

**U.S. Department of Housing and Urban
Development (HUD) Federal Housing
Administration (FHA)**

**Actuarial Review of FHA's Mutual Mortgage
Insurance Fund for HECM Loans**

December 11, 2013



SUBMITTED BY:

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December 11, 2013

The Honorable Carol J. Galante
Assistant Secretary for Housing – Federal Housing Commissioner
U.S. Department of Housing and Urban Development
451 Seventh Street, SW, Room 9100
Washington, DC 20410

Dear Commissioner Galante:

We are pleased to submit the attached report documenting our actuarial review of the Home Equity Conversion Mortgage (HECM) loans in Federal Housing Administration's Mutual Mortgage Insurance Fund (MMI Fund) as of the end of fiscal year (FY) 2013. This report excludes our evaluation of the forward portion of the MMI Fund.

We estimate that the economic value of the HECM portion of the MMI Fund was \$3.7 billion as of the end of FY 2013, and will be \$3.8 billion at the end of FY 2014. Insurance-in-force as of the end of FY 2013 is estimated to be \$85 billion.

We forecast that the economic value of the HECM portion of the MMI Fund will increase each year through FY 2020 as the result of improving economic conditions, recent HECM program changes, and the addition of new books of business.

Summit Consulting, LLC & Milliman, Inc. note that these estimates are subject to significant variability due to the nature of reverse mortgages as described in our report.

To estimate the impact of this variability, the economic value of the HECM portion of the MMI Fund as of the end of FY 2013 was estimated under six alternative economic scenarios. All of the economic scenarios were developed by Moody's Analytics and were used without adjustment by Summit Consulting, LLC & Milliman, Inc. Further details on the economic scenarios and variability of results are detailed in the report.


The authors and peer reviewers of this analysis are Members of the American Academy of Actuaries, Fellows of the Society of Actuaries, Accredited Professional Statistician of the American Statistical Association and/or have significant expertise in the evaluation of mortgage insurance or similar exposures.

Any reader of this analysis must possess a certain level of expertise in relevant areas to accurately interpret the significance of the assumptions and their impacts. The reader should be advised by actuaries or other professionals competent in the discipline of actuarial projections of this type, so as to properly interpret the projection results.


Respectfully submitted,



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Executive Summary

The Federal Housing Administration (FHA), an agency within the U.S. Department of Housing and Urban Development (HUD), provides mortgage insurance for reverse mortgages obtained from FHA-approved lenders through its Home Equity Conversion Mortgage (HECM) program. A HECM is a federally insured loan that enables seniors to withdraw some of the equity in their home or use the loan proceeds to buy a new primary residence. The 1990 Cranston-Gonzalez National Affordable Housing Act (NAHA) requires an independent actuarial analysis of the economic net worth of FHA's Mutual Mortgage Insurance (MMI) Fund. FHA has retained Summit Consulting, LLC and Milliman, Inc. (jointly "Summit & Milliman") to perform an independent actuarial review of FHA's MMI Fund.

The Housing and Economic Recovery Act of 2008 (HERA) moved the requirement for an independent actuarial review into 12 USC 1708(a)(4). HERA also moved all new HECM program endorsements into the MMI Fund effective in fiscal year (FY) 2009.

This report summarizes the actuarial review performed by Summit & Milliman of the HECM loans within the MMI Fund and reports the estimated economic values of the FY 2013 to FY 2020 HECM portfolios. A fiscal year's HECM portfolio consists of the loans endorsed between FY 2009 and the end of that fiscal year that are still active as of the end of that fiscal year. The economic value of a HECM portfolio is the discounted net present value (NPV) of the projected future cash flows of the loans in the portfolio, plus capital resources. Based on the actuarial review performed by Summit & Milliman, we estimate that the FY 2013 HECM portfolio has an economic value of \$3.7 billion. Our economic value estimates for FY 2014 to FY 2020 HECM portfolios, which include existing and future endorsements, are presented in Table 1 below. Projected improvements in macroeconomic conditions and the addition of new endorsements increase the projected economic value of future HECM portfolios. We estimate the economic value of the FY 2020 HECM portfolio to be \$7.1 billion.

Status of the FY 2013 HECM Portfolio

The status of the HECM portion of the MMI Fund depends on the adequacy of current and future capital resources to cover future net liabilities. At the end of FY 2013, the capital resource balance of the HECM portion of the MMI Fund, which consists of cash, investments, properties and mortgages, other assets and receivables, and liabilities, was \$9.1 billion. We estimate the NPV of the FY 2013 HECM portfolio's future cash flows to be *negative* \$5.5 billion, resulting in an economic value estimate of \$3.7 billion. Over the next seven fiscal years, we project that the economic value of the HECM portfolio will grow, to \$7.1 billion by the end of FY 2020. This is due to projected improvements in the performance of existing loans and the addition of new books of business, which we project to have positive economic value. The positive projected economic values of future books of business are attributable in part to recent and forthcoming HECM program changes, which are expected to improve loan performance. However, if the volume of HECM endorsements over the next seven years is lower than projected, the economic value of future HECM portfolios will be lower than projected. Additionally, if macroeconomic conditions are worse than forecasted, the economic values of future HECM portfolios will be lower than projected.

Table 1 below presents our economic value estimates for the HECM portion of the MMI Fund for FY 2013 through FY 2020. Included in that table are the components of economic value, including estimated capital resources and earnings on those resources, the NPV of current books of business, and the NPV of future books of business.

Table 1: HECM Portfolio Economic Value Estimates for FY 2013 to FY 2020 (\$ Millions)

Fiscal Year	Economic Value	NPV Future Cash Flows	NPV Current Books of Business	NPV Future Book of Business	Capital Resources	Return on Investment
2013	3,650	-5,469	-5,469	-	9,119	-
2014	3,800	-5,355	-5,731	376	9,155	36
2015	4,075	-5,163	-6,006	843	9,238	83
2016	4,548	-4,940	-6,294	1,354	9,488	250
2017	5,130	-4,718	-6,597	1,879	9,848	360
2018	5,753	-4,474	-6,914	2,440	10,227	379
2019	6,424	-4,188	-7,247	3,059	10,612	385
2020	7,139	-3,879	-7,596	3,717	11,019	407

Source: Summit & Milliman forecasts

Economic Value of the FY 2013 HECM Portfolio under Alternative Economic Scenarios

Summit & Milliman estimated the economic value of the FY 2013 HECM portfolio under six alternative economic scenarios. The alternative scenarios were developed by Moody's Analytics (July 2013 U.S. Macroeconomic Outlook Alternative Scenarios) and were not adjusted by Summit & Milliman. The alternative scenario economic value estimates are presented in Table 2 below. The largest projected decreases in economic value are under scenarios S4 (Protracted Slump) and S5 (Below-Trend Long-Term Growth). Under scenario S4, we estimate the economic value of the FY 2013 HECM portfolio to be \$2.8 billion. In this recession scenario, house prices are expected to decline significantly over the near-term, which increases the likelihood and severity of claims and decreases recoveries. Under scenario S5, we estimate the economic value of the FY 2013 HECM portfolio to be \$2.9 billion. In this low-performance scenario, house prices are expected to decline significantly over the near-term and remain lower than forecasted under the baseline scenario over the long-term. Similar to the S4 scenario, this increases the likelihood and severity of claims and decreases recoveries. These alternative scenarios highlight the sensitivity of HECM loan performance to fluctuations in economic conditions, particularly home prices. Detailed descriptions of all six alternative economic scenarios are provided in Section III of this report.



Table 2: FY 2013 Alternative Scenarios Economic Value Estimates (\$ Millions)

Scenario	Scenario Description	Economic Value	Difference from Baseline
	Baseline	3,650	-
S1	Stronger than Near-Term Rebound	3,593	-57
S2	Slower Near-Term Recovery	4,025	375
S3	Second Recession	3,918	268
S4	Protracted Slump	2,827	-823
S5	Below-Trend Long-Term Growth	2,916	-735
S6	Oil Price Increase, Dollar Crash Inflation	4,186	535

Source: Summit & Milliman forecasts

Impact of Economic Forecasts

The economic value of a HECM portfolio depends on various macroeconomic factors, including:

- **Home Values:** A borrower's decision to refinance their loan or to sell the HECM property is impacted by home price movements. Home values also play a role in determining the likelihood and severity of Claim Type 1 payments and the amount recovered by FHA on assigned notes.
- **Interest Rates:** Interest rates impact the amount of equity available to borrowers and the growth rate of loan balances and credit lines over time. Higher interest rates lead to lower initial principal limits for new endorsements; however, they may also lead to faster credit line and loan balance growth over time.
- **Economic Cycle:** Economy-wide fluctuations affecting borrower wealth may affect borrower cash draw rates, rates of tax and insurance delinquency, conveyance rates, and other borrower decisions that affect loan performance.

Risks, Assumptions, and Data Reliance

The economic value of a HECM portfolio also depends on several borrower- and loan-specific factors, including:

- **Termination Behavior:** HECMs terminate due to borrower death, loan refinancing, when the HECM property ceases to be the primary residence, or as the result of foreclosure when borrowers fail to pay real estate taxes or hazard insurance.
- **Cash Draw Behavior:** Borrowers may access their home equity using various payment plans based on their desired needs and timing. Borrowers may draw all or some of the equity available to them at loan closing or over time in installments. This impacts loan balance growth and ultimately the timing and probability of claims payments.
- **Conveyance Rates:** A HECM property is conveyed to HUD upon loan termination, if the estate or heirs choose not to engage in a direct sale. This is more likely to occur when the current loan balance exceeds the value of the property. When a conveyance occurs, HUD assumes the expenses of managing and selling the property, which lowers the amount recovered from the sale.



The forecasts presented in this review reflect projections of events more than 30 years into the future. These projections are dependent upon a number of assumptions, including economic forecasts provided by Moody's Analytics and the assumption that FHA's policies regarding refunds, premiums, distributive shares, underwriting or servicing rules, and administrative expenses remain stable. To the extent that these and/or other assumptions are subject to change, actual results may vary, perhaps significantly, from current projections.

In performing this actuarial review, Summit & Milliman has assumed that FHA (a) used its best efforts to supply accurate and complete data and (b) did not knowingly provide any inaccurate data. Summit & Milliman performed a limited review of the data used directly in Summit & Milliman's analysis for reasonableness and consistency and have not found material defects in the data. If there are material defects in the data, it is possible that they would be uncovered by a detailed, systematic review and comparison of the data to search for values that are questionable or relationships that are materially inconsistent. Such a review was beyond the scope of Summit & Milliman's assignment.



Introduction and Background

The Federal Housing Administration (FHA) provides mortgage insurance coverage to single-family homebuyers and reverse mortgage borrowers through the Mutual Mortgage Insurance (MMI) Fund, which is financed through the insurance premiums FHA receives from its insured borrowers.

Effective in 1990, the Cranston-Gonzalez National Affordable Housing Act (NAHA) required, among other things, that the MMI Fund be actuarially sound by maintaining a minimum capital ratio of two percent (2%) to sufficiently withstand a moderate economic downturn. As defined by NAHA, this required capital ratio is the ratio of the MMI Fund's net economic capital to its unamortized insurance in force (IIF). To ensure the necessary minimum capital ratio requirement, NAHA requires an annual independent actuarial review.

Scope

The U.S. Department of Housing and Urban Development (HUD) FHA has retained Summit & Milliman to perform a calculation of the economic value of FHA's MMI Fund Home Equity Conversion Mortgage (HECM) portfolio as of September 30, 2013. This report documents the results of the Summit & Milliman analysis for the HECM portion of the MMI Fund.

Management Discussion

Throughout the course of this analysis Summit & Milliman had discussions with FHA management concerning certain assumptions used in this analysis. Specifically, Summit & Milliman had discussions with FHA management concerning:

- Historical program changes and the potential impact or considerations on the models developed for this analysis;
- Loan-level data collected by FHA and how to use this data;
- Assumptions about future volume forecasts; and
- Capital resources for FHA as of the end of fiscal year 2013.

The design of the forecast models, including the selection of explanatory variables in the models, was developed independently from FHA. Summit & Milliman provided information regarding model updates to report progress in model development to FHA. However, Summit & Milliman's decisions regarding model form, variables considered for the model specifications, or adjustments to the models were not influenced by FHA.

Report Outline

The remainder of this report is organized into the following sections:

Section I: Program Overview

This section provides an overview of the HECM program. It includes a brief summary of reverse mortgage insurance and a discussion of policy changes that affect the economic value of a HECM portfolio.

Section II: Summary of Findings

This section provides a summary of the findings from this year's actuarial review. It reviews the current status of the HECM portion of the MMI Fund and presents economic value estimates for FY 2013 to FY 2020 HECM portfolios.

Section III: Sensitivity Analysis

The economic value of a HECM portfolio is sensitive to economic variables such as future home prices and interest rates. This section provides estimates of the economic value of the FY 2013 HECM portfolio under six alternative economic scenarios provided by Moody's Analytics.

Section IV: Summary of Methodology

The economic value of a HECM portfolio is estimated using models to forecast the future performance of HECM loans. This section of the report provides an overview of these models and how they were applied.

Section VI: Qualifications and Disclosures

Any actuarial report is subject to a discussion of the qualifications and limitations of the actuarial review. This section of the report provides a discussion of the qualifications and limitations applicable to this actuarial review.

List of Appendices

Appendix A: Discussion of Anticipated Portfolio Trends

This appendix provides details regarding the loan, borrower, and economic variables that affect HECM portfolio cash flows and economic value.

Appendix B: Discussion of Data Limitations

This appendix provides a technical description of the data limitations that potentially impact our cash flow and economic value projections.

Appendix C: Technical Details of Stage 1 Model

This appendix provides a technical description of the models used to forecast future HECM terminations, including the process used to develop these models.

Appendix D: Technical Details of Auxiliary Models

This appendix provides a technical description of the auxiliary models, projections, and assumptions required to estimate future HECM loan cash flows.

Appendix E: Technical Details of Stage 2 Model

This appendix provides a technical description of the components of HECM cash flows and the methods we used to project future HECM cash flows.

Section I: Program Overview

The HECM program insures what are commonly referred to as reverse mortgages, and was designed to enable senior homeowners to convert the equity in their homes into cash. HECM loan proceeds are paid out according to a payment plan chosen by the borrower.¹ Unlike a traditional mortgage, which is repaid over time, a reverse mortgage is repaid in a single payment after the borrower dies or no longer occupies the property as a principal residence. Additionally, because a HECM is a non-recourse loan, the borrower or estate will never owe more than the value of the mortgaged home, and no assets other than the home must be used to repay the loan. The amount that a borrower can receive from a HECM is known as the principal limit, which is based on the value of the HECM property, the borrower's age, and interest rates.

