depends on the discounted net present value of the future cash flows from the surviving portfolio of loans existing at the start of the valuation forecast (the end of the fiscal year under review). A fiscal year's economic value calculation does not include endorsements from future fiscal years. This type of valuation is often referred to as "runoff mode."

A. The FY 2011 Actuarial Review

The FY 2011 Actuarial Review assesses the actuarial soundness of the HECM portfolio in the MMI Fund as of the end of FY 2011 and projects the status of the portfolio through FY 2018. In this Review, we:

- Analyze all HECM historical termination experience and the associated recoveries using loan-level HECM data reported by FHA through June 2011.
- Develop loan termination models to estimate the relationship between loan termination cash flows and various economic, borrower and loan specific factors.
- Estimate future cash flows associated with the FY 2011 to FY 2018 HECM MMI portfolios using various assumptions. These assumptions include macroeconomic forecasts from Moody's Analytics, borrower characteristics for future endorsements, and assumptions regarding home-maintenance-risk adjustment factors. We used Moody's base-case economic scenario as our baseline scenario. For sensitivity analysis, we used four of Moody's alternative scenarios for sensitivity analysis and we added a fifth scenario to represent continued very low interest rates.
- Estimate the economic value of the HECM MMI portfolio for FY 2011 through FY 2018, using discount rates prescribed by the Office of Management and Budget.

The following is a summary of the major findings in this Review, as shown in Exhibit II-1.

- The economic value at the end of FY 2011 is estimated at $1,358 million, indicating that the HECM portion of the MMI Fund will have sufficient capital resources to meet its expected future liabilities and hence will not require support from the overall Fund.
- The economic value of the HECM MMI portfolio is projected to continue to increase over time reflecting the forecasted future economic recovery under Moody's base-case economic scenario and the recent increase in annual insurance premiums. The economic value from FY 2011 through FY 2018 increases at an annual compound rate of approximately 33 percent.

- The insurance-in-force (IIF) is expressed as the sum of the maximum claim amounts (MCAs) of all HECM loans remaining in the insurance portfolio (even though losses are not limited to the MCA). The estimated IIF reflects the combined, cumulative impacts of loan terminations and new endorsements. The IIF is estimated to be $68.4 billion at the end of FY 2011 and is estimated to increase to $209 billion by the end of FY 2018.
- The economic value of the HECM MMI portfolio is projected to grow at a faster rate than the IIF, representing an increasing ratio of the economic value to the insurance risk of the HECM portfolio in the MMI Fund over time. Similarly, the economic value for each new endorsement book increases each year.

Exhibit II-1: The Economic Value, Insurance-In-Force, and Endorsements for FY 2011 through FY 2018 ($ Millions)

Fiscal Year[1]	Economic Value	Insurance in Force[2]	Volume of New Endorsements[3]	Economic Value of Each New Endorsement Book	Investment Earnings on Fund Balance
2011	$1,358	$68,373	$18,792	-$159	
2012	2,107	85,077	17,981	742	8
2013	3,102	102,333	22,592	951	44
2014	4,212	121,274	26,425	1,027	83
2015	5,458	142,542	31,889	1,125	120
2016	6,824	164,957	36,243	1,205	162
2017	8,355	187,086	40,027	1,288	243
2018	10,033	208,691	43,451	1,325	353

(1) All values, except the volume of new endorsements, are as of the end of the fiscal year.
(2) Insurance in Force is estimated as the total of the MCAs of the remaining loans in the insurance portfolio.
(3) Projections based on the HECM demand count model in Appendix E multiplied by the average MCA.

B. Changes in the Economic Value

The FY 2010 HECM Review estimated that the HECM portfolio had an economic value of negative $503 million at the end of FY 2010 compared to the new estimate of positive $1,358 million at the end of FY 2011. Exhibit II-2 shows the accounting line items that underlie the year-over-year change in value. Total HECM capital resources were reported to be $3.03 billion at the end of FY 2010. As measured and projected during FY 2011, the net insurance income, the net gains from investments, the net change in value of properties in inventory and the transfer from the MMI capital reserve to the HECM financing account increased the HECM capital resources to $4.25 billion. We estimated that the net present value of future cash flows for surviving loans at the end of FY 2011 is negative $2.89 billion. As a result, the economic value at the end of FY 2011 is estimated as positive $1.36 billion ($4.25 billion minus $2.89 billion).

Exhibit II-2: Projected Economic Value of the HECM Portfolio in the MMI Fund at the end of FY 2011 ($ Millions)

Item	End of FY2010[(1)]	End of FY2011
Cash	$3,011	
Investments	20	
Properties and Mortgages	2	
Other Assets and Receivables	1	
Total Assets	$3,034	
Liabilities (Account Payables)	2	
Total Capital Resources	$3,032	
Net Gain from Investment[(2)]		$190
Net Insurance Income in FY 2011[(3)]		484
Net Change in Value of Property Inventory[(4)]		16
Net Change in Accounts Payable		(8)
Transfer to HECM Financing Account		535
Total Capital Resources as of EOY		**$4,248**
PV of Future Cash Flows on Outstanding Business		-2,890
Economic Value		**$1,358**
Insurance-In-Force		**$68,373**

(1) Source: Audited Financial Statements for FY 2010
(2) Net Gain from Investment is annualized based on the investment income from the Capital Reserve account and the interest income in the MMI Financing account as of July 2011.
(3) Includes premium inflow and claim outflow during the fiscal year

C. Decomposition of the Differences in FY 2011 Economic Value as Reported in the FY 2010 Review and the FY 2011 Review

The economic value of the HECM portfolio in the MMI fund changed from negative $503 in FY 2010 as estimated in the FY 2010 Review to positive $1,358 million in FY 2011 as reported in this year's Review, representing an increase in value of $1,861 million. This change results from data changes, assumption changes and modeling changes.

In this section, we present the analysis that decomposes the step-by-step changes in the economic value from the FY 2010 Review to the FY 2011 Review. Exhibit II-3 below shows the changes in economic value in each step. A similar change analysis for FY 2017 in the successive actuarial Reviews also is included. (FY 2017 is the latest fiscal year common to both Reviews.)

The FY 2011 HECM portfolio economic value presented in the FY 2010 Review was $83 million (line four in the table). In FY 2011, $535 million was transferred from the MMI capital reserve to the HECM financing account. After this adjustment and two much smaller adjustments, as shown in the table, we describe the decomposition in more detail starting with the FY 2011 Fund valued at $626 million.

Exhibit II-3: Summary of Changes in Economic Value for the HECM Portfolio in the MMI Fund between FY 2010 and FY 2011 ($ Millions)

Decomposition Steps	Change in FY 2011 Economic Value	FY 2011 Economic Value	Change in FY 2017 Economic Value	FY 2017 Economic Value
FY 2010 Economic Value Presented in the FY 2010 Review [(1)]		-503		
FY 2011 Economic Value Presented in the FY 2010 Review Excluding the FY 2011 Endorsements	48	-455		
Plus: Forecasted Value of FY 2011 Endorsements Presented in the FY 2010 Review, Including Upfront Premiums	538			
Equals: FY 2011 Economic Value Presented in the FY 2010 Review		83		5,819
Plus: Transfer from Capital Reserve to HECM Financing Account	535	618	618	6,437
Plus: Net Change in Value of Property Inventory	16	634	18	6,456
Plus: Net Change in Account Payable	-8	626	-9	6,446
Plus:(i) Updated Endorsement Volumes	-41	585	-541	5,905
Plus:(ii) Updated Forecast of Compositions	21	606	438	6,343
Plus:(iii) Updated Discount Factors	-28	578	333	6,676
Plus:(iv) Updated Capital Resources at the End of FY2010	-10	568	-12	6,664
Plus:(v) Updated Valuation Model	-949	-381	-2095	4,570
Plus:(vi) Updated Economic Forecast: HPI	1,383	1,002	3,180	7,750
Plus:(vi) Updated Economic Forecast: Interest Rates	356	1,358	605	8,355

(1) Economic value as of the end of FY 2010.

(i) Updated Endorsement Volumes

The updated endorsement volumes are listed as decomposition step (i) in Exhibit II-3. In the 2011 Review, the volume of endorsements occurring in FY 2010 and FY 2011 was about $2 billion lower than the endorsement projections used in the 2010 Review. The lower volume translates to about $41million in lower economic value. The lower volumes of projected future books reduce the economic value of the FY 2017 portfolio by $541 million.

(ii) Updated Forecast of Compositions

The FY 2010 Review assumed that the endorsement dollar volume would be evenly split between the Standard and Saver programs for FY 2011 and onward. The actual ratio of endorsement volume for the Standard and Saver programs is 96:4 as of June 30, 2011. This year's assumptions for the split of future Standard and Saver program dollar volumes are:

Exhibit II-4:

Endorsement Year	Standard/Saver Volume Split
2012	90/10
2013	88/12
2014	86/14
2015	84/16
2016	82/18
2017-2018	80/20

The realized and revised assumption of the Saver program share increases the FY 2011 and FY 2017 economic values by $21 and $438 million, respectively.

(iii) Updated FY 2011 Office of Management and Budget (OMB) Discount Factors

This decomposition step illustrates the effect of the updated discount factors. The latest OMB published discount factors are larger than the values used in last year's Reviews. (See Appendix C in each year's Review.) This change reflects lower interest rate assumptions and hence less aggressive discounting of future cash flows, as represented by the larger discount factor values. The higher discount factors make the present value of future negative cash flows more negative but increase the present value of future positive cash flows such as insurance premiums and recovery revenue. As a net result of these offsetting effects, the FY 2011 HECM economic value decreases by $28 million, whereas the FY 2017 HECM economic value increases by $333 million.

(iv) Updated Actual Capital Resources as of the end of FY 2010

The FY 2010 review was prepared using data as of June 2010 and cash flow elements are forecasted to the end of FY 2010 accordingly. The actual capital resources as of the end of FY 2010 are $10 million smaller than the forecasted amount. Consequently, the FY 2011 and FY 2017 economic values are estimated to decrease by $10 million and $12 million, respectively.

(v) Updated Valuation Model

The updated valuation model primarily refers to changes to cash flows resulting from model changes. However, it is also a catch-all for any changes that were not or could not be otherwise separated in the decomposition analysis.

As discussed in Appendix A, we re-estimated the base termination model (as distinct from the tax and insurance default model). The model update appears to have only a small impact, but the general trend is slower termination rates relative to last year's model and hence more delayed recoveries and lower economic values.

Appendix D describes the new tax and insurance default model that was implemented in the FY 2011 Review. In the FY 2010 Review, three percent of the endorsements were randomly assigned as tax and insurance defaults. In this year's Review, the timing, frequency and cash flow impacts of tax and insurance defaults follow from the model predictions and are thus implemented differently compared to last year. For example, a tax and insurance default can now

happen before or after a loan is assigned to FHA, unlike in last year's framework. If a borrower defaults from a tax and insurance delinquency, the amount of tax and insurance arrearage is added to the borrower's unpaid balance until a loan is disposed (two years after the occurrence of the default). Because post-assignment negative cash flows and delayed recoveries are more costly than pre-assignment claims, we expect that the change in the treatment of tax and insurance defaults has contributed significantly to a reduction in the FY 2011 economic value compared to last year's estimate.

Each year, FHA updates various parametric assumptions about the program and its implementation. For example, the assumed claim payment when a loan is assigned to FHA (when the unpaid balance exceeds 98 percent of the maximum claim amount) is reduced from 100 percent of the maximum claim amount to this year's assumption of 99 percent, which is the average level from historical data. The effect of this reduction on the claim payment is to increase the economic value of the HECM portfolio. Other parametric assumption changes can have similar positive or negative effects on the economic value.

Finally, given the change of outside consultants completing this Review from FY 2010 to FY 2011, we rewrote the forecasting system implementation in the SAS software language. This rewrite combined and redesigned previous code written in SPSS, SAS, and VBA. During the course of the rewrite, a variety of coding and modeling technicalities and details were refined.

The combined effect of valuation model and assumption changes is to decrease the FY 2011 and FY 2017 economic values by $949 million and $2,094 million, respectively.

(vi) Updated Economic Forecast: Home Price Growth Rates

The HECM portfolio is more concentrated in states with long-term house price growth rates that were higher compared to last year's projection. As was illustrated in Exhibit I-3, the high-volume states of California, Texas, Florida and New York have an average increase of 0.64 percentage points in the long-term house price growth rate in this year's Review compared to the projection used in the FY 2010 Review. As a result, this update has a positive impact on the FY 2011 and the FY 2017 economic values. The FY 2011 and FY 2017 economic values are estimated to increase by $1,383 million and $3,180 million, respectively, as a result of the change in house price growth forecasts. Clearly, the HECM portfolio values will remain very sensitive to house prices, which affect the incidence and severity of pre-assignment claims as well as post-assignment recovery values.

(vii) Updated Economic Forecast: Interest Rates

Compared to last year, this year's Review uses lower one-year Treasury rates. Lower interest rates have offsetting effects: they increase loan endorsement volume and delay assignment dates, but slow down the interest accrual on unpaid principal balances and hence lower annual insurance premiums. The effects also depend on the product type—fixed-rate HECM balances accrue depending on the HECM's initial ten-year Treasury rate (which determines the HECM contract rate) whereas adjustable-rate HECM balances accrue depending on the one-year Treasury or LIBOR rates. Compared to last year, this year's Review uses lower ten-year

Treasury rates in the near term but higher ten-year Treasury rates after FY 2012. These offsetting factors result in an increase of economic values in FY 2011 and FY 2017 of $356 million and $605 million, respectively, as a result of the change in interest rate forecasts.

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Section III. Current Status of HECMs in the MMI Fund

This section presents the components of the economic value in FY 2011 and discusses the projections through FY 2018. The HECM portion of the MMI Fund has a projected economic value of positive $1,358 million at the end of FY 2011. The economic value and the insurance-in-force of the HECM program are both projected to increase over time. Furthermore, HECM's economic value is estimated to grow at a faster rate than its insurance-in-force, representing an increasing ratio of the economic value to the insurance risk over time.

A. Estimating the Current Economic Value and Insurance-in-Force of HECM in the MMI Fund

The components that constitute the MMI capital ratio are the economic value and the insurance-in-force. This section discusses each of these components.

1. Economic Value

According to NAHA, the economic value of the Fund is defined as the "cash available to the Fund, plus the net present value of all future cash inflows and outflows expected to result from the outstanding mortgages in the Fund." We estimate the current economic value for the HECM component as the sum of the amount of capital resources and the net present value of all expected future cash flows from the estimated insurance-in-force as of the end of FY 2011. Exhibit III-1 presents the components of the economic value for FY 2011.[11] Data through August 2011 was annualized to estimate the total capital resources and the loan performance at the end of FY 2011. The total economic value consists of the following components:

- *Total Capital Resource* equals assets less liabilities in FY 2010 plus additional cash available from investments, fund transfers, and operational activities during FY 2011. We estimated the total capital resource to be $4.25 billion at the end of FY 2011, which consists of the following components:
    - *Total Assets*, which include cash and other assets, Treasury investments, and properties and notes held by FHA. The total assets were $3.03 billion as of FY 2010.
    - *Total Liabilities*, which include the accounts payable. This is equal to $2 million as of the end of FY 2010.
    - *Net Gain from Investments*, which includes the estimated revenue from the investment of capital resources and the interest from the HECM Financing Account during FY 2011. The total investment gain is $190 million.

[11] Note that Exhibit III-1 is the same as Exhibit II-2, reproduced in this section for easy reading.

- *Net Insurance Income in FY 2011* includes the estimated premium, claims, and recoveries, derived by annualizing the year-to-date data for FY 2011. The net insurance income from the still-active FY 2009 to FY 2011 endorsements is $484 million.

- *Net Change in Value of Property Inventory* refers to the change in the value of the inventory of HECM-funded properties that are real estate held by FHA. The value of properties in inventory is projected to increase by $16 million by the end of FY 2011, largely due to the increase in the number of such properties.

- *Net Change in Accounts Payable*, which represents the change of balance in Accounts Payable from the beginning to the end of FY 2011, is negative $8 million.

- *Transfer from Capital Reserve to HECM Financing Account*, which corresponds to the transfer of funds from the MMI Capital Reserve account to the HECM Financing Account. The net transfer was $535 million in FY 2011.

- *Present Value of Future Cash Flows on Outstanding Business:* HECM cash inflows consist of premiums and recoveries. Cash outflows consist of claims and note-holding expenses. The cash flow model projects cash inflows and outflows using economic forecasts and loan performance projections. The present value of net future cash flows is negative $2.89 billion as of the end of FY 2011.

Exhibit III-1: Projected Economic Value of the HECM portfolio in the MMI Fund at the end of FY 2011 ($ Millions)

Item	End of FY2010[(1)]	End of FY2011
Cash	$3,011	
Investments	20	
Properties and Mortgages	2	
Other Assets and Receivables	1	
Total Assets	$3,034	
Liabilities (Account Payables)	2	
Total Capital Resources	$3,032	
Net Gain from Investment[(2)]		$190
Net Insurance Income in FY 2011[(3)]		484
Net Change in Value of Property Inventory		16
Net Change in Accounts Payable		(8)
Transfer to HECM Financing Account		535
Total Capital Resources as of EOY		**$4,248**
PV of Future Cash Flows on Outstanding Business		-2,890
Economic Value		**$1,358**
Insurance-In-Force		**$68,373**

(1) Source: Audited Financial Statements for FY 2010.
(2) Net Gain from Investment is annualized based on the investment income from the Capital Reserve account and the interest income in the MMI Financing account as of July 2011.
(3) Includes premium inflow and claim outflow during the fiscal year.

2. Insurance-in-Force

Another major component of the capital ratio calculation is the insurance-in-force (IIF). According to NAHA, the IIF is defined as the "obligation on outstanding mortgages." We estimate the current IIF as the total maximum claim amount (MCA) of all HECM loans remaining in the insurance portfolio as of the end of FY 2011. Another possible IIF measure is the outstanding loan balances, which tend to increase over time from interest accruals, premiums, service fees and borrower cash draws. As the main purpose of this review is to assess the long-term financial performance of HECM, using the current loan balances to estimate the IIF could over- or under-represent FHA's long-term insurance exposure depending on the distribution of loan ages in the HECM portfolio. In contrast, the aggregate MCAs for the portfolio will only depend on insurance termination and will be more stable over time. MCA is the highest claim amount FHA can pay out at insurance termination (however, FHA may bear additional negative cash flows after a note assignment). Lenders can file two types of insurance claims: (i) a shortfall claim when the net sales proceeds are insufficient to pay off the loan balance at mortgage termination and (ii) an assignment claim when lenders choose to assign the mortgage note to FHA when the balance reaches 98 percent of the MCA.

