

**An Actuarial Analysis of
FHA Home Equity Conversion Mortgage Loans
In the Mutual Mortgage Insurance Fund
Fiscal Year 2010**

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By



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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 due to 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 Fund². Accordingly, an actuarial review must also be conducted on HECM books-of-business within the MMI Fund. This document reports the estimated economic value of the HECM FY 2009 and FY 2010 books-of-business and forecasts for the FY 2011 to FY 2017 insurance cohorts. Our projections indicate that, as of the end of FY 2010, the HECM portion of the MMI fund will not have sufficient capital resources to meet its future liabilities and hence will require support from the overall fund.

A. Status of the HECM Portfolio

In order to assess the adequacy of the current and future capital resources to meet estimated future liabilities, we analyzed all HECM historical terminations and associated recoveries using loan-level HECM data reported by FHA through June 30, 2010. Based on historical experience, 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 2009 to FY 2017 books-of-business using various assumptions; including macroeconomic forecasts from Moody's Analytics (Moody) and the expected HECM portfolio characteristics provided by FHA.

Using the estimated loan performance of the FY 2009 and 2010 books, we estimate the economic value of the HECM portion of the MMI fund at the end of FY 2010 to be negative \$503 million. We estimate the economic value of the HECM portfolio will subsequently increase over time with the addition of new books-of-business, the introduction of HECM Standard and Saver options in FY 2011, and improvements in forecasted economic conditions. The estimated economic value at the end of FY 2017 is \$5.8 billion.

The insurance-in-force (IIF) is expressed as the total maximum claim amount (MCA) of the active portfolio. The MCA of each loan is the minimum of the appraised value and FHA's loan limit at the time of origination. The MCA of all active insured loans represents FHA's maximum risk exposure to the portfolio. As new endorsements are added to the portfolio, projected HECM IIF increases from \$50.4 billion in FY 2010 to \$188.2 billion in FY 2017. 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. Table ES-1 provides the economic value, MCA, and endorsements for FY 2010 to FY 2017.

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).

Table ES-1: Economic Value, Insurance-in-Force, and Endorsements
For FY 2010 to FY 2017 (\$ Millions)

Fiscal Year ⁽¹⁾	Economic Value	Insurance in Force ⁽²⁾	Volume of New Endorsements ⁽³⁾	Economic Value of Each New Book of Business	Investment Income
2010	-\$503	\$51,397	\$21,732	-\$772	-
2011	83	69,893	20,541	538	48
2012	704	88,542	21,885	594	28
2013	1,427	107,185	23,763	678	44
2014	2,308	127,325	27,786	806	75
2015	3,326	148,739	31,677	904	114
2016	4,475	171,607	35,924	988	162
2017	5,819	197,128	40,653	1,125	219

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. Endorsement amount is expected to decrease in FY 2010 and FY2011 due to the house price depreciation projection and the discontinuation of the temporary increase in the FHA loan limit.

The economic value of the HECM portfolio in the MMI fund decreased by \$1.41 billion from the economic value of \$909 million included in the FY 2009 review. This change was primarily driven by four factors:

- The discount rates used in the FY 2010 review are higher than the FY 2009 review, which significantly reduce the economic value due to the delay between claim payments and ultimate recoveries to FHA.
- The national house price appreciation projections from Moody's in this year's review are lower than the Global Insight forecast in last year's review. Further, MSA-level house price projections are used to allow for the geographic distribution of the portfolio. Because the HECM portfolio is concentrated in areas with higher forecasted house price decline and lower forecasted long-term price growth lower future recoveries are expected.
- This year's review incorporates a revised approach for accounting for maintenance-risk associated with reverse mortgages, which has a negative effect on HECM's economic value.
- The transfer of \$1.74 billion from the capital reserve account of the MMI Single Family program to cover the expected net cost of the HECM FY 2009 book-of-business. The transfer increases the economic value of the HECM portfolio, but the increase is outweighed by the negative effect driven by the three factors mentioned above.

FHA will offer the HECM Saver option to borrowers starting in FY 2011, which has a lower upfront mortgage insurance premium and also lower principal limit factors. The new pricing option is expected to attract borrowers who require less equity and may not consider a Standard HECM due to the upfront mortgage insurance premium of two percent. At the same time, FHA also introduced an increase in annual premium from 0.5 percent to 1.25 percent across all HECM options. This will generate greater cash inflow for the HECM Program but also result in a more rapid accumulation of loan balance, with borrowers reaching the maximum claim amount more quickly. The impact on the future HECM economic value will depend on the actual ratio of endorsements under the Standard vs. Saver option and the borrower behavior under each pricing option.

On September 29, 2010, Congress passed Continuing Appropriations Act 2011 which extended the expiration of the temporary loan limit increase from December 31, 2010 to September 31, 2011. The

extension was made after the economic value analysis of this review and its impact is not included in the estimates. The continuation of the loan limit increase will attract more borrowers with higher home values to HECM in FY 2011 than estimated. With all other modeling assumptions held constant, the actual economic value of the FY2011 book-of-business is expected to be greater than the estimates presented in this review.

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 obtained from the Moody's July, 2010 forecast.
- **One-year and ten-year Treasury interest rates:** Impact the growth rate of the loan balance and the amount of equity available to the borrower at origination. Interest rate projections used are obtained from the Moody's July, 2010 forecast.
- **Mortality Rates:** Impact loan terminations due to 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:** Represents 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 driver's 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:

- S1: Strong Near-Term Recovery Scenario
- S2: Mild Second Recession Scenario
- S3: Deeper Second Recession Scenario
- S4: Complete Collapse/Depression Scenario

Table ES-2 presents the economic value under the base case assumptions and the various alternative scenarios. All four scenarios have a negative economic value for FY 2010, but the economic value of the MMI HECM portfolio is expected to increase in future years. As the economic scenario worsens, it takes longer for the economic value to become positive because it takes longer for the benefit of future economic and programmatic improvements to impact the portfolio.

Table ES-2: Economic Value for FY 2010 to FY 2017
Under Various Economic and Loan Scenarios (\$ Millions)

Fiscal Year ⁽¹⁾	Economic Value				
	Base Case	S1: Strong Near-Term Recovery Scenario	S2: Mild Second Recession Scenario	S3: Deeper Second Recession Scenario	S4: Complete Collapse/Depression Scenario
2010	-\$503	-\$276	-\$1,764	-\$2,874	-\$3,480
2011	83	302	-1,505	-3,098	-4,131
2012	704	922	-952	-2,769	-4,165
2013	1,427	1,649	-298	-2,209	-3,833
2014	2,308	2,527	492	-1,507	-3,302
2015	3,326	3,527	1,393	-689	-2,599
2016	4,475	4,673	2,430	251	-1,773
2017	5,819	5,975	3,619	1,351	-786

1. All values, except the volume of new endorsements, are expressed as of the end of the fiscal year.

Section I. Introduction

A. Implementation of NAHA and HERA

The National Housing Act requires an annual independent actuarial review of the Federal Housing Administration's (FHA) Mutual Mortgage Insurance (MMI) Fund¹. 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 (GI) Fund to the MMI Fund starting in fiscal year (FY) 2009. Therefore, an actuarial review must also be conducted on HECM books-of-business within the MMI Fund accordingly. This document reports the estimated economic value of the FY 2009 to FY 2010 HECM books-of-business and includes projections for FY 2011 to FY 2017 books-of-business. This review also provides the HECM portion of the economic value and IIF used to assess the overall MMI capital ratio. The analysis presented within utilizes historical loan performance data and expected future HECM originations provided by FHA, as well as forecasts of future economic conditions from Moody's Analytics (Moody).

B. 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 600,000 reverse mortgages. To be eligible for a HECM, a homeowner must be 62 years of age or older, have an outstanding mortgage balance that can be paid off with HECM proceeds, and must have received FHA-approved reverse mortgage counseling to learn about the program. HECM loans are available from FHA-approved lending institutions. It provides homeowners with cash payments or credit lines secured by their home's equity, and require no repayment as long as the borrower continues 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.

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 loan limit 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 holder of the note and services the loan until termination. At loan termination, FHA can 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 principal available at closing to cover the additional financial risks posed by reverse mortgages. Moreover, FHA insurance protects borrowers from lenders' failure to advance funds.

The unique characteristics of the HECM program include:

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.

1. Maximum Claim Amount (MCA)

MCA is the minimum of the appraised value of the home and the FHA loan limit at the time of origination. It is the maximum HECM insurance claim the lender can receive. The MCA is also used to calculate the amount of initial equity available to the borrower. A borrower's home can have an appraised value that exceeds the MCA, but the amount of equity FHA recognizes is capped by the loan limit. 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 proceeds³ can be used to pay off the outstanding loan balance, regardless of whether the maximum claim amount was capped by the FHA loan limit at origination.

2. Principal Limit and Principal Limit Factor (PLF)

FHA manages its insurance risk by limiting the percentage of equity available to the borrower through a set of Principal Limit Factors (PLFs). Conceptually, the PLF is similar to the loan-to-value ratio applied to a traditional mortgage. It represents the ratio of the amount of initial available equity to the MCA at origination. Table I-1 illustrates a selected number of PLFs as of August 2010. The PLF increases with the borrower's age at origination⁴ and decreases with the expected mortgage interest rate (with a floor of 5.5 percent).⁵

Table I-1: Selected Principal Limit Factors⁶

Expected Mortgage Interest Rate	Borrower Age at Origination		
	65	75	85
5.5%	0.584	0.659	0.737
7.0%	0.440	0.548	0.664
8.5%	0.332	0.453	0.594

The amount of equity available at origination is known as the initial principal limit and is calculated as the product of the PLF and the MCA. Over the course of the loan, the principal limit grows with the mortgage interest, mortgage insurance premium, and service fee. Once the HECM unpaid loan balance reaches the principal limit, no more cash advances are available to the borrower.

3. Payment Plan

HECM borrowers access the equity available to them according to the payment plan they select. Borrowers can change their payment 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 borrower stays in the 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
- Combination of line of credit and tenure or term

³ Net sales proceeds are the proceeds from selling the home less all eligible transaction costs.

⁴ For couples, the age of the younger borrower is used to determine the corresponding PLF.

⁵ The expected mortgage interest rate is defined as the sum of the ten-year interest rate at origination and the lender's margin for variable rate loans and is defined as the fixed mortgage interest rate for fixed rate loans.

⁶ The PLFs shown here are based on the recent update per Mortgagee Letter 2009-34, dated September 23, 2009. Further information on the design of the PLFs can be found in the Appendix of HUD's Interim Report to Congress: Home Equity Conversion Insurance Demonstration, October 1990.

4. Unpaid Principal Balance (UPB) and Loan Costs

HECM differs from other mortgage insurance products as it requires no repayment as long as the borrower continues to live in the home and follows 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 to the loan balance instead of paying for them out-of-pocket, which reduces the effective 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 is comprised of an upfront premium of two percent of the MCA and an annual premium of half a percent of the remaining mortgage balance.

5. Loan Terminations

HECM loans typically terminate because the borrower dies, the borrower's primary residence changes, the HECM is refinanced, or the house is sold. Other reasons for loan termination include when the borrower fails to pay property taxes or homeowners insurance, or when the borrower fails to follow FHA's guidelines in maintaining the condition of the home. When the loan terminates, the borrower is required to only pay back the current loan balance. If the proceeds from the sale of the home exceed the loan balance, the borrower or estate is entitled to the difference. If the proceeds from the sale of the property 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 FHA cannot use the borrower's other assets to cover any shortfall. In other words, HECM loans are non-recourse.

6. Assignment 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 incurring interest, premiums, and service fees. Borrowers can continue to draw cash as long as the loan balance is below the current 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.

C. FHA Policy Developments and Underwriting Changes

During FY 2010, FHA proposed several policy changes. In this section, we focus on four major changes that were proposed or implemented in FY 2010.

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 of the loan.

1. Reduction in Principal Limit Factors

In accordance to Mortgagee Letter 2009-34, FHA implemented a new set of PLFS effective at the beginning of FY 2010. The new PLFs are ten percent less than the previous PLFs. Table I-2 below illustrates a selected set of PLFs before and after the change.

Table I-2 Comparison of a Selected Set of Principal Limit Factors Prior to FY 2010 and those in FY 2010

Borrower Age at Origination	Expected Mortgage Interest Rate	PLFs	
		Prior to FY 2010	FY 2010
65	5.5%	0.649	0.584
65	7.0%	0.489	0.440
65	8.5%	0.369	0.332
75	5.5%	0.732	0.659
75	7.0%	0.609	0.548
75	8.5%	0.503	0.453
85	5.5%	0.819	0.737
85	7.0%	0.738	0.664
85	8.5%	0.660	0.594

The reduction in PLFs will reduce the amount of equity available to borrowers. This will lower the likelihood and size of claims in cohort 2010 and reduce FHA's financial risk accordingly.

2. Expiration of Temporary Loan Limit Increase

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 2010⁹.

As the temporary loan limit increase expires in 2011, the HECM loan limit is expected to return to the level mandated by HERA, which is \$417,000 nationwide except for Alaska, Hawaii, Guam, or the Virgin Islands, which has a loan limit of the minimum of 115 percent of the area median house price and 150 percent of the GSE Conforming Loan Limit (\$625,500). HERA also gave the HUD Secretary the authority to increase the HECM loan limit according to a FHA selected HPI index in the future. With the expiration of the FHA loan limit increase, borrowers with high-valued homes will be less likely to originate HECM loans than the previous two years when the loan limit increase was in effect.

On September 29, 2010, Congress passed the Continuing Appropriations Act 2011 (CR 2011)¹⁰ that further extended the loan limit increase to September 31, 2011. The change was made after the

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 Barack Obama on October 30, 2009.

¹⁰ CR 2011 was passed by the United State Congress on September 29, 2010 and signed by President Barack Obama on September 30, 2010.

economic value analysis of this review and its impact is not included in the estimates. It is expected that the actual economic value of the FY2011 book-of-business is expected to be greater than the estimates presented in this review (see Section II for more details).