The HECM program was introduced in 1987 under the NAHA to assess the demand for HECMs and the types of HECMs that best serve the needs of elderly borrowers. In 1989, the HECM program was officially established as a pilot program; it was made permanent by Congress in 1998. The program allows elderly homeowners to extract equity from their homes while continuing to live in their homes, with no requirement to make a monthly mortgage payment.²

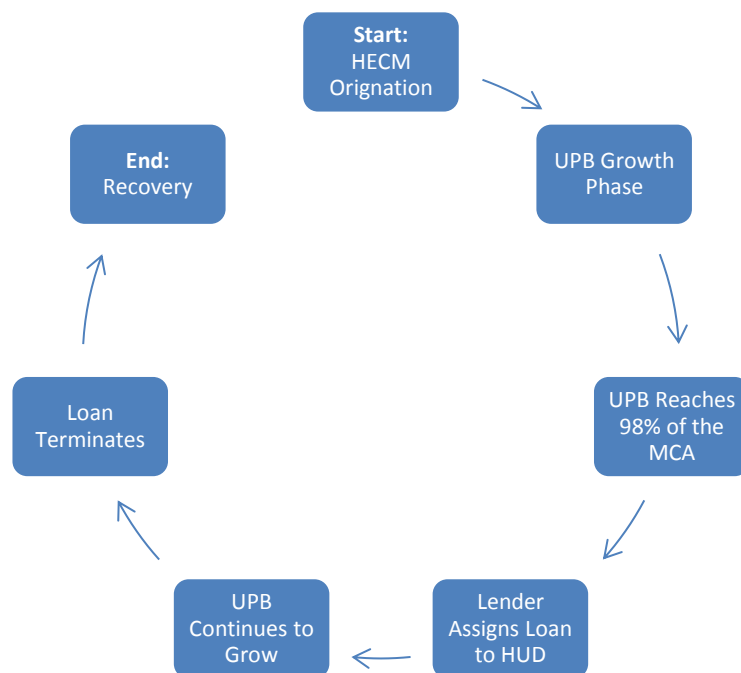
The number of HECM loans originated was limited during the pilot phase of the program. Since then, the number of endorsements per year increased substantially. The time period from 1998 through 2006 corresponds to a period of significant growth in the housing market, in terms of the volume of mortgages outstanding and home prices. The HECM insurance contract can be thought of as a put option on the value of the home, where the strike price is equal to the outstanding balance of the mortgage and the expiry date is uncertain. If home prices fall or fail to appreciate enough to exceed the outstanding balance of the mortgage at termination, then FHA experiences a shortfall claim or a lower recovery amount. During the time period from 1998 through the late 2000s, the number and severity of HECM terminations with a claim was relatively small, compared to more recent years, because most of the terminations were "out of the money," meaning sales of properties yielded positive recoveries. In more recent years, HECM terminations have been "in the money" and resulted in more claims for FHA. In addition, in more recent years, the classification of HECMs with a lump sum payment has shifted to a classification as fixed-rate HECMs with a line of credit. Recent changes to the HECM program, as discussed below, are expected to encourage a longer draw period for borrowers.

As described in ML 2013-27, since the 2009 housing and economic recession, the HECM portfolio has experienced significant changes that contribute additional risks to the MMI Fund and have resulted in higher payouts of insurance claims. These changes include younger borrowers with higher property indebtedness, an increasing number of tax and insurance delinquency defaults, and borrowers electing lump-sum distributions at closing rather than payments over time. Consequently, FHA has made several changes to the HECM program to reduce risks to the MMI Fund and protect the viability of the program. The most significant

¹ If the lender is unable to make payments to the borrower, HUD assumes the responsibility.

² Syzmanoski 1994, 347-366; U.S. Department of Housing and Urban Development, 2013

changes are limitations on the amount of mortgage proceeds that can be advanced during the first 12 months after closing, new initial MIP pricing options, and a reduction in Principal Limit Factors (PLFs). Additionally, effective January 13, 2014, borrowers must complete a financial assessment to evaluate their willingness and capacity to meet their financial obligations and their ability to comply with mortgage requirements. These changes are discussed in detail in ML 2013-27. The lifecycle of a HECM that survives through assignment can be summarized as follows:



Policy Changes

FHA has implemented several policy changes during recent years affecting loan ceilings, principal limit factors, upfront and monthly MIP rates, product availability, and foreclosure-related practices. Additionally, FHA scheduled policy changes impacting HECM volume originated after the date of this document's submission. This section of the report identifies policy changes enacted and soon to be enacted by FHA that are most significant to HECM portfolio economic valuation.

Principal Limit

The maximum mortgage limit for HECMs was increased first to \$417,000 in November 2008 and ultimately to \$625,500 in February 2009. FHA introduced a program called HECM Saver in 2010 that lowered PLFs and offered a substantially lower upfront premium compared to the HECM Standard option. Prior to the introduction of the HECM Saver, FHA also reduced PLFs on the Standard product and increased annual MIPs from 0.50% to 1.25%. Summit & Milliman reviewed the termination rates on these borrowers against the broader population to quantify any difference in termination rates and the behavior of borrowers in the HECM Saver and HECM Standard options.



Loss Mitigation

In 2011, HUD issued new loss mitigation guidance for the resolution of HECMs delinquent due to unpaid property charges, such as taxes and insurance (T&I), and mortgages with due and payable requests previously deferred by HUD. Under the new guidance, HECMs with T&I defaults are considered due and payable. Therefore, they are subject to foreclosure when the servicer determines the borrower is unwilling or unable to reimburse the property charges advanced on their behalf, or when all applicable loss mitigation options have been exhausted and the servicer is unable to cure the delinquency.

Mortgage Insurance Premiums

Upfront and annual mortgage insurance premiums are the primary source of revenue for the HECM program. Between FY 2009 and FY 2013, the upfront premium rate for a standard HECM was 2 percent of the maximum claim amount. In FY 2011, FHA introduced the HECM Saver for homeowners who wanted to borrow less in exchange for a lower upfront premium rate of 0.01 percent. For FY 2014, a new upfront mortgage insurance premium structure was created. The rate is 0.50 percent for borrowers that draw no more than 60 percent of the principal limit during the first 12 months. The rate is 2.50 percent for borrowers electing to draw more than 60 percent of the principal limit during the first 12 months. The annual mortgage insurance premium rate is 0.50 percent for loans endorsed in FY 2009 and FY 2010 and 1.25 percent for loans endorsed in FY 2011 and later. The annual premium is calculated as a percentage of the current loan balance.

Future Underwriting

Several HECM program changes are outlined in Mortgagee Letter (ML) 2013-27 and 2013-28:

1. initial disbursement limits;
2. new single disbursement lump sum payment option;
3. new initial mortgage insurance premium rates;
4. new principal limit factors;
5. new financial assessment requirements; and
6. new funding requirements for the payment of property charges based on the financial assessment.

The new financial assessment and funding requirements should strengthen the overall credit quality of HECM borrowers. These assessments and requirements, which are similar to a traditional loan underwriting process, include evaluation of credit history, cash flow/residual income analysis, determining if funding sources for property charges from HECM proceeds will be required; and completing a HECM financial assessment worksheet. These program changes are expected to improve loan performance and protect the viability of the HECM program.

Program Specifications

There are borrower and property eligibility requirements that must be met by program participants. In order to be eligible for a HECM, the borrower must be age 62 or older, own the property outright or have a mortgage that can be paid off with the HECM proceeds, occupy the



property as a principal residence, have no past delinquencies on any Federal debt, and complete HECM counseling.³ Additionally, as discussed above, significant changes to the HECM program are being introduced in FY 2014.

Most HECM mortgages are originated using the borrower's existing residence. However, eligible borrowers may use the HECM program to purchase a primary residence if cash on hand is used to pay the difference between the HECM proceeds and the sales price plus closing costs for the property being purchased (HECM for Purchase program).

The maximum loan amount for a HECM is a function of two factors: the PLF and the MCA.⁴ Both are established at or near loan origination and do not change over the life of the loan. The MCA is the appraised value of the home at loan origination, capped at the FHA mortgage limit at the time of origination. The PLF is the percent of the MCA that the borrower(s) can draw and is based on the age of the youngest borrower and interest rates when the loan is originated. PLFs increase with borrower age and decrease with interest rates.

The product of the PLF and the MCA is the initial principal limit. The amount the borrower is eligible to withdraw is the net principal limit, which accounts for loan proceeds used to satisfy other debts and obligations, including existing liens, closing costs, and set asides.

Table 3: HECM Selected Interest Rates and Principal Limit Factors

Borrower Age	Expected Rate	After 9/30/13 PLF	Before 9/30/13 PLF (Saver)	Before 9/30/13 PLF (Standard)
62	4%	0.526	0.523	0.619
75	4%	0.589	0.562	0.693
90	4%	0.660	0.610	0.776
62	6%	0.420	0.399	0.494
75	6%	0.502	0.460	0.590
90	6%	0.602	0.542	0.708
62	8%	0.281	0.210	0.330
75	8%	0.385	0.294	0.453
90	8%	0.521	0.413	0.613

Source: FHA

HECM Payment Plan Types

Borrowers are eligible for one of the following payment plans:

- **Tenure:** The borrower can elect to receive equal monthly payments as long as at least one borrower lives and continues to occupy the property as principal residence
- **Term:** The borrower can elect to receive equal monthly payments for a fixed-time horizon

³ Eligible properties include one-unit single-family residences, two- to four-unit properties with one unit occupied by the borrower, HUD-approved condominium projects, and manufactured homes built after June 15, 1976.

⁴ MCA represents the maximum claim amount for which a lender/servicer can file a claim



- **Line of Credit:** The borrower can elect to receive the proceeds as unscheduled payments or in installments, and in an amount of the borrower's choosing until the line of credit is exhausted
- **Modified Tenure:** The borrower can elect a combination of Line of Credit and Tenure options
- **Modified Term:** The borrower can elect a combination of Line of Credit and monthly Term options

If eligible, borrowers can change their payment plan option for a fee of \$20.

Termination

A HECM terminates when the last remaining HECM borrower dies, the property is sold or transferred, or the property ceases to be the borrower's primary residence for 12 consecutive months. In the latter two cases, the termination may be called a mobility termination or, if the borrower moves into a dependent care facility, a morbidity termination. Moreover, a HECM can terminate when the borrower defaults under the terms of the mortgage. Default can occur for a number of reasons, including not maintaining homeowner's insurance, not performing required maintenance, and not paying property taxes.⁵ Accordingly, the termination possibilities for the HECM Model are grouped into four categories:

1. Mortality termination,
2. Refinance termination,
3. T&I delinquency foreclosure termination, and
4. Other termination, primarily terminations due to mobility and/or morbidity.

Claims Associated with HECM Loans

A lender may file a claim to FHA for losses up to the MCA of each HECM. There are two such claim types:

1. **Claim Type 1:**

FHA, as insurer of the HECM program, reimburses HECM lenders for deficiencies that occur when the property supporting the HECM terminates prior to assignment and the proceeds of the sale are insufficient to cover the unpaid principal balance (UPB) of the loan. Summit & Milliman define this as a Claim Type 1, or a deficiency claim. In a Claim Type 1, the claim amount is calculated as the difference between the outstanding loan balance and the net proceeds from selling the home, capped at the maximum claim amount.

⁵ In Mortgagee Letter (ML) 2011-01, HUD issued new loss mitigation guidance for the resolution of HECMs that are delinquent due to unpaid property charges and mortgages wherein due and payable requests were previously deferred by HUD. Under the new guidance, HECMs with tax or insurance defaults are considered due and payable and, therefore, subject to foreclosure when the borrower determines the servicer is unwilling to reimburse the borrower for property charges advanced on their behalf, or when all applicable loss mitigation options have been exhausted and the servicer is unable to cure the delinquency.



2. Claim Type 2:

A type 2 claim occurs when a lender assigns a loan to HUD. Two types of assignments can occur:

- **Assignment:** The first type of assignment occurs if the mortgage is insured under the optional assignment option. Under this option, when the UPB reaches or exceeds 98% of the MCA, the lender/servicer makes a claim to FHA for the minimum of the UPB and the MCA in exchange for the property. This is the most common type of assignment.
- **Demand Assignment:** A demand assignment occurs when the lender or servicer of the HECM is no longer able to service the HECM and FHA requires assignment of the note. Demand assignments have been infrequent historically.

At assignment, HUD purchases the loan from the lender for the minimum of the loan's UPB and the MCA, and becomes the note-holder and servicer of the loan. The loan continues to accrue interest and MIP until loan termination. All fees, cash draws, and other cash outflows are paid by FHA on a monthly basis. Upon termination of the loan, the UPB is due and payable. This obligation can be satisfied by selling the home and remitting the net sales proceeds to HUD, even if less than the UPB, or by conveying the home to HUD. The borrower's estate can also "purchase" the home for 95% of the appraised value.



Section II: Summary of Findings

In this section we discuss our economic value estimates for the HECM portfolio for fiscal years 2013 to 2020. The economic value for a particular fiscal year is equal to capital resources at the end of the fiscal year plus the NPV of the projected cash flows of that year's HECM portfolio. Accordingly, the economic value estimate for FY 2013 excludes loans endorsed after FY 2013, since these loans are not a constituent of the FY 2013 HECM portfolio.

Current Status of the HECM Portion of the MMI Fund

The economic value of the FY 2013 HECM portfolio is estimated to be \$3.7 billion, which is the sum of capital resources at the end of FY 2013 (\$9.1 billion) and the NPV of projected cash flows of the FY 2013 HECM portfolio (*negative* \$5.5 billion).

Capital resources at the beginning of FY 2013 were \$2.5 billion. This balance grew to \$9.1 billion as the result of net gains on investments, net insurance income, net change in the value of properties in inventory, net change in accounts payable, a \$1.7 billion mandatory appropriation, and a \$4.3 billion transfer to the HECM financing account. Table 4 below shows the change in FY 2013 capital resources and our economic value estimate for FY 2013.

Table 4: FY 2013 HECM Portfolio Economic Value (\$ Millions)

Item	Amount
Capital Resources as of Oct. 1, 2012	2,496
Net Gain from Investments	352
Net Insurance Income	-38
Net Change in Property Inventory	328
Net Change in Accounts Payable	33
Mandatory Appropriation	1,686
Transfer to HECM Financing Account	4,263
Capital Resources as of Sep. 30, 2013	9,119
Actuarial Calculation	
NPV of Projected Cash Flows	-5,469
Economic Value	3,650

Source: FHA and Summit & Milliman forecasts

FY 2013 to FY 2020 Economic Value Estimates

The economic value of the HECM portfolio is projected to change over the next seven fiscal years as capital resources change, existing loans terminate, and new books of business are added to the portfolio. Over the next seven fiscal years, we project that the economic value of the portfolio will grow to \$7.1 billion by the end of FY 2020. This results from projected improvements in the performance of existing loans (2009 to 2013 books of business) and the addition of future books of business, which we project to have positive economic value. The positive projected economic values of future books of business are due in part to the recent HECM program changes, which are expected to improve loan performance. However, if the



volume of HECM endorsements over the next seven years is lower than projected, the economic value of the HECM portfolio will be lower than projected. Likewise, if macroeconomic conditions are worse than forecasted, the economic value of the portfolio will likely be lower than projected. Table 5 below provides our economic value estimates for fiscal years 2013 to 2020, including projected capital resources, the NPV of projected cash flows on current books of business (2009 to 2013 books) and on future books of business (2014 to 2020 books).

Table 5: HECM Portfolio Economic Value Estimates for FY 2013 to FY 2020 (\$ Millions)

Fiscal Year	Economic Value	NPV Future Cash Flows	NPV Current Books of Business	NPV Future Book of Business	Capital Resources	Return on Investment
2013	3,650	-5,469	-5,469	-	9,119	-
2014	3,800	-5,355	-5,731	376	9,155	36
2015	4,075	-5,163	-6,006	843	9,238	83
2016	4,548	-4,940	-6,294	1,354	9,488	250
2017	5,130	-4,718	-6,597	1,879	9,848	360
2018	5,753	-4,474	-6,914	2,440	10,227	379
2019	6,424	-4,188	-7,247	3,059	10,612	385
2020	7,139	-3,879	-7,596	3,717	11,019	407

Source: Summit & Milliman forecasts

Table 6 below provides our insurance-in-force and endorsement volume estimates for fiscal years 2013 through 2020. Insurance in Force is the sum total maximum claim amount of loans projected to survive through the end of the fiscal year excluding projected assignments. The volume of new endorsements is the sum total maximum claim amount of loans projected to be endorsed during the fiscal year.

Table 6: Insurance-in-Force and Endorsements for FY 2013 to FY 2020 (\$ Millions)

Fiscal Year	Insurance in Force	Volume of New Endorsements
2013	84,987	14,646
2014	90,364	11,861
2015	94,770	12,532
2016	96,984	13,111
2017	96,504	13,660
2018	94,028	14,349
2019	91,383	15,116
2020	93,244	15,989

Source: Summit & Milliman forecasts



Section III: Sensitivity Analysis

In addition to our baseline FY 2013 HECM portfolio economic value estimate, we produced economic value estimates under six alternative economic scenarios. The alternative scenario outcomes help us assess the sensitivity of our baseline economic value estimate to fluctuations in macroeconomic conditions. Specifically, we can quantify how sensitive our baseline estimate is to interest rate and home price movements. Below are descriptions of the alternative scenarios and a summary of our findings.