At the end of FY 2011, the estimated IIF is $28.8 billion for the FY 2009 endorsements, $20.8 billion for the FY 2010 endorsements, and $18.8 billion for the FY 2011 endorsements for a total of $68.4 billion.

B. Projected Future Economic Values and Insurance-In-Force of HECMs in the MMI Fund

In this section, we present the forecasts of the future economic values and insurance-in-force projections for MMI HECMs. We estimate these future values by applying our termination and cash flow models to the endorsements, which are forecasted by the HECM demand model described in Appendix E. FHA's forecast of borrower characteristics determines the loan-level composition of future endorsements.

Exhibit III-2 shows the estimated economic value of future MMI HECM books of business and the corresponding insurance-in-force.[12] All values in the Exhibit are discounted to the end of each corresponding fiscal year.

We estimate the projected economic value of the MMI HECM portfolio to increase steadily from positive $1.36 billion in FY 2011 to $10.03 billion in FY 2018, as shown in the first column of the exhibit. This increase is due to the projected increase in new endorsements, the recent increase in annual insurance premiums, and the return to positive house price appreciation in FY 2012.

With the addition of new endorsements, the total insurance-in-force is estimated to increase from $68.37 billion at the end of FY 2011 to $208.69 billion in FY 2018. As the house price forecast

[12] Note that Exhibit III-2 is the same as Exhibit II-1, reproduced in this section for convenience.

improves over time, the rate of increase in the economic value of the Fund is higher than the rate of increase in the insurance-in-force. This represents a growing ratio of the HECM portfolio's insurance value to insurance risk in the MMI Fund over time.

Exhibit III-2: Projected Economic Value of the HECM portfolio in the MMI Fund in Future Years ($ Millions)

Fiscal Year[1]	Economic Value	Insurance in Force[2]	Volume of New Endorsements[3]	Economic Value of Each New Book of Business	Investment Earnings on Fund Balance
2011	$1,358	$68,373	$18,792	-$159	
2012	2,107	85,077	17,981	742	8
2013	3,102	102,333	22,592	951	44
2014	4,212	121,274	26,425	1,027	83
2015	5,458	142,542	31,889	1,125	120
2016	6,824	164,957	36,243	1,205	162
2017	8,355	187,086	40,027	1,288	243
2018	10,033	208,691	43,451	1,325	353

1. All values, except the volume of new endorsements, are expressed as of the end of the fiscal year.
2. Insurance-in-force is estimated as the sum of the maximum claim amounts of the remaining insured loans.
3. Projections provided by FHA.

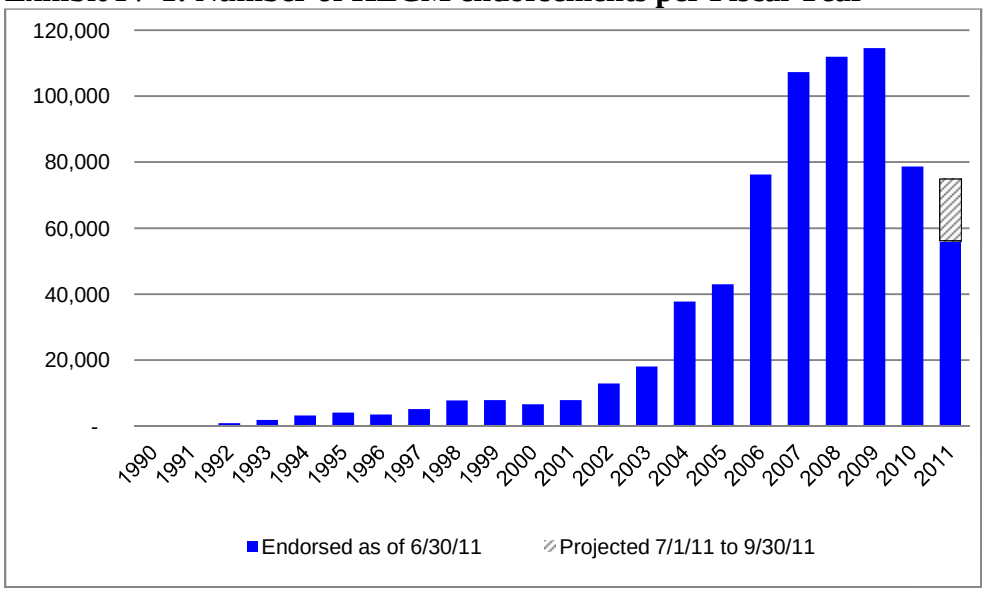
Section IV. Characteristics of the FY 2009, FY 2010 and FY 2011 HECM Books of Business

This section presents the characteristics of the FY 2009 through FY 2011 HECM endorsements. The HECMs from these books of business that have not terminated constitute the MMI HECM portfolio as of the end of FY 2011. A review of the characteristics of these books helps define the current risk posture of MMI HECMs, which includes just these books and, going forward, all future HECM books. Some of the characteristics are shown for prior books as well, to indicate trends. All data used for this analysis is provided by FHA as of June 30, 2011.

A. Volume and Share of Mortgage Originations

FHA endorsed 56,201 HECM loans from October 1, 2010 to June 30, 2011, with a total dollar value, defined as the MCA, of $15 billion. The annualized number of endorsements in FY 2011 is thus 74,935 and the corresponding dollar value is $18.8 billion. The number of endorsements in FY 2009 is 114,656 and the corresponding dollar value is $30.2 billion. The number of endorsements in FY2010 is 78,773 and the corresponding dollar value is $21 billion. Since the inception of the HECM program, it has been the largest reverse mortgage product, representing more than 90 percent of total reverse mortgage endorsements in the market. Figure IV-1 presents the count of HECM endorsements by fiscal years.

Exhibit IV-1: Number of HECM endorsements per Fiscal Year



B. Payment Types

HECM borrowers receive loan proceeds by selecting from various payment plans. Exhibits IV-1a through IV-1c present the distributions of FYs 2009-2011 HECM endorsements by payment plan. As of June 30, 2011, the majority of HECM borrowers selected the line of credit option. This option accounted for 73 percent of the FY 2009 endorsements, 68 percent of the FY 2010 endorsements and 72 percent of the FY 2011 endorsements.

Exhibit IV-1a: Distribution of FY 2009 HECM Loans by Payment Type

Payment Type	Number of Loans	Percent of Total
Line of Credit	83,386	72.7%
Tenure	26,014	22.7%
Term&Line of Credit	1,626	1.4%
Tenure & Line of Credit	1,725	1.5%
Term	1,903	1.7%
Missing Payment Type	2	0.0%
Total	**114,656**	**100**

Exhibit IV-1b: Distribution of FY 2010 HECM Loans by Payment Type

Payment Type	Number of Loans	Percent of Total
Line of Credit	53,516	67.9%
Tenure	22,407	28.5%
Term&Line of Credit	955	1.2%
Tenure & Line of Credit	1,081	1.4%
Term	803	1.0%
Missing Payment Type	11	0.0%
Total	**78,773**	**100**

Exhibit IV-1c: Distribution of FY 2011 HECM Loans by Payment Type

Payment Type	Number of Loans	Percent of Total
Line of Credit	40,736	72.2%
Tenure	13,866	24.6
Term & Line of Credit	740	1.3
Tenure & Line of Credit	577	1.0
Term	534	0.9
Missing Payment Type	6	0
Total	**56,459**	**100**

C. Interest Rate Type

HECM borrowers can select fixed or adjustable rate mortgages. Exhibits IV-2a, IV-2b and IV-2c show the distribution of FYs 2009-2011 endorsements by interest rate type. The majority of

HECM borrowers (88 percent) selected monthly or annually adjustable rate mortgages in FY 2009. The percentage of fixed-rate endorsements sharply increased to 69 percent in FY 2010 and stabilized at 67 percent of endorsements in FY 2011.

The LIBOR-indexed loans constituted 36 percent of the FY 2009 HECM endorsements, 60 percent of the FY 2010 endorsements and 59 percent of the FY 2011 HECM endorsements. FHA introduced the LIBOR as a HECM index option on October 12, 2007. LIBOR-indexed endorsements have steadily increased since then due to changes in market environment, one of which is that Fannie Mae, a major HECM purchaser, discontinued purchasing U. S. Treasury-indexed HECMs as of September 1, 2009.[13]

Exhibit IV-2a: Distribution of FY 2009 HECM Loans by Interest Rate Type

Interest Rate Type		Number of Loans	Percent of Total
US Treasury-Indexed	Monthly Adjustable	61,202	53%
	Annual Adjustable	833	1%
Fixed		10,792	9%
LIBOR-indexed	Monthly Adjustable	39,270	34%
	Annual Adjustable	26	0%
Fixed		2533	2%
Total		**114,656**	**100%**

Exhibit IV-2b: Distribution of FY 2010 HECM Loans by Interest Rate Type

Interest Rate Type		Number of Loans	Percent of Total
US Treasury-Indexed	Monthly Adjustable	206	0%
	Annual Adjustable	9	0%
Fixed		31,259	40%
LIBOR-Indexed	Monthly Adjustable	24,072	31%
	Annual Adjustable	9	0%
Fixed		23,218	29%
Total		**78,773**	**100%**

Exhibit IV-2c: Distribution of FY 2011 HECM Loans by Interest Rate Type

Interest Rate Type		Number of Loans	Percent of Total
US Treasury-Indexed	Monthly Adjustable	23	0%
	Annual Adjustable	4	0%
Fixed		23,113	41%
LIBOR-Indexed	Monthly Adjustable	18,367	33%
	Annual Adjustable	11	0%
Fixed		14,941	26%
Total		**56,459**	**100**

[13] See Fannie Mae Selling and Servicing Guides Announcement 09-16, published on June 1, 2009.

D. Product Type

Almost all of the loans endorsed in FY 2009 through FY 2011 are "traditional" HECMs, whereby the borrowers purchased their homes prior to taking out the reverse mortgage. The exception is the loans endorsed under the HECM-for-Purchase program that was introduced in January 2009 and allows seniors to purchase a new principal residence and obtain a reverse mortgage within a single transaction. Among the HECM-for-Purchase loans, 15 percent of FY 2009 borrowers, 14 percent of FY 2010 borrowers and 21 percent of FY 2011 borrowers drew at least 90 percent of their maximum available equity within the first month of loan endorsement. These loans represent a small portion of the total FYs 2009-2011 HECM endorsements as seen in Exhibits IV-3a, IV-3b and IV-3c.

Exhibit IV-3a: Distribution of FY 2009 HECM Loans by Product Type

Product Type		Number of Loans	Percent of Total
HECM for Purchase	First Month Cash Draw>=90% of Initial Principal Limit	86	0.1%
	First Month Cash Draw<90% of Initial Principal Limit	473	0.4
Traditional HECMs		114,097	99.5
Total		**114,656**	**100**

Exhibit IV-3b: Distribution of FY 2010 HECM Loans by Product Type

Product Type		Number of Loans	Percent of Total
HECM for Purchase	First Month Cash Draw>=90% of Initial Principal Limit	200	0.3%
	First Month Cash Draw<90% of Initial Principal Limit	1189	1.5%
Traditional HECMs		77,384	98.2%
Total		**78,773**	**1**

Exhibit IV-3c: Distribution of FY 2011 HECM Loans by Product Type

Product Type		Number of Loans	Percent of Total
HECM for Purchase	First Month Cash Draw>=90% of Initial Principal Limit	222	0.4%
	First Month Cash Draw<90% of Initial Principal Limit	847	1.5
Traditional HECMs		55,390	98.1
Total		**56,459**	**100**

E. Endorsement Loan Counts by State

Of all endorsements in FY 2009, FY 2010 and FY 2011, approximately 40 percent originated in California, Florida, Texas, and New York as measured by loan counts. California has the highest endorsement volume in FYs 2009-2011 at 13.7 percent, 14.1 percent, and 14.0 percent, respectively. While Florida has the second highest endorsement volume in both FY 2009 and FY 2010, the percentage in FY 2010 decreased by more than one third, from 13.2 percent to 9.4 percent. Its volume continued to drop to 7 percent in FY 2011, while the endorsement volume in Texas increased steadily over FYs 2009-2011 and became the second highest state of

endorsement volume during FY 2011. The breakdown of these top four states is seen below in Exhibits IV-4a, IV-4b and IV-4c.

Exhibit IV-4a: Percentage of Endorsements by State for FY 2009 HECM Loans

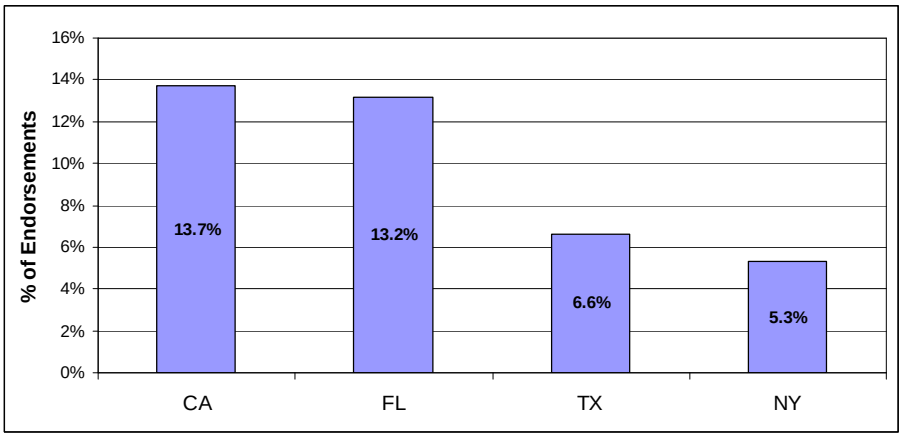


Exhibit IV-4b: Percentage of Endorsements by State for FY 2010 HECM Loans

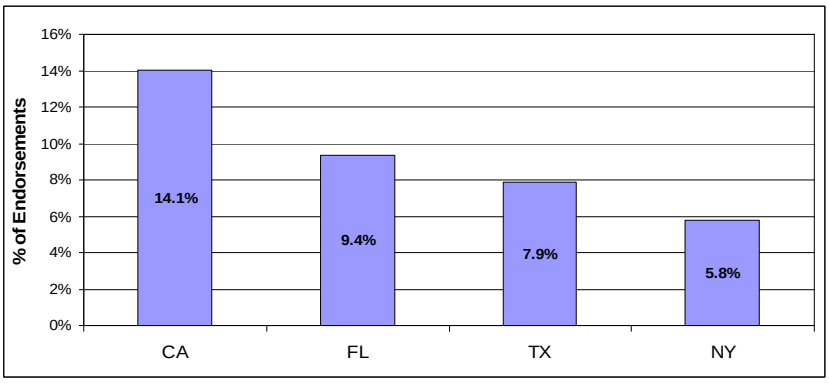
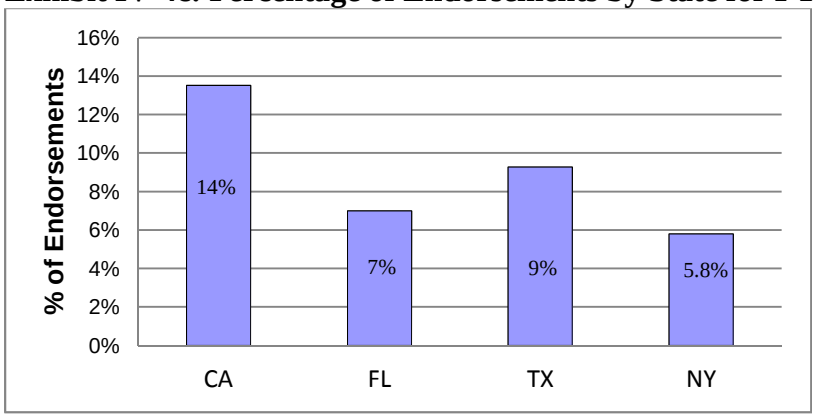


Exhibit IV-4c: Percentage of Endorsements by State for FY 2011 HECM Loans



F. Maximum Claim Amount Distribution

The MCA is the minimum of the FHA HECM loan limit and the appraised value (or if a home-for-purchase HECM, the minimum of the purchase price or appraisal). It is used as the basis of the initial principal limit determination and as the cap of the potential insurance claim amount. Exhibits IV-5a, IV-5b and IV-5c show the distribution of FYs 2009-2011 endorsements by MCA. Approximately 64 percent of loans endorsed in FY 2009 have an MCA less than $300,000 and approximately 66 percent for FY 2010. The number of loans with MCA less than $300,000 increased to 70 percent in FY 2011.

The percentage of FY 2009 endorsements with an MCA between $300,000 and $417,000 steadily increased from October 2008 to February 2009 at which time it represented 41 percent of endorsements. Subsequently, it dropped as the percentage of endorsements with an MCA greater than $417,000 increased from 13 percent in April 2009 to 26 percent in June 2009. Between June 2009 and the end of the FY 2009, the loan distribution of MCA remained steady.

The percentage of FY 2010 endorsements with an MCA greater than $417,000 decreased gradually from 24 percent in October 2009 to 18 percent by the end of FY 2010. The primary driver for this decrease is the shift of endorsements from historically high-cost areas like Florida, to the lower-cost areas like Texas and the Midwestern states. In FY 2011, the number of endorsements with an MCA greater than $417,000 stayed around 18 percent.