3. Future Changes in Premium and Principal Limit Factor

On July 31, 2010, Congress passed HR 5981 which increased HUD's flexibility with respect to the amount of premiums charged. The new legislation permits HUD to increase annual premiums up to 1.55 percent of the loan balance. According to Mortgagee Letter 2010-28, FHA will raise the annual premiums for HECM loans from 0.5 percent to 1.25 percent starting October 4, 2010.

The new premium structure will be accompanied by an overall reduction in PLFs, as described in Mortgagee Letter 2010-34. Table II-3 below illustrates a selected set of PLFs prior to FY 2010, in FY 2010, and FY 2011 onward. As illustrated in Table I-3, the percentage decline in PLFs varies based on the borrower's age at origination and expected interest rate. The PLF across all ages and interest rates above 5.5 percent are reduced by 5 percent on average. The biggest reductions occur for older borrowers in high interest rate scenarios with the maximum reduction in PLF being approximately 12 percent.

Table I-3 Comparison of a Selected Set of Principal Limit Factors in FY 2010 and those in FY 2011 and onward

Borrower Age at Origination	Expected Mortgage Interest Rate	PLFs		
		FY 2009 and Prior	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

The increase in premium rate and reduction in available equity to the borrower are expected to lower the financial risk associated with future books-of-business as it reduces the likelihood that unpaid principal balance exceed the proceeds from a house sale.

4. Introduction of HECM Saver

In Mortgagee Letter 2010-34, FHA introduced an alternative to the current HECM Program. In addition to the traditional or "Standard" option, beginning October 4, 2010, FHA is offering HECM borrowers the HECM Saver option. The HECM Saver has a much lower upfront mortgage insurance premium of 0.01 percent compared to two percent for the Standard option, but it also has a lower principal limit. The new option is expected to attract borrowers who require fewer funds and may not consider a Standard HECM due to the upfront mortgage insurance premium of two percent.

As a result, starting in FY 2011, HECM borrowers can choose between two combinations of PLFs and initial insurance premium rates depending on their needs. The impact of this new initiative on

product demand and loan composition is reflected in the demand forecast provided by FHA (see Appendix B for details).

D. 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 are obtained from Moody's July 2010 forecast. Moody's state and MSA house price forecasts take into consideration of local area economic environment forecasts including unemployment rates. Moody's July 2010 forecast provides estimates from the end of FY 2010 to FY 2040. We estimated the forecasts for FY 2041 and later based on the last three years' moving average.

This year's review is based on projections of slower house price growth projections than last year's review. According to this year's forecast, the annual average national house price growth rate during FY 2010 is projected to be negative 1.3 percent. National house prices will begin to experience positive growth starting in the second quarter of FY 2011. The forecast suggests house price appreciation will rebound to the high four percent in FY 2014 and will return to around a long-run average of three percent.

The majority of loans in the FY 2010 HECM portfolio are located in California, Florida 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. The house price trends can be seen below in Table I-4.

Table I-4 Comparison of House Price Forecasts for California, Florida, Texas and the Nation

State	Percent of FY 2010 Endorsements	House Price Growth	
		FY2010	Long Term Trend
California	13.8%	-6.4%	2.3%
Florida	11.9	-9.8	2.5
Texas	0.1	-0.3	2.3
National Average	-	-1.3	3.0

The continued deterioration in FY 2010 and the slow forecasted recovery of house prices affect the HECM portfolio in several ways. First, recoveries on terminations will be lower in a low house price growth environment. However, as early HECM terminations are relatively rare, the impact of near-term house price declines on the FY 2010 HECM portfolio is expected to be limited. Further, house price growth is forecasted to improve by the time the majority of the terminations are expected to occur. Second, a low 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 books-of-business, the forecasted house price depreciation will reduce the amount of equity available to future HECM borrowers. This can potentially lower the attractiveness of HECM as a retirement-financing option and impact HECM demand in the near term.

2. Interest Rates

According to Federal Reserve Board statistics, the U. S. Treasury note rate reached its lowest point since the 1950s in 2009 and remained low throughout 2010 as shown in Table I-5. 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 2010 and the one-year LIBOR rate has remained below one percent as seen in Table I-5.

Table I-5 Comparison of Historical Interest Rates for Selected Months in FY 2010

Rate Type	Interest Rate	
	October 2009	July 2010
1yr CMT	0.48%	0.29%
10yr CMT	3.39%	3.01%
1yr LIBOR	0.62%	0.60%
10yr LIBOR	3.53%	3.01%

The expected mortgage interest rate (expected 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 5.57 percent by FY 2012 and stabilize at around 4.5 percent by FY 2016.¹¹ 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, the average lender's margins have increased from an average of 1.5 percent for FY 2008 and prior to 2.5 percent in FY 2009 and FY 2010. This increase may partially offset the impact of low interest rates and limit the increase in equity available to borrowers.

Approximately 31 percent of loans in the FY 2010 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 one-year rate and the lender's margin. Moody's has forecasted the one-year Treasury rate to rise steadily and stabilize at 4.15 percent by FY 2015. The forecasted low mortgage interest rate environment results in slower growth in loan balances, which reduces the likelihood of a claim at loan termination. As stated previously, any increase in the lender's margin may partially offset this for future endorsements.

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, lower interest rates, higher home values, and higher loan limits. Demand steadied with the housing crisis with 115,000 endorsements in FY 2009, similar to the level in FY 2008. The implementation of the PLF reduction in FY 2010¹² resulted in a decrease in monthly endorsements starting in the beginning

¹¹ 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 estimated the future LIBOR ten-year using the Moody's Treasury rate forecast accordingly.

¹² Mortgagee Letter 2009-34 specified the PLF reduction for all loans that receive a HECM case number on or after October 4, 2009. Typically, there is a 1 to 3 months lag between the case number assignment date and the endorsement date.

of FY 2010. The decrease stabilized to about 5,000 endorsements per month in mid FY 2010. The estimated number of endorsements¹³ for FY 2010 is approximately 80,000.

With the introduction of the HECM Saver option starting in FY 2011, FHA projects the number of endorsements to increase by 6 percent to 85,217 in FY 2011, and continue to increase to 144,361 by FY 2016. The average MCA per endorsement is expected to decrease in FY 2011 due to Moody's projected house price depreciation and the expiration of the temporary FHA loan limit increase under ARRA. FHA projects the average MCA to increase starting in FY 2013 per Moody's forecast. Table I-6 contains the actual number and dollar of endorsements in FY 2009, the annualized values for FY 2009, and the volume projections for FY 2011 to FY 2017.

Table I-6: Actual FY 2009 and FY 2010 Endorsements and Forecasted FY 2011 to FY 2017 Endorsements

Fiscal Year	Number of Endorsements	Average MCA per Endorsement (\$ dollars)	Total Endorsements (\$ millions)
2009	114,656	\$263,212	\$30,179
2010	80,369	270,405	21,732
2011	85,217	241,045	20,541
2012	90,804	241,018	21,885
2013	97,646	243,361	23,763
2014	108,847	255,278	27,786
2015	119,840	264,326	31,677
2016	131,603	272,976	35,924
2017	144,361	281,608	40,653

Besides HECM, there are several proprietary reverse mortgage products. Typically, proprietary products have higher loan limits but offer a lower percentage of home equity to borrowers. The proprietary market share is relatively small for reverse mortgages originated to date. According to the American Association of Retired Persons (AARP), HECM accounts for approximately 90 percent of all reverse mortgages. Due to the recent credit crunch, the availability of proprietary products has decreased in FY 2009 and FY 2010, further increasing HECM market share. However, as the credit market recovers, the proprietary market is expected to recover as well.

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 continues, the number of reverse mortgages will continue to increase with the expected growth in the retiree population. In 2010, 16 percent of the population (approximately 50 million) is 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, people may have insufficient savings to sustain their financial needs in retirement, potentially increasing the demand for HECM.

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

¹³ Estimate is annualized based on data as of June 30, 2010.

base for the HECM product. Since the inception of the program, Fannie Mae has been the largest secondary market outlet for HECM loans. Fannie Mae estimates that its market share was approximately 90 percent of the total market of reverse mortgages as of December 31, 2008. Fannie Mae's reverse mortgage portfolio grew from \$41.6 billion to \$50.7 billion between the fourth quarter 2008 and the second quarter 2010.

Ginnie Mae implemented a HECM Mortgage Backed Security (HMBS) product in 2007. In this program, Ginnie Mae-approved issuers have pooled and securitized a small proportion of HECMs. The volume of Ginnie Mae HMBS has recently increased, providing liquidity in a tight credit environment. In the first ten months of FY 2010, Ginnie Mae issued approximately \$9.3 billion worth of HMBS, bringing the total Ginnie Mae issued HMBS to more than \$14 billion since inception.

E. Recently Announced New Plans and Initiatives

At the time of completing this review, FHA was expected to issue formal and clear guidance for handling the defaults related to tax and insurance. The guidance is expected to promote a consistent approach in handling tax and insurance default, and provide lenders with loss mitigation options to cure tax and insurance default.

F. Data Sources and Future Projections

This review focuses on the economic value of HECM loans in the MMI Fund, which consists of the current books-of-business (FY 2009 and FY 2010) and future books-of-business (FY 2011 to FY 2017). The estimate of the economic value of the HECM program in the MMI fund is based on various assumptions. Since these assumptions are estimates, the actual performance of the FY 2010 HECM portfolio may differ from the expected performance from our projections.

All historical HECM experience is used to understand the performance of the program and to determine the termination model specifications. This includes 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 in FY 2009 and FY 2010.

Borrower characteristics and loan features are based on loan-level data as of June 2010. Actual endorsement volume is annualized for the remaining three months of the fiscal year. Actual historical economic data is obtained from Moody. Examples include the one-year and ten-year Treasury rates and the house price appreciation rates for the Federal Housing Finance Agency (FHFA) Conventional and Conforming loans. FHA provided volume forecasts and borrower characteristics for the future books-of-business. FHA also provided the house price appreciation adjustment factors reflecting the home-maintenance basis 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.

G. 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 FY 2010 to FY 2017. It also provides a step-by-step description of changes from last year's review.
- Section III. Current Status of the HECM Program -- presents the estimated economic value for FY 2010 to FY 2017.
- Section IV. Characteristics of the FY 2010 HECM Book-of-Business -- presents various characteristics of the FY 2010 book-of-business.
- Section V. Sensitivity Analysis -- presents sensitivity analyses of the HECM portfolio using various economic and borrower assumptions.
- Section VI. Summary of Methodology -- presents the loan performance and cash flow models used to estimate the economic value included in this report.
- Section VII. Qualifications and Limitations -- presents any limitations in the data, assumptions, and models used to estimate the economic value included in this report.
- Appendix A. Econometric Analysis of Mortgages -- provides a technical description of our loan performance model.
- Appendix B. Loan Performance Projections and Economic Forecasts -- provides a technical description of the loan termination projection methodology and the characteristics of future books-of-business modeled in this review. It also explains the base case assumptions and the alternative economic scenarios.
- Appendix C. Cash Flow Analysis -- provides a technical description of our cash flow model.
- Appendix D. Loan Performance Model Results -- presents the results from the loan performance model.

Section II. Summary of Findings

This section presents the economic value of the FY 2009 to FY 2017 HECM books-of-business. It also provides an explanation of how the results in this year's review compare with those of the FY 2009 review.

A. The FY 2010 Actuarial Review

The FY 2010 actuarial review assesses the actuarial soundness of the HECM portfolio in the MMI Fund as of the end of FY 2010 and projects the status of the portfolio through FY 2017. In this review, we:

- Analyze all HECM historical termination experiences and the associated recoveries using loan-level HECM data reported by FHA through June 2010.
- Develop loan termination models to estimate the relationship between loan termination and various economic, borrower and loan specific factors.
- Estimate future cash flows associated with the FY 2009 to FY 2017 books-of-business using various assumptions. These including macroeconomic forecasts from Moody and borrower characteristics for future books-of-business and home-maintenance basis-risk adjustment factors provided by FHA.
- Estimate the economic value of the HECM portfolio for the FY 2010 to FY 2017 books of business.

Detailed descriptions of the termination model, cash flow model, and economic assumptions used are presented in Appendices A to D. The following is a summary of the major findings in this review, which are also illustrated in Table II-1.

- The economic value at the end of FY 2010 is estimated at negative \$503 million. It indicates that the HECM portion of the MMI fund will not have sufficient capital resources to meet its expected future liabilities and hence will require support from the overall fund. As the MMI Fund only includes the FY 2009 and subsequent HECM books-of-business, this estimate excludes books-of-business prior to FY 2009.
- The economic value of the HECM portfolio will return to positive by FY 2011 and will continue to increase over time. The economic value increases more rapidly from FY 2011 to FY 2013 with the addition of new books-of-business, new programmatic changes, and the forecasted future economic recovery. The rate of increase in economic values between fiscal years stabilizes to approximately 30 percent per year starting in FY 2015.
- The insurance-in-force (IIF) is expressed as the sum of the maximum claim amounts (MCA) of all HECM loans remaining in the insurance portfolio. The MCA is FHA's insurance commitment on HECM loans, and it represents FHA's maximum financial exposure. The estimated IIF increases with new endorsements from \$51.4 billion at the end of FY 2010 to \$197.2 billion in FY 2017.
- The economic value of the HECM 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.

Table II-1: The Economic Value, Insurance-In-Force, and Endorsements
for FY 2010 to FY 2017 (\$ Millions)

Fiscal Year ⁽¹⁾	Economic Value	Insurance in Force ⁽²⁾	Volume of New Endorsements ⁽³⁾	Economic Value of Each New Book of Business	Investment Income
2010	-\$503	\$51,397	\$21,732	-\$772	-
2011	83	69,893	20,541	538	48
2012	704	88,542	21,885	594	28
2013	1,427	107,185	23,763	678	44
2014	2,308	127,325	27,786	806	75
2015	3,326	148,739	31,677	904	114
2016	4,475	171,607	35,924	988	162
2017	5,819	197,128	40,653	1,125	219

(1) All values, except volume of new endorsement, are as of the end of the fiscal year.