Economic Forecasts

We relied on six alternative economic forecasts produced by Moody's Analytics⁶ to assess the sensitivity of the FY 2013 HECM portfolio to changes in macroeconomic conditions, namely interest and home price appreciation rates. Each alternative scenario is designed by Moody's so that there is a certain probability that the economy will, broadly speaking, perform better than the scenario. A description of these scenarios and the associated probabilities follow.

- 1. Stronger Near-Term Rebound ("S1") Scenario**
 - a. 10% probability the economy will perform better than in this scenario
- 2. Slower Near-Term Recovery ("S2") Scenario**
 - a. 75% probability the economy will perform better than this forecast
- 3. Second Recession ("S3") Scenario**
 - a. 90% probability the economy will perform better than this forecast
- 4. Protracted Slump ("S4") Scenario**
 - a. 96% probability the economy will perform better than this forecast
- 5. Below-Trend Long-Term Growth ("S5") Scenario**
 - a. 96% probability the economy will perform better than this forecast
- 6. Oil Price Increase, Dollar Crash Inflation ("S6") Scenario**
 - a. 90% probability the economy will perform better than this forecast

Figures 1 and 2 below provide a graphical representation of projected home price and interest rate paths under Moody's baseline and alternative scenarios. The projected home price paths under scenarios S1 and S2 don't differ significantly from the baseline path. However, the paths do differ significantly under scenarios S3, S4, S5, and S6. With respect to interest rates, under the baseline scenario rates begin to rise towards the end of 2014 and plateau three years later. Under scenarios S2, S3, S4, and S5, rates are projected to stay low for several additional

⁶ The alternative House Price Index (HPI) forecasts represent September 30, 2013 forecasts as opposed to July 30, 2013 forecasts as used in the baseline estimate of this report due to data availability for CBSA-level forecasts. The alternative purchase-only home price index forecasts as of July 30, 2013 contained limited CBSA-level forecasts.



quarters before rising and plateauing. Under scenarios S1 and S6, however, rates are expected to increase in the near-term before converging to baseline levels.

Figure 1: Moody's Analytics Purchase-Only Home Price Index

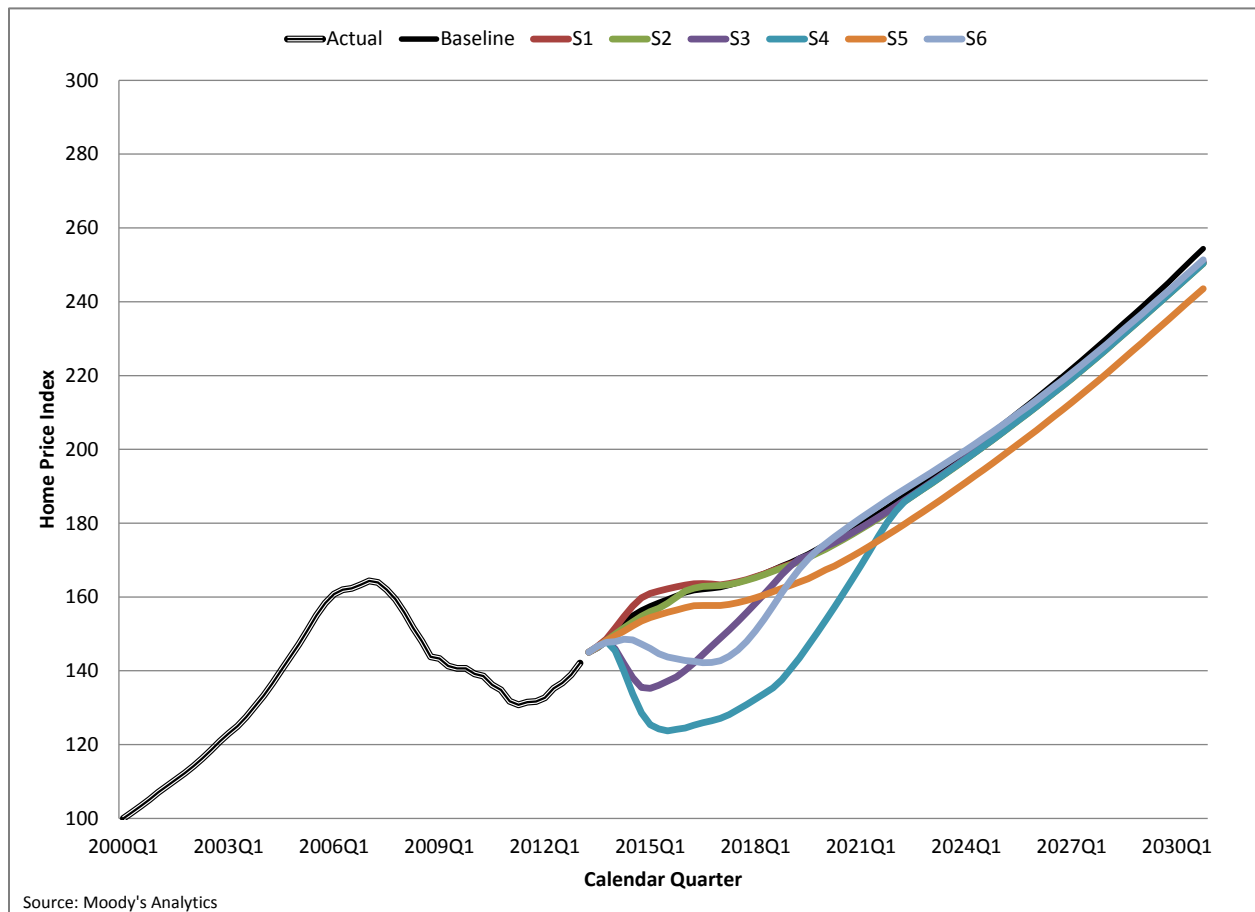
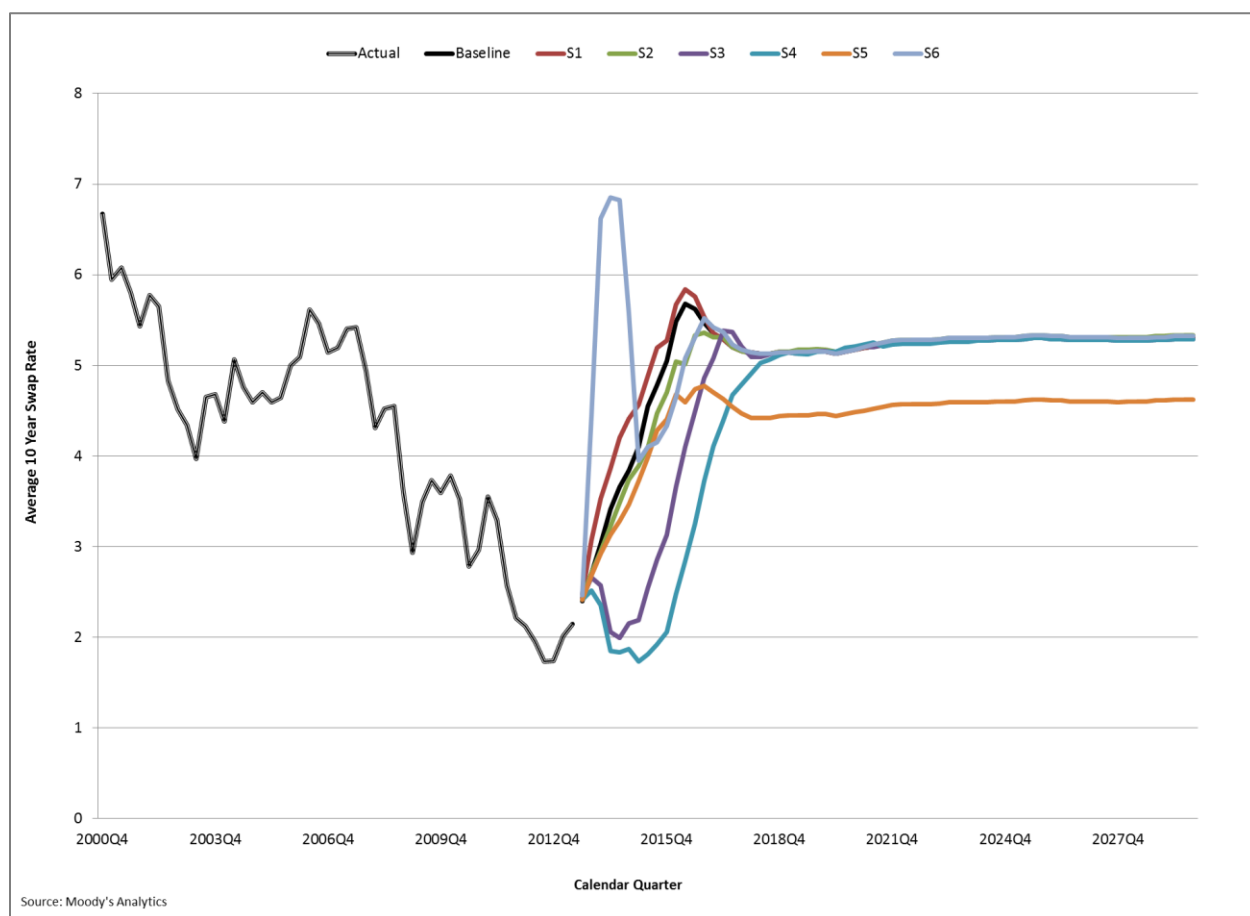


Figure 2: Moody's Analytics 10-Year Swap Rate



Alternative Scenario Economic Value Estimates

To quantify the sensitivity of our economic value estimate for the FY 2013 HECM portfolio, we estimate the portfolio's economic value under six alternative scenarios and compare the results with our baseline estimate. Table 6 below provides our economic values estimates under scenarios S1 to S6 and the differences from baseline.

Table 7: FY 2013 Baseline and Alternative Scenario Economic Value Estimates (\$ Millions)

Scenario	Scenario Description	Economic Value	Difference from Baseline
	Baseline	3,650	-
S1	Stronger than Near-Term Rebound	3,593	-57
S2	Slower Near-Term Recovery	4,025	375
S3	Second Recession	3,918	268
S4	Protracted Slump	2,827	-823
S5	Below-Trend Long-Term Growth	2,916	-735
S6	Oil Price Increase, Dollar Crash Inflation	4,186	535

Source: Summit & Milliman forecasts

For further information regarding Moody's Analytics alternative scenarios, please see the following document:

<http://www.economy.com/home/products/samples/Moodys-Analytics-US-Alternative-Scenarios.pdf>



Section IV: Summary of Methodology

Description of Data

The econometric and cash flow models developed by Summit & Milliman were created using loan-level data provided by FHA and economic data from Moody's Analytics. This section describes this data and the models we developed for estimating the economic value of the HECM portfolio. In-depth technical details regarding these models and related issues are located in the appendices.

- Appendix A provides a discussion of anticipated portfolio trends
- Appendix B provides a discussion of data limitations
- Appendix C provides the technical details of the Stage 1 model
- Appendix D provides the technical detail of auxiliary models
- Appendix E provides the technical details of the Stage 2 model

Loan Data from FHA

FHA provided Summit & Milliman with a data set containing loan, property, and borrower information on approximately 800,000 HECM loans endorsed through April 30, 2013. This was the primary data set used to develop the econometric and cash flow models we relied on for developing our economic value estimates. FHA also provided a data set containing synthetic loans for future books of business, which reflect their assumptions regarding the composition of these future books. This was the primary data set used to project the cash flows of future books of business, which Summit & Milliman used to estimate the economic value of FY 2014 to 2020 HECM portfolios. Below is a summary of our Stage 1 model, which we used to project terminations for all existing and future books of business. The Stage 1 model was developed using the historic loan data provided by FHA, in conjunction with historic economic data (home prices and interest rates) provided by Moody's Analytics. We also developed several auxiliary models required for projecting future cash flows using this historic and economic data. These auxiliary models are also described below.

Stage 1: A Multinomial Logistic Termination Model

The Stage 1 model was developed using actuarial and econometric methods and was used to predict termination rates (the probability of loan termination) for current and future books of business. Since a HECM loan can terminate for numerous, disparate reasons, Summit & Milliman employed a multinomial logistic framework for predicting termination rates.

At any point in time, a HECM can terminate because the last remaining borrower dies, a tax and insurance delinquency foreclosure occurs, the loan is refinanced, or the borrower(s) move. To account for these competing risks, we estimated four separate logistic models, one for each termination type. The separate termination probabilities can then be combined to produce a single termination rate. This approach also allows the modeler to specify different explanatory variables for each model, since different termination types are driven by different loan, borrower, and economic factors. For example, borrower age and gender affect the likelihood of mortality-based termination, whereas home price appreciation and interest rates affect the



likelihood of refinance termination. Appendix C contains a detailed description of these termination models and the methodology for combining separate termination probabilities into a single termination rate.

Auxiliary Models and Projections

In addition to the Stage 1 model, several auxiliary models and projections are required to project the future cash flows and economic value of a HECM loan. Summit & Milliman developed and used these models to project future line-of-credit cash draw behavior, UPB growth, home value appreciation, assignment timing, and the likelihood of property conveyance at loan termination. Below is a discussion of these auxiliary models and projections. A more thorough treatment is provided in Appendix D.

Cash Draw Projections

Borrowers with line-of-credit, modified term, or modify tenure payment plans may request additional cash drawn as long as at least \$50 remains in the line of credit. These draws are added to the outstanding balance and accrue interest and MIP on a monthly basis. Although the amount and timing of future cash draws are unpredictable, our analysis of historic HECM loan data revealed similar cash draw patterns across cohorts. Excluding borrowers who draw 100 percent of their loan's net principal limit at closing, borrowers generally draw more cash early on and progressively smaller amounts as their loans age. We assume a similar pattern for loans with existing lines of credit at the end of FY 2013. Specifically, we assume half of the principal limit remaining at the end of each forecast year is drawn during the next forecast year. This effectively depletes the principal balance remaining at the end of FY 2013 over the next seven forecast years. For future books of the business, FHA provided expected cash draw rates by policy year, based on historical cash drawn patterns and expectations regarding how recent policy changes will impact the cash draw behavior of future borrowers. These cash draw rates are consistent with the assumption we apply to existing loans: they start off high and decline to zero over time.

Home Maintenance Risk

HECMs are often used to help manage unexpected health care costs, and seniors with poor health may not be able to care for their homes. Furthermore, borrowers may not have adequate incentive to properly maintain their homes, especially in the case of anticipated negative equity. Therefore, when an HECM terminates and the property is sold on the open market, additional adjustments in the model may be required in order to account for this risk.⁷ In order to account for home maintenance risk, HUD staff developed analyses and estimates regarding the discount that should be applied against market-level housing price growth

⁷ Another important implication of regional real estate market cyclicity and autocorrelation is the potential for the adverse selection of properties in the HECM portfolio. This is due to asymmetrical information between borrowers and lenders, which can arise from local mean reversion and speculative price bubbles. This may call into question the appropriateness of using HECM collateral appraisals as inputs to a future home value forecasting model. However, Case and Shiller (1989) find that it is difficult to profit from such asymmetrical information, and this decreases the likelihood of adverse selection and likely decreases the difference in accuracy between long-term autocorrelation models and random walk models.



forecasts as measured by the difference between the market-level housing price growth rate and the HECM portfolio's housing price growth rate, which Summit & Milliman has leveraged to forecast home values.