Exhibit IV-5a: Distribution of FY 2009 HECM Loans by MCA Level

Month	Level of MCA					
	Less Than $100k	$100k to $200k	$200k to $300k	$300k to $417k	Greater Than $417k	Total
October 2008	13%	41%	28%	18%	0%	100%
November 2008	12%	41%	27%	20%	0%	100%
December 2008	10%	34%	23%	32%	0%	100%
January 2009	9%	29%	23%	39%	0%	100%
February 2009	8%	28%	23%	41%	0%	100%
March 2009	9%	30%	23%	35%	2%	100%
April 2009	9%	32%	23%	24%	12%	100%
May 2009	9%	30%	21%	20%	20%	100%
June 2009	9%	29%	20%	16%	26%	100%
July 2009	9%	29%	20%	15%	26%	100%
August 2009	9%	29%	21%	15%	26%	100%
September 2009	8%	30%	21%	16%	26%	100%
Total	**9%**	**32%**	**23%**	**18%**	**18%**	**100%**

Exhibit IV-5b: Distribution of FY 2010 HECM Loans by MCA Level

Month	Level of MCA					
	Less Than $100k	$100k to $200k	$200k to $300k	$300k to $417k	Greater Than $417k	Total
October 2009	10%	31%	20%	15%	24%	100%
November 2009	11%	33%	20%	15%	22%	100%
December 2009	11%	32%	21%	14%	22%	100%
January 2010	11%	33%	20%	14%	22%	100%
February 2010	12%	34%	20%	14%	20%	100%
March 2010	13%	35%	20%	14%	19%	100%
April 2010	12%	37%	20%	14%	18%	100%
May 2010	14%	35%	20%	14%	17%	100%
June 2010	14%	36%	21%	13%	17%	100%
July 2010	14%	36%	20%	13%	17%	100%
August 2010	14%	35%	19%	14%	18%	100%
September 2010	14%	36%	19%	13%	18%	100%
Total	**12%**	**34%**	**20%**	**14%**	**20%**	**100%**

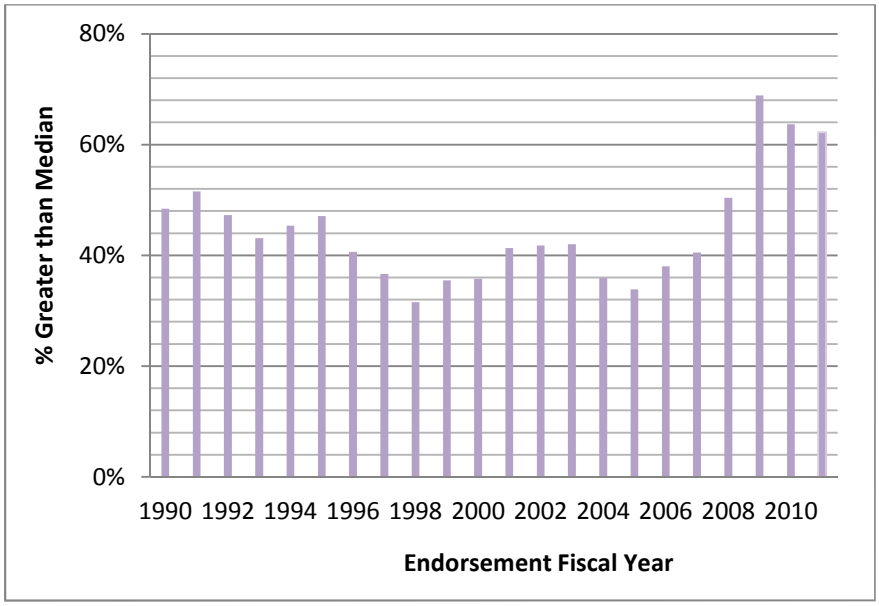
Exhibit IV-5c: Distribution of FY 2011 HECM Loans by MCA Level

Month	Level of MCA					
	Less Than $100k	$100k to $200k	$200k to $300k	$300k to $417k	Greater Than $417k	Total
October 2010	16%	37%	19%	12%	16%	100%
November 2010	14%	35%	20%	13%	18%	100%
December 2010	15%	34%	20%	13%	18%	100%
January 2011	13%	35%	20%	13%	19%	100%
February 2011	15%	34%	20%	12%	18%	100%
March 2011	14%	35%	19%	14%	18%	100%
April 2011	15%	37%	19%	13%	17%	100%
May 2011	16%	37%	19%	13%	15%	100%
June 2011	15%	36%	20%	13%	16%	100%
Total	**15%**	**35%**	**20%**	**13%**	**17%**	**100%**

G. Appraised House Value

FHA research has found that loans associated with properties with an appraised value greater than their area median at origination tend to have lower home maintenance risk than those below the area median (Capone *et al*. 2010). Exhibit IV-6 shows the percentage of HECM borrowers with an appraised house value greater than the area median value. Starting in the FY 2005 book-of-business, there has been an upward trend in the ratio of appraised values to the area medians. The passage of the American Recovery & Reinvestment Act and HERA increased the HECM loan limit and further accelerated the upward trend as seen in FY 2009. In the FY 2009 endorsement book-of-business, 69 percent of the HECM properties were appraised at higher than the area median. In the FY 2010 and FY 2011 endorsement books-of-business, 64 and 62 percent of the HECM properties were appraised at higher than the area median, respectively.

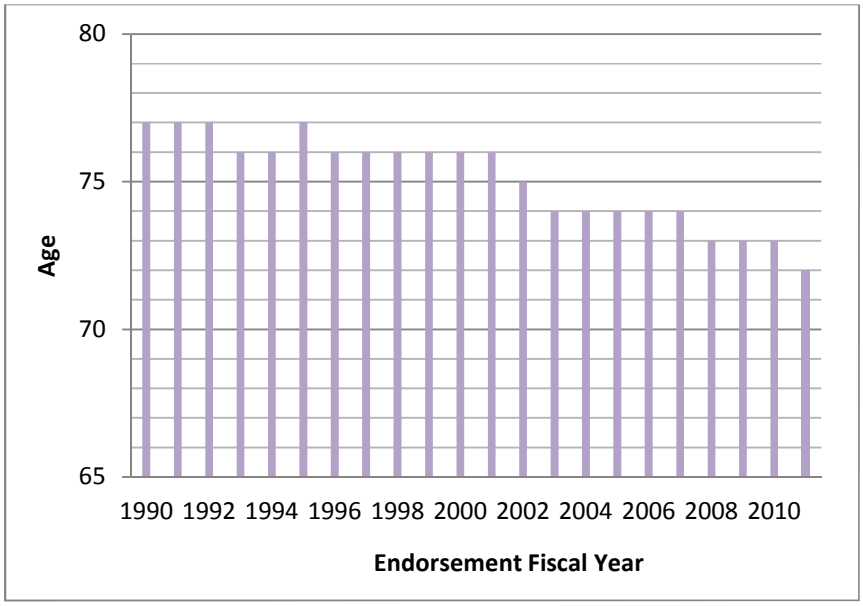
Exhibit IV-6: Percentage of Borrowers with Appraised House Value Greater than Area Median Value



H. Borrower Age Distribution

The borrower age profile of an endorsement year book of business affects loan termination rates and the percentage of initial equity available to the borrower. Exhibit IV-7 presents the average borrower age at origination for FY 1990-2011 endorsements (recall that only endorsements in FY 2009 and later are part of the MMI Fund). The average borrower age has declined over time. This indicates that HECM is becoming more popular with relatively younger borrowers. Younger borrowers are associated with a higher financial risk exposure for FHA as they have a longer life expectancy. To manage this risk, the PLFs are lower for younger borrowers, limiting them to a smaller portion of their equity. The average borrower age of the FYs 2009-2010 endorsements was about 73 years, and 72 years for FY 2011 endorsements.

Exhibit IV-7: Average Borrower Age at Origination by Fiscal Year



I. Borrower Gender Distribution

Gender also affects termination behavior due to differences in mortality (and possibly other factors). The gender distribution of the HECM portfolio has remained steady over time. HECM loan behavior indicates that males tend to terminate their loans the fastest, females terminate the second fastest, and couples terminate the slowest. Exhibits IV-8a, IV-8b and IV-8c present the gender distribution for the FYs 2009-2011 HECM endorsements. Females comprise the largest gender cohort of the FY 2009 endorsements at 41 percent, followed by couples at 37 percent, and males at 22 percent. Females also comprise the largest gender cohort of the FY 2010 endorsements at 42 percent, followed by couples at 35 percent, and males at 22 percent. A similar distribution pattern is observed for FY 2011 endorsements, with 41 percent single females, 21 percent single males and 38 percent couples.

Exhibit IV-8a: Distribution of FY 2009 HECM Endorsements by Gender

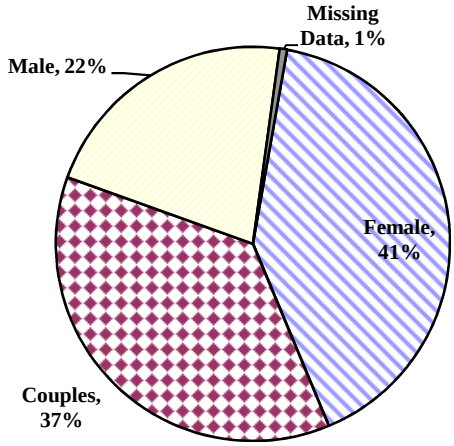


Exhibit IV-8b: Distribution of FY 2010 HECM Endorsements by Gender

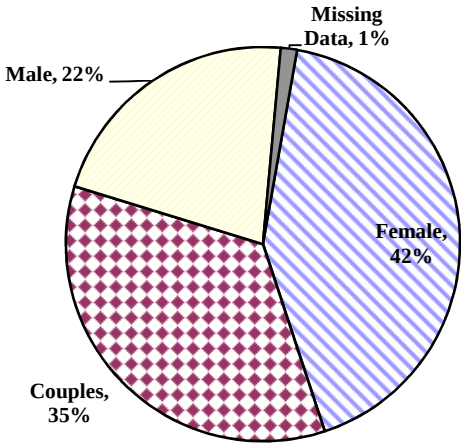
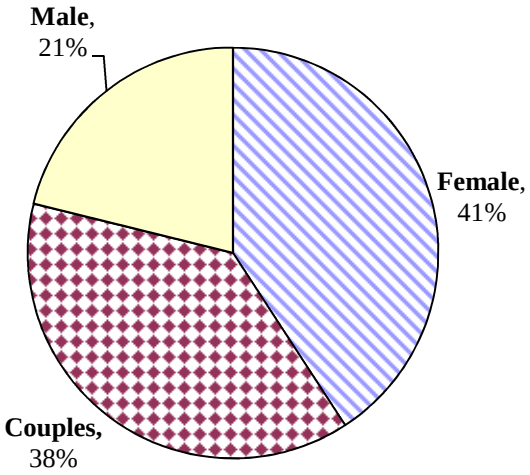


Exhibit IV-8c: Distribution of FY 2011 HECM Endorsements by Gender



J. Cash Draw Distribution

Data show that loans which have drawn a higher percentage of the initial amount of equity available have a higher likelihood of refinancing. Exhibits IV-9a, IV-9b and IV-9c show the distribution of the first-month cash draw as a percentage of the initial principal limit among different borrower age groups for FY 2009, FY 2010 and FY 2011 endorsements.

Younger borrowers tend to draw a higher percentage of the initial amount of equity available than older borrowers. In FY 2009, 64 percent of the 62-65 age group drew over 80 percent of the initial principal limit, compared to 45 percent for the greater than 85 years-old age group. In FY 2010, 83 percent of the 62-65 age group drew over 80 percent of the initial principal limit, compared to 53 percent for the greater than 85 years-old age group. Similarly, in FY 2011, 79 percent of the 62-65 age group drew over 80 percent of the initial principal limit compared to 50 percent for greater than 85 years-old age group.

Exhibit IV-9a: First-Month Borrower Cash Draw of FY 2009 HECM Endorsements as a Percentage of the Initial Principal Limit

Age Group	Number of Loans	Variable Rate Loans			Fixed Rate Loans		
		0-40% of Initial Principal Limit	40-80% of Initial Principal Limit	80-100% of Initial Principal Limit	0-40% of Initial Principal Limit	40-80% of Initial Principal Limit	80-100% of Initial Principal Limit
62-65	23,741	12%	24%	51%	0%	0%	13%
66-70	28,264	15%	24%	48%	0%	0%	13%
71-75	24,989	19%	24%	45%	0%	0%	11%
76-85	28,969	25%	24%	41%	0%	0%	10%
85+	8,693	35%	20%	37%	0%	0%	8%
Total	**114,656**	**19%**	**24%**	**45%**	**0%**	**0%**	**11%**

Exhibit IV-9b: First-Month Borrower Cash Draw of FY 2010 HECM Endorsements as a Percentage of the Initial Principal Limit

Age Group	Number of Loans	Variable Rate Loans			Fixed Rate Loans		
		0-40% of Initial Principal Limit	40-80% of Initial Principal Limit	80-100% of Initial Principal Limit	0-40% of Initial Principal Limit	40-80% of Initial Principal Limit	80-100% of Initial Principal Limit
62-65	17,636	7%	8%	4%	0%	1%	79%
66-70	18,767	9%	10%	5%	0%	1%	75%
71-75	16,571	13%	11%	6%	0%	1%	69%
76-85	19,339	20%	14%	6%	0%	1%	59%
85+	6,460	32%	15%	8%	0%	0%	45%
Total	**78,773**	**14%**	**11%**	**6%**	**0%**	**1%**	**68%**

Exhibit IV-9c: First-Month Borrower Cash Draw of FY 2011 HECM Endorsements as a Percentage of the Initial Principal Limit

Age Group	Number of Loans	Variable Rate Loans			Fixed Rate Loans		
		0-40% of Initial Principal Limit	40-80% of Initial Principal Limit	80-100% of Initial Principal Limit	0-40% of Initial Principal Limit	40-80% of Initial Principal Limit	80-100% of Initial Principal Limit
62-65	14,208	9%	10%	5%	1%	1%	74%
66-70	13,944	11%	11%	5%	1%	1%	71%
71-75	11,558	15%	12%	5%	1%	1%	66%
76-85	12,526	22%	14%	5%	1%	1%	57%
85+	4,223	36%	13%	6%	1%	0%	44%
Total	**56,459**	**16%**	**12%**	**5%**	**1%**	**1%**	**66%**

Although younger borrowers typically draw a higher percentage of the initial principal limit in the first month, the amount of cash drawn represents a smaller percentage of the MCA, because the PLF is lower for younger borrowers to account for their longer life expectancy.

Section V. Sensitivity Analysis

A sensitivity analysis was conducted to assess the impact of various economic scenarios on the economic value of the FY 2011 through FY 2018 MMI HECM portfolio. This section presents the results of this analysis. Five alternative scenarios were considered to assess the effects of more or less severe economic scenarios than the base-case scenario on the economic value of the MMI HECM portfolio. The first four alternative economic scenarios were based on Moody's Analytics forecasts published in July 2011 and we designed a fifth alternative scenario to represent continued very low interest rates. Moody's alternative scenarios represent various percentiles along the distribution of possible economic scenarios, as indicated below. The five alternative scenarios are:

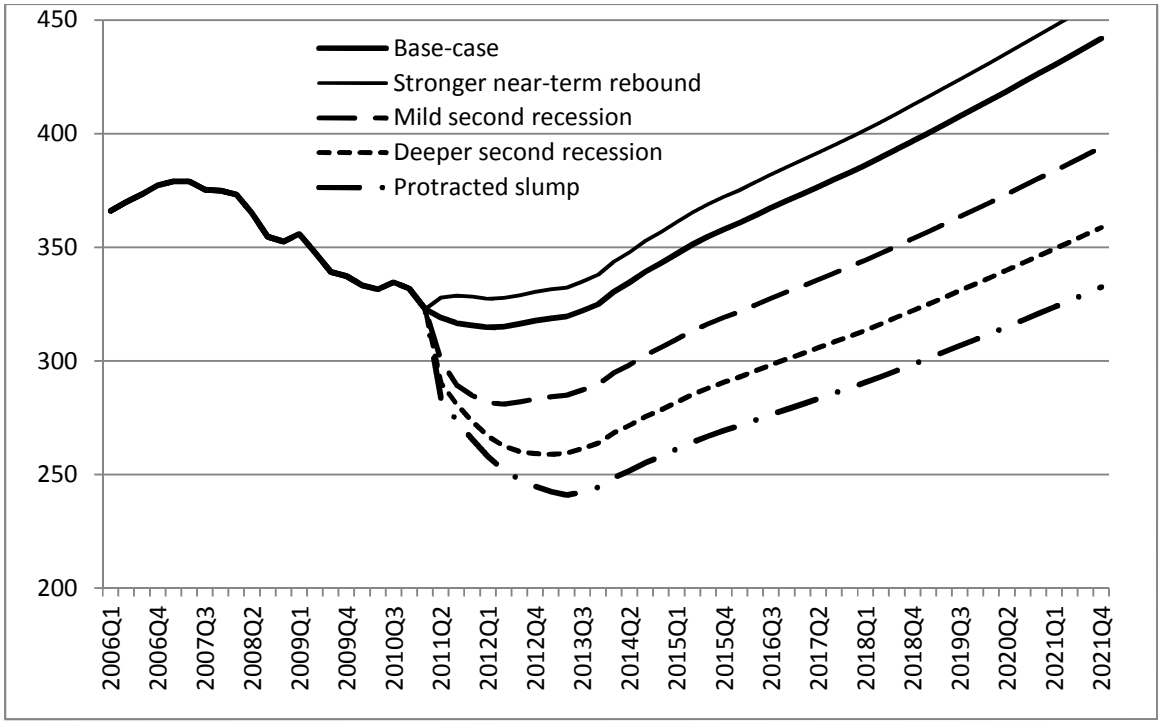
- S1: Stronger Near-Term Rebound Scenario, representing the 90th percentile of the economic scenarios (a 10% chance the economy will perform as well as or better than this scenario).
- S2: Mild Second Recession Scenario, representing the 25th percentile of the economic scenarios.
- S3: Deeper Second Recession Scenario, representing the 10th percentile of the economic scenarios.
- S4: Protracted Slump Scenario, representing the 4th percentile of economic scenarios.
- S5: Low Interest Rates Scenario, representing a continuation of the historically very low rate environment prevailing at the end of FY 2011.

In Moody's base-case and its four alternative economic scenarios, the future paths of interest rates all rise rapidly in the near term. In a press release during August of 2011, the Federal Reserve Board announced its intention to keep the federal funds rate low for the next two years. To recognize this policy, for the fifth alternative scenario S5 we couple the base-case home price scenario with an interest rate path that flat-lines at the current very low level through the end of FY 2013 and then linearly rises to match the base-case rate scenario by the end of FY 2015.

Under Moody's forecast methodology, the levels of the house price indices for any scenario converge to similar long-term index values. As has been done in the Actuarial Reviews for forward mortgages (IFE Group (2010)), we used an adjustment to this methodology where the growth rates converge to long-run growth rates instead of converging the indices to their long term levels. This adjustment avoids having the stress scenarios show relatively much faster growth after cyclical bottoms. (See Appendix B for more details.)

Exhibit V-1 shows the future movements of the national-level House Price Index under the July 2011 base-case and the four Moody's alternative economic scenarios after our adjustment.

Exhibit V-1 Future National House Price Index for Different Economic Scenarios



The macroeconomic factors that serve as inputs to the HECM model components include the FHFA national, state, and MSA house price indices, the ten-year Treasury rate, the one-year Treasury rate and the one-year and ten-year LIBOR rates. Moody's house price forecasts are part of its macroeconomic model which considers local area economic environments including unemployment rates. The base-case mortality rates were based on the 1999-2001 U. S. Decennial Life Exhibit published by the Center for Disease Control and Prevention in 2004. Borrower cash draw assumptions were based on past program experience, with adjustments to account for the different borrower composition provided by FHA.