(2) Insurance in Force is estimated as the total of maximum claim amount of remaining loans in the insurance portfolio.

(3) Projections provided by FHA

On September 29, 2010, Congress passed the Continuing Appropriations Act 2011 (CR 2011) that further extended the loan limit increase to September 31, 2011. The change was made after the economic value analysis of this review and its impact is not included in the estimates. The continuation of the higher loan limit will likely attract more borrowers with higher home values. Based on historic experience, HECM loans associated with homes with greater values than the local median tend to have lower home maintenance risk and hence have higher recoveries at termination. As a result, with all other modeling assumptions held constant, the actual economic value of the FY2011 book-of-business is expected to be greater than the estimate presented in this review.

B. Changes in the Economic Value

Table II-2 includes the components of the economic value of the HECM portfolio in the MMI Fund, and its change from the end of FY 2009 to the end of FY 2010. The FY 2009 review estimated the HECM portfolio had \$909 million in economic value at the end of FY 2009 to cover future losses.

In this review, we estimated that the HECM portfolio in the MMI Fund has a total of negative \$503 million in capital resources by the end of FY 2010. The net insurance income in FY 2010 on the FY 2009 and FY 2010 books-of-business is \$500 million. Combining this with the net assets, net transfer from the capital reserve to the HECM financing account, and net gain from investment during the fiscal year, results in total capital resources of \$3.0 billion. The estimated net present value of future cash flows is negative \$3.5 billion. As a result, the economic value at the end of FY 2010 is estimated at negative \$503 million, implying that the HECM portfolio has insufficient capital resources and cash inflows to meet future cash outflows on the FY 2009 and FY 2010 books-of-business.

Table II-2 Projected Economic Value of the HECM Portfolio
in the MMI Fund at the end of FY 2010 (\$ Millions)

Item	End of FY2009 ⁽¹⁾	End of FY2010
Cash	\$275	
Investments	376	
Properties and Mortgages	0	
Other Assets and Receivables	2	
Total Assets	\$653	
Liabilities (Account Payables)	0	
Total Capital Resources	\$653	
Net Gain from Investment ⁽²⁾		\$141
Net Insurance Income in FY 2010 ⁽³⁾		500
Net Transfer from Capital Reserve to HECM Financing Account		1,748
PV of Expected Insurance Income from Assigned Notes ⁽⁴⁾		0
Total Capital Resources as of EOY		\$3,042
PV of Future Cash Flows on Outstanding Business		-3,545
Economic Value		-\$503
Insurance-In-Force		\$51,397

(1) Source: Audited Financial Statements for FY 2009

(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 2010.

(3) Includes premium inflow and claim outflow during the fiscal year

(4) The present value of expected future recoveries of HECM notes assigned during the fiscal year (including pending assignments and completed assignments)

The economic value of the HECM portfolio in the MMI fund is estimated to decrease by \$1.4 billion from the FY 2009 review. This change is primarily driven by three factors: discount rates, the house price forecast, and home maintenance risk.

The discount rates used for future cash flows are based on the latest interest rates provided by the Office of Management Budget at the time of the review. The discount rates used for the FY 2009 review were lower than those experienced in most historical years of program experience while the discount rates for this year's review returned to the FY 2007 level. Due to the time delay between claim payments and ultimate recoveries to HUD when most borrowers move and properties are sold, the higher interest rates in the FY 2010 review significantly reduced the net present value of the recovery income compared to last year.

Another driver of the decline in economic value is the deterioration in the house price forecast adopted for the HECM portfolio. This year's review projected a slower house price recovery for the nation than last year's review. Moreover, this year's Moody forecast included house price projections at the MSA-level (the FY 2009 review used Global Insights Inc. forecasts, which provided projections at the national-level). The MSA-level forecast enabled the FY 2010 review to consider the geographic distribution of the HECM portfolio in estimating future house prices. The HECM portfolio is more concentrated in areas with higher forecasted house price decline and lower forecasted long-term house price growth. As a result, this year's review estimated lower future recoveries at loan termination, which suppressed the estimated economic value of the overall HECM portfolio.

Moreover, recent research on the HECM portfolio presents a revised approach for accounting for home maintenance-risk associated with reverse mortgages. Maintenance risk measures the effect of the moral hazard in insufficiently maintaining the property, as the differences in house price appreciation rates between the HECM portfolio and the market-average. The research subset HECM borrowers into

“stayers” and “movers” based on the expected tenure. The estimated home appreciations among movers are higher than market average whereas the estimated home appreciations among stayers are lower than market average. The higher than market average appreciation among the movers has a positive effect on HECM’s economic value. However, since HECM loan balances tend to increase over time, the lower than market average appreciation among stayers (who have longer expected tenure) has a negative effect on the economic value of the HECM portfolio.

C. Decomposition of the Differences in Economic Value of the FY 2009 Review to the FY 2010 Review

In this section, we present the decomposition analysis that details the step-by-step changes in the economic value from the FY 2009 review to those in the FY 2010 review. Table II-3 below shows the changes in economic value in each step.

Table II-3 Summary of Changes in Economic Value for the HECM Portfolio in the MMI Fund Between FY 2009 and FY 2010 (\$ Millions)

Decomposition Steps	Change in FY 2010 Economic Value	FY 2010 Economic Value	Change in FY 2016 Economic Value	FY 2016 Economic Value ⁽³⁾
FY 2009 Economic Value Presented in the FY 2009 Review ⁽¹⁾		\$909		
FY 2010 Economic Value Presented in the FY 2009 Review Excluding the FY 2010 Book-of-Business ⁽²⁾	2	911		
Plus: Forecasted Value of FY 2010 Book-of-Business Presented in the FY 2009 Review	964			
Equals: FY 2010 Economic Value Presented in the FY 2009 Review		1,875		19,830
Plus: Net Transfer from Capital Reserve to HECM Financing Account	1,748	3,623	1,748	21,578
Plus: (i) Updated Origination Volume in FY 2009	10	3,633	11	21,588
Plus: (ii) Updated Actual Capital Resources as of the End of FY 2009	39	3,672	45	21,633
Plus: (iii) Updated Cash Flow Model	2,024	5,696	4,678	26,311
Plus: (iv) Updated Forecast of Future Book Volume	-736	4,960	-4,932	21,379
Plus: (v) Updated Forecast of Compositions and Premium Structure per Programmatic Changes	0	4,960	3,233	24,613
Plus: (vi). Updated Economic Forecast	-2,991	1,969	-6,151	15,229
Plus: (vii) Updated Home-Maintenance Risk Adjustment	-941	1,028	-3,829	11,399
Plus: (viii) Updated to FY 2011 OMB Discount Factors	-1,783	-755	-7,493	3,907
Plus: (ix) Updated Termination Rates Econometric Model	252	-503	568	4,475

(1) Economic value as of the end of FY 2009.

(2) Since HECM became part of the MMI fund in FY 2009, this line item only includes the FY 2009 book-of-business.

(3) The FY 2016 economic value is the last year that can be directly compared between the FY 2009 and FY 2010 Reviews.

(i) Updated Origination Volume in FY 2009

The updated origination volume for FY 2009 is the first decomposition step illustrated in Table II-3. The FY 2009 review was prepared using data as of June 2009 and cash flow elements are forecasted to the end of FY 2009 accordingly. The actual endorsement volume of the FY 2009 book-of-business is 3.4 percent greater than the forecasted volume in the FY 2009 review. The greater endorsement volume increases the economic value of the FY 2009 book by \$10 million.

(ii) Updated Actual Capital Resources as of the end of FY 2009

The impact of actual capital resources as of the end of FY 2009 is the second decomposition step illustrated in Table II-3. The FY 2009 review was prepared using data as of June 2009 and cash flow elements are forecasted to the end of FY 2009 accordingly. The actual capital resources as of the end of FY 2009 are \$39 million greater than the forecasted amount. Consequently, the FY 2010 and FY 2016 economic values are estimated to increase by \$39 million and \$45 million, respectively.

(iii) Updated Cash Flow Model

The third decomposition step illustrated in Table II-3 is the effect of incorporating loan-level termination rates for cash flow estimation. In last year's review, the loan-level termination rate projections were aggregated prior to estimating the cash flow for individual books-of-business. In this year's review, the loan-level termination rate projections were applied directly for cash flow estimates, including the cash outflows from assignment claims and note holding expenses and cash inflows from notes recoveries. The updated approach improves the alignment of the timing of cash flow events and termination rates for individual HECM loans. This results in improvements in the FY 2010 and FY 2016 economic values, estimated to increase by \$2.0 billion and \$4.7 billion, respectively.

(iv) Updated Forecast of Future Book Volume

The realized volume of FY 2010 book-of business and the forecasted volume for FY 2011 books-of-business and onward are less than last year's review. The actual FY 2010 book-of-business volume is approximately 30 percent less than last year's forecast. Cumulatively, the volume of FY 2010 to FY 2016 books-of-business decreased by approximately 20 percent compared to last year's forecast. Consequently, the FY 2010 and FY 2016 economic values are estimated to decrease by \$7.4 million and \$4.9 billion, respectively.

(v) Updated Forecast of Compositions and Premium Structure per Programmatic Changes

Since the preparation of last year's review, there have been several changes to the HECM Program and the market environment that increased the premium rates and resulted in updates to the forecasted portfolio compositions. Section I describes the changes in the recent and proposed changes in the HECM Program. The major changes include increases in the percentage of fixed rate full-draw endorsements, reduction in principal limit factors, expiration of temporary loan limit increase, and the introduction of the HECM Saver option. These programmatic changes have a positive effect on the HECM loan performance. Since the changes will become effective in early FY 2011, the economic value as of the end of FY 2010 is estimated to remain unchanged. The FY 2016 economic value is estimated to increase by \$3.2 billion.

(vi) Updated Economic Forecast

In last year's review, the Global Insight Inc. forecasts were used for the economic projections, including interest rates and house prices, where the house price forecast was available at the national-level. In this year's review, Moody's forecasts are used, where the house price forecast is available at various levels of details, including MSA, State and national. This year's review projected a slower house price recovery for the nation than last year's review. Moreover, the MSA-level forecast enabled this year's review to consider the geographical distribution of HECM endorsements in estimating future house prices. The HECM portfolio is more concentrated in areas with higher forecasted decline and lower forecasted long-term house price growth. As a result, this update has a negative impact on the HECM economic value. The FY 2010 and FY 2016 economic values are estimated to decrease by \$2.9 billion and \$9.3 billion, respectively.

(vii) Updated Home Maintenance-Risk Adjustment

This decomposition step illustrates the effect of the updated home maintenance-risk adjustment. Recent research on the HECM portfolio presents a revised approach of accounting for maintenance-risk posed by reverse mortgage. The estimated home appreciation rates among movers are higher than market average which has a positive effect on the HECM economic value. The estimated home appreciation rates among stayers are lower than market average which has a negative effect on the HECM economic value. The overall effect of the updated maintenance-risk adjustment approach decreases the FY 2010 and FY 2016 economic values by \$941 million and \$3.8 billion, respectively.

(viii) Updated to FY 2010 OMB Discount Factor

This decomposition step illustrates the effect of the updated discount factors. The latest OMB published interest rates at the time of the review are used to discount future cash flows to their present values. The OMB interest rates for last year's review were lower than those for this year's review. Due to the time delay between assignment claim payments and ultimate recoveries to FHA at loan terminations, the higher interest rates in this year's review have a negative effect on the net present value of the recovery income. This resulted in a decrease in FY 2010 and FY 2016 HECM economic values by \$1.8 billion and \$7.5 billion, respectively.

(ix) Updated Termination Rates Econometric Model

The last decomposition step illustrates the effect of the updated econometric model in estimating future termination rates. This year's review followed a similar econometric modeling approach as last year's with several enhancements. The major enhancements included the consideration of house price volatility and the relative value of the HECM property on borrower's mobility behavior; and the adoption of gender-specific mortality risk. Appendix A describes the changes of the model specification. The enhanced econometric model has a positive effect on the HECM economic value. The FY 2010 and FY 2016 economic value increase by \$252 million and \$568 million, respectively.

Section III. Current Status of HECM in MMI Fund

This section presents the components of the economic value in FY 2010 and discusses the projections through FY 2017. The HECM portion of the MMI Fund has a projected economic value of negative \$503 million at the end of FY 2010. The economic value is estimated to return to positive by the end of FY 2011. The economic value and the insurance-in-force of the HECM program are both estimated 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 capital ratio are the economic value and the insurance-in-force.

A. 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 2010. Table III-1 presents the components of the economic value for FY 2010.¹⁴ June 2010 data was annualized to estimate the total capital resources and the loan performance at the end of FY 2010. The total economic value consists of the following components:

- *Total Capital Resource* equals assets less liabilities in FY 2009 plus additional cash available from investments, fund transfers, and operational activities during FY 2010. We estimated the total capital resource to be \$3.0 billion at the end of FY 2010, 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 asset was \$653 million as of FY 2009.
 - *Total Liabilities*, which include the accounts payable. This is equal to zero as of the end of FY 2009.
 - *Net 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 for the FY 2009 re-estimate. The net transfer was \$1.7 billion in 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 2010. The total investment gain is \$141 million.
 - *Net Insurance Income in FY 2010*, which corresponds to the net insurance income including the estimated premium, claims, and recoveries according to annualized activities data in FY 2010. The net insurance income from the FY 2009 and FY 2010 books-of-business is \$500 million.
 - *Net present value of income from assigned notes*, which is the estimated net present value of future recoveries and note holding expenses of all assigned notes in FHA's portfolio. There are no assignments associated with the FY 2009 and FY 2010 books-of-business.