Assignment Timing Projection

A lender may choose to assign a HECM loan to HUD once the loan's UPB reaches 98 percent of the maximum claim amount. At assignment, the lender assigns the note to HUD and HUD pays the lender an amount equal to the unpaid principal balance, up to the maximum claim amount. This payment is referred to as a Claim Type 2 payment. Accordingly, a loan assigned to HUD will result in a Claim Type 2 payment that ranges between 98 percent and 100 percent of the maximum claim amount. Since cash draws on remaining lines of credit can occur at any time and accrued interest and MIP are added to loan balances monthly, it's unlikely that all Claim Type 2 payments are equal to 98 percent of the maximum claim amount. Assuming so could underestimate the expected claims liability of the HECM portfolio. Accordingly, we assume the probability of assignment is uniformly distributed on the interval between 98 percent and 100 percent of the maximum claim amount. This results in an expected Claim Type 2 payment equal to 99% of the maximum claim amount. We apply this assumption to our cash flow projections for existing and future books of business.

Loan Conveyance Projection

A critical factor in determining the value of a HECM portfolio is the projection of loan conveyance, which impacts the expected magnitude of post-assignment claims and recoveries. In the event of a post-assignment non-refinance termination, the HECM becomes due and payable, and it is the responsibility of the owner or the estate executor of the property to pay back the amount due. According to HUD regulations at 24 CFR 206.125(c), "if the mortgage is due and payable at the time the contract for sale is executed, the borrower may sell the property for at least the lesser of the mortgage balance or five percent under the appraised value." However, in the event the owner or estate executor does not want to directly engage in the property sale, the property may be conveyed to HUD. After such a conveyance, HUD is in charge of executing the property sale and, moreover, directly incurs the additional costs associated with maintaining and selling the property.

Conveyance may result from economic conditions that cause housing price depreciation and an increase in costs associated with the sale of a property. For instance, the owners or estate executors may be less likely to engage in the direct sale of the property if the home is in a negative equity position. Similarly, if the value of the home at termination is less than the UPB at termination, the owner or estate executor may have less incentive to engage in a direct sale of the property. However, if the home has appreciated beyond UPB over the life of the HECM, the owner or estate executor will have an incentive to execute the property sale and, thereby, reap the gains after covering all costs associated with the sale.

Our projection of loan conveyance is handled on a loan-by-loan basis. First we identify loans that are expected to terminate for reasons other than refinance or mobility during each forecast year. For each loan, we project UPB balance and home price appreciation and compare the two estimates. As discussed above, there is little incentive for the estate or heirs to engage



in a direct sale if the property is underwater. Accordingly, we assume the estate or heirs will exercise the option to convey the home to HUD in instances where the property is underwater. The amount we project HUD to recover upon disposition of these properties is then reduced to account for carrying costs and sales expenses.

Stage 2: Projecting Future Cash Inflows and Outflows

Stage 2 leverages the outputs from Stage 1 and the auxiliary projections to generate expected cash inflows and outflows for computing the NPV of a HECM portfolio. The Stage 2 model projects the following cash inflows and outflows, at the loan level, for each policy year:

- Upfront mortgage insurance premiums (inflow)
- Monthly mortgage insurance premiums (inflow)
- Claim Type 1 payment (outflow)
- Claim Type 2 payment (outflow)
- Note holding expense (outflow)
- Recovery (inflow)

Termination and cumulative survival rates from our Stage 1 model are then applied to these cash flows to arrive at their expected values. These expected cash flows are then aggregated across loans to compute portfolio-level cash flows for each fiscal year of the forecast period. These nominal cash flows are then discounted to present value and summed to produce a NPV estimate for the portfolio. Discounting is performed using cohort-specific single effective rates (SER) provided by FHA, which are based on discount rates published in OMB's Credit Subsidy Calculator 2 (i.e., CSC2; version 1.4.4b, released November 2012). Single effective rates are used to calculate interest earned from or owed to U.S. Treasury on un-invested balances in federal agency financing accounts.

Future HECM Endorsement Volumes

At this point in time, there isn't sufficient historic data to project the impact of recent substantive HECM program changes⁸ on future loan volumes. Based on discussions with FHA management, these recent program changes are expected to lower the FY 2014 loan volumes by 20 to 25 percent. Industry and association groups anticipate a reduction in endorsements due to reduced principal limit factors, limits on cash draws within the first 12 months of a loan's life, and new financial assessment requirements. Lenders will have to use these new requirements to determine if borrowers can qualify for a HECM loan. This includes an evaluation of credit history, cash flow/residual income analysis, determining if funding sources for property charges from HECM proceeds will be required, and completing a financial assessment worksheet. Summit & Milliman attempted to capture the effect of all of these program changes in our forecast of future volumes. Accordingly, we arrived at our volume projection for FY 2014 by reducing the number of loans endorsed in FY 2013 (60,091 loans) by 25 percent. However, this reduction is partially offset by an expected 3.25 percent annual

⁸ HUD ML 2013-27 and ML 2013-28



increase in the age 65+ population projected by the U.S. Census Bureau. For fiscal years 2015 to 2020, we project volumes to stay near the volume projected for FY 2014. However, we account for expected increases in demand associated with a growing senior population by increasing our volume projection at an annual rate of 3.25%. Table 7 below contains our volume projections for the next seven fiscal years. These volumes were used to compute the NPV of future HECM portfolios, as well as the economic value estimates provided in Section II: Summary of Findings.

Table 8: FY 2014 to FY 2020 Projected Endorsement Volumes

Fiscal Year	Loan Count
2014	46,533
2015	48,046
2016	49,608
2017	51,221
2018	52,887
2019	54,606
2020	56,381

Source: Summit & Milliman forecasts

Anticipated continued appreciation in home values may be viewed as a mitigating factor to the potential initial decline in endorsements and supports the economic demand for the HECM program for those borrowers that qualify.

In addition, estimates for low interest rates through 2015 and moderate rates thereafter support the feasibility of financing or refinancing HECMs as more applicants will have lower payments and potentially higher PLFs during housing appreciation growth years.

The key components of the policy adjustments as outlined in HUD ML 2013-27 are as follows:

1. New principal limit factors;
2. Initial disbursement limits;
3. New single disbursement lump sum payment option;
4. Initial mortgage insurance premiums;
5. Initial mortgage insurance premium calculation for refinance transactions;
6. Financial assessment requirements; and
7. Funding requirements for the payment of property charges based on the financial assessment (includes escrows or hold backs for tax and insurance payments where applicable).

These policy changes are expected to improve the loan performance of future books of business and increase the economic value of future HECM portfolios.



Section V: Qualifications and Disclosures

Summit & Milliman staff who conducted this analysis are Members of the American Academy of Actuaries, Fellows of the Casualty Actuarial Society, and/or have significant expertise in the evaluation of mortgage insurance and reverse mortgages. In conducting this analysis, Summit & Milliman relied on data and other inputs provided by or on behalf of FHA. Summit & Milliman did not audit the data or perform detailed verifications of the data and information. If the provided data or information is inaccurate or incomplete, the results of Summit & Milliman's analysis may likewise be inaccurate or incomplete. Except where noted specifically within this report, Summit & Milliman are not aware of any relevant events or changes to the data subsequent to Summit & Milliman's analysis that would materially impact the result of the analysis.

In performing this evaluation, Summit & Milliman have assumed that FHA:

- (a) Used its best efforts to supply accurate and complete data; and
- (b) Did not knowingly provide any inaccurate data.

Summit & Milliman performed a limited review of the data used directly in Summit & Milliman's analysis for reasonableness and consistency and have not found material defects in the data. If there were material defects in the data, a detailed systematic review and comparison of the data for materially inconsistent relationships could be performed. Such a review was beyond the scope of Summit & Milliman's assignment.

These analyses and conclusions provided in Summit & Milliman's deliverables are based on data provided to Summit & Milliman by third-party sources. Summit & Milliman do not warrant the accuracy or completeness of any third-party data, and Summit & Milliman disclaim any and all liability in connection with such third-party data. Any errors in the data provided may affect the results of Summit & Milliman's analysis. Summit & Milliman are not liable for the results of its analysis to the extent errors are contained in third-party data sources.

Any analysis of unpaid claims or study of future operating results involves estimates of future contingencies. While Summit & Milliman's results were arrived at after careful analysis of the available information, it is important to note that a significant degree of variation from Summit & Milliman's projections is not only possible but is, in fact, probable. Summit & Milliman have attempted to reflect this variability by providing a range of projected outcomes under various scenarios. The sources of this variation are numerous: future national or regional economic conditions, reverse mortgage termination rates, and legislative changes affecting FHA's business are examples. There is no assurance that the actual ultimate outcomes will fall within the range provided.

The uncertainty associated with Summit & Milliman's estimates is also magnified by the nature of providing insurance on reverse mortgages. Reverse mortgage risk is sensitive to economic factors such as housing market conditions, interest rates, and borrower termination trends. Past experience may not be indicative of future conditions. A loan underwritten in a given year is generally insured over several calendar years. Therefore, adverse economic conditions in a given calendar year could affect results not only for the current underwriting year but also for



prior underwriting years. Future economic developments that increase crossover risk and the frequency and severity of Claim Type 1 payments will impact ultimate losses, and unprecedented changes and stresses in the market add to uncertainty. Forecasts are significantly more uncertain given economic deterioration, adverse home price trends, and elevated default and conveyance rates. Some of these variables are at unprecedented levels and historical trends may not be indicative of future outcomes. The overall results are potentially sensitive to any of these variables and reasonable deviations from the embedded assumptions could materially change the results.

Any reader of this report must possess a certain level of expertise in areas relevant to this analysis to appreciate the significance of the assumptions and the impact of these assumptions on the illustrated results. The reader should be advised by, among other experts, actuaries or other professionals competent in the area of actuarial projections of the type in this report, so as to properly interpret the projection results.

Disclosures

Actuarial Standards require Summit & Milliman to disclose the following:

Purpose

The purpose of this analysis is to independently forecast the economic value of HECM loans in the MMI Fund at the end of FY 2013, and at the end of each fiscal year through FY 2020. Our economic value estimates for FY 2014 through FY 2020 include existing and new books of business. Unless otherwise noted, these estimates we produced using historic HECM loan data through April 30, 2013 and assumptions regarding future endorsements, both provided by FHA. Baseline and alternative scenario interest rate and home price forecasts were produced Moody's Analytics and provided by FHA.

Constraints

The data provided to Summit & Milliman contains several valuable data elements to estimate the economic value of the HECM program under the MMI Fund. However, the data is also missing key elements that are required to estimate the value of the program. Where data elements are missing, Summit & Milliman had to make assumptions about the data. The following provides a summary of the key missing data elements⁹:

- The data does not provide for a concise definition of the reason of a HECM termination, and Summit & Milliman had to develop an algorithm to identify the type of termination for each HECM;
- HECM endorsements may contain "silent spouses" in order to take advantage of larger principal limit factors. HUD cannot identify silent spouses, and the lack of data on these borrowers may distort historical and forecasts of HECM termination rates;

⁹ Appendix B provides a detailed discussion of each of the data elements



- The data includes property sale amounts only on mortgages that were disposed of by HUD. This data was utilized to estimate the maintenance risk adjustment discussed in this report. To the extent these properties appreciate differently than other HECM mortgages, these predictive models may overestimate the maintenance risk adjustment; and
- The HECM program has undergone several program changes since 2009 to ensure viability of the program. As these program changes are relatively recent and the duration of a HECM may extend several years into the future, data on the impact of these program changes on borrower behavior is not available.

Scope

Summit & Milliman's estimates are discounted and undiscounted with respect to the time value of money. For the discount rate, Summit & Milliman use SERs, which define FHA's borrowing costs from the U.S. Department of the Treasury.

FHA does not enter into reinsurance agreements with third parties. Therefore, Summit & Milliman's estimates are presented on both a gross basis (i.e., direct plus assumed) and a net basis (i.e., gross less ceded) with respect to reinsurance recoverables. Summit & Milliman has not made any provisions for uncollectible reinsurance as this assumption is not applicable to this review.



Appendix A: Discussion of Anticipated Portfolio Trends

HECM cash flows are sensitive to many factors, including the timing of loan termination and assignment, housing market conditions, and interest rate levels. This appendix identifies factors that influence HECM cash flows and provides a discussion of the relationship between these factors and our forecasts.

HECM Cash Flow Drivers

The value of a HECM portfolio is the net present value of the projected net cash flows (inflows less outflows) of the loans in the portfolio. Inflows include upfront mortgage insurance premiums, monthly mortgage insurance premiums, and post-assignment recoveries. Outflows include Claim Type 1 and Claim Type 2 payments and note holding expenses.

A claim Type 1 payment occurs when an unassigned loan terminates and the net proceeds from the sale of the mortgaged property are insufficient to pay off the current loan balance. The difference, or shortfall, is paid by HUD to the lender. When the net proceeds are sufficient to pay off the loan balance, a non-claim termination occurs, resulting in no payment from HUD. Since the inception of the HECM program, claim type 1 terminations have been relatively rare.

A Claim Type 2 payment occurs when a lender assigns a loan to HUD, which can occur once the loan balance reaches 98% of the maximum claim amount. In our current model, we assume assignment occurs once UPB reaches 99% of the maximum claim amount and that HUD purchases the loan at par value (99% of the maximum claim amount). Since every loan that is projected to survive to assignment will result in a Claim Type 2 payment, which can be up to \$619,245 (99% of \$625,500), Claim Type 2 payments account for the vast majority of projected outflows. Given the size of these claims, the projected timing of assignment has a significant impact on our net present value calculation due to discounting. Assignment timing is also critical because, after assignment, HUD owns the note and is no longer liable for Claim Type 1 or 2 payments. Additionally, post-assignment, HUD no longer collects monthly mortgage insurance premiums, which is a significant cash inflow. However, monthly MIP continues to accrue on the loan's unpaid principal balance and will be recouped at loan termination.