Exhibit V-2 presents the projected economic value as of FY 2011 through FY 2018 under the base-case scenario.[14] The economic value of the HECM portfolio in the MMI Fund at the end of FY 2011 is positive $1.36 billion. The economic value of the HECM portfolio of the MMI Fund grows steadily to $10.03 billion by the end of FY 2018.

[14] Note that Exhibit V-2 is the same as Exhibit II-1, reproduced in this section for convenience.

Exhibit V-2: HECM Projected Fund Performance under the Base-Case Scenario ($ Millions)

Fiscal Year[1]	Economic Value	Insurance in Force[2]	Volume of New Endorsements[3]	Economic Value of Each New Book of Business	Investment Earnings on Fund Balance
2011	$1,358	$68,373	$18,792	-$159	
2012	2,107	85,077	17,981	742	8
2013	3,102	102,333	22,592	951	44
2014	4,212	121,274	26,425	1,027	83
2015	5,458	142,542	31,889	1,125	120
2016	6,824	164,957	36,243	1,205	162
2017	8,355	187,086	40,027	1,288	243
2018	10,033	208,691	43,451	1,325	353

1. All values, except the volume of new endorsements, are expressed as of the end of the fiscal year.
2. Insurance-in-force is estimated as the MCAs of the remaining insured loans.
3. Projections provided by the HECM demand model in Appendix E times the average MCA.

The impact of each of the alternate scenarios on the performance of the HECM portion of the MMI Fund is now presented.

S1. Stronger Near-Term Rebound Scenario

Exhibit V-3 presents the projected economic values over FY 2011 through FY 2018 under the stronger near-term rebound scenario. The economic value at the end of FY 2011 increases from the baseline positive $1.36 billion to $1.73 billion under this alternative scenario. This is primarily due to the higher near-term House Price Appreciation (HPA) which increases the amount of recovery at termination. The impact on the future books of business is relatively small as this scenario's economic forecast for later years is similar to the baseline. The FY 2018 value is about $1.45 billion higher than in the base-case scenario.

Exhibit V-3: HECM Projected Fund Performance under the Stronger Near-Term Rebound Scenario ($ Millions)

Fiscal Year	Economic Value	Insurance in Force	Volume of New Endorsements	Economic Value of Each New Book of Business	Investment Earnings on Fund Balance
2011	$1,727	$68,373	$18,792	-$80	
2012	2,538	87,838	20,742	801	10
2013	3,680	108,195	25,845	1,090	52
2014	4,943	130,282	29,990	1,165	98
2015	6,355	154,896	35,928	1,271	141
2016	7,890	180,728	40,557	1,347	188
2017	9,606	206,175	44,513	1,435	281
2018	11,479	230,889	48,043	1,467	406

S2. Mild Second Recession Scenario

Exhibit V-4 presents the projected economic values as of FY 2011 to FY 2018 under the mild second recession scenario. The economic value at the end of FY 2011 decreases from the baseline positive $1.36 billion to negative $878 million under this alternative scenario. The negative impact on the near-term books of business carried over to all the forecasted fiscal years, pulling down the economic value at the end of FY 2018 in this scenario to $4.7 billion, a 53 percent reduction compared to the baseline. The decrease in economic values is primarily due to the lower HPI. With lower forecasted house values, the likelihood of HECM loan balances exceeding house values rises, increasing the probability of higher claim losses and lower post-assignment recovery. Moreover, lower cumulative house price growth lowers the likelihood of refinance and reduces borrowers' incentive to move out, extending the duration of the risk exposure.

Exhibit V-4: HECM Projected Fund Performance under the Mild Second Recession Scenario ($ Millions)

Fiscal Year	Economic Value	Insurance in Force	Volume of New Endorsements	Economic Value of Each New Book of Business	Investment Earnings on Fund Balance
2011	-$878	$68,373	$18,792	-$665	
2012	-390	78,780	11,685	493	-5
2013	212	88,353	14,452	610	-8
2014	905	99,630	17,681	687	6
2015	1,704	112,660	21,923	773	26
2016	2,601	126,530	25,493	846	50
2017	3,618	140,155	28,756	925	93
2018	4,742	153,615	31,831	971	153

S3. Deeper Second Recession Scenario

Exhibit V-5 presents the projected economic values as of FY 2011 to FY 2018 under the deeper second recession scenario. This scenario naturally results in a sizeable decrease in economic values for the FY 2011 through FY 2018 portfolios. The economic values at the end of FY 2011 and at the end of FY 2018 are estimated to decrease to negative $2.61 billion and to positive $1.21 billion, respectively. Similar to the Mild Second Recession Scenario (S2), the decrease in economic values in this scenario is due primarily to the lower forecasted house values and the consequent greater claim severity and reduced recoveries.

Exhibit V-5: HECM Projected Fund Performance under the Deeper Second Recession Scenario ($ Millions)

Fiscal Year	Economic Value	Insurance in Force	Volume of New Endorsements	Economic Value of Each New Book of Business	Investment Earnings on Fund Balance
2011	-$2,614	$68,373	$18,792	-$1,110	
2012	-2,252	76,491	9,395	376	-15
2013	-1,882	81,836	9,936	416	-46
2014	-1,439	88,684	12,722	493	-50
2015	-898	97,196	16,480	583	-41
2016	-276	106,369	19,510	649	-27
2017	429	115,154	22,316	714	-10
2018	1,211	123,823	25,022	764	18

S4. Protracted Slump Scenario

Exhibit V-6 presents the projected economic values as of the FY 2011 through FY 2018 under the protracted slump scenario. This scenario results in the lowest economic values for all books of business in this review. The economic values at the end of FY 2011 and at the end of FY 2018 are estimated to decrease to negative $3.91 billion and negative $1.26 billion, respectively. The FY 2018 value is approximately $9 billion less than base-case scenario. Recall that the S1 rebound scenario had only a $1.45 billion increase in the FY 2018 economic value relative to the base-case, emphasizing the asymmetric nature of the HECM insurance risks. That is, the reductions in HECM portfolio values for weak economies far exceed the increases in HECM portfolio values in strong economies.

Exhibit V-6: HECM Projected Fund Performance under the Protracted Slump Scenario ($ Millions)

Fiscal Year	Economic Value	Insurance in Force	Volume of New Endorsements	Economic Value of Each New Book of Business	Investment Earnings on Fund Balance
2011	-$3,913	$68,373	$18,792	-$1,464	
2012	-3,637	75,243	8,147	299	-22
2013	-3,404	78,376	7,594	308	-75
2014	-3,128	82,234	9,467	367	-91
2015	-2,763	87,638	12,845	455	-89
2016	-2,323	93,743	15,695	521	-82
2017	-1,817	99,628	18,296	589	-83
2018	-1,261	105,381	20,748	633	-77

S5. Low Interest Rates Scenario

Exhibit V-7 presents the projected economic values as of the FY 2011 through FY 2018 MMI HECM portfolio under the low interest rate scenario. This scenario results in somewhat higher economic values than the baseline scenario for all books of business. The economic value at the end of FY 2011 is estimated to increase from positive $1.36 billion as in the base scenario to positive $1.59 billion, and from $10.03 billion to $10.47 billion at the end of FY 2018. Compared to the base-case scenario, the lower interest rates significantly increase HECM demand volume. Some of the increase in demand will be old HECM loans refinancing into new HECM loans. Lower interest rates reduce assignment volumes given the reduced rate of balance accrual. However, the same effect reduces annual insurance premiums. Thus, a net result very similar to the base-case conforms to expectations.

Exhibit V-7: HECM Projected Fund Performance under the Low Interest Rates Scenario ($ Millions)

Fiscal Year	Economic Value	Insurance in Force	Volume of New Endorsements	Economic Value of Each New Book of Business	Investment Earnings on Fund Balance
2011	$1,594	$68,373	$18,792	-$133	
2012	2,107	85,304	18,208	504	9
2013	2,772	104,028	24,064	621	44
2014	3,782	127,244	30,717	936	74
2015	5,200	155,509	38,667	1,310	108
2016	6,799	184,937	43,475	1,445	154
2017	8,565	213,887	47,341	1,524	242
2018	10,474	241,440	50,727	1,547	362

Section VI. Summary of Methodology

This section describes the overall analytical approach implemented in this review. Detailed descriptions of the component models for HECMs are provided in Appendices A-E.

A. HECM Base Termination Model (Appendix A)

No repayment of principal is required on a HECM loan when the loan is active. Termination of a HECM loan typically occurs due to death, move-out, or voluntary termination via refinance or payoff. The termination model estimates the probabilities of the three mutually exclusive HECM termination events denoted as mobility, refinance, and mortality. A multinomial logit regression modeling approach is adopted to capture the competing-risk structure of the different termination events. This is consistent with the academic literature and the FHA single-family forward mortgage Actuarial Reviews.

The termination model adopts four main categories of explanatory variables:

- Fixed initial borrower characteristics: borrower age at origination and gender.
- Fixed initial loan characteristics: expected mortgage interest rate, origination year and quarter, the first month cash draw percentage and the estimated ratio of property value to the local area's median home values at time of origination.
- Dynamic variables based entirely on loan/borrower characteristics: mortgage age (i.e., policy year, mortality rate.)
- Dynamic variables derived by combining loan characteristics with external macroeconomic data: interest rates, house price indices (determines the cumulative house price growth), the amount of additional equity available to the borrower through refinancing, and the probability of negative equity.

For each termination event, a separate binomial logit model is estimated based on loan-level historical HECM data and economic factors. The three logit models are then aggregated to estimate the overall termination probabilities for the HECM program, following the approach suggested in Begg and Gray (1984). The logit model for each termination event is unique, including only the variables that impact the occurrence of that particular event. For example, the mobility model includes an estimate of the probability of negative equity over time to model the impact of potential gains from resale on the likelihood of move-out. The refinance model includes a first-month cash draw variable that acts as an indicator of the borrowers' behavioral pattern drawing cash. The mortality model includes the attained age of the borrower over the life of the loan and the borrower's gender for the impact of age and gender on the probability of death.

B. Loan Performance Projections (Appendix B)

The estimated HECM future termination rates are based on the surviving portfolio at the end of FY 2011 as well as the level of future endorsements. Each loan creates an annual observation from its origin to the policy year associated with the loan being 35 years old, the maximum assumed duration of a HECM loan. The future HECM endorsements for FY 2012 through FY 2018 were cloned from past endorsements. The characteristics of the future loans followed assumptions provided by FHA. To forecast the economic values of the MMI HECM portfolio, the base-case economic scenario and four alternative scenarios were downloaded from Moody's economic.com website in July 2011. The economic scenarios are determined by Moody's proprietary general equilibrium model of various markets. We constructed a fifth alternative scenario based on continued very low interest rates. These scenarios serve as the macroeconomic inputs to the base termination model, the HECM tax and insurance default model, and the HECM demand model.

C. HECM Cash Flow Analysis (Appendix C)

The cash flow model estimates the HECM economic values for the FY 2011 through FY 2018 books of business. It computes the net present value of future cash flows for these books of business. The HECM cash flow model consists of four components: upfront and annual HECM mortgage insurance premiums, lender insurance claims before assignment, note holding expenses (post-assignment), and recoveries on assigned notes in inventory. The cash flows are discounted according to the most recent Federal credit subsidy present value conversion factors.[15]

D. HECM Tax and Insurance Default Model (Appendix D)

In this year's Review, we built a new econometric model of HECM tax and insurance defaults. The specification is binomial logit, estimating the probability that a borrower defaults on their tax and insurance obligations as a function of various borrower, loan and economic characteristics. The model's implementation allows these defaults to happen before or after loan assignment. The HECM portfolio of active loans as of June 30, 2011 has a projected cumulative tax and insurance default rate of 2.2%.

E. HECM Demand Model (Appendix E)

We also introduce this year a new HECM demand volume model. The model is a quarterly time series econometric model built on data for HECM loan counts, house price growth rates at the national level, the change in the senior population size, and 1-year Treasury rates. The model predicts the future number of HECM loans that will be endorsed in FY 2012 through FY 2018. The different economic scenarios for house prices and interest rates now generate different predictions of the future HECM loan counts.

[15]At the time of this Review, the latest annual discount factors published by the Office of Management and Budget (OMB) were in November 2010.

Section VII. Qualifications and Limitations

The economic value estimates provided in this Review are based on the component models that were discussed in Section VI. The models make predictions about HECM-related markets that will naturally change over time in response to economic and institutional factors.

A. Basic Data and Model Limitations

The quality of any model built on historical data will be constrained by the scope, availability and accuracy of the data. Key variables determining market behavior may not be observed or they may be observed with error. Moreover, the theoretical specification of a model may not adequately capture the economic phenomena it tries to represent.

As an example of data limitations, HECM has a relatively short program history. The pilot program began in FY 1989 and became permanent in FY 1998 after endorsing only 20,000 loans. The endorsements exceeded 10,000 loans per year in FY 2002 and reached 100,000 per year in FY 2007. Unlike the MMI Single Family forward mortgage program, HECM has a limited number of loans that have remained in FHA's portfolio for more than six years. The lack of long-run performance data potentially limits the robustness of the models' predictive capacity for later policy years.

As an example of model risk, the financial estimates presented in this review require economic forecasts of interest rates and house prices as far as forty years into the future. The extent to which the realized experience differs from these model assumptions will affect how close our current estimates will be to the realized results in the future. Due to the long-term nature of HECM cash flows, the estimates of economic value are also quite sensitive to the discounting assumptions. Unlike the MMI Single Family forward mortgages, whose claim and recovery cash flows typically occur within the first seven years following loan origination, the majority of HECM cash flows occur in later policy years. Hence, the present value of HECM cash flows is particularly sensitive to the discount factors adopted in this review. As the interest rate environment changes, updated yield curve assumptions will have a noticeable impact on the projected cash flows in future years.

B. Changing Reverse Mortgage Market Landscape

Changes in financial markets and retirement needs will affect both the reasons why borrowers participate in the HECM Program and the specifics of new product offerings. This will affect the loan characteristics and performance of future endorsements including cash draw patterns and repayment behavior. Borrower characteristics will vary with the changing demographic as the large baby boomer population transitions to retirement. Hence, the accuracy of the estimates on the performance of future books is sensitive to the borrower composition and behavioral assumptions.

As discussed, FHA started to offer the HECM Saver option to borrowers in FY 2011. The HECM Saver has a lower upfront mortgage insurance premium and also lower PLFs. The pricing option should attract borrowers who require less funds and may not consider a Standard HECM due to the upfront mortgage insurance premium of two percent. These borrowers' cash draw and termination patterns could likely differ from the past experience of the HECM program. The modeling assumptions for HECM Saver are adjusted accordingly based on the insights drawn from FHA's industry research on similar commercial products. The impact of this on the HECM economic value will depend on the actual number of endorsements and the realized borrower behavior under this option.

FHA recently increased the annual premium for HECMs from 0.5 percent to 1.25 percent. For each new endorsement, this change will generate larger cash inflows. On the other hand, the change may reduce HECM demand and lower portfolio-level revenues and realized economic values if the change had not been made. It also results in a more rapid accumulation of loan balances with borrowers reaching the maximum claim amounts more quickly. Quantifying the tradeoffs between insurance rates and economic values should remain an area of attention of the HECM program management.

This review has not explicitly modeled the impact of future possible changes in longevity on the HECM program. This remains another area that could be investigated in the future.

Appendix A: HECM Base Termination Model

This appendix describes the methodology used to estimate the termination behavior of HECM loans. The FY 2010 HECM Review was prepared by IBM Global Business Services, while this year's report (FY 2011 HECM Review) was prepared by the IFE Group. To promote consistency in the actuarial analysis, we retained the same methodology and model specification that was used in the FY 2010 HECM Review. The primary changes this year were the updating of data and the re-estimation of model parameters.

HECM loans terminate due to borrower move-outs (mobility), loan refinancing, or borrower mortality (death). A multinomial logit model was specified and estimated to capture the loan termination behavior. Pursuant to Mortgagee Letter 2011-01, HECM loans now can be also terminated under foreclosure when borrowers fail to pay their real estate taxes or hazard insurance premiums as required by the HECM contract. In replacing last year's assumption-driven approach, the IFE Group built a new econometric model of tax and insurance (T&I) defaults (discussed in Appendix D). When necessary, we distinguish the base termination model discussed in this appendix from the T&I default termination model described in Appendix D. To clarify another possible confusion, the HECM insurance coverage for a third-party investor terminates at the mortgage note assignment to FHA but the HECM loan itself does not terminate at this time. Hence, note assignments were not modeled as HECM loan terminations. Also note that the HECM model is an annual model, whereas the actuarial review models used for FHA forward mortgages are quarterly.

The available FHA historical HECM termination and survivorship data were used to re-estimate the base termination model. These data include loans that were endorsed under the General Insurance (GI) fund between FY 1990 and FY 2008, and loans endorsed under the Mutual Mortgage Insurance (MMI) fund in FY 2009 through the end of March of 2011.

A1. The Multinomial Logit Model

Similar to Szymanoski, DiVenti, and Chow (2000), Yuen-Reed and Szymanoski (2007) and previous actuarial reviews of forward mortgages (IFE Group 2010), a competing risk multinomial regression model is used to estimate the probabilities of HECM loan termination events (not including T&I default terminations).

Given survival to the beginning of time period *t*, the conditional probabilities that a loan will terminate due to mortality ($P_D(t)$), mobility ($P_M(t)$) or refinance ($P_R(t)$) are given by:

$$P_D(t) = \frac{e^{\alpha_D + X_D(t)\beta_D}}{1 + e^{\alpha_M + X_M(t)\beta_M} + e^{\alpha_R + X_R(t)\beta_R} + e^{\alpha_D + X_D(t)\beta_D}} \qquad \{Equation\ 1\}$$

$$P_R(t) = \frac{e^{\alpha_R + X_R(t)\beta_R}}{1 + e^{\alpha_M + X_M(t)\beta_M} + e^{\alpha_R + X_R(t)\beta_R} + e^{\alpha_D + X_D(t)\beta_D}} \qquad \{Equation\ 2\}$$

$$P_M(t) = \frac{e^{\alpha_M + X_M(t)\beta_M}}{1 + e^{\alpha_M + X_M(t)\beta_M} + e^{\alpha_R + X_R(t)\beta_R} + e^{\alpha_D + X_D(t)\beta_D}} \qquad \{Equation\ 3\}$$

The probability of remaining active during the period is simply one minus the sum of these three probabilities. The constant terms α_D, α_R, and α_M as well as the coefficient vectors β_D, β_R and β_M are the parameters estimated by the multinomial logit model. The subscripts "D", "R" and "M" denote mortality, refinance and mobility, respectively. The vectors of dependent variables for predicting the conditional probability of termination due to mortality, refinance and mobility are represented by $X_D(t)$, $X_R(t)$ and $X_M(t)$, respectively. Several economic, loan and borrower characteristics are included in each vector to predict HECM terminations. Some of these components are held constant over the life of the loan while others may vary over time.