¹⁴ Note that Table III-1 is the same as Table II-2, reproduced in this section for easy reading.

- *Net 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 net future cash flow is estimated to be \$2.0 billion (undiscounted) for the current book-of-business. The corresponding net present value is negative \$3.5 billion as of the end of FY 2010.

Table III-1 Projected Economic Value of the HECM portfolio
in the MMI Fund at the end of FY 2010 (\$ Millions)

Item	End of FY2009 ⁽¹⁾	End of FY2010
Cash	\$275	
Investments	376	
Properties and Mortgages	0	
Other Assets and Receivables	2	
Total Assets	<u>\$653</u>	
Liabilities (Account Payables)	<u>0</u>	
Total Capital Resources	\$653	
Net Gain from Investment ⁽²⁾		\$141
Net Insurance Income in FY 2010 ⁽³⁾		500
Net Transfer from Capital Reserve to HECM Financing Account		1,748
PV of Expected Insurance Income from Assigned Notes ⁽⁴⁾		<u>0</u>
Total Capital Resources as of EOY		\$3,042
PV of Future Cash Flows on Outstanding Business		<u>-3,545</u>
Economic Value		-\$503
Insurance-In-Force		\$51,397

(1) Source: Audited Financial Statements for FY 2009

(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 2010.

(3) Includes premium inflow and claim outflow during the fiscal year

(4) The present value of expected future recoveries of HECM notes assigned during the fiscal year (including pending assignments and completed assignments)

B. 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 2010. MCA is FHA’s insurance commitment on HECM loans, and it represents FHA’s maximum financial exposure. Due to the unique design of the HECM program, loan balances 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 balance to estimate the IIF would under-represent FHA’s long-term insurance exposure.

MCA is the highest claim amount FHA can pay out at insurance termination. 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. Consequently, the total MCA for all loans in FHA’s insurance portfolio represents FHA’s total

risk exposure for a given book-of-business. At the end of FY 2010, the estimated IIF is \$29.7 billion for the 2009 book and \$21.7 billion for the 2010 book, a total of \$51.4 billion.

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

In this section, we present the forecasts of the future economic values and insurance-in-force projections for HECM. We estimate these future values by applying our termination and cash flow models to the endorsement and borrower characteristic forecasts provided by FHA.

Table III-2 shows the estimated economic value of future HECM books-of-business and the corresponding insurance-in-force.¹⁵ All values in the table are discounted to the end of each corresponding fiscal year.

We estimate the projected economic value for each book-of-business to increase steadily from negative \$503 million in FY 2010 to \$5.8 billion in FY 2017. This is due to the projected increase in new endorsements, new programmatic changes, and the improvement in the economic forecast over time. Consequently, the economic value of the entire HECM portfolio is estimated to increase over time. The increase is most significant between FY 2010 and FY 2011, where the economic value of the individual books of business is estimated to increase from negative \$772 million for the FY 2010 book to positive \$538 million for the FY 2011 book. This is due to various reasons, including the increases in premium rates, the introduction of HECM Saver option, and the forecasted house price recovery.

With the addition of new endorsements, the total insurance-in-force is estimated to increase from \$50.4 billion at the end of FY 2010 to \$188.2 billion in FY 2017. As the house price forecast improves over time and the programmatic changes, the rate of increase in the economic value of the Fund is higher than the rate of increase in insurance-in-force. This represents a growing ratio of the HECM portfolio's insurance value to insurance risk in the MMI Fund over time.

Table 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 Income
2010	-\$503	\$50,438	\$21,732	-\$772	-
2011	83	66,771	20,541	538	48
2012	704	83,369	21,885	594	28
2013	1,427	100,285	23,763	678	44
2014	2,308	118,880	27,786	806	75
2015	3,326	139,280	31,677	904	114
2016	4,475	161,934	35,924	988	162
2017	5,819	188,165	40,653	1,125	219

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.

¹⁵ Note that Table III-2 is the same as Table II-1, reproduced in this section for easy reading.

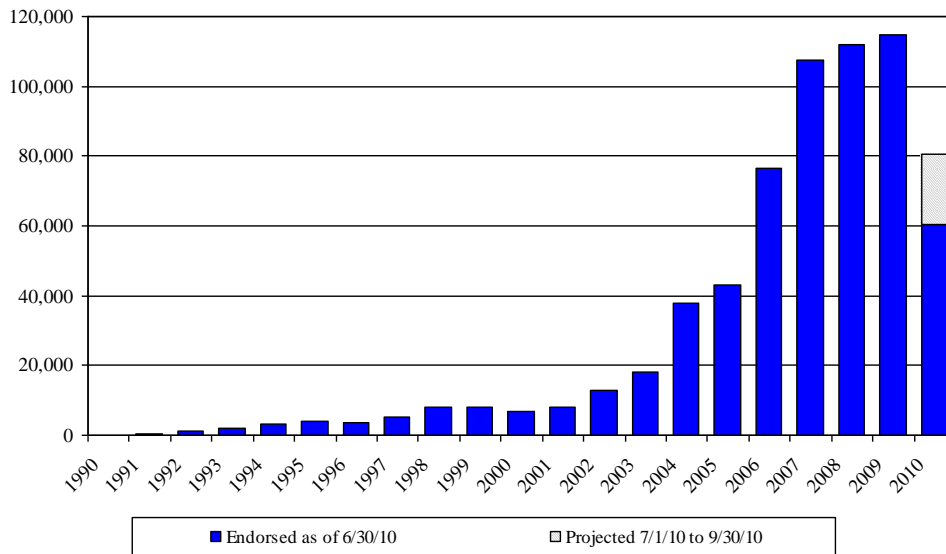
Section IV. Characteristics of the FY 2009 and FY 2010 HECM Book-of-Business

This section presents the characteristics of the FY 2009 and FY 2010 HECM books-of-business. All data used for this analysis is provided by FHA as of June 30, 2010.

A. Volume and Share of Mortgage Originations

FHA endorsed 60,277 HECM loans with a total dollar value, defined as the MCA, of \$16.4 billion from October 1, 2009 to June 30, 2010. The annualized number of endorsements in FY 2010 is 80,369 and the corresponding dollar value is \$21.7 billion. The number of endorsements in FY 2009 is 114,656 and the corresponding dollar value is \$30.2 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 over time.

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



B. Payment Types

HECM borrowers receive loan proceeds by selecting from various payment plans. Tables IV-1a and IV-1b present the distribution of FY 2009 and FY 2010 HECM loans by payment plan. As of June 30, 2010, the majority of HECM borrowers selected the line of credit option. This option accounted for 91 percent of the FY 2009 book-of-business and 93 percent of the FY 2010 book-of-business. Approximately four percent in FY 2010 and six percent in FY 2009 chose a line of credit plan combined with a term or tenure payment plan.

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

Payment Type	Number of Loans	Percent of Total
Line of Credit	104,066	90.8%
Tenure	2,621	2.3
Term & Line of Credit	3,831	3.3
Tenure & Line of Credit	2,701	2.4
Term	1,433	1.2
Missing Payment Type	4	0.0
Total	114,656	100

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

Payment Type	Number of Loans	Percent of Total
Line of Credit	56,106	92.7%
Tenure	1,072	1.8
Term & Line of Credit	1,315	2.2
Tenure & Line of Credit	1,080	1.8
Term	505	0.8
Missing Payment Type	455	0.8
Total	60,533	100

C. Interest Rate Type

HECM borrowers can select fixed or adjustable rate mortgages. Tables IV-2a and IV-2b show the distribution of FY 2009 and FY 2010 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 increased steadily throughout FY 2009, constituting 12 percent of the endorsements, and the percentage continues to increase to 69 percent in FY 2010.

The LIBOR-Indexed loans constituted 36 percent of the FY 2009 HECM endorsements and 62 percent of the FY 2010 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 to purchase U. S. Treasury-indexed HECMs as of September 1, 2009.¹⁶

Table 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	2,533	2
Total		114,656	100

Table 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	413	1%
	Annual Adjustable	8	0
	Fixed	22,417	37
LIBOR-Indexed	Monthly Adjustable	18,440	30%
	Annual Adjustable	7	0
	Fixed	19,248	32
Total		60,533	100

¹⁶ 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 and FY 2010 are traditional HECMs, whereby the borrower purchased their home prior to taking out the reverse mortgage. The exception is the loans endorsed under the HECM for Purchase program that were introduced in January 2009. Among the HECM for Purchase loans, 15 percent of FY 2009 borrowers and 13 percent of FY 2010 drew 90 percent of their maximum available equity within the first month of loan endorsement. These loans represent a small portion of the total FY 2009 and FY 2010 HECM books-of-business as seen in Tables IV-3a and IV-3b.

Table 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

Table 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	136	0.2%
	First Month Cash Draw < 90% of Initial Principal Limit	878	1.5
Traditional HECMs		59,519	98.3
Total		60,533	100

E. Endorsements by State

Of all the endorsements in FY 2009 and FY 2010, approximately forty percent of them originated in either California, Florida, Texas, or New York. California has the highest endorsement volume in both FY 2009 and FY 2010 with 13.7 percent and 14.1 percent, respectively. While Florida is the second highest in 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. The breakdown of these top four states is seen below in Figure IV-2a and IV-2b.

Figure IV-2a: Percentage of Endorsements by State for FY 2009 HECM Loans

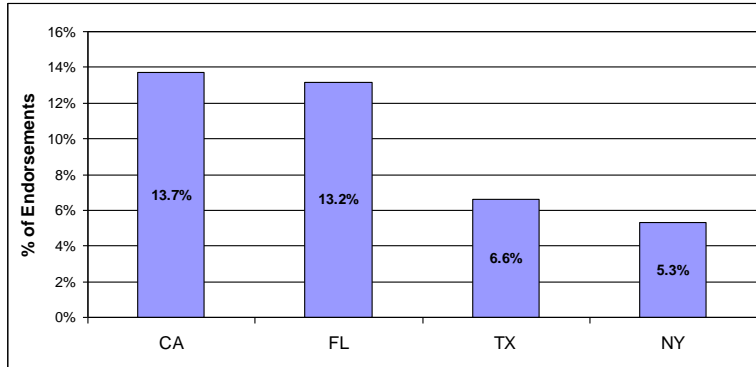
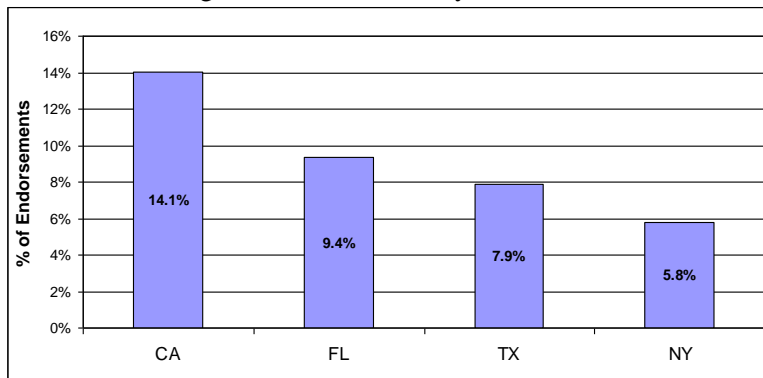


Figure IV-2b: Percentage of Endorsements by State for FY 2010 HECM Loans



F. Maximum Claim Amount Distribution

The MCA is the minimum of the FHA loan limit and the appraised value. It is used as the basis of the initial principal limit determination and as the cap of the potential insurance claim amount. Tables IV-4a and IV-4b show the distribution of FY 2009 and FY 2010 endorsements by MCA. Approximately 64 percent of loans endorsed in FY 2009 have an MCA less than \$300,000 and approximately 65 percent for FY 2010.

As discussed in Section I, FHA HECM loan limits changed several times in FY 2009. The FHA loan limits increased from area-specific loan limits capped at \$362,790 in non-high-cost areas to a nationwide limit of \$417,000 in November 2008. In February 2009, the limit was temporarily increased to a nationwide limit of \$625,500 until December 31, 2010 and is expected to return to \$417,000 on January 1, 2011. According to an analysis on endorsement data, the average MCA has gradually increased with the loan limit changes. The increase follows a typical time lag, resulting from the time for application and market adoption of the new policy.

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 12 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 17 percent in June 2010. The primary driver for the decrease is due to the shift of endorsements from historically high cost area like Florida, to the lower cost area like Texas and the Midwestern states.