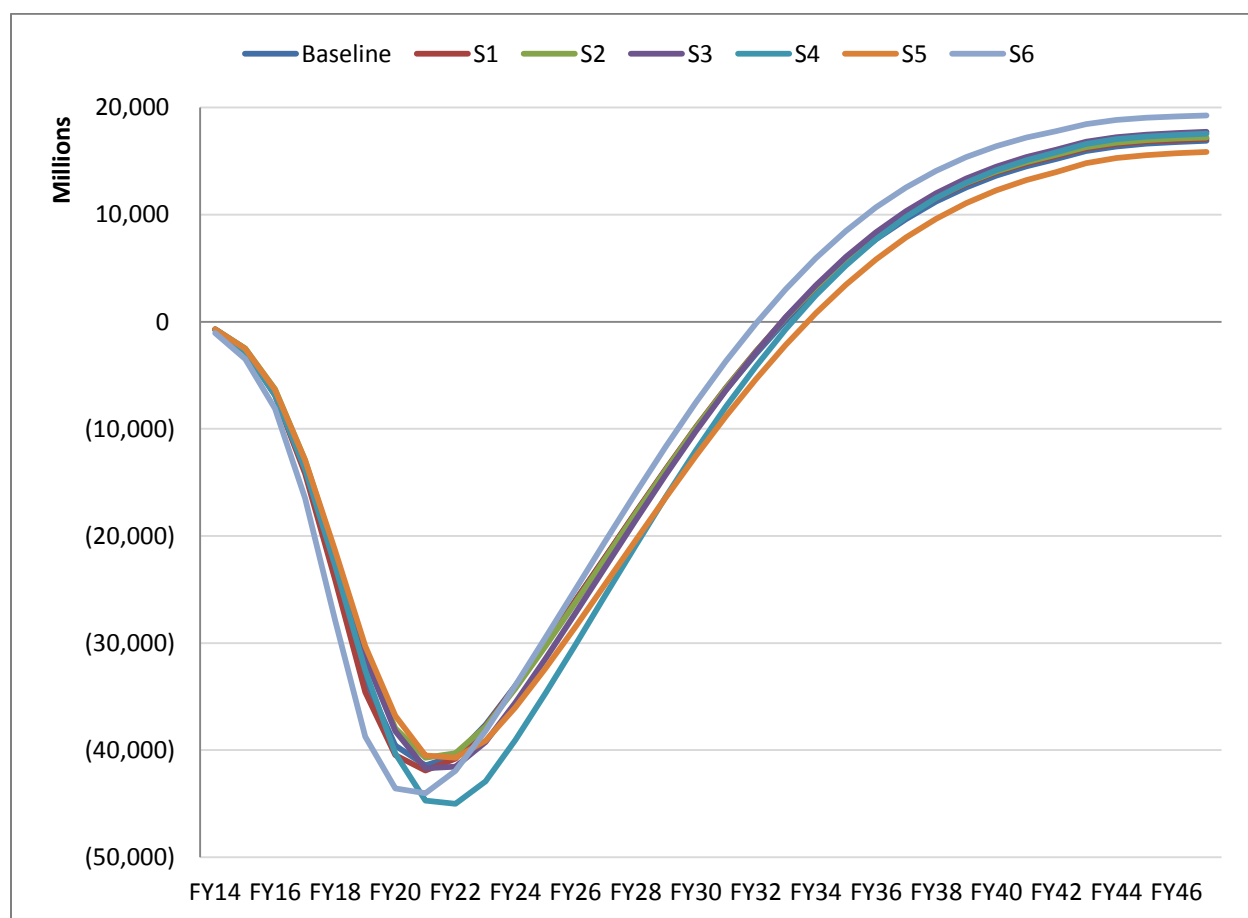
HECM Cash Flow Projections

Although PLFs vary from loan to loan, the average PLF of loans in the FY 2013 HECM portfolio is 0.61. Additionally, our analysis indicates that many borrowers draw all or a significant portion of their principal limit at loan closing or within the first policy year. Consequently, the average HECM has a loan balance equal to 61% of the maximum claim amount by the end of the first policy year. With accrual rates (interest plus MIP) averaging approximately 6% per year, FY 2013 HECM portfolio loan balances are, on average, projected to reach 98% of the maximum claim amount by the end of policy year eight. Given the relatively young age of the loans in the FY 2013 HECM portfolio, most of these loans are unassigned. Accordingly, we are projecting large cash outflows over the next several fiscal years associated with assignment claims for loans expected to survive to assignment. Consequently, net cash flows (inflows less outflows) are projected to be negative over the first half of the forecast horizon (FY 2014 to FY 2047), but

positive over the second half. After assignment, cash flows are limited to note holding expenses (installment payments and cash draws on remaining lines of credit) and recoveries on assigned notes. Recoveries on assigned notes are the largest component of cash inflows and are projected to exceed note holding expenses by a substantial margin.

On a nominal basis, this results in a full recovery to a breakeven position sometime during fiscal year 2032 for the baseline, S1, S2, S3, and S6 economic scenarios, and sometime during fiscal year 2033 under the S4 and S5 economic scenarios. The chart below illustrates the cumulative cash flow, on a nominal basis, forecasted for fiscal years 2014 through 2047, with an emphasis on the nominal breakeven points.

Figure 3: Cumulative Projected Nominal Net Cash Flows

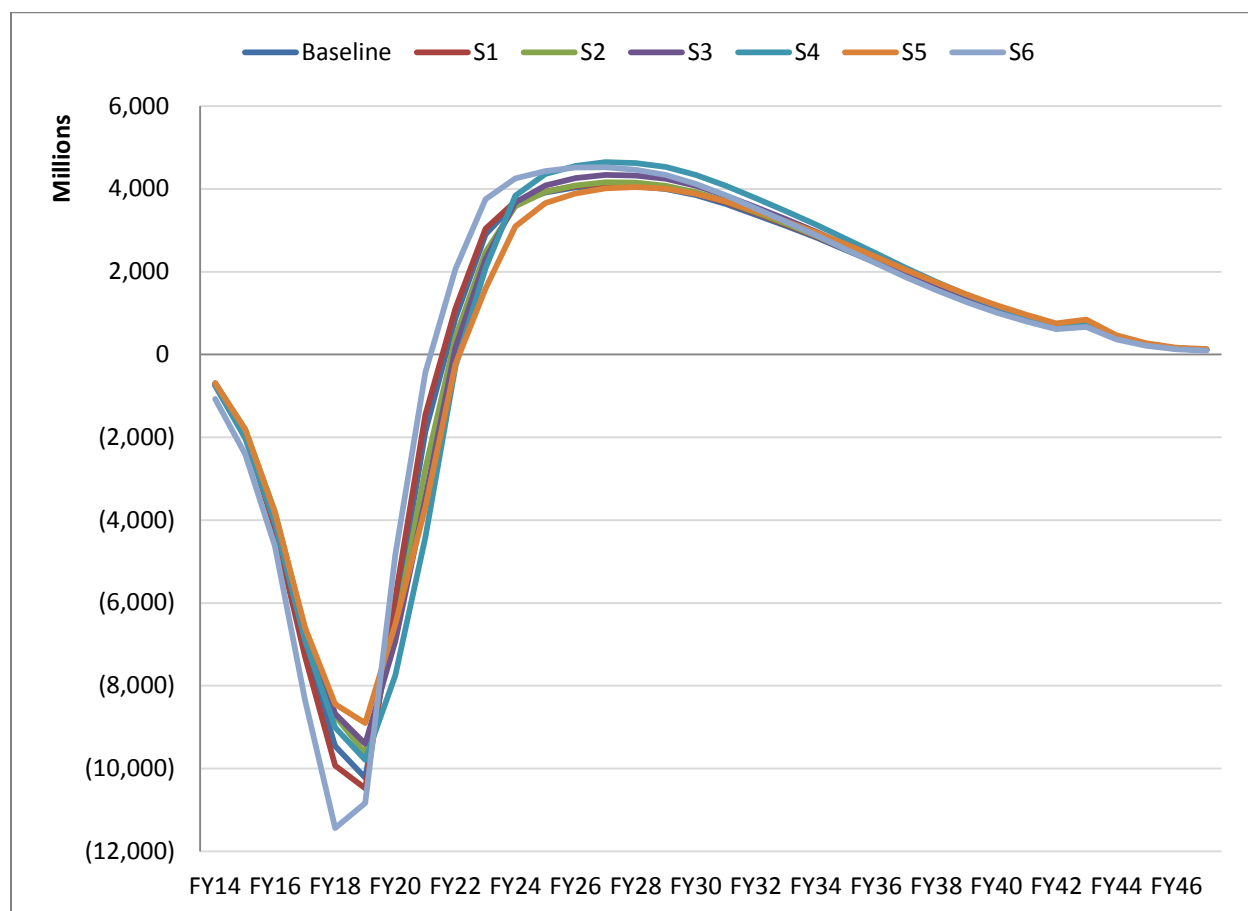


Source: Summit & Milliman

On an incremental basis, net nominal cash flows are projected to return to positive sometime during fiscal year 2021 under the baseline, S1, S2, S3, and S6 economic scenarios, and sometime during 2022 under the S4 and S5 economic scenarios. The chart below illustrates forecasted nominal net cash flows and when they are expected to become positive.



Figure 4: Incremental Projected Nominal Net Cash Flows

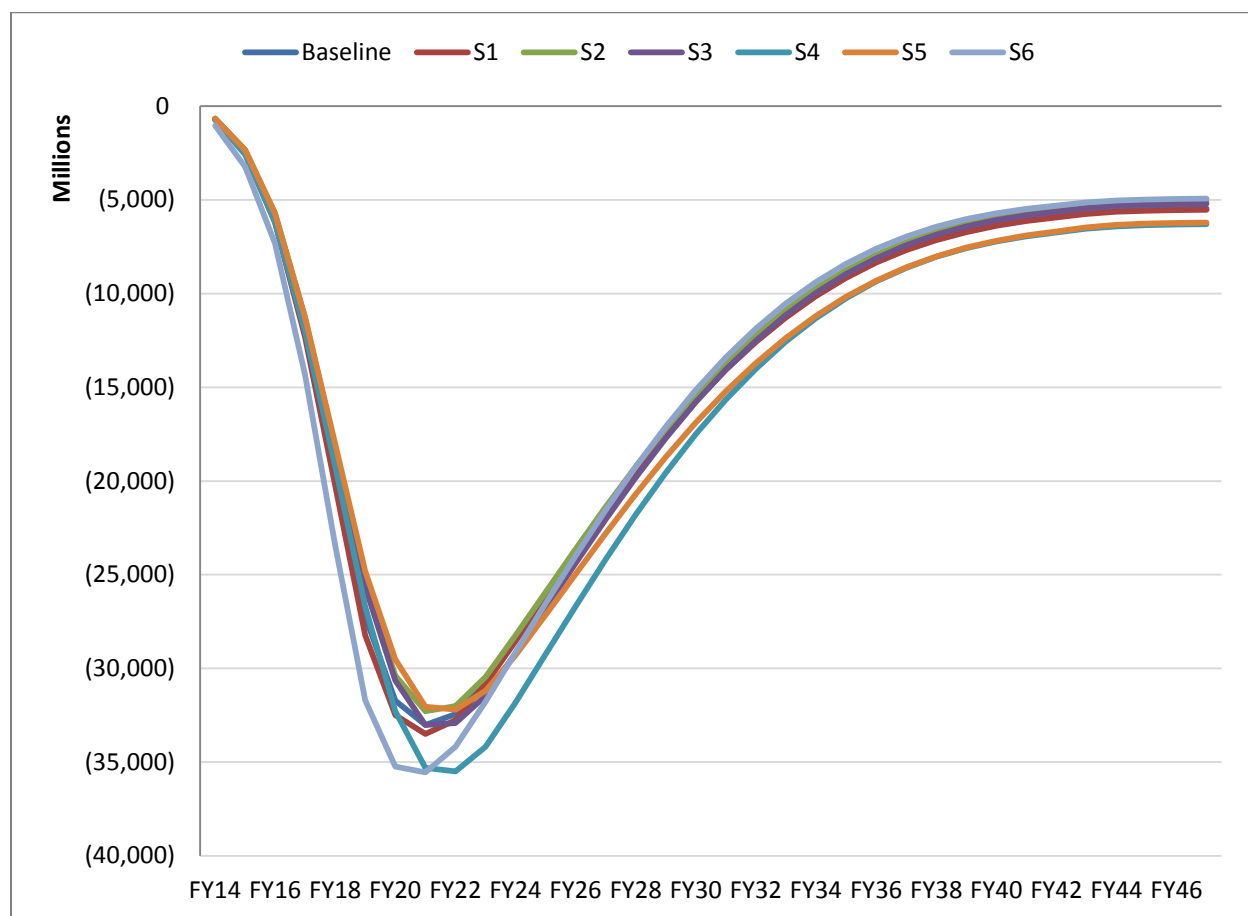


Source: Summit & Milliman

On a present value basis, the timing mismatch of projected inflows and outflows is much more significant. And because our economic value estimates rely on discounted net cash flows, the timing of projected inflows and outflows becomes paramount. When discounting a stream of future cash flows, the weight, or significance, of each cash flow hinges on how far into the future the cash flow occurs. Due to compounding, the further into the future the cash flow, the less it contributes to the net present value calculation. As the previous chart illustrates, projected net cash flows are negative in the near term and positive in later years. Thus, the projected near-term negative cash flows carry more weight than the far-term positive net cash flows, when computing net present value. It is for this reason that the FY 2013 HECM portfolio has positive projected total net cash flows but a negative projected net present value. The chart below displays cumulative net cash flows on a present value basis.



Figure 5: Cumulative Projected Discounted Net Cash Flows



Source: Summit & Milliman

As illustrated in the chart above, on a present value basis, HUD does not fully recover to a breakeven position during the forecast horizon under the baseline and alternative economic scenarios.

One factor affecting the timing of future cash flows, and thus contributing to the large cash outflows projected for the coming fiscal years, is the PLF of a HECM loan. As discussed in Section I, the PLF represents the percent of the home's value that the borrower can draw. The PLF is based on the age of the borrower and expected future interest rates at loan origination. The PLF generally increases as the borrower's age increases and expected rates decrease. FHA has made several changes to PLFs in recent years. In April of 2013, FHA consolidated the pricing options and principal limit factors for fixed rate loans under the HECM Saver pricing and principal limit factors. Numerous additional program changes went into effect on October 1, 2013. These changes include initial disbursement limits, a new single lump sum payment option, revised mortgage insurance premium rates, and a revised PLF schedule. Additionally, case numbers assigned on or after January 13, 2014 will be subject to new financial assessment requirements and funding requirements for the payment of property charges based on the financial assessment. Collectively, these changes should improve loan performance and reverse the recent trend of higher payouts of insurance claims. Lower PLFs and initial disbursements



limits should increase the time it takes for loan balances to reach 98 percent of the maximum claim amount. Increasing the time to assign provides for additional MIP inflows and reduces the present value of projected Claim Type 2 payments.

Conveyance

When a loan terminates after the note has been assigned to HUD, one of three things can occur: 1) the estate or heirs can buy the home for 95% of its appraised value; 2) the home can be sold and the net sales proceeds used to pay off the loan; 3) the home can be conveyed to HUD. With a conveyance, HUD owns the property and has the right to hold or sell the property. When the home is sold, a recovery occurs in an amount equal to the net sales proceeds. The scenario where a conveyance occurs typically has a negative influence on net cash flows. This is because HUD, as owner of the property, is responsible for maintenance, property taxes, and insurance on the property during the holding period, as well as any real estate commissions and additional selling expenses. These costs reduce the net proceeds from the sale of the home. Based on data provided by FHA, we assume that the expenses associated with a conveyance sale are 12% higher than a 3rd party sale. That is, net sales proceeds from a conveyance sale are assumed to be 12% less than the net sales proceed from a non-conveyance sale. Accordingly, higher conveyance rates lead to lower recoveries, lower net cash flows, and lower net present value and economic value estimates.

There is considerable uncertainty regarding which loans will result in a conveyance upon termination. In a negative equity situation (loan balance exceeds the home's value), the estate has no monetary incentive to engage in a direct sale. Nonetheless, history indicates that not every underwater property will be conveyed to HUD. The estate may buy the home for 95% of the appraised value, or sell it, rather than relinquish it to HUD. However, underwater properties do exhibit higher conveyance rates and conveyance rates have increased in recent years. To account for these factors, our cash flow model assumes higher conveyance rates for underwater homes. Accordingly, conveyance rates are higher for assigned loans projected to terminate over the next few years, before home price appreciation rates are forecasted to return to their long-run levels.



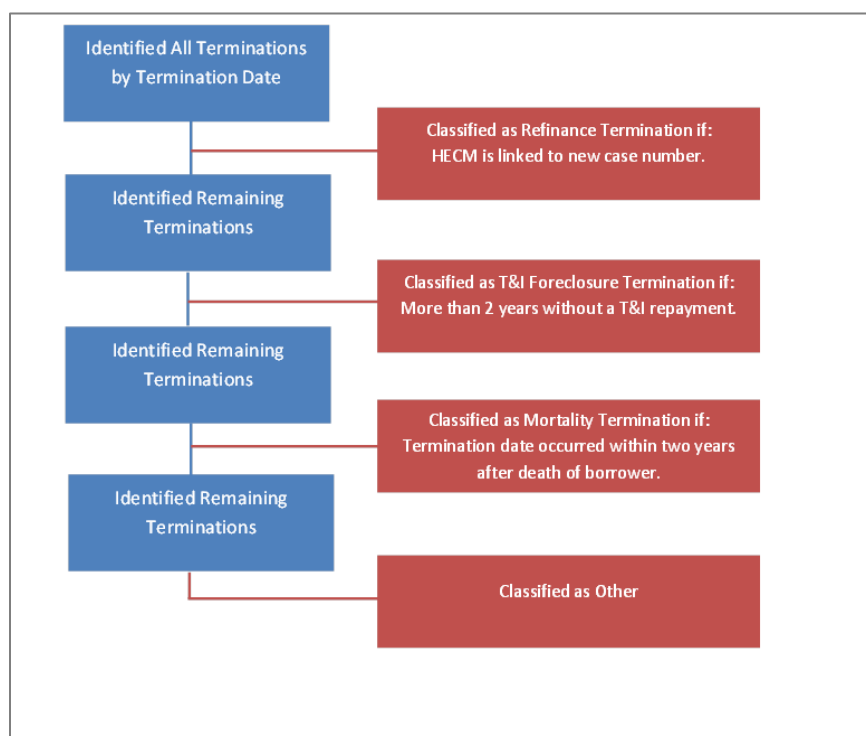
Appendix B: Discussion of Data Limitations

FHA provided Summit & Milliman with historic HECM loan data, which we relied on to perform the actuarial review described in this report. During the review, Summit & Milliman identified several data limitations that could impact model results. This appendix describes the data limitations we identified.