To classify observed terminations among the three possible outcomes, terminations that resulted from refinances were based on FHA's endorsement records. The remaining terminations were cross-referenced with the Social Security Administration's mortality data provided by FHA. If a loan terminated within one year prior to and two years after the borrower's recorded death date[1], the loan is considered to have terminated due to death. The remaining terminations are classified as mobility terminations.

The estimation technique for the multinomial equation system follows Begg and Gray (1984), who showed that it is statistically equivalent to model a multinomial logit regression model as an aggregation of individually estimated binomial logit regression models. For more details, see the FY 2010 Actuarial Review (IFE Group 2010) of forward mortgages. The next subsections describe the three binomial logit sub-models.

A1.1. Mortality Model

The mortality model estimates the probability that a HECM loan terminates due to the death of the borrower. Social Security Administration mortality data obtained by FHA indicate the date of death for HECM borrowers. The IFE Group received updated mortality data in March of 2011. Death dates were aligned with termination dates to determine which loans terminated due to death.

In contrast to the mobility and refinance model, the mortality model does not include economic or loan characteristics. The three major variables in forecasting death terminations are mortality rates, gender, and policy year.

The *GenderSpecificMortality* variable is used as the baseline of the mortality model. It is the gender-specific mortality rates from the 1999-2001 U.S. Decennial Life Table from the Center for Disease Control and Prevention, shifted by two years to account for the time lag of recorded termination dates and the actual death dates. For loans with co-borrowers (couples), the likelihood of both borrowers not surviving up to the period is used to estimate the loan's overall mortality rates. *Equation 4* depicts the *GenderSpecificMortality* [*M(t)*] calculation.

[1] For loans with multiple borrowers, the most recent date of death among all borrowers is used.

$$M(t) = \begin{cases} m_{female}(t-2) & \text{if gender = female} \\ m_{male}(t-2) & \text{if gender = male} \\ 1-[1-m_{male}(t-2)]*[1-m_{female}(t-2)] & \text{if gender = couple} \end{cases} \quad \textit{\{Equation 4\}}$$

where $M(t)$ represents the gender-specific mortality for borrower with attained age t
$m_g(t)$ represents the mortality rate of gender g for borrower with attained age t based on the U.S. Decennial Life Table

Two additional variables specific to couples are included to capture the unique characteristics for loans with more than one borrower. Past data show that mortality-related termination rates for couples tend to be lower than the joint mortality rate estimated in Equation 4. However, the rate of increase per attained age tends to be greater than the joint mortality as the borrowers' attained ages increase. The dummy variable *Gender(Couple)*, which equals 1 if a couple and 0 otherwise, and the interaction term *Gender(Couple) x M(t)* are designed to account for this experience.

Prior HECM experience also indicates that the likelihood of death terminations increases with policy year while the death termination in the first policy year tends to be low. The time-dependent variable *PolicyYear* and the dummy variable $1stYear_{Dummy}$ capture these factors. The former has a value equal to the number of years the loan has been active and the latter has the value 1 in the first policy year and 0 otherwise.

A1.2. Refinance Model

The refinance model was constructed to estimate the probability a HECM loan will terminate due to the borrower refinancing the loan. The model consists of three types of explanatory variables: duration, borrower-related, and economic variables.

A1.2.1. Duration Variables for Refinance Model

Prior HECM experience shows that the majority of refinances occur beyond the first few years of the loan. To capture this experience, the variables *PolicyYear* and $1stYear_{Dummy}$ are the same as defined in the mortality model; the variables $2ndYear_{Dummy}$ and $3rdYear_{Dummy}$ are additional dummy variables for the earlier policy years.

A1.2.2. Borrower-related Variables for Refinance Model

The variables *OriginationAge* and *Gender* are the two borrower characteristics in the refinance model. *OriginationAge* is the borrower's age at endorsement and is held constant for the life of the loan; historical experience suggests that older borrowers are less likely to refinance. Similarly, borrowers with different genders also refinance at differing rates. *Gender* refers to categorical variables representing female, male, and couple, with female as the baseline in this model. Historical experience suggests that couples are less likely to refinance than females, and males are more likely to refinance than females.

The likelihood of refinancing is also affected by the cash draw utilization of the borrower. An analysis of the data suggests that the first-month cash draw (*1st month cash draw*) foreshadows the likelihood of future refinances. Specifically, borrowers who draw large amounts of cash initially are more likely to refinance than borrowers who do not. We set this dummy variable to 1 if the first month's cash draw was > 85 percent of the contracted amount available and to 0 otherwise.

A1.2.3. Economic Variables for Refinance Model

The refinance incentive measure is designed to model HECM borrowers' willingness and ability to refinance a loan. The refinance incentive measure represents the net increase in principal limit for a borrower given the costs associated with refinancing. *Equation 5* shows the structure of the refinance incentive measure:

$$rfi_t = MAX\left[\frac{\min\left(MCA_0 \times \Delta H, LoanLimit_t\right) \times PLF_t - C - PL_t}{C}, 0\right] \qquad \{Equation\ 5\}$$

where MCA_0 = Original maximum claim amount for loan at time 0

$\Delta H = \frac{HPI_t}{HPI_0}$, HPI is the FHFA house price index per MSA (or state if loans are located outside of an MSA)

$LoanLimit_t$ = FHA loan limit for time t

PLF_t = New principal limit factor for the borrower's age and the current interest rate at time t

C = Transaction cost to originate the refinanced loan

PL_t = Gross principal limit on the original HECM loan at time t

A1.3. Mobility Model

The mobility model estimates the probability that a HECM loan terminates due to the borrower moving out of the HECM property. Factors such as borrower characteristics, economic conditions, and loan specific variables are used to define this last sub-model specification.

A1.3.1. Duration Variables for Mobility Model

As before, the $FirstYear_{Dummy}$ variable has a value of 1 if it is the first year of the loan and 0 for all other years of the loan. This variable was included in the model to reflect the limited number of loans terminating in the first policy year.

Historical experience shows that mobility begins to taper off starting in the tenth year. To model this experience, a duration variable for policy years greater than nine was used. The specification of the duration variable is shown in *Equation 6.*

$$Duration(year9+) = \begin{cases} 0, & \text{if } PolicyYear \le 9 \\ PolicyYear - 9, & \text{if } PolicyYear > 9 \end{cases} \qquad \{Equation\ 6\}$$

A1.3.2. Borrower-related Variables for Mobility Model

Borrower specific characteristics are also key drivers of move-out likelihood. Historical experience suggests that gender and gender-specific mortality rates are two major determining factors.

The *Gender* categorical values are female, male, and couple. The female category is used as the baseline since the majority of HECM borrowers are females. Results show that couples are less likely to move out and males are more likely to move out.

The *GenderSpecificMortality* variable *M(t)* is designed to capture the borrower's mobility based on health reasons, such as moving to a nursing home or assisted living facility. The gender-specific mortality rates described earlier are used as a proxy for this morbidity notion, except there is no time lag included (that is, there is no two-year shift for this variable).

A1.3.3. Economic Variables for Mobility Model

Historical experience suggests that higher house price appreciation increases the likelihood of move-outs. Moreover, moving out is more likely when the loan interest rate rises, which increases the outstanding loan balance. Quarterly house price appreciation rates and one-year Treasury rates were obtained from Moody's economy.com website as of July 2011. The *CumulativeHPA* variable captures the expected change in the resale value of the home. The *ChangeOneYearCMT* variable captures changes in the relevant interest rates.

The *HomeValueVsAreaMedian* variable estimates the ratio of appraised property value at origination to median value in the local area. The local median house price data is obtained from Moody's at the MSA and state level, with the most granular level available being used for each property. This variable is designed to capture the implicit differences in move-out behavior of borrowers whose homes have higher relative values than that of borrowers whose homes have lower relative values.

The *ProbabilityOfNegEquity* is a dummy variable based on the probability of negative equity being greater than or less than ten percent. The probability of negative equity represents the likelihood of the estimated home value falling below the projected loan balance during the period of observation. Historical experience indicates that HECM borrowers with higher probability of negative equity tend to remain in their homes longer than borrowers with lower probability of negative equity.

The distributions of individual home values are estimated based on the house price drift and volatility parameters derived from computed house price indexes. The parameters α and β below represent the variability of home values within a geographical area, which are specific to MSAs and states. The parameter c represents the variability of home values over time, which is also specific to MSAs and states. The parameters α and β are provided by FHA and sourced from the financial regulator FHFA and the parameter c is directly calculated by the IFE Group.

Equation 7 illustrates the calculation of the diffusion volatility of an individual property based on the time elapsed since origination. Equation 8 and Equation 9 show the calculation of the probability of negative equity and the calculation of the associated binary explanatory variable, respectively.

$$\sigma(t) = \sqrt{\alpha * t + \beta * t^2} \qquad \textit{\{Equation 7\}}$$

$$\Pr\{negEquity\}(t) = \Phi\left\{\frac{\ln(UPB(t)) - \ln(HomePrice(\mathrm{t}))}{\sigma(t)}\right\} \qquad \textit{\{Equation 8\}}$$

where $\Phi(x)$ is the standard normal cumulative distribution function evaluated at x.

UPB(t) is the projected unpaid loan balance at time *t*

HomePrice(t) is the projected median home value at time *t*, estimated as the multiple of the house price at origination and the change in the house price index for the MSA/State

$$probabilityOfNegEquity = \begin{cases} 0, & \text{if } \Pr\{\text{negEquity}\} \le 0.10 \\ 1, & \text{if } \Pr\{\text{negEquity}\} > 0.10 \end{cases} \qquad \textit{\{Equation 9\}}$$

A1.4. Combining the Three Risks

A joint termination hazard rate can be defined as

$$P(t) = \sum_{j=1}^{3} P_j(t) \qquad \textit{\{Equation 10\}}$$

where the P_j were defined in Equations 1, 2, and 3 and are constructed from the binomial logit models for mortality, refinance, and mobility following the methodology of Begg and Gray (1984).

The majority of HECM loans have been endorsed in the past seven years, which limits the number of loans that have remained in FHA's portfolio for a significant amount of time. As a result of this limited seasoning experience, the accuracy of the model to predict terminations for later policy years is potentially poor. Experience with elderly homeowners has shown that as the borrower ages, the likelihood of move-outs (mobility) and refinances decreases and hence mortality would dominate as the cause of terminations. Therefore, to enhance the model's accuracy for loans surviving many years, the termination model combines the hazard rate from *Equation 10* with the borrower's mortality rate.

$$h_i(t) = \begin{cases} P(t), & \text{for } PolicyYear\ t \le 5 \\ MAX\{P(t), m_i(t)\}, & \text{for } PolicyYear\ t > 5 \end{cases} \qquad \{Equation\ 11\}$$

where $m_i(t) = \text{mortality of borrower's attained age for loan } i \text{ at time } t$

Consequently $h_i(t)$ is an augmented joint conditional probability that a HECM loan will terminate due to any one of the three competing risks, with $m_i(t)$ serving as a floor for policy years greater than five. These $h_i(t)$ probabilities are calculated at the loan level and used to estimate the future cash flows.

A2. Model Estimation Results

Exhibits A2.1, A2.2, and A2.3 present the coefficient estimates for the parameters for the binomial logit regression models that estimate mortality, refinance, and mobility termination probabilities. To facilitate comparisons, the parameter values from last year's actuarial review are also given.

Exhibit A2.1: Mortality Termination Model Specifications

Variable Name	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	2010 Estimate
Intercept	-4.168	0.012	131824.9	<.0001	-4.054
First Year (Dummy)	-0.731	0.016	2122.2	<.0001	-0.779
Policy Year	0.046	0.002	475.6	<.0001	0.041
Gender (Couple)	-2.182	0.028	6062.7	<.0001	-2.135
Gender Specific Mortality Rate (Shifted)*	10.334	0.077	18119.5	<.0001	11.031
Interaction (Couple by Mortality) (%)	1.561	0.170	84.5	<.0001	1.063

Goodness-of-Fit	
-2 Log Likelihood	354,623
Number of Observations	1,956,251
Likelihood Ratio Chi-Square	43,313
Probability > Chi-Square	<.0001
Predictive Power	
Percent Concordant	77.0
Percent Discordant	20.3

* Mortality rates shifted 2 years to account for delay in termination date after death date

Exhibit A2.2: Refinance Termination Model Specifications

Variable Name	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	2010 Estimate
Intercept	-2.705	0.062	1889.3	<.0001	-2.171
Policy Year	-0.167	0.005	1363.8	<.0001	-0.174
First Year (Dummy)	-1.252	0.024	2662.5	<.0001	-1.491
Second Year (Dummy)	-0.451	0.020	518.6	<.0001	-0.560
Third Year (Dummy)	-0.175	0.018	100.3	<.0001	-0.173
Origination Age	-0.009	0.001	136.0	<.0001	-0.013
Gender (Couple)	-0.084	0.007	130.4	<.0001	-0.090
Gender (Male)	0.119	0.009	180.5	<.0001	0.142
Refinance Incentive Measure	0.290	0.002	14719.4	<.0001	0.259
First Month Cash Draw > 85% (Dummy)	0.506	0.011	2343.6	<.0001	0.605

Goodness-of-Fit	
-2 Log Likelihood	376,514
Number of Observations	1,955,975
Likelihood Ratio Chi-Square	19,287
Probability > Chi-Square	<.0001
Predictive Power	
Percent Concordant	64.1
Percent Discordant	29.6

Exhibit A2.3: Mobility Termination Model Specifications

Variable Name	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	2010 Estimate
Intercept	-3.801	0.011	130148.4	<.0001	-3.763
Duration (year 9+)	-0.221	0.009	643.6	<.0001	-0.195
First Year (Dummy)	-0.810	0.014	3524.8	<.0001	-0.871
Gender (Couple)	-0.166	0.007	517.6	<.0001	-0.154
Gender (Male)	0.030	0.009	10.8	0.0010	0.038
Cumulative HPA (%)	0.011	0.000	5620.9	<.0001	0.011
1-Year CMT Change < -10% (Dummy)	-0.422	0.007	3299.3	<.0001	-0.334
1-Year CMT Change > 10% (Dummy)	0.145	0.008	332.6	<.0001	0.125
Gender Specific Mortality Rate	5.087	0.073	4925.8	<.0001	5.026
Property Value > MSA Median (Dummy)	0.139	0.010	193.5	<.0001	0.128
Pneg > 0.10 (Dummy)	-0.827	0.023	1285.5	<.0001	-0.747

Goodness-of-Fit	
-2 Log Likelihood	410,683
Number of Observations	1,955,975
Likelihood Ratio Chi-Square	34,186.2
Probability > Chi-Square	<.0001
Predictive Power	
Percent Concordant	72.9
Percent Discordant	24.0

A3. Base Termination Model Implementation

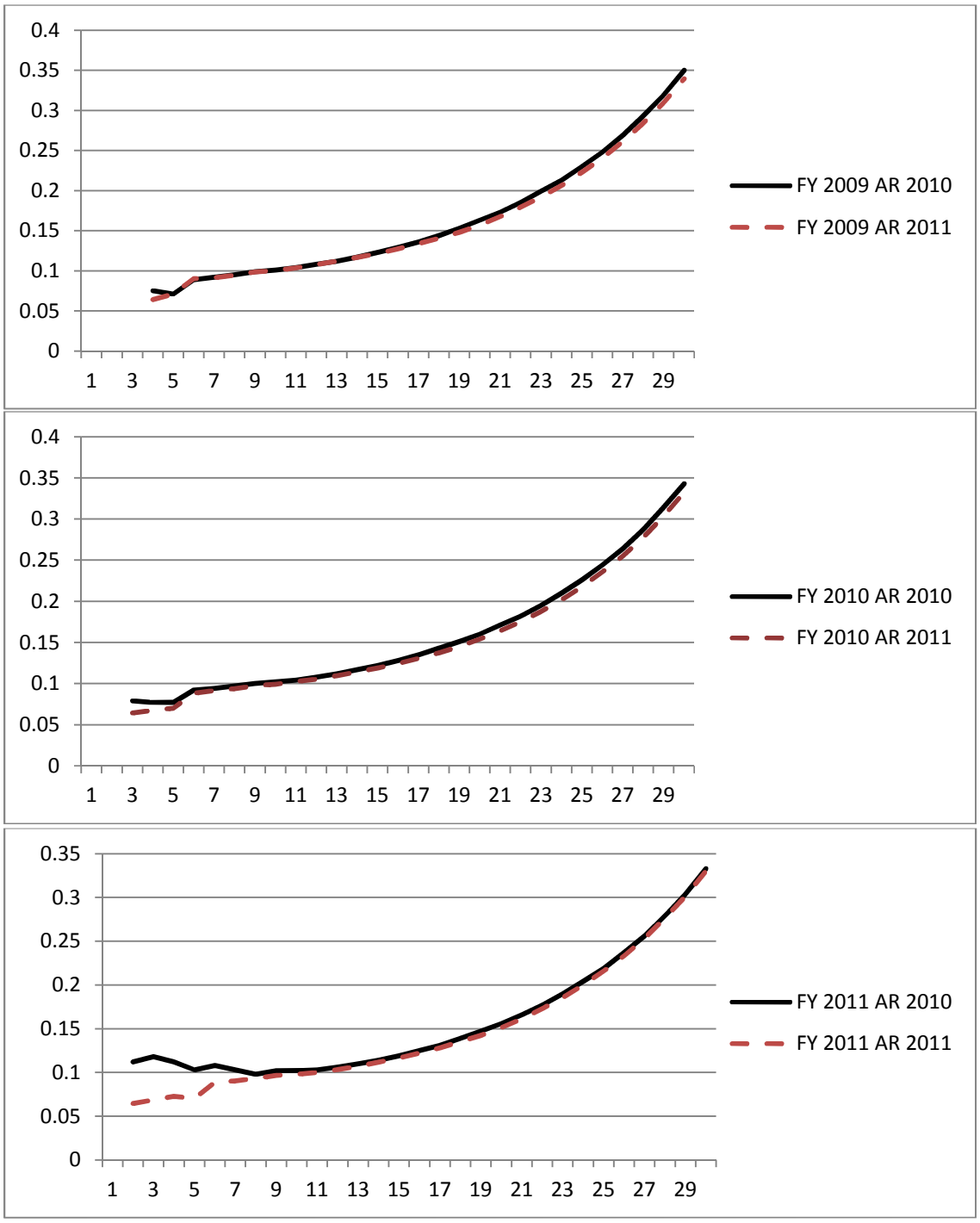
Representing the joint hazard defined in Equation 11, Table A3.1 below shows the conditional HECM termination rates by policy year (loan age) and the fiscal years that loans were endorsed. This table updates Appendix D in the FY 2010 HECM report prepared by IBM Global Services (2010).