Table IV-4a: Distribution of FY 2009 HECM Loans by MCA Level

Month	Level of MCA					Total
	Less Than \$100k	\$100k to \$200k	\$200k to \$300k	\$300k to \$417k	Greater Than \$417k	
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

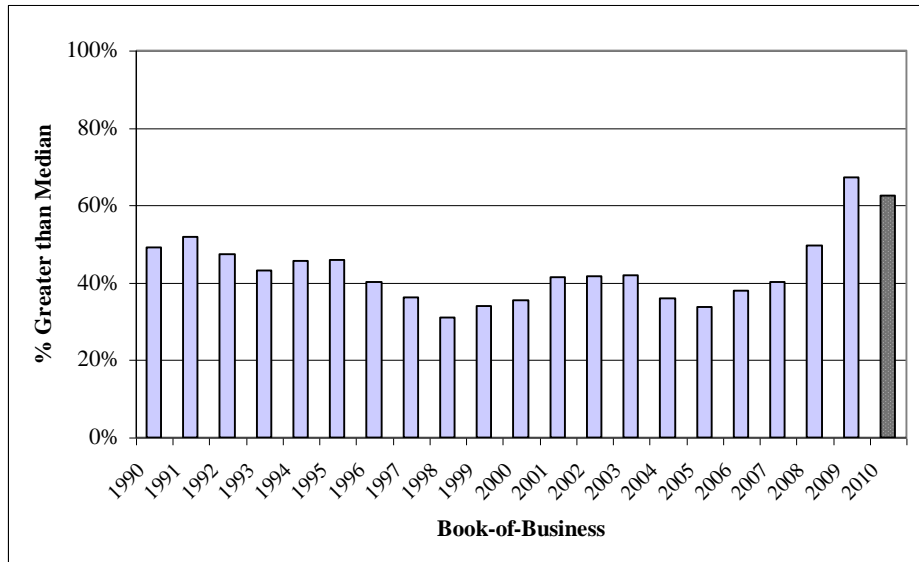
Table IV-4b: Distribution of FY 2010 HECM Loans by MCA Level

Month	Level of MCA					Total
	Less Than \$100k	\$100k to \$200k	\$200k to \$300k	\$300k to \$417k	Greater Than \$417k	
October, 2009	10%	31%	20%	15%	24%	100%
November, 2009	11	32	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	19	14	18	100
May, 2010	14	35	20	14	17	100
June, 2010	14	36	21	13	17	100
Total	12	33	20	14	21	100

G. Appraised House Value

Research shows that loans associated with properties with appraised value greater than their area median at origination tend to have lower home maintenance risk than those below the area median. Figure IV-3 shows the percentage of 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 ARRA and HERA increased the HECM loan limit and further accelerated the upward trend starting in FY 2009. In the FY 2009 book-of-business, 67 percent of the HECM properties were appraised at higher than the area median. In the FY 2010 book-of-business, 62 percent of the HECM properties were appraised at higher than the area median.

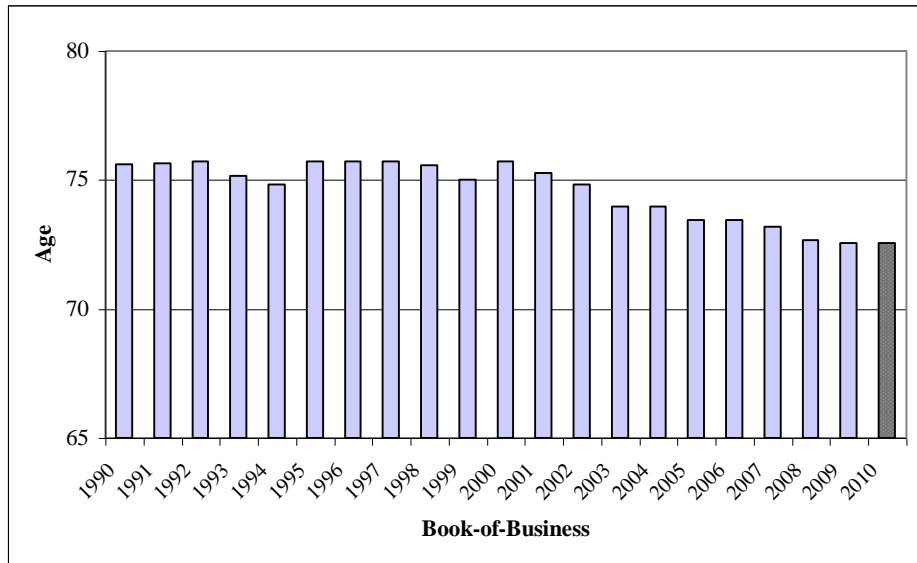
Figure IV-3: Percentage of Borrowers with Appraised House Value Greater than Area Median Value



H. Borrower Age Distribution

The age profile of a book-of-business affects loan termination rates and the percentage of initial equity available to the borrower. Figure IV-4 presents the average borrower age at origination for FY 1990 to FY 2010 books-of-business (note that only FY 2009 and FY 2010 books-of-business are a part of the MMI Fund). The average borrower age has declined over time. This indicates that HECM is becoming more popular with younger borrowers. Younger borrowers are associated with greater mortality risk for FHA as they have a longer life expectancy. To manage this risk, the PLFs are lower for younger borrowers, allowing them to access a smaller portion of their equity. The average age of the FY 2009 and FY 2010 books-of-business is 73 years.

Figure IV-4: Average Borrower Age at Origination by Book-of-Business



I. Borrower Gender Distribution

Gender also affects termination behavior due to differences in mortality. The gender distribution of the HECM portfolio has remained steady over time. HECM performance-to-date shows that males tend to terminate the fastest, followed by females, and couples terminate most slowly. Figures IV-5a and IV-5b present the gender distribution for the FY 2009 and FY 2010 HECM books-of-business. Females comprise the majority of the FY 2009 book-of-business at 41 percent, followed by couples at 37 percent, and males at 22 percent. Females also comprise the majority of the FY 2010 book-of-business at 42 percent, followed by couples at 35 percent, and males at 22 percent.

Figure IV-5a: Distribution of FY 2009 HECM Endorsements by Gender

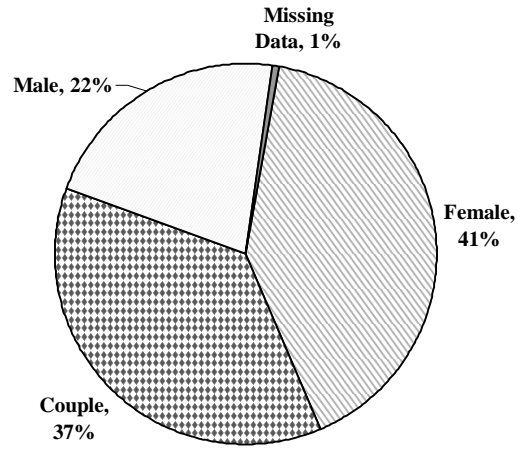
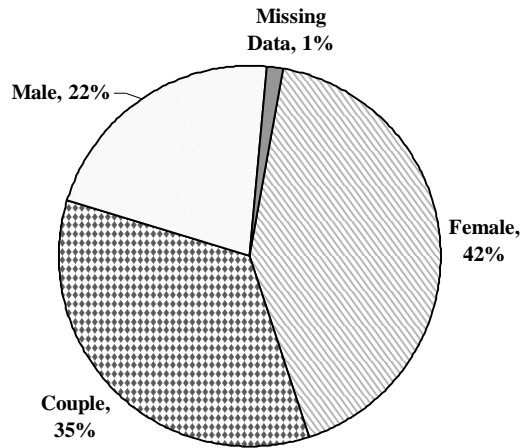


Figure IV-5b: Distribution of FY 2010 HECM Endorsements by Gender



J. Cash Draw Distribution

Data shows that loans which have drawn a higher percentage of the initial amount of equity available have a highly likelihood of refinancing. Tables IV-5a and IV-5b show the distribution of first month cash draw as a percentage of the initial principal limit among different borrower age groups for FY 2009 and FY 2010. In FY 2009, 12 percent of the endorsements took a full draw within the first month. In FY 2010, the percentage grew to 69 percent as the percentage of fixed rate loans continued to increase.

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 to 65 age group drew over 80 percent of the initial principal limit, compared to 43 percent for the greater than 85 years-old age group. In FY 2010, 84 percent of the 62 to 65 age group drew over 80 percent of the initial principal limit, compared to 52 percent for the greater than 85 years-old age group.

Table IV-5a: First Month Borrower Cash Draw of FY 2009 HECM Endorsements as a Percentage of the Initial Principal Limit¹⁷

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	Full Draw (100% of Initial Principal Limit)
62 - 65	23,741	12%	24%	50%	14%
66 - 70	28,264	15	24	48	13
71 - 75	24,989	19	24	45	11
76 - 85	30,745	25	24	41	10
85 +	6,917	37	20	35	8
Total	114,656	20	24	45	12

Table IV-5b: 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	Full Draw (100% of Initial Principal Limit)
62 - 65	13,368	8%	8%	4%	80%
66 - 70	14,379	10	9	5	76
71 - 75	12,733	14	11	6	69
76 - 85	15,902	20	14	7	59
85 +	4,151	34	15	9	43
Total	60,533	14	11	6	69

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 appraised value of their home. This is because the PLF is lower for younger borrowers to account for their longer life expectancy.

¹⁷ As of the time of this review, about 1,770 loans do not have cash draw data populated. For the purpose of this analysis, these loans are considered to have no cash draw in the first month.

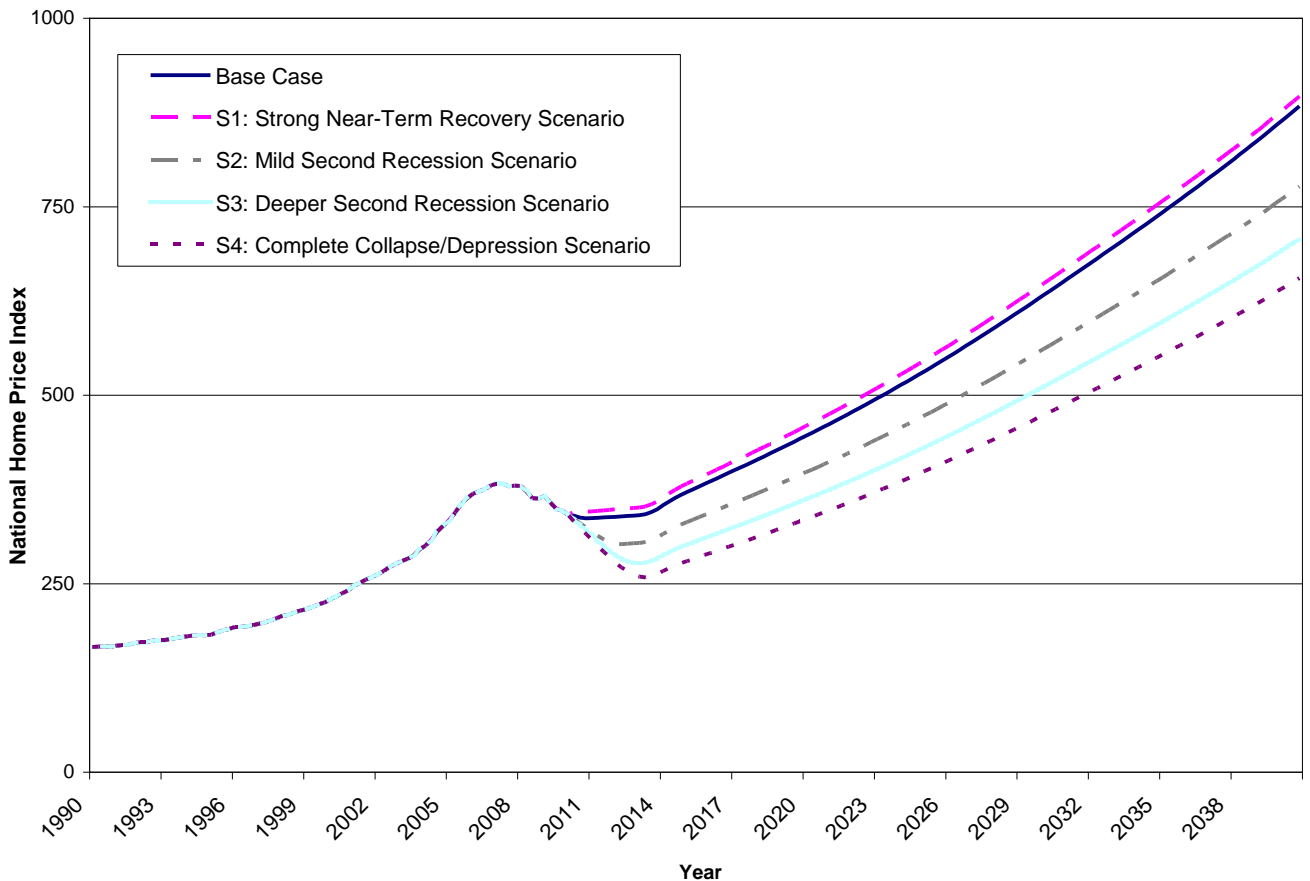
Section V. Sensitivity Analysis

A sensitivity analysis was conducted to assess the impact of various economic scenarios on the economic value of the FY 2009 to FY 2017 HECM books-of-business. This section presents the results of this analysis. Four relevant scenarios were considered to determine the effects of more severe and less severe economic scenarios on the economic value of the HECM program. The economic scenarios were based on Moody published in July 2010, with adjustments to the long-term house price appreciation rate. The scenarios represent various percentiles along the distribution of possible economic scenarios, including:

- S1: Strong Near-Term Recovery Scenario, representing the 90th percentile of the economic scenarios
- 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: Complete Collapse/Depression Scenario, representing the 4th percentile of economic scenarios.

Chart V-1 shows the future movements of the national-level HPI under the base-case and the first four alternative economic scenarios. See Appendix B for details.

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



The base case economic scenario used the Moody’s July 2010 forecast. This includes the FHFA national, state, and MSA house price index, the ten-year Treasury rate, and the one-year Treasury rate¹⁸. Moody’s house price forecasts are part of its macroeconomic model with consideration of local area economic environments including unemployment rates. The base case mortality rates were based on the 1999-2001 U. S. Decennial Life Table 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. The data used for each of these economic scenarios is presented in Appendix D.

Table V-1 presents the projected economic value as of FY 2010 to FY 2017 under the base case scenario.¹⁹ The economic value of the HECM portfolio in the MMI Fund at the end of FY 2010 is negative \$503 million. Table V-I also presents the projected economic value through FY 2017. The economic value is positive for all books-of-business, with the economic value of the HECM portfolio of the MMI Fund growing to \$5.8 billion by the end of FY 2017.

Table V-1: HECM Economic Value under 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 Income
2010	-\$503	\$50,438	\$21,732	-\$772	-
2011	83	66,771	20,541	538	48
2012	704	83,369	21,885	594	28
2013	1,427	100,285	23,763	678	44
2014	2,308	118,880	27,786	806	75
2015	3,326	139,280	31,677	904	114
2016	4,475	161,934	35,924	988	162
2017	5,819	188,165	40,653	1,125	219

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.