Termination Cause

The estimated value of a HECM portfolio depends on a number of factors, including assumptions regarding the rate at which loans will terminate in the future. Our termination models were estimated using historic loan data provided by FHA. Accordingly, identifying a termination date and type for each terminated loan is critical for estimating accurate termination models. However, the data we received presented limitations in classifying loan termination type. Refinance terminations were clearly identified in the data; however, the termination cause for non-refinance terminations were not clearly identified. That is, we did not know whether a particular loan terminated because the borrower died, moved, sold the property, paid off the mortgage, or due to foreclosure or deed-in-lieu. Consequently, we relied on proxy information (e.g., borrower death dates, delinquency data, claim codes) to determine how each loan terminated. The process we followed is outlined in the figure below.

Figure 6: Process of Assigning a Termination Type



Source: Summit & Milliman

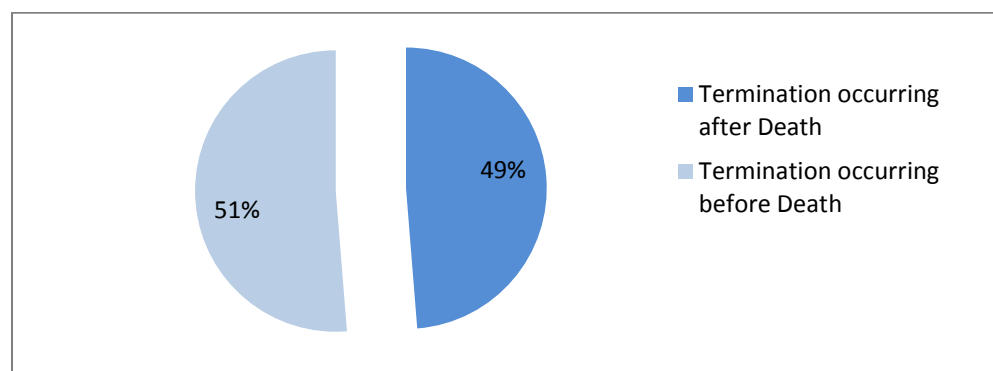


Summit & Milliman categorized loan terminations by first identifying refinance-related terminations. The dataset provided by FHA had a refinance indicator variable (the FHA case number of the new HECM loan), which we used to identify refinance-related terminations. All other terminations were deemed non-refinance terminations.

Next, Summit & Milliman identified tax and insurance default foreclosure terminations by comparing case numbers with those in several tax and insurance transaction datasets provided by FHA. Data on tax and insurance foreclosure is scarce prior to the release of ML 2011-01, because this data wasn't collected prior to that. As such, a variable that leverages historical delinquency and borrower repayment data was produced to serve as a proxy of pre-2011 circumstances that, under current policy conditions, may have resulted in tax and insurance delinquency foreclosure termination. In particular, this proxy is equal to one when there have been at least two years of tax and insurance delinquency and no borrower repayments. This rule for identifying tax and insurance foreclosure terminations is based on policies described in ML 2011-01.

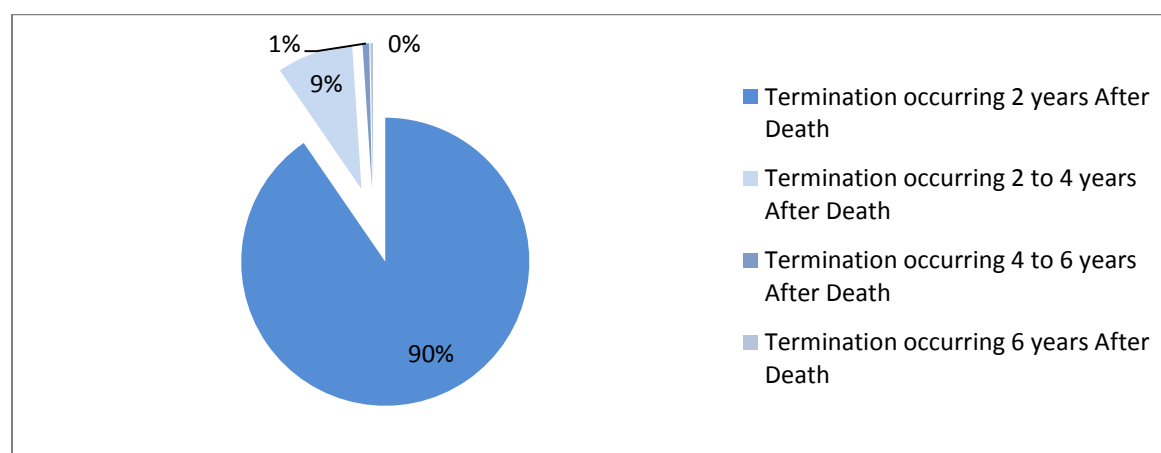
Next, Summit & Milliman relied on borrower death dates provided by FHA to identify terminations that were likely due to borrower death. Since the data we received did not explicitly identify death-related terminations, we compared terminations dates with death dates as a proxy. Loans that terminated prior to the death of the last surviving borrower were excluded during this step. However, loans that terminated within a certain period of time after the death of the last surviving borrower were identified as potential candidates. Figure 7 below provides the split between these two events. Figure 8 provides the distribution of the lag between date of death and termination date, when the termination occurred after the death date.

Figure 7: Distribution of Termination Date Relative to Death Date



Source: FHA



Figure 8: Distribution of Termination Date Occurring after Death Date

Source: FHA

Approximately 90 percent of these terminations occurred within 24 months of the death of the last surviving borrower. Summit & Milliman flagged these terminations as death-related terminations.

Lastly, after identifying terminations due to refinance and those likely due to foreclosure or borrower death, the remaining terminations were flagged as “other terminations”. These loans likely terminated because the borrower repaid the loan, sold the HECM property, or moved. However, the precise termination cause is not known.

The steps outlined above resulted in the assignment of one of four termination types for each terminated loan. However, because we approximated the cause of termination using proxy information, it is possible that we incorrectly coded some terminations. Accordingly, since we used this data to develop our Stage 1 termination models, these models may or may accurately predict future terminations.

Non-Borrower Spouses

PLFs vary by borrower age and expected interest rates. For joint borrowers, the principal limit factor is determined using the age of the youngest borrower. In order to maximize the amount of cash available from a home, younger spouses may not apply as a co-borrower. The oldest borrower completes the application, receiving a higher principal limit factor compared to applying jointly for the HECM. These borrowers are sometimes referred to as “silent spouses.” The presence of silent spouses is not reported to FHA and therefore cannot confirm which endorsed HECMs include silent spouses.

Termination data provided to Summit & Milliman contains loans that terminated long after the death of the borrower, suggesting the presence of silent spouses. Since termination rates depend on borrower age, gender, and marital status, our projections may over- or under-estimate future termination rates depending on the presence of silent spouses.



HECM Property Values

There is some evidence to support the notion that HECM properties appreciate at rates different from non-HECM properties. This may be due, for example, to the willingness or ability of HECM borrowers to maintain their home vis-à-vis non-HECM borrowers. Unfortunately, limited data is available for determining the spread between HECM and non-HECM property home values. For HECM properties, HUD only collects the sales prices when the home is sold by HUD (conveyance sale). Data is not collected on when the property is sold by the borrower or servicer. In order to accurately estimate the spread between HECM and non-HECM property values, sales data for both non-conveyed and conveyed properties is required. Given this lack of data, we relied on research performed by Shiller and Weiss (2000) and Capone et al. (2010) to project the value of HECM properties. Their research found that HECM properties with a higher value than the area's median value appreciate at higher rates than those with lower values. The adjustment factors we used to project HECM property values are presented in Appendix D.

Program Changes

The HECM program has undergone several program changes since 2009 in order to ensure viability of the program. As these program changes are relatively recent and the duration of a HECM may extend several years into the future, data on the impact of these program changes on borrower behavior is not available. For example, HUD recently enacted financial requirements for eligibility for a HECM. If this requirement systematically changes the types of borrowers that are eligible for a HECM, the termination rates for these borrowers or the maintenance risk discussed above may similarly change. Such changes will not be reflected in these estimates until more data are available to analyze potential program impacts.



Appendix C: Technical Details of Stage 1 Model

Multinomial Logistic Model

Using historic HECM data provided by FHA, Summit & Milliman estimated a separate binary logistic regression model for each termination type. The predicted probabilities were then combined to replicate the results of a single multinomial logistic regression model, which is used when there are more than two outcomes of interest. The advantage of this approach is the ability to specify a unique function form and set of explanatory variables for each model.

The multinomial logit model is a series of linked logit models that, following the results in Begg and Gray (1984), can be modeled as separate binomial logistic models for each termination type. This framework is based on the assumption of independent irrelevant alternatives (IIA).¹⁰ According to the IIA assumption, the probabilities for each termination type are estimated separately, using different explanatory variables, and then combined to calculate final probabilities. Each binomial logit model estimates the hazard rate for a HECM at each year since loan origination. The model specification for each termination type, j , is represented by Equation 1.

$$\text{Equation 1} \quad \log\left(\frac{\tilde{q}_j(t)}{1 - \sum_j \tilde{q}_j(t)}\right) = \alpha_j + X_j(t)\beta_j$$

$\tilde{q}_j(t)$ is the hazard rate for event j at time t , α_j is the model constant for termination type j , $X_j(t)$ is the vector of covariates relevant for termination j , and β_j is a vector of coefficients for each covariate.

After estimating model parameters $\hat{\beta}_j$ for all event types in J , forecasts of future $\tilde{q}_j(t)$ for each successive loan age are calculated using the formula given in Equation 2.

$$\text{Equation 2} \quad \tilde{q}_j(t) = \frac{e^{\alpha_j + X_j(t)\beta_j}}{1 + \sum_j e^{\alpha_j + X_j(t)\beta_j}}$$

Given each predicted $\tilde{q}_j(t)$, the overall forecasted termination rates, $\tilde{q}(t)$, for all termination types in J is calculated using Equation 3.

$$\text{Equation 3} \quad \tilde{q}(t) = \sum_j \tilde{q}_j(t)$$

For subsequent analyses, it is of particular interest to isolate the probability of termination at time t for reasons other than refinance. This value, denoted by $\tilde{q}_{NR}(t) = NRTerm_Prob_t$, is calculated per Equation 4.

$$\text{Equation 4} \quad \tilde{q}_{NR}(t) = [\sum_j \tilde{q}_j(t)] - \tilde{q}_R(t)$$

The overall probability of survival to time t , $\tilde{p}(t)$, is determined by Equation 5.

$$\text{Equation 5} \quad \tilde{p}(t) = \prod_{\tau=0}^t [1 - \tilde{q}(\tau)]$$

¹⁰ The IIA assumption generally implies that adding or removing more termination events would not affect the odds of the original termination events. This is a strong assumption, but it can be tested throughout the model development process.



Explanatory Variables

Each of the four binary logistic regression models we estimated includes a unique set of explanatory variables. We considered the following borrower, loan, and economic variables for inclusion in these models:

- Borrower
 - Borrower age
 - Loan age
 - Borrower gender
 - Indicator for co-borrowers
 - Categorical variables for property location
- Loan (Static)
 - Loan amount
 - Maximum claim amount
 - Principal limit factor
 - Indicator for Saver or Standard
 - Loan type
- Loan (Dynamic)
 - UPB
 - Tax and insurance delinquency payments
- Macroeconomic
 - Home prices
 - Interest rates
- Geographical differences in mobility patterns of elderly homeowners
- Indicators for policy changes
- Spline terms or other functional forms designed to capture non-linearity in effects

We selected the specifications and form of the explanatory variables from this list based on testing alternative specifications, explanatory significance, and model fit.



Termination Models

Refinance Model

Model Predictors

We used a combination of borrower, underwriting, and economic variables to develop the model for refinance terminations.

1. Borrower characteristics

- ***Borrower age***

- Borrower age at each date of observation is used as an input to the model. Borrower age should have a negative relationship with the probability of refinance. As borrowers age, they have less time to take advantage of the remaining balance on their HECM. Consequently, they have less incentive to refinance, as the benefit from increasing their loan balance will be spread across fewer years. Younger borrowers, however, have greater life expectancy and the benefit from refinance can be spread across more years.

- ***Borrower gender***

- The variable *Gender* is a categorical variable that identifies whether the borrower is a male, a female, or a couple. Note that the *Gender* variable does not distinguish between all-male or all-female couples. Single males are expected to be more likely to refinance than single females or couples.

$$Gender = \begin{cases} 1, & \text{if Single Male} \\ 2, & \text{if Single Female} \\ 3, & \text{if Couple} \end{cases}$$

2. Loan characteristics

- ***Loan age***

- The variable for loan age is segmented into four distinct piecewise functions in order to account for the bimodal distribution of refinances across loan age. Loan age is anticipated to have a bimodal relationship with the probability of refinance. In particular, other factors being equal, the literature points to a phenomenon known as “burnout,” in which repayment probabilities decline as loans age (Foster and Van Order 1991; Quigley 1987; Hal 2000; Pavlov 2001). Loan age has a negative quadratic relationship with probability of refinance, in which the odds of refinance increase early in the loan’s life and then gradually diminish.



$$dur0 = \begin{cases} loan\ age - 1, & \text{if } loan\ age \leq 2 \\ 1, & \text{if } loan\ age > 2 \end{cases}$$

$$dur1 = \begin{cases} 0, & \text{if } loan\ age \leq 2 \\ loan\ age - 2, & \text{if } 2 < loan\ age \leq 6 \\ 4, & \text{if } loan\ age > 6 \end{cases}$$

$$dur2 = \begin{cases} 0, & \text{if } loan\ age \leq 6 \\ loan\ age - 6, & \text{if } 6 < loan\ age \leq 13 \\ 7, & \text{if } loan\ age > 13 \end{cases}$$

$$dur3 = \begin{cases} 0, & \text{if } loan\ age \leq 13 \\ loan\ age - 13, & \text{if } loan\ age > 13 \end{cases}$$

- **Property appraisal value**

- This is a time-varying variable that uses HPI forecasts to estimate the property appraisal value at the observation date as a proportion of the initial house appraisal value. An increase in the projected house value, compared to initial house value, may entice borrowers to sell their homes and pay off the UPBs.