Exhibit A3.1: HECM Termination Rates Conditional on Surviving to the Beginning of the Policy Year

	Endorsement Fiscal Year									
Policy Year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
1	.	.	.	3.38%	4.26%	3.50%	3.21%	3.20%	3.21%	3.20%
2	.	.	6.45%	7.67%	8.88%	7.01%	6.86%	6.86%	6.86%	6.83%
3	.	6.45%	6.87%	8.37%	8.97%	7.62%	7.52%	7.52%	7.48%	7.50%
4	6.40%	6.78%	7.26%	8.35%	9.35%	8.24%	8.09%	8.02%	8.09%	7.98%
5	7.10%	7.00%	7.05%	8.60%	9.40%	8.41%	8.26%	8.20%	8.21%	8.13%
6	9.03%	8.85%	8.87%	9.76%	10.33%	9.62%	9.47%	9.46%	9.45%	9.42%
7	9.11%	9.13%	9.03%	9.98%	10.52%	9.89%	9.74%	9.73%	9.68%	9.69%
8	9.43%	9.39%	9.33%	10.31%	10.82%	10.25%	10.07%	10.06%	10.07%	10.01%
9	9.84%	9.74%	9.67%	10.63%	11.08%	10.59%	10.46%	10.47%	10.45%	10.37%
10	10.07%	9.93%	9.80%	10.53%	10.97%	10.55%	10.45%	10.44%	10.40%	10.39%
11	10.38%	10.23%	10.01%	10.62%	10.94%	10.63%	10.49%	10.54%	10.48%	10.44%
12	10.78%	10.54%	10.33%	10.81%	11.20%	10.80%	10.74%	10.71%	10.76%	10.71%
13	11.20%	10.95%	10.71%	11.15%	11.41%	11.16%	11.05%	11.05%	11.06%	11.06%
14	11.65%	11.43%	11.18%	11.52%	11.80%	11.55%	11.45%	11.42%	11.50%	11.46%
15	12.15%	11.89%	11.65%	12.01%	12.25%	11.97%	11.93%	11.95%	11.97%	11.98%
16	12.72%	12.43%	12.22%	12.53%	12.82%	12.52%	12.49%	12.48%	12.48%	12.51%
17	13.38%	13.05%	12.81%	13.17%	13.40%	13.15%	13.01%	13.10%	13.11%	13.08%
18	14.03%	13.75%	13.55%	13.84%	14.01%	13.75%	13.75%	13.75%	13.77%	13.77%
19	14.81%	14.50%	14.24%	14.62%	14.81%	14.60%	14.51%	14.51%	14.50%	14.51%
20	15.69%	15.42%	15.12%	15.49%	15.70%	15.41%	15.42%	15.42%	15.35%	15.39%
21	16.75%	16.40%	16.13%	16.47%	16.71%	16.45%	16.36%	16.39%	16.45%	16.41%
22	17.92%	17.52%	17.28%	17.59%	17.81%	17.53%	17.49%	17.53%	17.53%	17.52%
23	19.21%	18.75%	18.55%	18.88%	19.04%	18.79%	18.78%	18.78%	18.81%	18.78%
24	20.65%	20.21%	19.98%	20.23%	20.44%	20.19%	20.20%	20.21%	20.26%	20.25%
25	22.28%	21.76%	21.60%	21.83%	22.04%	21.77%	21.74%	21.77%	21.75%	21.80%
26	24.07%	23.56%	23.35%	23.57%	23.74%	23.49%	23.53%	23.61%	23.53%	23.56%
27	26.09%	25.49%	25.32%	25.58%	25.69%	25.49%	25.48%	25.52%	25.48%	25.52%
28	28.39%	27.75%	27.65%	27.79%	27.88%	27.69%	27.68%	27.71%	27.68%	27.82%
29	30.95%	30.34%	30.14%	30.38%	30.47%	30.35%	30.34%	30.31%	30.35%	30.31%
30	33.93%	33.24%	33.03%	33.19%	33.31%	33.08%	33.10%	33.18%	33.13%	33.14%
31	37.16%	36.51%	36.36%	36.54%	36.59%	36.33%	36.46%	36.38%	36.40%	36.44%
32	40.92%	40.18%	40.18%	40.28%	40.40%	40.21%	40.17%	40.33%	40.36%	40.21%
33	45.40%	44.64%	44.78%	44.90%	44.98%	44.81%	44.72%	44.86%	44.81%	44.84%
34	49.93%	49.32%	49.63%	49.78%	49.76%	49.68%	49.60%	49.69%	49.72%	49.69%
35	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

The graphs below compare the 2010 Actuarial Review's conditional total termination rates (AR 2010) to these new results (AR 2011) for loans endorsed in FY 2009, FY2010 and FY 2011, respectively. The update to the model parameters reveals little to no impact. The early policy year differences (along the x-axis) are due to updated loan data and to the fact that the FY 2011 endorsed loans were actual loans in this year's review but hypothetical loans in last year's review.

Exhibit A3.2



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Appendix B: HECM Loan Performance Projections

This appendix explains how the HECM termination model, described in Appendix A, was used to forecast future loan terminations. We briefly summarize the economic scenarios for interest rates and home prices that were used in our projections. The adjustments to home price growth rates to account for deferred maintenance risk follow last year's assumptions and are also recapped below. Finally, this appendix describes how the future cohort characteristics assumptions and the HECM loan volume forecasts generate new loan-level endorsements for the future fiscal years 2012-2018.

B1. General Approach to Loan Termination Projections

HECM loan termination rates are estimated for all future policy years for each surviving (active) loan. Policy year is the annual loan age and by assumption all HECM loans will terminate no later than 35 years of life. To illustrate the initial conditions of the forecast, a loan endorsed in FY 2009 has its first termination rate estimated in policy year four since the first three policy years have already elapsed by the end of FY 2011 (the starting date of the forecast). Active loans are distinguished by the fiscal year of endorsement over FY 2009 through FY 2011. In addition to surviving loans from past cohorts, future endorsements are created for FY 2012 to FY 2018 as described in Section B4 below.

The variables used in the analysis are derived from loan characteristics and economic forecasts. Moody's July 2011 forecasts of interest rates and house price indices are combined with the loan data to create all required variables. MSA-level forecasts of house price indices apply to loans in metropolitan areas, otherwise loans inherit their state-level house price index forecasts. Moody's house price forecasts depend on various macroeconomic variables including the local unemployment rate.

For each loan and future policy year, the derived loan variables serve as inputs to the logistic models described in Appendix A. The HECM model is an annual simulation model. Appendix A's termination type models combine to generate a single conditional termination rate per policy year, representing the (joint) probability the loan will terminate in a policy year given that it survived to the end of the prior policy year. The HECM cash flow model uses these forecasted termination rates and projects the associated cash flows at termination.

B2. Economic Scenarios

We used five economic scenarios reported by Moody's economy.com website as of July 2011. The economic factors include the FHFA national, state and MSA housing price indices, the ten-year Treasury rate, the one-year Treasury rate and the one-year LIBOR rate.

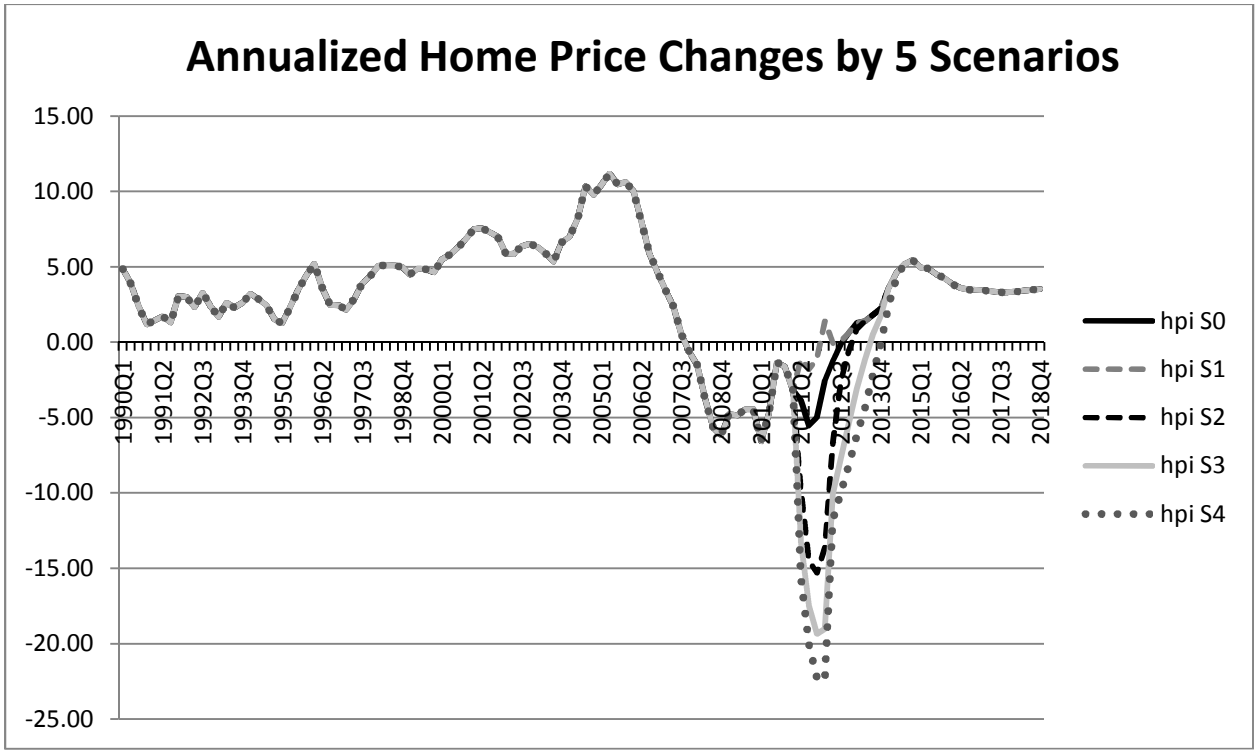
The five scenarios are:

S0- Baseline forecast representing the expected scenario,

S1- Stronger near-term rebound,
S2- Mild second recession,
S3- Deeper second recession,
S4- Protracted slump.

Under Moody's forecast methodology, the levels of the home price indices for any scenario converge to similar long-term index values. As has been done in the actuarial reviews for forward mortgages (IFE Group (2010)), we used an adjustment to this methodology where the growth rates converge to long-run growth rates instead of converging to the levels of the indices. This adjustment avoids having the stress scenarios show relatively much faster growth after cyclical bottoms. Based on quarterly data, the graph below depicts the annualized national home price changes historically and by the five Moody's scenarios after the IFE adjustment (hpi S0, e.g., refers to the HPI for scenario S0).

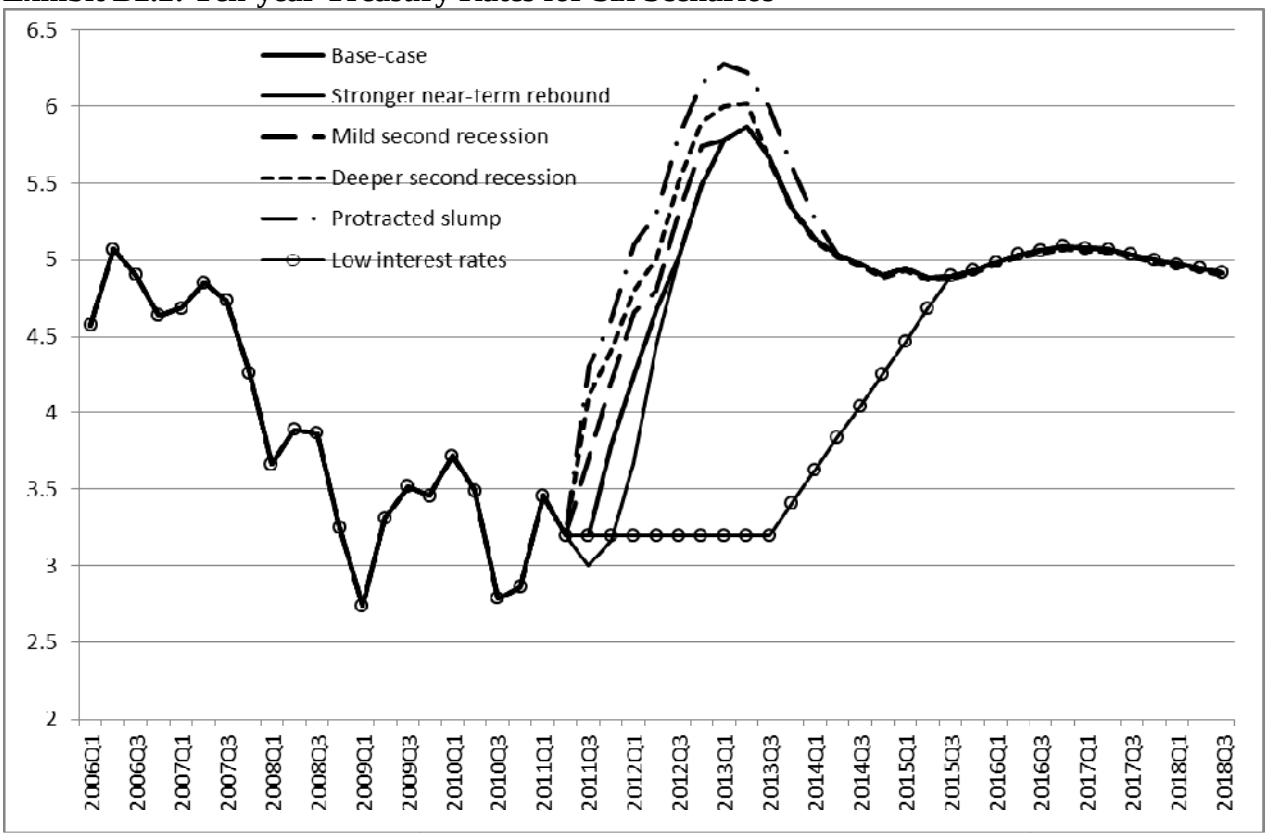
Exhibit B2.1



A similar chart for the 10-year constant maturity Treasury (CMT) rates appears below. To better analyze the interest rate sensitivity of the HECM portfolio, we construct a fifth alternative scenario. In Moody's base-case and its four alternative economic scenarios, the future paths of interest rates all rise rapidly in the near term. In a press release during August 2011, the Federal Reserve Board announced its intention to keep the federal funds rate low for the next two years. To recognize this policy, for the fifth alternative scenario we couple the base-case home price scenario with an interest rate path that remains at the current very low level through the end of FY 2013; the rates then gradually rise toward the long term stable levels of the base-case scenario.

The one-year and ten-year LIBOR rates tend to be a small, positive and time-varying credit spread over Treasury rates of the same duration. These series are not shown for brevity.

Exhibit B2.2: Ten-year Treasury Rates for Six Scenarios



B3. Maintenance-Risk Adjustments

Recent research on the HECM portfolio indicates the need to account for the home maintenance-risk posed by HECM borrowers. Maintenance-risk refers to the moral hazard that borrowers may underinvest in the maintenance on their homes. Based on the work of Shiller and Weiss (2000) and Capone et al. (2010), the effect of maintenance-risk is measured by the spread between the market-level house price growth rate and the HECM portfolio's house price growth rate. The research found that HECM properties with a higher value than the area's median value appreciate at higher rates than those with a lower value than the area's median value.

Exhibit B3.1: Maintenance-Risk Adjustment Factors

	Annual HPA Adjustment	
Loan Age Bucket	**Loans with Property Value Above the Local Area's Median Value at Origination**	**Loans with Property Value Below the Local Area's Median Value at Origination**
1 to 2 Years	+ 2000 bps	+ 600 bps
3 to 4 Years	+ 350 bps	0 bps
5 to 6 Years	+ 160 bps	- 10 bps
7 to 8 Years	+ 100 bps	- 125 bps
9 to 10 Years	+ 0 bps	- 140 bps
11 to 12+ Years	-80 bps	- 170 bps

Thus, FHA estimated the maintenance-risk adjustment factors as listed in the above Exhibit B3.1. These values remain the same as the values used in the 2010 Actuarial Review. Letting HPI denote the level of the house price index, these adjustment factors enter through the formula for the adjusted home price change multiplier "HPM":

*HPM = Exponential{Natural Log (HPI at time t /HPI at origination) + adjustment factor from Exhibit B3.1*loan age in years},*

so that

Adjusted Property Revenue Recovery = HPM*Original Property Value.

The maintenance-risk adjustment factors apply only to property revenue recovery at the projected HECM loan termination date.

B4. Forecasted Endorsement Volume and Portfolio Composition

Based on HECM loan data observed through June of 2011, on the Moody's baseline economic forecast, and on the HECM total demand count model in Appendix E, Exhibit B4.1 shows forecasted HECM endorsement volumes and MCAs for FY 2011 through FY 2018. FHA recently introduced the Saver product, which has a lower upfront insurance premium and lower principal limits in comparison to the original Standard product. FHA estimated the split of total future demand counts into Saver and Standard counts: the Saver share will rise to 10 percent in FY 2012 and steadily increases to 20 percent by FY 2017.

Exhibit B4.1: HECM Volume and MCA Projections

FY	Saver Average MCA	Saver Total Volume	Standard Average MCA	Standard Total Volume	Total Average MCA (Stnd & Saver)	Total Count Volume (Stnd & Saver)	Total Dollar Volume ($m, Stnd & Saver)
2011*	$ 357,616	3,005	$ 246,315	71,916	$ 250,779	74,921	$ 18,789
2012**	$ 349,719	7,142	$ 240,875	64,278	$ 251,759	71,420	$ 17,981
2013	$ 354,225	10,540	$ 243,979	77,294	$ 257,209	87,834	$ 22,592
2014	$ 368,390	13,713	$ 253,736	84,236	$ 269,788	97,949	$ 26,425
2015	$ 387,029	17,850	$ 266,574	93,711	$ 285,847	111,561	$ 31,889
2016	$ 401,973	21,790	$ 276,867	99,268	$ 299,386	121,058	$ 36,243
2017	$ 415,836	25,634	$ 286,415	102,535	$ 312,299	128,169	$ 40,027
2018	$ 430,177	26,899	$ 296,293	107,595	$ 323,070	134,494	$ 43,451

* 2011 data has been annualized by multiplying actual 2011 data as of 6/30/11 by (4/3)
** 2012 data reflects 10% reduction in market volume due to lender withdrawals from the HECM market

The assumptions on the age and gender distribution for FY 2012-2018 were based on 2011 data and are shown below separately for the standard and saver programs.