The impact of each of the alternate scenarios on the performance of the HECM portion of the MMI Fund is detailed below.

S1. Strong Near-Term Recovery Scenario

Table V-2 presents the projected economic values as of FY 2010 to FY 2017 under the strong near-term recovery scenario. The economic value at the end of FY 2010 increases from the baseline negative \$503 million to negative \$276 million under this alternative scenario. This is primarily due to the higher near-

¹⁸ At the time of the review, Moody’s 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 estimated the future LIBOR ten-year using the Moody’s Treasury rate forecast accordingly.

¹⁹ Note that Table V-1 is the same as Table II-1, reproduced in this section for easy reading.

term 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.

Table V-2: HECM Economic Value under
S1. the Strong Near-Term Recovery 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 Income
2010	-\$276	\$51,397	\$21,732	-\$641	-
2011	302	69,799	20,541	524	54
2012	922	88,214	21,885	583	37
2013	1,649	106,521	23,763	673	54
2014	2,527	126,307	27,786	793	85
2015	3,527	147,401	31,677	875	124
2016	4,673	170,103	35,924	974	172
2017	5,975	195,964	40,653	1,072	229

S2. Mild Second Recession Scenario

Table V-3 presents the projected economic values as of FY 2010 to FY 2017 under the mild second recession scenario. The economic value at the end of FY 2010 decreases from the baseline negative \$503 million to negative \$1,764 million under this alternative scenario. The negative impact on the FY 2010 book-of-business carried over to all the forecasted fiscal years such that the economic value at the end of FY 2017 in this scenario is \$3.6 billion. The decrease in economic values is primarily due to the lower house price appreciation. With lower forecasted home values, the likelihood of HECM loan balance exceeding home values rises, increasing the probability of higher loan losses. Moreover, lower cumulative house price growth lowers the likelihood of refinance and reduces borrowers' incentive to move out, extending the length of risk exposure.

Table V-3: HECM Economic Value under
S2. the Mild Second Recession 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 Income
2010	-\$1,764	\$51,397	\$21,732	-\$1,401	-
2011	-1,505	70,092	20,541	247	-
2012	-952	89,141	21,885	590	-
2013	-298	108,397	23,763	685	-
2014	492	129,262	27,786	794	-
2015	1,393	151,191	31,677	875	26
2016	2,430	174,343	35,924	973	64
2017	3,619	199,442	40,653	1,071	117

S3. Deeper Second Recession Scenario

Table V-4 presents the projected economic values as of FY 2010 to FY 2017 under the interest rate deeper second recession scenario. The result of this scenario resulted in a decrease in economic values for FY 2010 through FY 2012 books-of-business. Under this scenario, the economic values at the end of FY 2010 and at the end of FY 2017 are estimated to decrease to negative \$2.9 billion and \$1.4 billion, respectively. Similar to the Mild Recession Scenario (S2), the decrease in economic values in this scenario is due to the lower forecasted home values but with greater severity.

Table V-4: HECM Economic Value under
S3. the Deeper Second Recession 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 Income
2010	-\$2,874	\$51,397	\$21,732	-\$1,875	-
2011	-3,098	70,157	20,541	-205	-
2012	-2,769	89,405	21,885	431	-
2013	-2,209	109,056	23,763	673	-
2014	-1,507	130,476	27,786	794	-
2015	-689	152,922	31,677	888	-
2016	251	176,167	35,924	981	-
2017	1,351	200,654	40,653	1,091	8

S4. Complete Collapse/Depression Scenario

Table V-5 presents the projected economic values as of the FY 2010 to FY 2017 under the complete collapse/depression scenario. The result of this scenario resulted in a decrease in economic values for all books-of-business in this review. Under this scenario, the economic values at the end of FY 2010 and at the end of FY 2017 are estimated to decrease to negative \$3.5 billion and negative \$786 million, respectively. Similar to the Deeper Second Recession Scenario (S3), the decrease in economic values in this scenario is due to the lower forecasted home values but with greater severity.

Table V-5: HECM Economic Value under
S4. the Complete Collapse/Depression 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 Income
2010	-\$3,480	\$51,397	\$21,732	-\$2,221	
2011	-4,131	70,185	20,541	-615	-
2012	-4,165	89,544	21,885	111	-
2013	-3,833	109,492	23,763	507	-
2014	-3,302	131,438	27,786	698	-
2015	-2,599	154,346	31,677	860	-
2016	-1,773	177,639	35,924	962	-
2017	-786	201,633	40,653	1,081	-

Section VI. Summary of Methodology

This section describes the overall analytical approach implemented in this review. Detailed descriptions of the statistical model for HECM loan terminations are provided in Appendix A. Appendix B provides details on the forecasting model and the sensitivity analysis. Appendix C provides details on the cash flow model.

A. Termination Model Specification

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 three mutually exclusive HECM termination events: mobility, refinance, and mortality. Multinomial logit regression modeling is adopted to capture the competing-risk structure of the different termination events. This is consistent with literature, HECM experience, and the FHA Single Family forward mortgage actuarial review.

The multinomial logit approach has several benefits. First, logit models eliminate the likelihood of a negative probability for any estimated event. Second, the multinomial approach ensures the event probabilities sum to 100 percent. In other words, a HECM loan can experience only one of the four possible outcomes in any period: move-out, refinance, death, or survival. Third, it captures the zero-sum nature of the different termination events, whereby the increased probability of one risk decreases the probabilities of the other risks.

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 extraneous economic 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 logit model is estimated based on economic indicators and loan-level historical HECM data. 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 Event and Economic Data

The termination model specifications are determined using historical data from all endorsed HECM loans (from FY 1990 to FY 2010 books-of-business) and actual economic experience through June 30, 2010. We used loan-level data to construct the quarterly history by relating mortgage origination information to contemporaneous values of time-dependent factors.

Loan-level historical experience obtained from FHA is used to align with key economic predictors of HECM terminations such as changes in house prices and interest rates. The Federal Housing Finance Agency (FHFA) Metropolitan Statistical Area (MSA)-level house price appreciation rates are used when available; otherwise, state-level FHFA data is used. Interest rate data is obtained from Moody.

The estimated future termination rates are based on all characteristics of the surviving portfolio and forecasts of economic variables. Each loan is expanded from its origin to the policy year associated with the borrower age reaching 109, the maximum age in the mortality tables. Actual data is used between the time of origination and FY 2010 and forecasted data is used beginning in FY 2011. For future house price appreciation, MSA level forecasts are used for house price appreciation with state level forecasts being used if the MSA level data is not available. The recently announced PLFs that will come into effect on October 4, 2010 are leveraged to estimate future refinance incentives.

C. Cash Flow Modeling

The cash flow model estimates the HECM economic value for the FY 2009 to FY 2017 books-of-business. It projects the net present value of future cash flows for these books-of-business in the FHA insurance portfolio. For existing books-of-business, it estimates cash flows for all surviving loans at the time of this review. For future books-of-business, we utilize the expected borrower characteristics, volume, and loan size forecasts provided by FHA.

The HECM cash flow model consists of four components: premiums, claims, payments, and recoveries on notes in inventory. Cash flows are discounted according to the most recent Federal credit subsidy present value conversion factors.²⁰

²⁰ At the time of this review, the latest annual discount factors published by the Office of Management and Budget (OMB) were in November 2009.

Section VII. Qualifications and Limitations

The estimates provided in this review are based on models that are constructed according to certain assumptions, forecasts, and theoretical frameworks. The two models are the econometric model and the cash flow model. In this section, we discuss the limitations and potential constraints of the model estimates.

The econometric model relates the rates of loan termination to a number of parameters, including borrower characteristics, loan characteristics, and key macroeconomic variables such as house prices and interest rates. It captures the three major competing risks of loan terminations to date: mortality, mobility and refinance. The impact of these parameters on loan terminations is calibrated using FHA's actual historical experience through a statistical optimization technique known as maximum likelihood estimation. Future termination estimates are determined based on the calibrated model using future loan portfolio characteristics and certain economic assumptions.

The cash flow model estimates the present value of all future cash flows for each book-of-business. The key inputs to the model are the estimated termination rates from the econometric model, loan characteristics, macroeconomic forecasts, and the current discount factors. The cash flow model also draws on assumptions based on past FHA experience, including lenders' behavior regarding their option to assign as well as borrowers' behavior in drawing cash over the life of the loan.

A. Sensitivity to Economic Projections and Discount Factors

The financial estimates presented in this review require economic forecasts forty years into the future. The economic forecasts, including house price appreciation and interest rate trends are from Moody. 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 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, the updated yield curve assumptions will have a noticeable impact on the projected cash flows in future years.

B. Limited Program Experience

HECM has a relatively short program history. The pilot program began in 1989 and became permanent in 1998 after endorsing only 20,000 loans. The endorsements exceeded 10,000 loans per year in 2002 and reached 100,000 per year in 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 five years. The lack of long-run performance data potentially limits the robustness of the models' predictive capacity for later policy years.

C. 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 will offer the HECM Saver option to borrowers starting in FY 2011. The HECM Saver will have a lower upfront mortgage insurance premium and also lower PLFs. The pricing option is expected to attract borrowers who require fewer 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.

At the same time, FHA also will increase the annual premium for HECM from 0.5 percent to 1.25 percent. This will generate greater cash inflow for the HECM Program. On the other hand, it will result in a more rapid accumulation of loan balance, across all HECM options with borrowers reaching the maximum claim amount more quickly. It will be necessary to monitor the impact these various factors will have on the overall demand for the HECM program and its performance.

Lastly, Congress recently extended the loan limit increase to September 31, 2011. The change was made after the economic value analysis of this review and its impact is not included in the estimates. The continuation of the higher loan limit will likely attract more borrowers with home values greater than the local area median. As a result, the actual economic value of the FY2011 book-of-business is expected to be different, and likely to be higher, than the estimate presented in this review.

Appendix A: Loan Performance Expectations of HECM Loans

This appendix describes the methodology used to estimate the historical and future performance of HECM loans. The most common reasons why HECM loans terminate are mobility, refinance, and mortality. Since each loan can terminate for only one of these reasons, a competing risk logit model was created. A separate logit model was developed for each type of termination. The probability of termination from each model was then aggregated to estimate the probability a particular loan would terminate in any policy year.

All historical HECM termination and survivorship data is used to formulate this model. This includes 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 and FY 2010. The change from the GI fund to MMI fund has been a transparent process to the lenders and borrowers with no impact on the lending operation. It is assumed that the fund has no impact on loan termination behavior. It is also important to note that insurance is terminated at mortgage note assignment but the HECM loan does not terminate at this time. Hence, note assignments are not modeled as terminations in this review.

The structure of this appendix is as follows: Section I provides a general background of logistic regression, specifically the competing risk logit model. Section II details the model specification for each of the three competing risk models. Section III shows the final parameter estimates and model fit statistics for each of the three competing risk models.

I. The Competing Risk Logit Model

Similar to Szymanoski, DiVenti, and Chow (2000) and Yuen-Reed and Szymanoski (2007), a competing risk logistic regression or logit model approach is used to estimate the probability of HECM loan termination events. The termination of HECM loans is unique because a loan can terminate due to one of three reasons (mobility, refinance, and mortality), and for only one of these reasons. For instance, a loan that terminates due to mortality cannot terminate at a later time due to a refinance. The multinomial model recognizes the competing nature of the three termination drivers so it is ideal for modeling HECM terminations. The competing risk logit model also ensures the probability that the loan terminates under all three outcomes and the probability that the loan survives always sum to 100 percent.

Begg and Gray (1984) showed that it is statistically equivalent to model a multinomial logit regression model as an aggregation of individually estimated binomial logit regression models. Specifically, the parameters are first determined in individual multinomial logit regression model per risk. The models are then aggregated to estimate the total likelihood of termination. This methodology requires that all risk outcomes are compared to each other in separate logit models. For HECM termination modeling, this means that active loans are compared to mobility terminations, refinance terminations, and mortality terminations to create three individual model specifications. These risks are then combined to create a single competing risk model. This approach allowed us to effectively account for the censoring effect of one termination outcome on the other two potential outcomes. For example, when a loan was terminated due to a move-out, we are able to account for its censoring effect of the other two termination outcomes, which are refinance and death.

II. Individual Model Specifications

Each individual termination model specification estimates the conditional probability that a loan will terminate due to one of three reasons: mortality ($P_D(t)$), mobility ($P_M(t)$) and refinance ($P_R(t)$). The mathematical expressions that correspond to each of these three risks are given by:

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

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

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

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 unknown parameters that are 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. There are several economic, loan, and borrower characteristics used 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 (t).

To classify historic terminations between the three possible outcomes, we first identified the terminations that resulted in refinances based on FHA’s endorsement records. The remaining terminations are cross referenced with the Social Security Administration’s mortality data provided by FHA. If a loan terminated within one year prior and two years after the borrower’s recorded death date¹, the loan is considered to terminate due to death. The remaining terminations are considered as mobility terminations.

A. Mortality Model

The mortality model was designed to estimate the probability a HECM loan would terminate due to the death of the borrower. We utilized the Social Security Administration data provided by FHA to determine the date of death for HECM borrowers. 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 factors 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

¹ For loans with co-borrowers, the more recent death date between the borrowers and co-borrowers is used.

surviving until the time-of-interest is used to estimate the loan's overall mortality rates. *Equation 4* depicts the *GenderSpecificMortality* calculation.

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

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 shows 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 age increase. The dummy variable *Gender(Couples)* and the interaction term *Couple_{Dummy} x GenderSpecificMortality* are designed to account for this experience.

Prior HECM experience also indicates that the likelihood of death terminations increase with policy year while the death termination in the first policy year is suppressed. The time-dependent variable *PolicyYear* and the dummy variable *1stYear_{Dummy}* are in place to capture this experience. The variable *PolicyYear* has a value equal to the number of years the loan has been active.