3. Economic Factors

- The current version of the refinance termination model incorporates variables that represent multiple economic indicators, in an effort to account for incentives to refinance.
- ML 2004-18 stipulates that all HECM borrowers must receive related counseling from an eligible third-party entity, except in the case of a refinance transaction, if the following three conditions are met:
 - a) The servicer receives the required HUD Anti-Churning Disclosure form;
 - b) The increase in the principal limit exceeds the total cost of refinancing by an amount equal to five times the cost of the transaction; and
 - c) The time between the closing on the HECM being refinanced and the refinance application does not exceed five years, even if fewer than five years have passed since a previous refinancing.
- **Refinanced appraisal value**
 - The variable *refi_lever_prp_valu* is a time-varying binary variable that uses HPI data at each observation date until the date of termination or censoring in order to project the value of the current home, if it is refinanced, and compare that value to the existing UPB. If the appraisal value is greater than the existing UPB, then the borrower has a strong incentive to refinance. The refinance disincentive proxy leverages HPI and interest rate forecasts to project future home values and PLFs. The value of the loan after refinancing is equal to the minimum of the appreciated appraisal value of the home or the loan limit multiplied by the principal



limit factor at time t . Summit & Milliman applied different loan limits, based on the date of observation. If the date of observation occurred before 2008, then the loan limit was set to \$362,790. Between 2008 and 2009, the loan limit was set to \$417,000. Any observation date after 2009 had a loan limit of \$625,500.

$$refi_lever_prp_valu = \begin{cases} 1, & \text{if Refinanced Appraisal Value} < UPB \\ 0, & \text{if Refinanced Appraisal Value} \geq UPB \end{cases}$$

Refinance Termination Model Estimates

Table 9: Maximum Likelihood Estimates for Refinance Termination Model

Parameter	DF	Estimate	SE	Wald ChiSq	Pr > ChiSq
Intercept	1	-10.1782	0.1112	8379.6222	<.0001
Borrower Age	1	-0.0144	0.000784	339.3131	<.0001
Single Male	1	0.5224	0.0853	37.5092	<.0001
Single Female	1	0.4227	0.0848	24.8329	<.0001
Couple	1	0.3151	0.0849	13.7851	0.0002
Loan Age < 3	1	0.9239	0.022	1769.8983	<.0001
Loan Age 3 to 6	1	0.3621	0.00879	1698.0933	<.0001
Loan Age 7 to 13	1	-0.1897	0.00729	677.542	<.0001
Loan Age > 13	1	-0.5754	0.0875	43.2036	<.0001
Refinance Indicator	1	1.2593	0.0172	5369.5268	<.0001
Property Value Appreciation (loans less than 4 years old)	1	2.7947	0.0302	8560.4097	<.0001
Property Value Appreciation (loans more than 4 years old)	1	2.3388	0.027	7512.9285	<.0001

Source: Summit & Milliman

T&I Delinquency Foreclosure Model

T&I delinquencies are identified by matching loan case numbers with case numbers in the T&I transaction datasets. From those delinquent loans, repayment histories are used to identify which terminations were likely due to T&I delinquency. Following policies set forth in ML 2011-01, we flag loans that have not had a repayment in two or more years as a T&I delinquency termination. Using the assigned T&I terminations, the probability of T&I termination is modeled in the multinomial logistic framework outlined in the main body of the text.



Model Predictors

In developing the T&I termination methodology, Summit & Milliman selected a combination of borrower and loan characteristics, as well as economic indicators, to serve as model predictors. Many of the variables are similar to those used in the refinance termination model.

1. Borrower characteristics

○ ***Borrower age***

- Borrower age is a time-varying variable at each observation date. For loans with multiple borrowers, the age of the youngest borrower is used.

○ ***Gender***

- Gender is identical to the variable *gender* described earlier. This variable could account for income differences among single borrowers and coupled borrowers that, in turn, may affect T&I repayment rates. Coupled borrowers may be more likely to repay lender advances due to the potential for multiple sources of income.

2. Loan characteristics

○ ***Loan age***

- This is a time-varying variable for loan age since origination. This variable is divided into three piecewise functions, with

$$dur0 = \begin{cases} loan\ age - 1, & \text{if } loan\ age \leq 2 \\ 1, & \text{if } loan\ age > 2 \end{cases}$$

$$dur1 = \begin{cases} 0, & \text{if } loan\ age \leq 2 \\ loan\ age - 2, & \text{if } 2 < loan\ age \leq 4 \\ 2, & \text{if } loan\ age > 4 \end{cases}$$

$$dur2 = \begin{cases} 0, & \text{if } loan\ age \leq 4 \\ loan\ age - 4, & \text{if } loan\ age > 4 \end{cases}$$

○ ***UPB as a percentage of MCA***

- This is calculated as total UPB as a percentage of the maximum claim amount. Borrowers may be less likely to repay any T&I as the UPB-to-MCA percentage grows.

○ ***Line of credit indicator***

- This is a static binary variable that indicates whether or not a HECM has a line of credit payment plan.



3. Economic Factors

○ *State indicator*

- This is a categorical variable identifying the U.S. state in which the delinquent HECM resides. This variable is a proxy for property tax rates, ground rents, flood and hazard insurance premiums, and other costs associated with tax and insurance payments, which vary by state.

In addition, several other variables were tested for inclusion in the model and were not found to be statistically significant. These include variables for the presence of family dependents, the total dollar amount advanced to the borrower, and an indicator for a borrower's history of T&I delinquencies.

Tax and Insurance Termination Model Estimates

Table 10: Maximum Likelihood Estimates for T&I Foreclosure Termination Model

Parameter	DF	Estimate	SE	Wald ChiSq	Pr > ChiSq
Intercept	1	-16.8576	0.8798	367.1687	<.0001
Borrower Age	1	0.000366	0.00104	0.124	0.7247
Single Male	1	0.4086	0.1128	13.1191	0.0003
Single Female	1	0.2841	0.1124	6.3941	0.0115
Couple	1	-0.6534	0.1132	33.3455	<.0001
Loan Age < 3	1	3.0177	0.3565	71.6555	<.0001
Loan Age 3 to 4	1	1.846	0.0242	5803.1066	<.0001
Loan Age > 4	1	-0.1872	0.00503	1383.4489	<.0001
UPB-MCA Group 1	1	-1.6532	0.5425	9.2863	0.0023
UPB MCA Group 2	1	-0.5621	0.5041	1.2436	0.2648
UPB-MCA Group 3	1	1.9421	0.5008	15.0417	0.0001
Line of Credit Indicator	1	0.9906	0.0477	430.9528	<.0001
State – CA	1	-0.4507	0.0254	315.547	<.0001
State – FL	1	0.2737	0.0205	177.567	<.0001
State – MI	1	0.7864	0.0294	716.5218	<.0001
State – TX	1	0.738	0.0226	1067.5344	<.0001

Source: Summit & Milliman

“Other” Termination Model

Model Predictors

In developing the model for other terminations, Summit & Milliman considered a combination of borrower, loan, and economic variables. Model regression outputs, including coefficient estimates and model statistics, are presented below.

The variables related to borrower characteristics include gender, couple/single status, borrower age, and the presence of children in the home.



1. Borrower characteristics

○ *Gender*

- This variable is identical to variable *Gender* used in previous models. It is anticipated that multiple-borrower HECMs are less likely to experience other terminations because the presence of other co-borrowers reduces the likelihood of borrowers moving away.

○ *Borrower age*

2. Property characteristics

○ *Above-median home value*

- This is an indicator variable that takes on a value of 1 if the original property appraisal value exceeds local median property values.

○ *Property appraisal value*

- This is a time-varying variable that uses HPI forecasts to estimate the property appraisal value at the observation date as a proportion of the initial house appraisal value. An increase in the projected house value, compared to initial house value, may entice borrowers to sell their homes and pay off the UPBs.

3. Economic Factors

○ *State indicators*

- We used indicators for properties located in California, Florida, New York, and Texas. These four states have the largest HECM endorsement volumes and their indicators were found to be statistically significant.

Other Termination Model Estimates

Table 11: Maximum Likelihood Estimates for Other Termination Model

Parameter	DF	Estimate	SE	Wald ChiSq	Pr > ChiSq
Intercept	1	-10.639	0.0727	21393.6647	<.0001
Borrower Age	1	0.059	0.0005	12520.1051	<.0001
Single Male	1	0.2086	0.0574	13.1941	0.0003
Single Female	1	0.1238	0.057	4.7194	0.0298
Couple	1	0.1229	0.0571	4.6351	0.0313
Above-Median Home Value	1	-0.1629	0.0087	353.8093	<.0001
Property Value Appreciation (loans less than 4 years old)	1	1.5626	0.0177	7764.8627	<.0001
Property Value Appreciation (loans more than 4 years old)	1	2.1075	0.018	13661.9163	<.0001
State – CA	1	0.1787	0.01	318.3283	<.0001
State – FL	1	-0.2288	0.0143	254.3419	<.0001
State – NY	1	-0.112	0.0181	38.227	<.0001
State – TX	1	0.0485	0.0171	8.0555	0.0045

Source: Summit & Milliman



Mortality Model

Model Predictors

The termination likely due to mortality was modeled against borrower characteristics.

1. Borrower characteristics

- **Borrower age**
 - Borrower age is a time-varying variable at each observation date. For loans with multiple borrowers, the age of the youngest borrower is used.
- **Gender**
 - Gender is identical to the variable *gender* described above

Mortality Termination Model Estimates

Table 12: Maximum Likelihood Estimates for Mortality Termination Model

Parameter	DF	Estimate	SE	Wald ChiSq	Pr > ChiSq
Intercept	1	-12.554	0.0788	25386.6058	<.0001
Borrower Age	1	0.1024	0.00057	32798.2829	<.0001
Single Female	1	0.5938	0.0642	85.4341	<.0001
Single Male	1	0.3361	0.0639	27.6373	<.0001
Couple	1	-0.7162	0.0649	121.8678	<.0001

Source: Summit & Milliman



Appendix D: Technical Details of Auxiliary Models

Summit & Milliman developed several auxiliary models for the purposes of this actuarial review. These models, described in this appendix, are required to project future HECM cash flows.

Cash Draw Down Projections

HECM borrowers with line-of-credit, modified term, or modified tenure payment plans can draw cash from their home as long as line-of-credit funds remain. These cash draws are added to the loan's UPB and accrue interest and MIP for the life of the loan. Accordingly, to project future UPB one must project cash draw behavior. Our analysis of historic HECM loan data revealed similar cash draw patterns across cohorts. Excluding borrowers who draw 100 percent of their loan's net principal limit at closing, borrowers generally draw more cash early on and progressively smaller amounts as their loans age. We assume a similar pattern for loans with existing lines of credit at the end of FY 2013. Specifically, we assume half of the principal limit remaining at the end of each forecast year is drawn during the next forecast year. This effectively depletes the principal balance remaining at the end of FY 2013 over the next seven forecast years. For future books of the business, FHA provided expected cash draw rates by policy year, based on historical cash drawn patterns and expectations regarding how recent policy changes will impact the cash draw behavior of future borrowers. These cash draw rates are consistent with the assumption we apply to existing loans: they start off high and decline over time.

Home Value Projections

For each HECM, we project the value of the mortgaged property at the end of every policy year through policy year 35. The property value at the end of a policy year is a function of the appraisal value at origination, HPI at origination and the end of the policy year, and an adjustment factor based on the property's appraisal value at origination and loan age. Origination appraisal values were provided by FHA, historic and projected HPI values were provide by Moody's Analytics, and adjustment factors were calculated by Summit & Milliman using inputs from FHA. The equation below was used to calculate future property values.

Equation 6

$$HV_k = A_0 \times \frac{HPI_k}{HPI_0} \times MRA_k$$

In this equation, HV_k is the projected home value at the end of policy year k , A_0 is the appraisal value at origination, HPI_0 is the HPI value at origination, HPI_k is the HPI value at the end of policy year k , and MRA_k is the maintenance risk adjustment at the end of policy year k .

Recent research on HECM property values suggests that HECM properties may appreciate at rates that differ from non-HECM properties. This is because HECM borrowers may overinvest or underinvest in the maintenance of their homes relative to non-HECM borrowers. We account for this by applying a maintenance risk adjustment to home values. The direction and size of the adjustment is a function of the home's value at origination (specifically, whether it is above or below the local median value) and the length of time since loan origination (loan age).



Table 13 below gives the maintenance risk adjustments by loan age bucket that we used in our home value projections. These adjustments were estimated by FHA and are identical to those used for the FY 2011 and FY 2012 actuarial reviews.

Table 13: Maintenance Risk Adjustment Factors

Loan Age	Annual HPA Adjustment	
	Property Value Above Median	Property Value Below Median
1 or 2 years	+ 2000 bps	+ 600 bps
3 or 4 years	+ 350 bps	0 bps
5 or 6 years	+ 160 bps	- 10 bps
7 or 8 years	+ 100 bps	- 125 bps
9 or 10 years	0 bps	- 140 bps
11 years or more	- 80 bps	- 170 bps

Source: FHA

Net Sales Value Projections

When a HECM property is sold, the amount available to pay off the loan balance or recovered by HUD will be less than the contract price. This is because the sales proceeds are typically used to cover selling expenses (i.e., commissions and transfer taxes). The funds that remain are the net sales proceeds. When a conveyed property is sold by HUD, the *net* amount recovered (net sales proceeds less maintenance and other carrying costs) will likely be less than the net sales proceed from a non-conveyance sale. This is due to the additional cost incurred by HUD as owner and seller of the conveyed property. We account for this with the following net sales proceeds formula:

Equation 7

$$NSP = \begin{cases} HV \times (1 - S), & \text{if not conveyed} \\ HV \times (1 - S - C), & \text{if conveyed} \end{cases}$$

In this equation, HV is the projected home value at the time of sale, S is the selling expense, and C is the additional expense associated with a conveyance sale. Both C and S are expressed as a percent of the home value and were derived from data provided by FHA.

Assignment Timing Projections

A lender may choose to assign a HECM loan to HUD once the loan's UPB reaches 98 percent of the maximum claim amount. At assignment, the lender assigns the note to HUD and HUD pays the lender an amount equal to the unpaid principal balance, up to the maximum claim amount. This payment is referred to as a Claim Type 2 payment. Accordingly, a loan assigned to HUD will result in a Claim Type 2 payment that ranges between 98 percent and 100 percent of the maximum claim amount. Since cash draws on remaining lines of credit can occur at any time and accrued interest and MIP are added to loan balances monthly, it's unlikely that all Claim Type 2 payments are equal to 98 percent of the maximum claim amount. Assuming so could underestimate the expected claims liability of the HECM portfolio. Accordingly, we assume the



probability of assignment is uniformly distributed on the interval between 98 percent and 100 percent of the maximum claim amount. This results in an expected Claim Type 2 payment equal to 99% of the maximum claim amount. We apply this assumption to our cash flow projections for existing and future books of business.

Loan Conveyance Projections

A critical factor in determining the value of a HECM portfolio is the projection of loan conveyance, which impacts the expected magnitude of post-assignment claims and recoveries. In the event of a post-assignment non-refinance termination, the HECM becomes due and payable, and it is the responsibility of the owner or the estate executor of the property to pay back the amount due. According to HUD regulations at 24 CFR 206.125(c), “if the mortgage is due and payable at the time the contract for sale is executed, the borrower may sell the property for at least the lesser of the mortgage balance or five percent under the appraised value.” However, in the event the owner or estate executor does not want to directly engage in the property sale, the property may be conveyed to HUD. After such a conveyance, HUD is in charge of executing the property sale and, moreover, directly incurs the additional costs associated with maintaining and selling the property.

Conveyance may result from economic conditions that cause housing price depreciation and an increase in costs associated with the sale of a property. For instance, the owners or estate executors may be less likely to engage in the direct sale of the property if the home is in a negative equity position. Similarly, if the value of the home at termination is less than the UPB at termination, the owner or estate executor may have less incentive to engage in a direct sale of the property. However, if the home has appreciated beyond UPB over the life of the HECM, the owner or estate executor will have an incentive to execute the property sale and, thereby, reap the gains after covering all costs associated with the sale.

Our projection of loan conveyance is handled on a loan-by-loan basis. First we identify loans that are expected to terminate for reasons other than refinance or mobility during each forecast year. For each loan, we project UPB balance and home price appreciation and compare the two estimates. As discussed above, there is little incentive for the estate or heirs to engage in a direct sale if the property is underwater. Accordingly, we assume the estate or heirs will exercise the option to convey the home to HUD in instances where the property is underwater. The amount we project HUD to recover upon disposition of these properties is then reduced to account for carrying costs and sales expenses.