Exhibit B4.2: Future Endorsement Age and Gender Distribution

Standard FY 2012-18				
Age Group	Male	Female	Couple	Row Totals
62 to 65	24%	33%	44%	100%
66 to 70	21%	34%	45%	100%
71 to 75	19%	39%	42%	100%
76 to 85	21%	49%	30%	100%
85+	22%	68%	10%	100%
Column Totals	**21%**	**41%**	**38%**	**100%**

Saver FY 2012-18				
Age Group	Male	Female	Couple	Row Totals
62 to 65	30.7%	33.7%	35.6%	100%
66 to 70	17.1%	33.2%	49.7%	100%
71 to 75	16.3%	42.0%	41.7%	100%
76 to 85	17.9%	52.4%	29.6%	100%
85+	16.5%	74.1%	9.4%	100%
Column Totals	**19.5%**	**47.0%**	**33.5%**	**100%**

Based on recent data and expected market changes, assumptions about the future market shares of loan amortization types were projected by FHA as in Exhibit B4.3.

Exhibit B4.3: Future Distribution of Loan Amortization Types

FY	Standard fixed rate loan %	Standard variable rate loan %	Saver fixed rate loan %	Saver variable rate loan %
2012	70%	30%	15%	85%
2013-2018	50%	50%	15%	85%

Additional assumptions about future cash draws and related variables were also provided by FHA based on historical averages. All of these assumptions form the basis for generating loan-level data representing future HECM endorsements for FY 2012 to FY 2018. The technique clones recent endorsement records and updates the loan variables according to the various assumptions above made about the future HECM market.

Appendix C: HECM Cash Flow Analysis

This appendix describes the calculation of the present value of future cash flows. Future cash flow calculations are based on projected variables, such as house price appreciation and interest rates, in addition to individual loan characteristics and borrower behavior assumptions. There are four major components of HECM cash flows: insurance premiums, claims, note holding expenses, and recoveries on notes in inventory. HECM cash flows are discounted according to the latest discount factors published by the Office of Management and Budget (OMB). All these elements of cash flow and present value calculations are described in this appendix.

C1. Definitions

The following definitions will facilitate the discussion of HECM cash flows:

- **Maximum Claim Amount (MCA):** Maximum claim amounts are calculated as the minimum of three amounts: the HECM property's appraised value at the time of loan application, the sales price, and the national HECM FHA loan-limit ($625,500 for FY 2012).

- **Insurance-In-Force (IIF):** Refers to the active loans in the HUD insurance portfolio (prior to loan assignment) and calculated as the total of their maximum claim amounts.

- **Conditional Claim Type 1 Rate (CC1R):** Among loans that terminated before note assignment, the percentage of such loans that had a shortfall. The shortfalls are labeled as claim type 1. The other terminations before assignment have zero claim amounts, corresponding to when the property value exceeds the outstanding loan balance by more than the sales transactions cost.

- **Note Holding Period:** The amount of time from note assignment to loan termination. During this period, HUD takes possession of the loan, now called an assigned note, and services it until loan termination.

- **Recoveries**: The property recovery amount received by the FHA at the time of note termination after assignment, expressed as the minimum of the loan balance and the predicted net sales proceeds at termination.

C2. Cash Flow Components

HECM cash flows are comprised of premiums, claims, assignment costs, and recoveries. Premiums consist of upfront and annual mortgage insurance premiums, which are inflows for the HECM program. Recoveries after assignment, a cash inflow, represent cash recovered from the sale or property disposition once the loan has terminated. Claim type 1 payments are a cash outflow paid to the lender when the sale of a property is insufficient to cover the balance of the

loan. Assignment claims and note holding payments are additional outflows. Exhibit C1 summarizes the HECM inflows and outflows.

Exhibit C1: HECM Cash Flows

Cash Flow Component	Inflow	Outflow
Upfront Premiums	X	
Annual Premiums	X	
Claim Type 1 Payments		X
Claim Type 2 (Assignment) Payments		X
Note Holding Expenses		X
Recoveries	X	

We next discuss the major components and calculations associated with these HECM cash flows.

C2.1. Loan Balance

The unpaid principal balance (UPB) is a key input to the cash flow calculations. The UPB at a given time *t* is calculated as follows:

$$UPB_t = UPB_{t-1} + Cash\ Draw_t + Accruals_t$$

The UPB for each period *t* consists of the previous loan balance plus any new borrower cash draws and accruals. The accruals include interest, mortgage insurance payments, and service fees. Future borrower draws are estimated by assigning draw patterns to loans based upon the first-month draw. As noted in Appendix D, we assume that tax and insurance default terminations will accrue additional UPB at an annual rate of 2.5 percent of estimated property value for the assumed two years between the default date and the property disposition date. The possibility of T&I defaults and their accrual assumption has the effect of potentially worsening the present value of HECM insurance losses, depending on property values at termination relative to the UPB.

C2.2. Premiums

Upfront and annual mortgage insurance premiums are the primary source of FHA revenue for the HECM program. Borrowers typically finance the upfront premium when taking out a HECM loan. Similarly, the recurring annual premiums are added to the balance of the loan.

C2.2.1. Upfront Premiums

The upfront premium is paid to the FHA at the time of loan closing. It is equal to a stated percentage of the MCA. Since FY 2009, the upfront premium rate for the Standard HECM contract has been 2 percent of the MCA. We assume that it remains the same throughout our projection period. For FY 2011 and onward, the upfront premium rate for the recently introduced Saver option is 0.01 percent (1 basis point) of the MCA. Typically, the upfront premium is financed by the HECM loan and hence added to the loan balance.

C2.2.2. Annual Premiums

The annual premium is calculated as a percentage of the current loan balance. For FY 2009 and FY 2010 endorsement books of business, the annual premium was 0.5 percent of the UPB. From FY 2011 and onward, the annual premium is set to 1.25 percent of the UPB for both the Standard and Saver options. Typically, the annual premium is paid by the servicer to FHA and added to the accruing loan balance.

C2.3. Claims

HECM claims consist of claim type 1s and claim type 2s.

C2.3.1. Claim Type 1 (Pre-assignment)

Claim type 1s factor into HECM cash flows as payments to the lender when a property is sold and the net proceeds from the sale are insufficient to cover the balance of the loan at termination. Since the inception of the HECM program in 1989, the occurrence of claim type 1 has been relatively rare. The losses from claim type 1s can be expressed as:

Indicator of pre-assignment termination * CC1R defined above * historical severity rate for claim type 1 * unpaid balance, where indicator = 1 if unpaid balance < 98%*MCA and 0 otherwise.

C.2.3.2. Claim Type 2 (Assignment)

Lenders can assign the loan to HUD when the UPB reaches 98 percent of the MCA. HUD acquires the note resulting in acquisition costs equal to the loan balance (up to the MCA). The majority of HECM lenders require the loans to be assigned to HUD when the UPB reaches 98 percent of the MCA. Thus, the HECM forecasting model assumes that the assignment occurs when the projected UPB reaches the 98 percent of MCA threshold. Based on the historical average, the cash outflow at assignment equals 99 percent of the MCA. (In previous HECM actuarial reports the cash outflow was set to 100 percent of the MCA.) The net losses from claim type 2s also depend on the next two factors.

C2.4. Note Holding Expenses after Assignment

The note holding expenses equal the additional borrower cash draws that occur under the historically-based cash drawdown assumptions.

C2.5. Recoveries from Assigned Loans

At note termination for assigned loans, the HECM loan is due and payable to FHA. The timing of loan terminations after assignment (when UPB reaches 98% of MCA) depends on the base termination model in Appendix A and the T&I default model in Appendix D. The amount of recovery equals the minimum of the loan balance and the predicted net sales proceeds at termination, where net sales proceeds equals the difference between projected property value less property selling expenses. For tax and insurance defaults that occur after assignment, the dollar

amount of tax and insurance default accruals are subtracted from the recovery. In effect, FHA books the T&I arrearage through UPB accrual and then pays out the T&I arrearage at loan termination using recovered revenue. According to this modeling convention, T&I arrearage thus functions like an additional property selling expense. Treating T&I default accruals as holding period expenses (as in C2.4) instead of selling expenses would be more realistic if payments were periodically dispersed.

C3. Net Future Cash Flows

The portfolio cash flow for a book-of-business can be computed by aggregating the individual components:

$$\begin{aligned} \textit{Net Cash Flow}_t = \quad & \textit{Upfront Premiums}_t + \textit{Annual Premiums}_t + \textit{Recoveries}_t \\ & - \textit{Claim Type 1s}_t - \textit{Claim Type 2s}_t - \textit{Note Holding Expenses}_t \end{aligned}$$

Note that a negative net cash flow indicates that outflows exceed inflows and a positive cash flow indicates the opposite, that the HECM program is generating a net income. As one example, negative cash flows will occur for a portfolio of HECM loans when the upfront premiums were received in a previous period and there was a preponderance of claim type 2s paid in the current period prior to subsequent recoveries associated with those claims.

To obtain the present value of cash flows, the cash flows are discounted for each policy year and loan cohort according to the latest federal present value discount factors. At the time of this review, the latest discount factors published by the Office of Management and Budget (OMB) were released in November 2010, shown below in Exhibit C2. For this year's actuarial review of HECM, we used end-of-year factors whereas last year's HECM review used middle-of-the-year values. As these discount factors represent the standard to be used by all federal agencies, they do not vary with the different interest rate and home price scenarios that were referenced in Appendix B. OMB is expected to update the discount factors in November 2011.

Exhibit C2: OMB Discount Factors as of November 2010

Fiscal Year	Discount Factor	Fiscal Year	Discount Factor
2012	0.9944	2031	0.4385
2013	0.9743	2032	0.4163
2014	0.9490	2033	0.3952
2015	0.9227	2034	0.3750
2016	0.8961	2035	0.3558
2017	0.8654	2036	0.3375
2018	0.8303	2037	0.3201
2019	0.7944	2038	0.3035
2020	0.7586	2039	0.2877
2021	0.7234	2040	0.2727
2022	0.6893	2041	0.2584
2023	0.6565	2042	0.2449
2024	0.6250	2043	0.2320
2025	0.5947	2044	0.2199
2026	0.5657	2045	0.2084
2027	0.5380	2046	0.1974
2028	0.5114	2047	0.1871
2029	0.4860	2048	0.1773
2030	0.4617	2049	0.1680

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Appendix D: HECM Tax and Insurance Default Model

D1. Background

In Mortgagee Letter (ML) 2011-01, FHA announced that HECM loans with tax or insurance (T&I) delinquencies are considered due and payable, and therefore subject to foreclosure if they do not comply with repayment plans. Through impacts on termination speeds and recovery rates, this servicer guidance has the potential to impact the economic value of the HECM program. The IFE Group developed a new methodology for treating HECM tax and insurance defaults in the analysis conducted for the 2011 Actuarial Review.

D2. Data

FHA's data systems can identify which HECM loans have had episodes of T&I delinquency. Some of these loans will terminate through foreclosure pursuant to ML 2011-01, some will cure, and some will terminate for other reasons. For purposes of this analysis, "cure" is defined as any partial repayment of a T&I delinquency within 12 months of the initial delinquency date, no matter how small the repayment or how large the delinquent amount. Experimenting with more stringent definitions of cure yielded similar statistical results. Under the very broad definition of cure, a mere $10 repayment on a $1000 T&I delinquency would qualify as a cure, provided the repayment date is less than or equal to 12 months after the initial delinquency date. We defined T&I defaults as delinquent cases that were not cured and where the elapsed time since delinquency inception was greater than or equal to 12 months. As described below, a binomial logistic regression estimates the probability of a T&I default in a given year as a function of various explanatory variables.

We processed the HECM loan data provided by FHA[1] to create a unique record for each loan number/activity year combination. The panel data's annual periodicity conforms to the general HECM implementation framework that has been used for several years. In order to build the predictive model, we obtained the following static loan attributes for the entire active HECM loan universe as of March 31, 2011: collateral property state, product type (ARM vs. FRM), borrower age at origination, borrower gender, origination date, initial month cash drawdown as a percentage of the maximum allowable draw, an indicator of whether the home value was above or below the local area median value, and loan age.

[1] The data covers the tax and insurance transaction activity of HECM loans from January 1, 2000 to March 31, 2011.

D2.1. Variable Definitions

We used the following variable specifications in our regression analysis. The omitted categorical variables are indicated as such.

timeDfltAny =1 when the loan reaches 12 months delinquency status during the year with no partial repayments; = 0 if not delinquent or fully cured, partially repaid delinquent, or delinquent less than 12 months during the year. (dependent variable)

cdd_bucket = 1 if initial month cash drawdown >= 80 percent of maximum; 0 otherwise.

origAge6265 = 1 if borrower age at origination is [62, 65]; 0 otherwise.

origAge6670 = 1 if borrower age at origination is [66, 70]; 0 otherwise.

origAge7175 = 1 if borrower age at origination is [71, 75]; 0 otherwise.

origAge7680 = 1 if borrower age at origination is [76, 80]; 0 otherwise.

origAge8185 = 1 if borrower age at origination is [81, 85]; 0 otherwise.

origAge8690 = 1 if borrower age at origination is [86, 90]; 0 otherwise.

origAge91Plus =1 if borrower age at origination >=91; 0 otherwise. {omitted}

gender (baseline=couple) =

0 if there is a borrower and coborrower;

1 if male borrower, no female coborrower;

2 if female borrower, no male coborrower.

stateFL = 1 if collateral property in Florida; 0 otherwise.

stateCA = 1 if collateral property in California; 0 otherwise.

stateTX = 1 if collateral property in Texas; 0 otherwise.

frm = 1 if product=Fixed Rate Mortgage; 0 otherwise.

hp_above_med =1 if HECM home value is above area median value; 0 otherwise.

currLnAgeQtr0_4 =1 if current loan age <=1 year; 0 otherwise. {omitted}

currLnAgeQtr5_8 =1 if current loan age is (1,2] years; 0 otherwise.

currLnAgeQtr9_12 =1 if current loan age is (2,3] years; 0 otherwise.

currLnAgeQtr13_16 =1 if current loan age is (3,4] years; 0 otherwise.

currLnAgeQtr17Plus =1 if current loan age >4 years; 0 otherwise.

D2.2. Descriptive Statistics

Exhibits D1 and D2 show selected variable statistics for the general dataset prior to the application of the regression filters noted in the next section. Because all variables were bucketed, we show the number and percentage of cases that equal zero or one.

Exhibit D1: Descriptive Statics, Static Attributes, Active Loans

Variable	N	# obs=0	# obs=1	% =0	% =1
cdd_bucket	475,876	269,360	206,516	56.6%	43.4%
Frm	475,876	430,564	45,312	90.5%	9.5%
origAge6265	475,876	386,192	89,684	81.2%	18.8%
origAge6670	475,876	358,948	116,928	75.4%	24.6%
origAge7175	475,876	362,946	112,930	76.3%	23.7%
origAge7680	475,876	388,853	87,023	81.7%	18.3%
origAge8185	475,876	427,909	47,967	89.9%	10.1%
origAge8690	475,876	459,240	16,636	96.5%	3.5%
origAge91Plus	475,876	471,168	4,708	99.0%	1.0%
stateCA	475,876	392,828	83,048	82.6%	17.4%
stateFL	475,876	411,024	64,852	86.4%	13.6%
stateTX	475,876	446,175	29,701	93.8%	6.2%

Exhibit D2: Descriptive Statistics, Active Loan Time Series

Variable	N	# obs=0	# obs =1	% = 0	% =1
currLnAgeQtr0_4	2,232,834	1,622,211	610,623	72.65%	27.35%
currLnAgeQtr5_8	2,232,834	1,721,344	511,490	77.09%	22.91%
currLnAgeQtr9_12	2,232,834	1,828,401	404,433	81.89%	18.11%
currLnAgeQtr13_16	2,232,834	1,939,924	292,910	86.88%	13.12%
currLnAgeQtr17Plus	2,232,834	1,819,456	413,378	81.49%	18.51%
timeDfltAny	2,157,698	2,149,012	8,686	99.60%	0.40%

D3. T&I Default Model

In estimating the T&I default model, we restrict the data to active loans as of 3/31/2011 to align with the ML 2011-01 announcement. Endorsements prior to 2000 are excluded because of data quality considerations. Regression results are provided below in Exhibits D3-D6.