B. 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(s), and economic variables.

1. Duration Variables

Prior HECM experience shows that the majority of refinances occur after the first few years of the loan. The variables *PolicyYear*, *1stYear_{Dummy}*, *2ndYear_{Dummy}*, and *3rdYear_{Dummy}* are designed to account for this experience. The variable *PolicyYear* has a value equal to the number of years the loan has been active.

2. Borrower(s) Variables

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, because historical experience suggests that older borrowers are less likely to refinance. Similarly, borrowers with different genders also refinance at differing rates. *Gender* is a categorical variable with possible values of female, male, and couple; with female as the baseline. Historical experience suggests that couples are less likely to refinance than females, and males are more likely to refinance than females.

The likelihood of refinances is also driven by the cash draw pattern of the borrower. We found that the first-month cash draw (*1st month cash draw*) is a representative indicator to the likelihood of

future refinances. Borrowers who draw large amounts of cash initially are more likely to refinance than borrowers who do not.

3. Economic Variables

To further explain the behavior of HECM borrowers’ willingness and ability to refinance a loan, the refinance incentive measure was created. The refinance incentive measure represents the net increase in principal limit for a borrower given the costs associated with refinancing. Equation 5 depicts the refinance incentive measure calculation

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

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 a 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

C. Mobility Model

The mobility model was constructed to estimate the probability that a HECM loan terminates due to the borrower moving out and paying off the loan. Factors such as borrower characteristics, economic factors, and loan specific variables were examined to define the final model specification.

1. Duration Variables

Historical experience of mobility terminations shows the likelihood of a HECM borrower paying off their loan due to mobility. 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 then 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.

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

2. Borrower(s) Variables

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

The *GenderSpecificMortality* variable intends 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 as described in Section A are used except there is no time lag included (aka there is no two-year shift for this variable).

The *Gender* categorical variable includes values of female, male, and couple. Female 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.

3. Economic Variables

Historical experience suggests that faster house price appreciation increases likelihood of move-outs. Moreover, move-out is more likely when the one-year Treasury rate increases, which accelerates the rate of loan balance growth. Quarterly house price appreciation data is from Moody's Analytics (Moody) house price Index (HPI) based on the MSA (or state if the loan is located outside of a MSA). Historical data on interest rates is obtained from Moody. The *CumulativeHPA* variable captures the expected resale value of the home. The *ChangeOneYearCMT* variable reflects the changes in the speed of interest accruals, which acts as a trigger event related to the perception of product cost.

The *HomeValueVsAreaMedian* variable, which estimates the ratio of appraised property value at origination to median value in the local area, is added to this year's review. The local median house price data is attained from Moody at the MSA and state level, with the most granular level available being used for each property. This variable intends 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* variable is also added to this year's review, which is a binary variable based on the probability of negative equity 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 suggests that HECM borrowers with higher probability of negative equity tend to remain in their homes longer than borrowers with lower probability of negative equity. This is because borrowers with high probability of negative equity have a lower probability of having equity remaining after paying off the HECM loan.

The distributions of individual home values are estimated based on the house price drift and volatility parameters based on FHFA House Price Indexes (HPIs). The parameters α and β represent the variability of home values within a geographical area, which are specific to MSA and state. The parameter c represents the variability of home values over time, which is also specific to MSA and state. These parameter values are provided by FHA.

Equation 7 depicts 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 binary explanatory variable, respectively.

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

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

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 house price index for the MSA/State

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

D. Combining the Three Risks

The results of the mortality, refinance, and mobility termination rates can be aggregated as a single hazard rate according to Begg & Gray (1984) as follows:

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

where $P_j(t)$ is derived from *Equations 1, 2, and 3*.

The majority of HECM loans have been endorsed in the past five years, so there are a limited number of loans that have remained in FHA’s portfolio for a significant amount of time. As a result, the accuracy of the competing risk logit model to predict terminations for later policy years is limited. Experience with elderly homeowners has shown that as the borrower ages, the likelihood of voluntary move-outs (mobility) and refinances decrease and hence mortality would dominate the risk of terminations. Therefore, to mitigate the risk of limited long-term surviving loans on model accuracy, the termination model integrates the hazard rate from *Equation 11* with the borrower’s mortality rate.

$$h_i(t) = \begin{cases} P(t), & \text{for } PolicyYeart \leq 5 \\ MAX\{P(t), m_i(t)\}, & \text{for } PolicyYeart > 5 \end{cases} \quad \{Equation 11\}$$

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

The final result of $h_i(t)$ is the conditional probability that a HECM loan will terminate due to one of the three competing risks. These probabilities are calculated at the loan level so that each loan has a conditional probability of termination to estimate the future cash flows. Appendix B discusses the technical approach to estimating future terminations at the cohort and policy year level.

Model Estimation Results

Tables A-1, A-2, and A-3 present the coefficient estimates for the parameters for the logit regression models that estimate mortality, refinance, and mobility termination probabilities.

Table A-1: Mortality Termination Model Specifications

Variable	Coefficient
Intercept	-4.054
First Year (Dummy)	-0.779
Policy Year	0.041
Gender (Couple)	-2.135
Gender Specific Mortality Rate (Shifted)*	11.031
Interaction (Couple by Mortality) (%)	1.063
Goodness-of-Fit	
-2 Log Likelihood	287,837
Number of Observations	1,467,276
Likelihood Ratio Chi-Square	36,916
Probability > Chi-Square	<.0001
Predictive Power	
Percent Concordant	77.3
Percent Discordant	20.3

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

Table A-2: Refinance Termination Model Specifications

Variable	Coefficient
Intercept	-2.171
Policy Year	-0.174
First Year (Dummy)	-1.491
Second Year (Dummy)	-0.560
Third Year (Dummy)	-0.173
Origination Age	-0.013
Gender (Couple)	-0.090
Gender (Male)	0.142
Refinance Incentive Measure	0.259
First Month Cash Draw > 85% (Dummy)	0.605
Goodness-of-Fit	
-2 Log Likelihood	315,241
Number of Observations	1,468,452
Likelihood Ratio Chi-Square	18,313
Probability > Chi-Square	<.0001
Predictive Power	
Percent Concordant	67.2
Percent Discordant	28.6

Table A-3: Mobility Termination Model Specifications

Variable	Coefficient
Intercept	-3.763
Duration (year 9+)	-0.195
First Year (Dummy)	-0.871
Gender (Couple)	-0.154
Gender (Male)	0.038
Cumulative HPA (%)	0.011
1-Year CMT Change < -10% (Dummy)	-0.334
1-Year CMT Change > 10% (Dummy)	0.125
Gender Specific Mortality Rate	5.026
Property Value > MSA Median (Dummy)	0.128
Pneg > 0.10 (Dummy)	-0.747
Goodness-of-Fit	
-2 Log Likelihood	347,549
Number of Observations	1,473,921
Likelihood Ratio Chi-Square	25,972.7
Probability > Chi-Square	<.0001
Predictive Power	
Percent Concordant	71.7
Percent Discordant	25.6

Appendix B: Loan Performance Projections

This appendix will discuss how the termination model, discussed in Appendix A, is used to forecast future terminations. It will also describe the future economic conditions and future cohort characteristics required to forecast termination rates in future years. This appendix discusses the forecasts and methodology used in projecting future loan performance.

I. Overall Approach

Estimated terminations are developed for all future policy years for each active loan as of June 30, 2010. For example, in this review, for a loan endorsed in FY 2009 we estimate termination rates beginning in policy year three since the first two policy years have already elapsed by the end of FY 2010 and the termination behavior is included in actual experience. For each of these years, macroeconomic variables are derived based on loan characteristics and economic forecasts; these variables include loan duration, loan characteristics, and other economic assumptions. The Moody's Analytics (Moody) July 2010 forecast of interest rates and house price appreciations is used to develop termination specifications. MSA level forecasts are used for house price appreciation and state level forecasts are used if the MSA level data is unavailable. Moody's house price forecasts are a function of various macroeconomic variables including the local unemployment rate. The recently announced new HECM Standard and Saver PLFs that will come into effect on October 4, 2010 are leveraged to estimate future refinance incentives.

For every loan and future policy year, these parameter values are then applied to the multinomial logit models as specified in Appendix A. This generates a single conditional termination rate per policy year, representing the probability the loan will terminate in a policy year given it survived to the end of the prior policy year. The projected conditional termination rates for every loan and its future policy years are imported into the HECM cash flow model to estimate future terminations and associated cash flows of the HECM program.

II. Forecasted Endorsement Volume and Portfolio Composition

To project future performance of FY 2009 and FY 2010 books-of-business, we utilized the endorsement data as of June 30, 2010. The characteristics of these books are described in Section IV of the review. For the FY 2011 to FY 2017 books-of-business, FHA provided the cohort characteristics for future books-of-business. Table B-1 below shows the actual and forecasted endorsement volume and MCA for FY 2009 to FY 2017.

Table B-1: Actual FY 2009 and FY 2010 Endorsements and Forecasted FY 2011 to FY 2017 Endorsements¹

Fiscal Year	Number of Endorsements	Average MCA per Endorsement (\$ dollars)	Total Endorsements (\$ millions)
2009	114,656	\$263,212	\$30,179
2010	80,369	270,405	21,732
2011	85,217	241,045	20,541
2012	90,804	241,018	21,885
2013	97,646	243,361	23,763
2014	108,847	255,278	27,786
2015	119,840	264,326	31,677
2016	131,603	272,976	35,924
2017	144,361	281,608	40,653

FHA projected the percentage of fixed rate loans to remain around 70.0 percent in FY 2011 and FY 2012 and return to 50.0 percent by FY 2013. The borrower demographics (age at origination and gender), geographical distribution, and ratio of property value to median home value are expected to remain at similar levels as the FY 2010 book-of-business in the next several of years.

III. Base Case Economic Forecast

The base case economic scenario utilized Moody's July 2010 forecasts for FY 2011 to 2040. These economic factors include the FHFA national, state and MSA housing price index, the ten-year Treasury rate, and the one-year Treasury rate. The base case mortality rates were obtained from the 1999-2001 U.S. Decennial Life Table published by the Center for Disease Control and Prevention (CDC). The base case scenario is illustrated in Table B-2.

Table B-2: Base Case Economic Forecast

Fiscal Year	FHFA National Housing Price Index	1-Year Treasury Rate (%)	10-Year Treasury Rate (%)
2010	341.5	0.39	3.46
2011	337.1	0.95	4.40
2012	338.9	2.85	5.53
2013	342.1	4.09	4.99
2014	356.6	4.24	4.60
2015	373.5	4.12	4.50
2016	387.9	4.08	4.47
2017	402.4	4.08	4.45
2018	417.0	4.08	4.41
2019	432.2	4.08	4.38
2020	447.7	4.27	4.33

¹ Table B-1 is a repeat of Table I-6 for easy reference.

IV. Maintenance-Risk Adjustments

Recent research on the HECM portfolio presents a revised approach to accounting for the maintenance-risk posed by HECM borrowers. Maintenance-risk is the moral hazard where borrowers provide insufficient property maintenance on their home. Based on the work of Shiller and Weiss (2000) and Capone et al. (2010), the revised scheme measured the effect of maintenance-risk as the spread between the market-level house price appreciation rate and the HECM portfolio's house price appreciation rate. Borrowers were divided into "stayers" and "movers" categories based on the borrower's expected tenure. The research found that "movers" homes appreciate at higher rates than the market average whereas "stayers" homes appreciate at lower rates than market average. Moreover, 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.

Table B-3: Maintenance-Risk Adjustment Factor

Loan Age Bucket	Annual HPA Adjustment	
	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

The maintenance-risk adjustment factors are provided by FHA, illustrated in Table B-3 above. The adjustment factors are applied to the annual house price appreciation based on the age of the loan, which affect the amount of expected recovery at loan termination.

V. Alternative Economic Scenarios

Four sensitivity scenarios were considered to determine the effects of more severe and less severe economic scenarios on the HECM program value. These scenarios are based on Moody's forecast published in July 2010, with adjustments to the long-term house price appreciation. Each scenario represents a different percentile along the distribution of possible economic outcomes. According to Moody, the economic scenarios are described as follows:

1. S1: Strong Near-Term Recovery Scenario

The "Stronger Near-term Recovery" scenario corresponds to the 90th percentile on the distribution of possible economic outcomes. It is based on the assumption of better-than-expected recovery with considerable consumer and business confidence rebound during the remainder of 2010. In this scenario, the quarterly-average unemployment rate peaked in the fourth quarter of 2009 at 10.0 percent, and declines to the low eight percent range by early 2011. The recent increases in house prices are expected to sustain with minimal additional increases in 2010 and 2011. In this scenario, the trough was in the second quarter of 2009, based on the National Association of Realtors median sale price measure, and the peak-to-trough decline was 25%.

2. S2: Mild Second Recession Scenario

The "Mild Second Recession" scenario corresponds to the 25th percentile of the possible economic outcomes. It is based on the assumption that the growth rate of consumer spending slows further from its pace earlier in 2010. Additionally, European debt problems weaken the global rebound and consequently the growth rate of U.S. exports. Further, U.S. federal budget constraints prevent more aggressive fiscal policy initiatives to support the recovery. The unemployment rate rises, peaking at 12 percent, about 2 percentage points higher than the peak in the baseline, in the second quarter of 2011. In this scenario, the house prices are estimated to resume their decline after mid-2010, and the NAR median sales price ultimately falls by 36% cumulatively, with the trough occurring in mid-2011.

3. S3: Deeper Second Recession Scenario

The "Deeper Second Recession" scenario is a downturn similar to the S2, but more severe, corresponding to the 10th percentile of the possible economic outcomes. First, as in S2, households do not sustain the early-2010 gains in spending, because of continued lack of credit availability and diminished confidence. The weakness in spending results in consumer price deflation during the second half of 2010 and the first quarter of 2011. Second, European debt problems magnify to the extent that a significant second European recession develops, causing U.S. exports to decline. Following the end of the temporary boost to employment from Census-related hiring, a second U.S. recession develops. The deeper contraction in the labor market causes the unemployment rate to hit a peak of 14% in the fourth quarter of 2011. House prices, as measured by the NAR median sales price, resume their decline and fall 40% from peak to trough before bottoming out in early 2012.