Appendix E: Technical Details of Stage 2 Model

The Stage 2 model leverages the outputs from the Stage 1 and auxiliary models to generate cash flows for loans in the HECM portfolio. The model projects cash flows by policy year, through policy year 35, for each loan in a HECM portfolio. The economic value of a HECM portfolio is computed by discounting these cash flows to present value. The table below describes the cash inflows and outflows produced by the model.

Table 14: Cash Flow Components

Output Variable	Flow	Definition
Upfront Premium (At Closing)	+	The upfront premium paid to FHA at loan closing. It is equal to a stated percentage of the maximum claim amount.
Annual Premium (Life of Loan)	+	The annual premium is calculated as a percentage of the current loan balance. Typically, the annual premium is paid by the servicer and added to the loan balance.
Claim Type 1 (Pre-Assignment)	-	Payment to a lender when a mortgaged property is sold and the net proceeds from the sale are insufficient to cover the loan balance.
Claim Type 2 (At Assignment)	-	A lender can assign a loan to HUD when the loan balance reaches 98 percent of the maximum claim amount. HUD purchases the loan from the lender at par, up to the maximum claim amount.
Note-Holding Expense (Post-Assignment)	-	Borrower cash draws and installment payments on assigned loans
Recovery (Post-Assignment)	+	The amount recovered by HUD when an assigned loan terminates. For refinance terminations, the amount recovered is the loan balance. For all other terminations, the amount recovered is the lesser of the loan balance and the net proceeds from the sale of the mortgaged property.

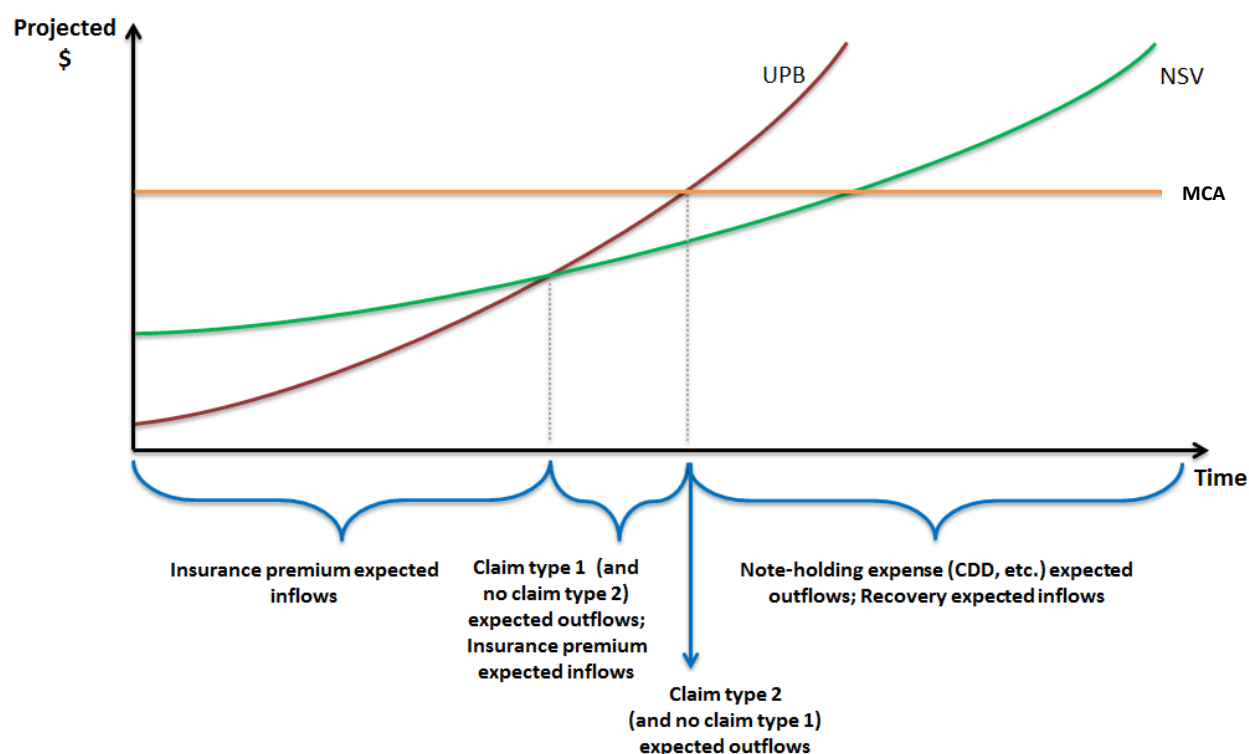
Source: Summit & Milliman

Note: A "+" indicates a cash inflow to FHA, while a "-" indicates a cash outflow

The figure below demonstrates the timing of cash inflows and outflows for a single loan that survives to assignment. Prior to assignment, cash flows include upfront and annual premiums. Additionally, if the loan terminates prior to assignment and the UPB exceeds the net sales proceeds, a Claim Type 1 payment may occur. The payment amount is the difference between the UPB and the net sales proceeds, up to the maximum claim amount. At assignment, a Claim Type 2 payment occurs. The payment amount is equal to the loan balance, up to the maximum claim amount. After assignment, cash flows include note holding expenses and, at termination, a recovery. The recovery amount is equal to the UPB if the loan is refinanced; otherwise, it is equal to the lesser of the UPB and the net sales proceeds. Note holding expenses only occur if the borrower makes additional cash draws or a term or tenure payment plan is in place.



Figure 9: Summary of Cash Flows



Intermediary Calculations

This section describes the intermediary calculations required by the cash flow model. All calculations are performed at the loan-level, unless otherwise noted.

HECM Size and Claim Limits

Maximum Claim Amount (MCA): The MCA is the minimum of three values: the HECM property's appraised value at the time of loan application, the property purchase price (HECM for Purchase only), and the national HECM FHA loan limit.

Principal Limit Factor (PLF): The PLF is derived from source data and varies as a function of borrower age and the expected interest rate.

Initial Principal Limit (IPL): The IPL is the product of the MCA and the principal limit factor.

Termination and Survival Rates

The following rates must be calculated from the Stage 1 model outputs:

Termination Probability ($Term_Prob_t$): This is the probability of loan termination at time t .



Survival Rate ($Survival_{(t|y)}$): This item is the probability of survival to time t , conditioned upon survival through all previous periods y .¹¹

Loan Balance

The loan balance at time t is equal to the balance at time $t-1$ plus interest and annual MIP accruals, cash draws, and the servicing fee for period t . Our cash flow model

Equation 8

$$UPB_t = UPB_{t-1} + Accruals_t + Cash\ Draws_t + Service\ Fee_t$$

Cash Inflow and Outflow Calculations

The final calculations used to estimate the expected premiums, claims, note-holding expenses, and recoveries for each loan are discussed in this section.

Premiums

FHA's HECM program collects two mortgage insurance premiums as revenue: upfront MIP and annual MIP.

Upfront Premium: Paid to FHA at the time of loan closing and calculated as a percentage of the maximum claim amount. The upfront premium can be collected at closing or financed and added to the loan balance. Case numbers assigned on or after September 30, 2013 are charged an upfront premium rate of either 2.50% or 0.50% of the maximum claim amount, depending on the amount draw at closing and during the first 12-month disbursement period.

Annual Premium: The annual premium is calculated as a percentage of the current loan balance. For FY 2009 and FY 2010 endorsements, the annual premium rate is 0.5 percent. For loans endorsed between FY 2011 and FY 2013, the annual premium rate is 1.25 percent. Our cash flow model assumes an annual premium rate of 1.25 percent for all future books of business (FY 2014 to FY 2020).

Claim Type 1

A Claim Type 1 occurs when an unassigned loan terminates and the net proceeds from the sale of the mortgaged property are insufficient to cover the loan balance. Our cash flow model computes the difference between the projected loan balance and home value at the end of each policy year. The difference between the projected loan balance and the net sales proceeds is the Claim Type 1 amount. This amount is then multiplied by the non-refinance termination rate estimated by our Stage 1 model to compute an *expected* Claim Type 1 amount.

As shown in Equation 10, Claim Type 1 amounts are calculated as a function of the non-refinance termination probability at time t , the likelihood of survival to period t (conditioned on

¹¹ Where the hazard rate estimates generated in Stage 1 are a function of both **Term_Prob_t** and **Survival_(t|y)**, defined as the probability of termination at time t , conditional on survival to time t .



survival through all previous periods y), a pre-assignment status indicator, and the difference between loan balance and net sales proceeds. Claim Type 1 amounts are capped at the maximum claim amount and are only calculated for unassigned loans.

$$\text{Equation 9} \quad \text{PreAssignment}_t = \begin{cases} 1, & \text{if } \text{UPB}_t < 0.99 * \text{MCA} \\ 0, & \text{otherwise} \end{cases}$$

$$\text{Equation 10} \quad \text{Claim 1}_t = \text{NRTerm}_{\text{Prob}(t)} * \text{Survival}(t|y) * \text{PreAssignment}_t * (\text{UPB}_t - \text{NSP}_t)$$

Claim Type 2

When the balance of a loan reaches 98 percent of the maximum claim amount, the lender may assign (sell) the loan to HUD at par, up to the maximum claim amount. *Expected* Claim Type 2 amounts are calculated by multiplying the estimated Claim Type 2 amounts ($0.99 \times \text{MCA}$) by survival probabilities from the Stage 1 model.

$$\text{Equation 11} \quad \text{Assignment}_t = \begin{cases} 1, & \text{if } \text{UPB}_t \geq 0.99 * \text{MCA} \\ 0, & \text{otherwise} \end{cases}$$

$$\text{Equation 12} \quad \text{Claim 2}_t = (\text{Assignment}_t - \text{Assignment}_{t-1}) * \text{Survival}(t|y) * 0.99 * \text{MCA}$$

Note Holding Expense

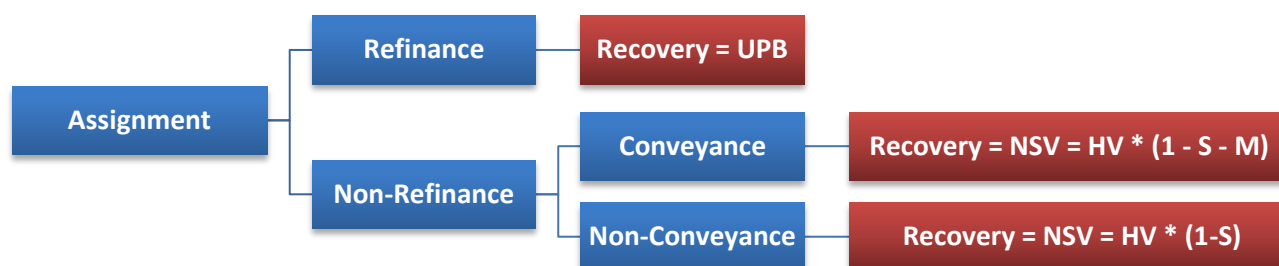
Note holding expenses consist of borrower cash draws and installment payments on term and tenure payment plans for assigned loans. *Expected* note holding expenses are calculated by factoring in survival probabilities from the State 2 model.

$$\text{Equation 13} \quad \text{Note Holding Expense}_t = \text{Assignment}_t * \text{Survival}(t|y) * \text{Payments}_t$$

Recoveries

When an assigned loan terminates, borrowers or their estates are required to repay the lessor of the loan balance and the net proceeds from the sale of the mortgaged property. If a loan terminates due to refinance, the amount repaid will be the loan balance. If the loan terminates for other reasons, the amount repaid will be the net sales proceeds. For a given property, the net sales proceeds will be less if the property is conveyed to HUD due to maintenance and selling expenses incurred by HUD. The figure below shows the recovery amount for each post-assignment recovery outcome (refinance, non-conveyance sale, conveyance sale).

Figure 10: Net Sale Value Calculations by Termination Path



For refinances, the recovery amount is calculated as the probability of refinance (Refi_Prob_t) multiplied by the loan balance at time t , conditioned upon assignment and survival to time t through all previous periods y .



Equation 14

$$\text{Refinance Recovery Amount}_t = \text{Refi_Prob}_t * \text{Survival}(t|y) * \text{UPB}_t * \text{Assignment}_t$$

For conveyed properties, the recovery amount is the lessor of the loan balance and the net sales proceeds and conditioned on survival to time t , the occurrence of a non-refinance termination (NRTerm_Prob_t) at time t , and the probability of conveyance at time t .

Equation 15

$$\text{Conveyance Recovery Amount}_t = \text{NRTerm_Prob}_t * \text{Survival}(t|y) * \text{Min}(\text{UPB}_t, \text{Conveyance NSP}_t) * \text{Assignment}_t * \text{Conveyance Risk}_t$$

For properties not conveyed, the recovery amount is the lessor the loan balance and the net sales proceeds and conditioned on survival to time t , the occurrence of a non-refinance termination (NRTerm_Prob_t) at time t , and 1 minus the probability of conveyance at time t .

Equation 16

$$\text{Non - Conveyance Recovery Amount}_t = \text{NRTerm_Prob}_t * \text{Survival}(t|y) * \text{Min}(\text{UPB}_t, \text{Non - Conveyance NSP}_t) * \text{Assignment}_t * (1 - \text{Conveyance Risk}_t)$$

Discounting Methodology and Assumptions

The economic value of the HECM portion of the MMI Fund is calculated by discounting the cash flow components, described in prior sections, to an NPV, which is added to the current capital resources of the fund. To calculate the NPV, each cash flow component is discounted at the cohort-level, using a set of present value factors. These present value factors are derived from the single effective discount rates, or SERs.

The methodology described in this section was used to calculate present value factors. FHA provided Summit & Milliman with the latest SERs, calculated as of the close of FY 2013. The SERs provided by FHA are listed in the following table:

Table 15: Single Effective Rates

Book of Business	SER
2009	5.15%
2010	3.13%
2011	5.00%
2012	4.73%
2013	4.57%

Source: FHA

The discount factor for a particular forecast year is calculated as follows, where n represents the number of years from the start of the forecast period:

Equation 17

$$\text{Discount Factor} = 1 / (1 + \text{SER})^n$$

For the FY 2014 book of business, the CSC2 (version 1.4.4b, released November 2012) is used to calculate present value factors, based upon the discount rate assumptions in the President's Budget Year 2014.



In the absence of updated budget assumptions for FY 2015 through FY 2020, it is necessary to derive future present value factors not produced by the CSC2. This derivation is done by fixing the 2014 present value factors for the first economic valuation year. The derivation for subsequent valuation years is conducted as shown in the following equation, the present value factor for evaluation period t, when estimating the economic value for period y is the present value factor for period t divided by the present value factor for period end y.

Equation 18

$$PV(t, y) = PV(t) / PV(y)$$

Net cash inflows and outflows to FHA are multiplied by the corresponding present value factors for each cash flow period to calculate the NPV for each cohort. The sum of the NPV for each cohort is added to the existing capital resources of the HECM portion of the MMI Fund and the annual return on investment (ROI) of the HECM portion of the MMI Fund. Capital resources refer to the starting fund balance at the beginning of the fiscal year, and the ROI on the HECM portion of the MMI Fund is the annual interest accrued on that balance.

Thus, the economic value can be summarized as follows:

Equation 19

$$EV = \text{Capital Resources} + ROI + NPV \text{ of Future Cash Flows}$$

Return on Investment

As a generalization of projected fiscal year activities, FY 2013 capital resources may be assigned an ROI. This ROI calculation applies continuous compounding using Moody's Analytics 1-year Constant Maturity Treasury (CMT) forecast rates and assumes net gains from investment, income, property, and accounts are averaged out by the forecast interest rate. The rates are calculated as averages of the quarterly 1-year CMT rates over the projected fiscal year.

Table 16: Average 1 year CMT Rate Forecast

Fiscal Year	1-yr CMT Rate
2013	0.18%
2014	0.39%
2015	0.90%
2016	2.67%
2017	3.73%
2018	3.77%
2019	3.70%
2020	3.76%

Source: Moody's Analytics