Exhibit D3: Analysis of Maximum Likelihood Estimates of T&I Default Model

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	−10.9086	0.2690	1644.6	<.0001
cdd_bucket	1	1.1758	0.0240	2392.3	<.0001
origAge6670	1	−0.1806	0.0323	31.3	<.0001
origAge7175	1	−0.4021	0.0339	140.5	<.0001
origAge7680	1	−0.4655	0.0365	162.6	<.0001
origAge8185	1	−0.3929	0.0430	83.4	<.0001
origAge8690	1	−0.4722	0.0691	46.8	<.0001
origAge91Plus	1	−0.4863	0.1302	14.0	0.0002
gender female vs. couple	1	0.2879	0.0152	358.5	<.0001
gender male vs. couple	1	0.3781	0.0180	442.6	<.0001
stateFL	1	0.1654	0.0319	26.9	<.0001
stateCA	1	−0.5604	0.0368	231.7	<.0001
stateTX	1	0.6626	0.0332	398.2	<.0001
frm	1	−0.7628	0.1103	47.8	<.0001
hp_above_med	1	−0.4211	0.0269	245.8	<.0001
currLnAgeQtr5_8	1	4.4331	0.2692	271.2	<.0001
currLnAgeQtr9_12	1	5.8555	0.2679	477.6	<.0001
currLnAgeQtr13_16	1	5.9233	0.2682	487.6	<.0001
currLnAgeQtr17Plus	1	5.5706	0.2684	430.6	<.0001

Exhibit D4: Odds Ratio Estimates

Effect	Point Estimate	95% Wald Confidence Limits	
cdd_bucket	3.241	3.091	3.397
origAge6670	0.835	0.784	0.889
origAge7175	0.669	0.626	0.715
origAge7680	0.628	0.584	0.674
origAge8185	0.675	0.621	0.734
origAge8690	0.624	0.545	0.714
origAge91Plus	0.615	0.476	0.794
gender female vs. couple	2.596	2.451	2.749
gender male vs. couple	2.841	2.660	3.035
stateFL	1.180	1.108	1.256
stateCA	0.571	0.531	0.614
stateTX	1.940	1.818	2.070
frm	0.466	0.376	0.579
hp_above_med	0.656	0.623	0.692
currLnAgeQtr5_8	84.191	49.676	142.687
currLnAgeQtr9_12	349.158	206.513	590.333
currLnAgeQtr13_16	373.630	220.862	632.069
currLnAgeQtr17Plus	262.591	155.158	444.411

Exhibit D5: Partition for the Hosmer and Lemeshow Test

Group	Total	timeDfltAny = 1		timeDfltAny = 0	
		Observed	Expected	Observed	Expected
1	211715	4	1.37	211711	211714
2	212381	2	3.58	212379	212377
3	210289	10	19.27	210279	210270
4	212935	104	161.93	212831	212773
5	208540	235	302.79	208305	208237
6	208532	457	466.52	208075	208066
7	212615	813	755.34	211802	211860
8	207859	1108	1074.90	206751	206784
9	207371	1801	1643.24	205570	205728
10	187026	3588	3692.69	183438	183333

Exhibit D6: Association of Predicted Probabilities and Observed Responses

Percent Concordant	78.8	Somers' D	0.655
Percent Discordant	13.3	Gamma	0.712
Percent Tied	7.9	Tau-a	0.005
Pairs	16,821,807,202	c	0.828

Based on the regression results in Exhibit D3, borrowers with a large initial cash draw exhibit a significantly higher default propensity than those with a low initial cash draw, as expected. Default risk shows a nearly monotonic inverse relationship with original borrower age, with origAge8185 as the only exception. Default risk is greater in Florida and Texas, and lower in California, other things equal. Through the first four years since origination, default is also an increasing function of elapsed time from origination, although the fourth year of seasoning (currLnAge13_16) adds only marginally to default propensity relative to the third. Default propensity is lower among fixed-rate borrowers (vs. ARMs) and those with home prices above the area median, as expected. Single borrowers of either gender are more likely to default compared to the omitted category representing borrower and co-borrower couples.

D4. T&I Default Model Implementation

We forecast T&I default behavior using the T&I binomial logistic default model described above. A T&I default can happen in a future year only if a loan survives to the end of that year. Thus, the base termination model described in Appendix A takes sequential precedence over the T&I default termination model. We assume that T&I defaults will accrue delinquent UPB at an annual rate of 2.5 percent of estimated property value and that an assumed fixed two-year period will elapse between the T&I default event and subsequent property disposition.

D4.1. Treatment of HECM loans meeting the default definition at the start of the forecast

We assume that active HECM loans already meeting the default definition, i.e. with 12 or more months of delinquency history without any repayment, will be resolved through involuntary termination. There were approximately 8,000 such loans as of March 31, 2011. In view of the two year disposition time assumption, these defaulted loans were treated as if default occurred in FY 2011 and the disposition will occur in FY 2013. Thus, during model implementation, the T&I default model is not applied to these loans.

D4.2. Forecast implementation of T&I default model for the at-risk population

Active delinquent loans meeting the cure definition, uncured active delinquencies with less than one year of delinquency history, active loans with no delinquency history, and future endorsements will all be treated as part of the "at risk" population for future T&I default. We start by applying the default model to determine the likelihood of default of each loan in each future fiscal year. Each loan is assigned a random number between zero and one each year as a benchmark. A loan is tagged as a T&I default in the fiscal year if the probability of default exceeds the random number benchmark. Once a loan is flagged as a default, we set the effective date of property disposition 24 months into the future.

Due to the longer remaining loan terms, recently endorsed loans will get more random draws compared to older endorsements, therefore the cumulative probability of ever T&I defaulting increases for each additional year of default hazard a loan will experience. This compounding effect produced T&I default rates much higher than FHA's expected rate. A scale factor proportional to the endorsement year was used to calibrate the cumulative HECM portfolio T&I default rates between the 2% and 3% expectation suggested by FHA.

It is reasonable to assume that borrower behavior will change in response to Mortgagee Letter 2011-01 and that T&I default might become extremely infrequent in the future. Because the cumulative future default rate on the current HECM book was a judgmental calibration, incoming empirical evidence of borrower and servicer responses to ML 2011-01 should be used to reconsider the reasonableness of the 2% to 3% calibrated cumulative default level.

D5. Summary Forecast Results

To quantify the implementation of the model, the annual T&I default probabilities were forecasted for all active loans at the end of June 30, 2011 for all remaining years of the 35 year limit assumed for every HECM loan. The resultant cumulative lifetime T&I default rates by historical fiscal years of endorsement for the active loans appear in the exhibit below. The results include loans meeting the default definition as of the forecast start date (July 1, 2011).

Exhibit D7: Lifetime Tax and Insurance Default Rates by Endorsement Year

Fiscal Year of endorsements	HECM loan count	Lifetime T&I default rate
1990	9	0.00%
1991	27	3.15%
1992	85	1.29%
1993	185	1.27%
1994	412	1.04%
1995	447	0.80%
1996	464	1.03%
1997	727	0.87%
1998	1211	2.47%
1999	1572	2.69%
2000	1318	2.19%
2001	1898	4.22%
2002	4226	3.14%
2003	8281	3.43%
2004	18,925	3.76%
2005	28,063	3.21%
2006	58,849	2.38%
2007	91,965	2.36%
2008	102,012	1.94%
2009	107,080	2.43%
2010	76,045	1.45%
2011*	55,893	1.49%
Total	**559,694**	**2.20%**
*2011 endorsements through 6/30/2011		

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Appendix E: HECM Demand Model

E1. Background

The actuarial review requires forecasting future borrower demand for HECM loans for the fiscal years 2012-2018 in order to be able to project future overall MMI economic values. The HECM demand forecasting model was designed to respond appropriately to the different Moody's scenarios for interest rates and home prices. While the HECM implementation framework uses an annual periodicity, the demand model uses a quarterly periodicity that is then aggregated to an annual basis.

E2. Data

Data for the number of new HECM endorsements by calendar quarters were compiled from FHA data files. To be consistent with the existing HECM production implementation, the HECM demand model predicts loan counts, not dollar volumes. Quarterly historical and forecasted data for interest rates and home price indices were collected from Moody's economy.com website at the end of July 2011. The macroeconomic time series used in the regression and scenario forecasts were (as labeled by economy.com):

Exhibit E2.1

FHFA All Transactions Home Price Index: U.S. National HPI Series	Treasury Interest Rates: 1-Year Constant Maturity Securities	Moody's July 2011 Scenario Descriptions
FHOFHOPI.US	FRGT1Y.US	Baseline Scenario
FHOFHOPI_S1.US	FRGT1Y_S1.US	Stronger Near-Term Rebound Scenario
FHOFHOPI_S2.US	FRGT1Y_S2.US	Mild Second Recession Scenario
FHOFHOPI_S3.US	FRGT1Y_S3.US	Deeper Second Recession Scenario
FHOFHOPI_S4.US	FRGT1Y_S4.US	Protracted Slump Scenario

The home price alternative scenarios S1, S2, S3 and S4 were adjusted according to the methodology used in the Actuarial Review of forward mortgages (IFE Group 2010; also see Appendix B in this Review). In this year's Review, we also created a fifth alternative scenario consisting of Moody's baseline scenario for home prices and a flat one-year Treasury Rate of 0.205% until FY 2014, after which it rises to match Moody's baseline interest rate scenario.

HECM demand depends on the number of eligible senior homeowners who might choose the product. To proxy this demographic demand driver, historical estimates and future forecasts of the U.S. population aged 62 years and older were obtained from the U.S. Census Bureau's website:

http://www.census.gov/population/www/projections/downloadablefiles.html.

Because the census forecast of future senior population had an annual instead of quarterly periodicity, simple linear interpolation was used to infill the intra-year quarters for model implementation purposes.

The number of quarterly observations used in the regression was 68 (1994:Q2-2011:Q1), reflecting data availability and beginning period quarters dropping out after applying lags on the variables. The forecasted data cover the periods 2011:Q2 through 2018:Q3 to encompass the fiscal years 2012-2018. Forecasts for 2011:Q2 and 2011:Q3 are needed as a basis for the 2011:Q4 forecast and beyond. The following table illustrates the raw input data to the demand regression, where we have randomly removed some observations in the series for display purposes only.

Exhibit E2.2

Period	HECM loan count	U.S Pop >= 62 years old	1-year Treasury Rate	HPI index
1993Q1				174.68
1994Q1	759	38,938,452	3.910	180.38
1994Q4	1013	39,108,184	6.597	181.97
1995Q1	1254	39,200,444	6.727	182.66
1995Q2	961	39,331,600	5.970	185.75
1995Q3	965	39,424,388	5.653	188.64
1995Q4	916	39,517,392	5.443	190.17
1996Q1	918	39,587,624	5.123	192.42
1997Q4	1741	39,989,796	5.483	203.63
1998Q1	1473	40,065,052	5.313	206.78
2000Q3	1093	41,450,780	6.130	236.33
2001Q1	1963	41,753,388	4.597	246.27
2001Q2	1743	41,641,928	3.780	250.36
2001Q3	2133	41,740,848	3.303	254.19
2001Q4	2460	41,840,004	2.243	257.50
2002Q1	3674	41,960,512	2.320	261.16
2002Q4	3592	42,367,456	1.530	274.83
2003Q4	7172	43,184,524	1.300	293.65
2004Q2	9834	43,444,736	1.777	305.50
2005Q3	12735	44,284,368	3.787	351.89
2006Q3	20677	44,989,424	5.090	373.32
2007Q4	24687	46,792,992	3.620	374.89
2008Q1	30517	47,113,548	2.100	373.26
2008Q3	28271	47,731,396	2.123	354.62
2009Q1	30196	48,355,036	0.567	355.90
2009Q4	24734	49,193,492	0.350	337.25
2010Q2	15270	49,739,692	0.380	331.55
2010Q4	18392	50,322,088	0.257	331.82
2011Q1	20644	50,669,320	0.273	322.80

E3. Quarterly Time Series Model of HECM Demand

The HECM demand model specification used the natural log of the number of HECM loans endorsed in a quarter as the dependent variable. The independent variables included the first and second lags of the dependent variable, the contemporaneous level of the one-year Treasury rate, the year-over-year change in home prices, and the quarter-over-quarter change in the senior population size. Specification experiments included:

- Adding other macro variables, such as the mortgage rate, to the equation;
- Using seasonal dummy variables;
- Adding more lags of the explanatory variable; and
- Changing the lag periodicities.

The signs and significance of the coefficients, contributions to model fit, and the preference for simplicity led to the final equation shown below.

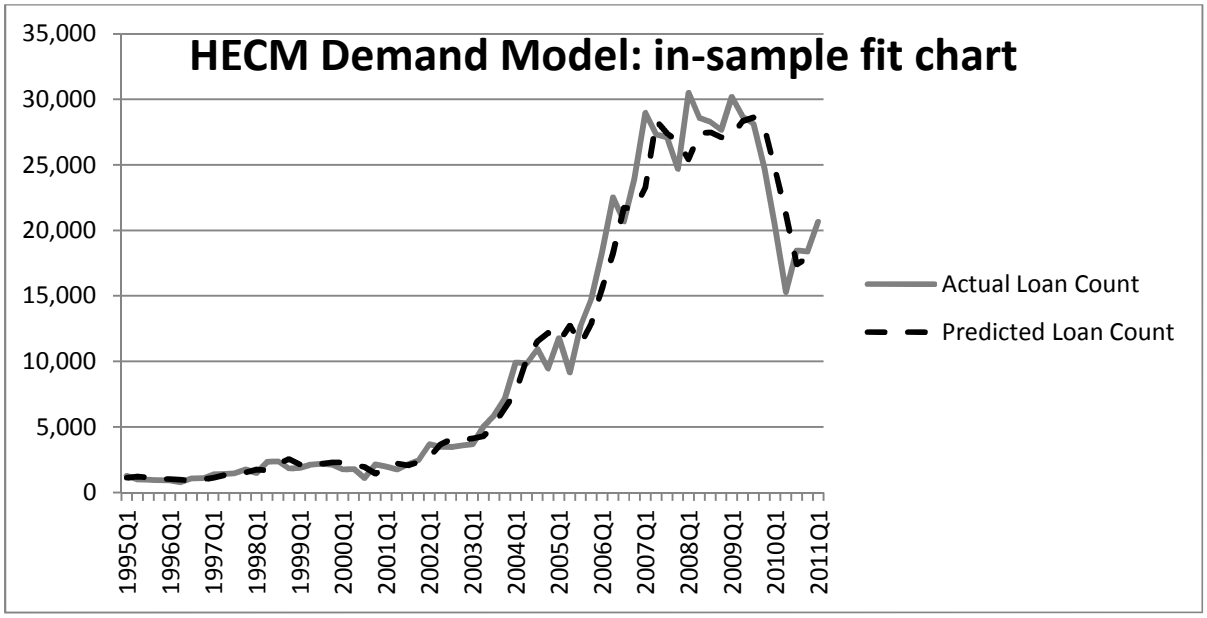
Exhibit E3.1: Linear Regression of Natural Log of HECM Loan Count

	Parameter Estimate	Standard Error	t-stat value	Pr > |t|
Intercept	0.2811	0.2766	1.02	0.3134
1-quarter lag of natural log of loan count	0.6508	0.1175	5.54	<.0001
2-quarter lag of natural log of loan count	0.3227	0.1184	2.73	0.0083
1-year Treasury rate at quarter t	-0.0170	0.0157	-1.08	0.2832
Nat log (HPI at t / HPI at t - 4)	1.2981	0.5921	2.19	0.0321
Nat log(Pop>=62 yr at t/ Pop>=62 yr at t - 1)	6.0886	13.0623	0.47	0.6428
Adj R-Sq = 0.9769				
Durbin-Watson = 1.920				
Number of Observations = 68				

Retaining the two insignificant variables—the one-year Treasury rate and the senior population growth rate—was necessary to endow the forecast implementation with more responsiveness to macro factors. Possible future efforts could search for better demographic variables other than the senior population, which does not account for senior homeownership.

The model's in-sample fit is shown below.

Exhibit E3.2



E4. Forecasts of HECM Loan Counts based on HECM Demand Model

The implemented HECM demand model takes as inputs Moody's baseline forecasts of interest rates and home prices, the senior population change forecast and lagged values of the dependent variable to predict future HECM loan counts. The steady growth in future senior population and general autoregressive momentum produced forecasts that somewhat exceeded expectations. The HECM volume model's 0.28 intercept was reduced by 5 percent in the model implementation to align with FHA's projection of demand volumes.

During 2011, Wells Fargo Bank and Bank of America both announced their planned withdrawal from the HECM market. FHA analyzed the possible industry changes resulting from these actions. Giving other lenders such as MetLife a year or so to replace the volumes lost to the market exits, the predictions for FY 2012 were reduced by 10% for all six scenarios in this first year of the forecast. The table below includes this impact and represents the finalized demand forecasts used in the 2011 Actuarial Review for HECMs.

Exhibit E4.1: Forecasts of HECM Loan Counts for Various Economic Scenarios

Fiscal Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
2012*	71,420	80,508	50,007	42,086	37,488	72,322
2013	87,834	98,191	60,773	45,153	36,520	93,557
2014	97,949	108,627	70,885	55,186	43,805	113,855
2015	111,561	122,822	82,955	67,472	56,097	135,272
2016	121,058	132,380	92,101	76,263	65,444	145,213
2017	128,169	139,282	99,596	83,625	73,135	151,589
2018	134,494	145,316	106,572	90,638	80,169	157,017

*FY 2012 estimates reduced by 10% to reflect lender exits from the HECM market

As expected, for each fiscal year, the loan counts monotonically decrease as the alternative scenarios move from a stronger rebound, to a mild second recovery, to a deeper second recession and to a protracted slump (S1, S2, S3, S4). Under Scenario 5's flat interest rates coupled with Moody's baseline home price scenario, HECM demand shows significantly higher levels for all fiscal years. This sharp response highlights the modeled sensitivity of HECM demand to the macro factors.

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References

Begg, C. B. and Gray, R. (1984). *Calculation Of Polychotomous Logistic Regression Parameters Using Individualized Regressions.* Biometrika (71), 1, 11-18.

Capone, C. A., K. L. Chang and C. A. Cushman (2010). *Identification of Home Maintenance Risk in Reverse Mortgages: An Empirical Examination of Home Price Appreciation among HECM Borrowers.* American Real Estate and Urban Economics Association 2010 Mid-Year Conference: Washington, D.C.

IBM Global Services (2010). *An Actuarial Analysis of FHA Home Equity Conversion Mortgage Loans in the Mutual Mortgage Insurance Fund Fiscal Year 2010.* U. S. Department of Housing and Urban Development: Washington, D.C.

IFE Group (2010). *Actuarial Review of the Federal Housing Administration Mutual Mortgage Insurance Fund (Excluding HECMs) for Fiscal Year 2010.* U. S. Department of Housing and Urban Development: Washington, D.C.

Shiller, R. J. and A. N. Weiss (2000). *Moral Hazard in Home Equity Conversion.* Real Estate Economics (28.1):1-32.

Szymanoski, E. J., DiVenti, T. R. and Chow, M. H. (2000). *Understanding reverse mortgage cash flows: a hazard model of HECM loan terminations.* U. S. Department of Housing and Urban Development: Washington, D.C.

U. S. Department of Housing and Urban Development (9/1/2010). Mortgagee Letter 2010-28. Changes to FHA Mortgage Insurance. Washington, D.C.

U. S. Department of Housing and Urban Development (9/21/2010). Mortgagee Letter 2010-34. Home Equity Conversion Mortgage Program – Introducing HECM Saver; Mortgage Insurance Premiums and Principal Limit Factor Changes for HECM Standard. Washington, D.C.

U. S. Department of Housing and Urban Development (1/3/2011). Mortgagee Letter 2011-01. Home Equity Conversion Mortgage Property Charge Loss Mitigation. Washington, D.C.

U. S. Department of Housing and Urban Development (8/19/2011). Mortgagee Letter 2011-29. Federal Housing Administration's (FHA) Maximum Loan Limits Effective October 1, 2011 through December 31, 2011. Washington, D.C.

Yuen-Reed, G. and Szymanoski, E. J. (2007). *What's a Savvy Senior to Do? A Competing Risk Analysis of HECM Reverse Mortgage Loan Terminations.* American Real Estate and Urban Economics Association 2007 Mid-Year Conference: Washington, D.C.

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