4. S4: Complete Collapse/Depression Scenario

The "Complete Collapse/Depression Scenario" corresponds to the 4th percentile of the possible economic outcomes. It represents an economic situation similar to S3 with restricted credit and fallen exports, but with greater severity for a more sustained length of time. This scenario assumes that the U.S. federal government reaches the limit of its resources to boost the economy, rendering it unable to prevent a deep economic slump. The effects of the 2009 federal stimulus proved to be only temporary. The recovery in the economy after mid-2009 essentially ended after the first half of 2010, and the downturn accelerates and continues until the end of 2011. The unemployment rate reaches a high of 15% in mid-2012 and remains in double digits until 2015. The extreme weakness results in consumer price deflation from mid-2010 through the end of 2011. House prices resume their decline, and the NAR median existing sales price ultimately falls cumulatively by 45% from its 2005 peak to the third quarter of 2012.

Next, we describe the adjustments made to the Moody's house price forecast series adopted in this review. Moody projects future house price appreciation scenarios where the local house price appreciation rate (HPA) changes from the base case scenario by a constant rate across all locations for each future quarter. These scenarios are built on the assumption that the future House Price Index (HPI) converges to the base case scenario in the long term. For example, in the optimistic scenarios stronger short-term HPA is followed by a period of weaker HPA such that the HPI tracks the base case HPI scenario in the long run.

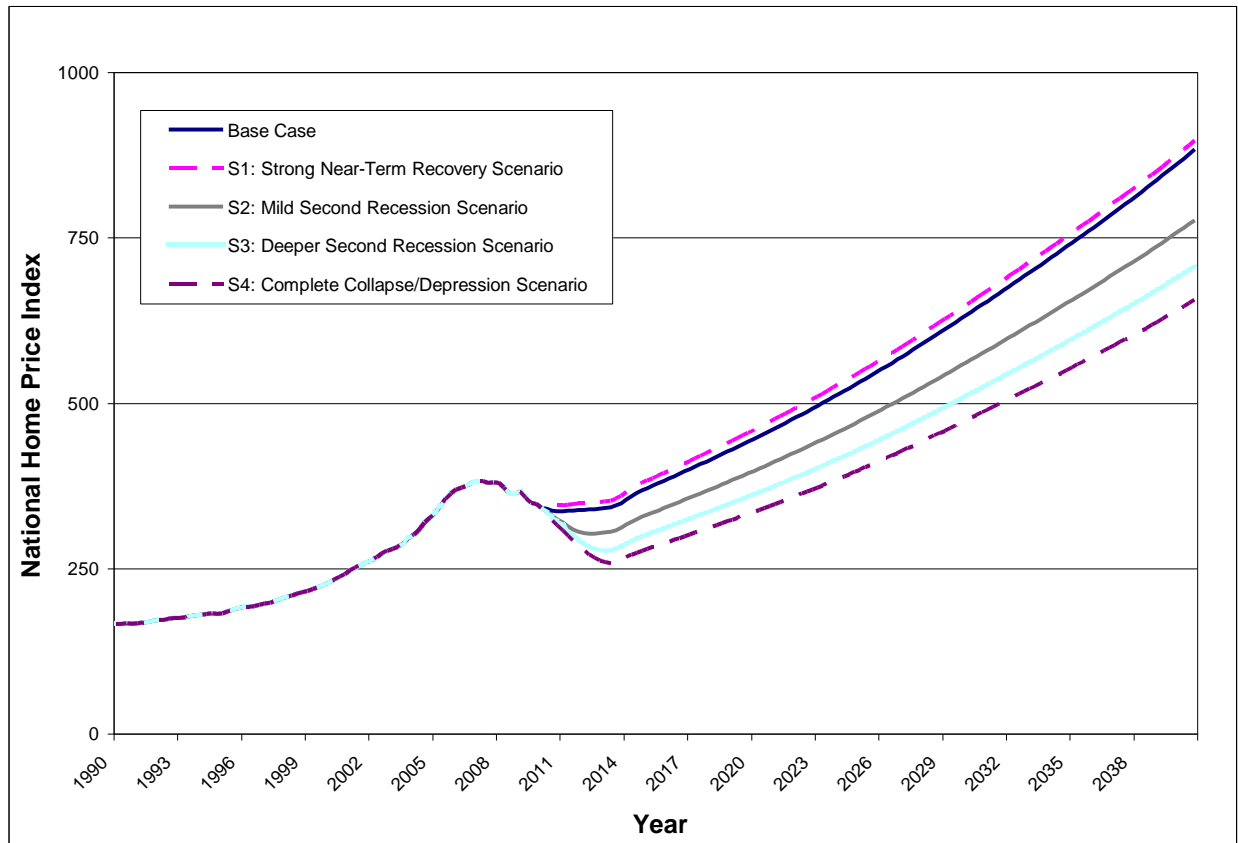
In comparison, the mortgage industry typically thinks HPA rates converge to a stable level over the longer term, rather than the HPI. We, therefore, modified the alternative scenarios provided by Moody's

so the HPA converges to a long run level. The approach applied to adjust the alternate forecasts provided by Moody’s is as follows:

- Compute quarterly HPAs for the base case and each alternative scenario.
- Determine the quarter in which each alternative scenario HPA following the original Moody’s HPA path, crosses the base case scenario HPA. The cross-over for scenario S1, S2, S3 and S4 is 2012 Q2, 2012 Q3, 2013 Q3, and 2013 Q4 respectively.
- Apply the base case scenarios HPA after the cross-over quarter.

The advantage of using this approach is the HPI for the pessimistic or optimistic scenarios are lower or higher than the base case scenario, respectively. Chart B-1 shows the national HPI to 2038 under the base case and four alternative economic scenarios. The graph illustrates how the movement in HPI is affected by the HPA scenarios with the more pessimistic scenarios impacting the HPI more severely. As the HPA scenario becomes more pessimistic, the longer it takes for the HPI to recover to historical levels.

Chart B-1: Path of the Future National House Price Index in Different Scenarios



Appendix C: Cash Flow Analysis

This appendix describes the calculation for the present value of future cash flows. Future cash flow calculations are based on factors, 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: premiums, claims, note holding expenses, and recoveries on notes in inventory. HECM cash flows are discounted according to the latest official annual federal credit subsidy present value conversion factors, specified later in this appendix.

I. Definitions

The following definitions are provided to facilitate the discussion of HECM cash flows:

- **Insurance-In-Force (IIF):** Refers to the number of active loans in the HUD insurance portfolio (prior to assignment) and the corresponding total unpaid balance.
- **Maximum Claim Amount (MCA):** The minimum of the appraised home value at origination and the HUD loan limit. This is the maximum amount for which a lender can file an insurance claim.
- **Conditional Claim Type 1 Rate (CC1R):** The likelihood a loan terminates as a shortfall claim (claim type 1), given it survived to the beginning of the time period.
- **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 recovery amount received by FHA at the time of note termination, expressed as a percentage of all the cash outflow since note assignment, which includes note acquisition and note holding costs.

II. 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, a cash inflow, represent cash recovered from the sale or property disposition once it 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. Table C-1 summarizes the HECM inflows and outflows.

Table C-1: 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.

A. Loan Balance

The unpaid principal balance (UPB) is a key input to the cash flow calculations. The UPB at a given point in 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.

B. Premiums

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

1. Upfront Premiums

Upfront premium is due to FHA at the time of closing, equal to a percentage of the MCA. For FY 2009 and FY 2010 books-of-business, the upfront premium rate is two percent of the MCA. For FY 2011 and onward, the upfront premium rate for the standard option and the saver option is two percent and 0.1 percent, respectively. Typically, the upfront premium is financed by the HECM loan and hence added to the loan balance.

2. Annual Premiums

The annual premium is calculated as a percentage of the growing loan balance. For FY 2009 and FY 2010 books-of-business, the annual premium is 0.5 percent of the UPB. From FY 2011 and

onward, the annual premium is 1.25 percent of the UPB for both the Standard and Saver options. Typically, the annual premium is paid by the servicer and it is added to the accruing loan balance.

C. Claims

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

1. Claim Type 1

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 rare. The number and amount of claim type 1's are estimated based on historical experience adjusted by insurance-in-force.

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 balance (up to the MCA). The majority of HECM investors require the loans to be assigned to HUD when the UPB reaches 98 percent of the MCA. The model estimates assignments to occur when the projected UPB reaches 98 percent of the MCA.

D. Note Holding Expenses

Note holding expenses are cash outflows on assigned notes during the note holding period, including any cash disbursed to the borrower.

E. Recoveries

At note termination, the HECM loan is due and payable to FHA. The timing of loan terminations is based upon the results of the termination model. The details of the termination projections are discussed in Appendix A and Appendix B. The amount of recovery is estimated as the minimum of the loan balance and the net sales proceeds at termination, where net sales proceeds are estimated as the difference between projected property value less property holding and selling expenses.

III. Net Future Cash Flows

The cash flow for a book-of-business can be found by aggregating the individual components.

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

Note that a negative net cash flow indicates that outflows have exceeded inflows and a positive cash flow indicates the HECM program is generating a net income. To obtain the present value of cash flows, the cash flows are discounted for each policy year and cohort according to the latest official 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 in November 2009, shown below:

FY	Discount Factor	FY	Discount Factor
2011	0.9956	2031	0.3951
2012	0.9746	2032	0.3754
2013	0.9420	2033	0.3565
2014	0.9020	2034	0.3386
2015	0.8626	2035	0.3215
2016	0.8239	2036	0.3051
2017	0.7852	2037	0.2896
2018	0.7473	2038	0.2748
2019	0.7120	2039	0.2606
2020	0.6789	2040	0.2472
2021	0.6476	2041	0.2344
2022	0.6175	2042	0.2223
2023	0.5885	2043	0.2108
2024	0.5606	2044	0.1999
2025	0.5338	2045	0.1896
2026	0.5081	2046	0.1798
2027	0.4834	2047	0.1705
2028	0.4599	2048	0.1617
2029	0.4373	2049	0.1533
2030	0.4157	2050	0.1454

Appendix D: Econometric Model Results

Table D-1: HECM Termination Rates Forecast for Each Books-of-Business over Time.

Book-of-Business	Policy Year														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2009			7.4%	7.5%	7.1%	8.9%	9.2%	9.5%	9.9%	10.1%	10.4%	10.8%	11.2%	11.7%	12.3%
2010		7.4%	7.9%	7.7%	7.7%	9.2%	9.4%	9.7%	10.0%	10.2%	10.4%	10.8%	11.2%	11.7%	12.2%
2011	4.9%	11.2%	11.8%	11.2%	10.3%	10.8%	10.3%	9.8%	10.2%	10.2%	10.3%	10.6%	11.0%	11.4%	11.9%
2012	5.5%	12.5%	13.5%	12.7%	11.4%	11.4%	10.8%	10.3%	10.6%	10.5%	10.7%	10.9%	11.2%	11.6%	12.2%
2013	5.4%	12.0%	13.0%	12.2%	11.0%	11.3%	10.7%	10.2%	10.5%	10.5%	10.6%	10.8%	11.2%	11.6%	12.1%
2014	4.9%	11.0%	11.8%	11.3%	10.5%	10.9%	10.4%	10.0%	10.3%	10.3%	10.4%	10.7%	11.0%	11.4%	11.9%
2015	4.8%	10.7%	11.5%	11.1%	10.3%	10.8%	10.3%	9.9%	10.3%	10.3%	10.4%	10.6%	11.0%	11.4%	11.9%
2016	4.7%	10.7%	11.5%	11.1%	10.3%	10.8%	10.3%	9.9%	10.3%	10.3%	10.4%	10.6%	11.0%	11.4%	11.9%
2017	4.7%	10.6%	11.5%	11.0%	10.3%	10.8%	10.3%	9.9%	10.2%	10.2%	10.4%	10.6%	11.0%	11.4%	11.9%

Book-of-Business	Policy Year														
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
2009	12.9%	13.6%	14.4%	15.3%	16.3%	17.3%	18.5%	19.9%	21.3%	23.0%	24.8%	26.9%	29.3%	31.9%	35.0%
2010	12.8%	13.5%	14.3%	15.1%	16.0%	17.1%	18.2%	19.5%	21.0%	22.6%	24.4%	26.4%	28.7%	31.4%	34.3%
2011	12.5%	13.1%	13.9%	14.7%	15.6%	16.6%	17.7%	19.0%	20.4%	21.9%	23.7%	25.6%	27.9%	30.4%	33.3%
2012	12.7%	13.4%	14.1%	15.0%	15.9%	16.9%	18.0%	19.2%	20.6%	22.1%	23.9%	25.8%	28.1%	30.6%	33.5%
2013	12.7%	13.3%	14.1%	14.9%	15.8%	16.8%	17.9%	19.1%	20.5%	22.1%	23.8%	25.8%	28.0%	30.5%	33.4%
2014	12.5%	13.2%	13.9%	14.7%	15.6%	16.6%	17.7%	19.0%	20.3%	21.9%	23.6%	25.6%	27.8%	30.4%	33.3%
2015	12.5%	13.1%	13.8%	14.7%	15.6%	16.6%	17.7%	18.9%	20.3%	21.9%	23.6%	25.6%	27.8%	30.4%	33.3%
2016	12.5%	13.1%	13.8%	14.7%	15.6%	16.6%	17.7%	18.9%	20.3%	21.9%	23.6%	25.6%	27.8%	30.4%	33.3%
2017	12.5%	13.1%	13.8%	14.7%	15.6%	16.6%	17.7%	18.9%	20.3%	21.9%	23.6%	25.6%	27.8%	30.4%	33.3%

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