Annual Actuarial Review of

The FHA Mutual Mortgage Insurance Fund

Home Equity Conversion Mortgages (HECM) Loans

Fiscal Year 2026

Submitted to:

United States Department of Housing and Urban Development

Submitted by:

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November 10, 2026

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November 10, 2026

The Honorable Joe Gormley
Performing delegable duties of the Assistant Secretary for Housing - FHA Commissioner
U.S. Department of Housing and Urban Development (HUD)
2415 Eisenhower Ave, Alexandria, VA 22314

Dear Mr. Gormley,

IT Data Consulting, LLC (ITDC) has finalized and is submitting the Fiscal Year 2026 Independent Actuarial Review of the Home Equity Conversion Mortgages (HECM) under the Mutual Mortgage Insurance Fund, pursuant to contract number 86615723C00002.

This report is based on data as of September 30, 2026, providing an overview of the Economic Net Worth and details regarding the Cash Flow Net Present Value (NPV) for the Mutual Mortgage Insurance (MMI) HECM Loan portfolio as of the conclusion of Fiscal Year 2026. We have included a comparison with the corresponding estimate from the end of Fiscal Year 2025, evaluation under various scenarios, and offered detailed insights into the models employed for developing this estimate. The Appendix G tables of historical and projected loan termination rates are delivered as a separate attachment accompanying this report.

ITDC is here to answer any questions or address any comments you may have about the report and its conclusions.

Respectfully,



Benny Asnake
President and CEO
IT Data Consulting, LLC

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November 10, 2026

The Honorable Joe Gormley
Performing delegable duties of the Assistant Secretary for Housing - FHA Commissioner
U.S. Department of Housing and Urban Development (HUD)
2415 Eisenhower Ave, Alexandria, VA 22314

Dear Mr. Gormley,

I, Min Ji, am a Professor of Actuarial Science and Risk Management at Towson University. My research focuses on applying actuarial models to the risk management of insurance and financial products. I am a member of the American Academy of Actuaries (MAAA), a Fellow of the Society of Actuaries (FSA), and a Fellow of the Institute and Faculty of Actuaries (FIA). I serve on the Society of Actuaries' exam and research committees, keeping well connected to academia and the latest actuarial research in the insurance industry.

I meet the Qualification Standards for Actuaries Issuing Statements of Actuarial Opinion in the United States of the American Academy of Actuaries to render the actuarial opinion contained herein. I have reviewed the "*Annual Actuarial Review of the FHA Mutual Mortgage Insurance Fund, HECM Loans, for Fiscal Year 2026*". The purpose of my review was to determine the soundness of the methodology used, the appropriateness of the underlying assumptions applied, and the reasonableness of the resulting estimates derived in the Review.

The review was based on data and information provided by the Federal Housing Administration (FHA). I have relied on FHA for the accuracy and completeness of this data. In addition, I have also relied on the reasonableness of the assumptions used in the economic projections from the FY 2027 Mid-Session Review for the President's Economic Assumptions (PEA).

In my opinion, the Cash Flow NPV estimate provided by FHA for use in the FHA Annual Report to Congress is $1.355 billion, compared with $6.334 billion in FY 2025, representing a decrease of approximately $4.979 billion, or 78.6%. ITDC attributes much of the NPV decline to FHA's correction of previously excluded note sales in its conveyance and payoff data, reducing projected payoffs. Although FHA's estimate falls outside ITDC's moderate scenario range, it remains within its broader stochastic range. FHA's higher projected costs reflect a more conservative assessment without indicating additional solvency risk.

Based on its review of the underlying model changes, their financial impacts, and the range of projected outcomes, ITDC considers FHA's FY 2026 Cash Flow NPV estimate reasonable.

Respectfully,



Min Ji, Ph.D., MAAA, FSA, FIA

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Summary of Deliverables

Below we summarize the findings associated with each of the required deliverables:

Deliverable 1: Produce a written Actuarial Study for HECM that provides actuarial central estimates of Mutual Mortgage Insurance (MMI) Fund as of the end of Fiscal Year 2026 and assesses HUD's estimates of Economic Net Worth.

The Economic Net Worth is defined as cash available to the MMI Fund plus the Net Present Value (NPV) of all future cash outflows and inflows that are expected to result from the mortgages currently insured by the MMI Fund. Based on data as of September 30, 2026, ITDC's Actuarial Central Estimate (ACE) of the MMI HECM Cash Flow NPV is positive $6.307 billion.

The total capital resource of the HECM portfolio is positive $2.093 billion as of September 30, 2026. Thus, the estimated Economic Net Worth of the HECM part of MMI Fund is positive $8.400 billion.

Deliverable 2: Include a review of the risk characteristics of existing MMI loans including commentary on how such characteristics have changed in recent years.

A review of the risk characteristics of existing MMI HECM loans and commentary of how these risk characteristics have changed is included in Section III. HECM has been the largest reverse mortgage program in the U.S. market, and the majority of HECM borrowers select the line of credit option. Detailed characteristics of HECM loans are summarized in Section III.

Deliverable 3: Apply the final actuarial HECM model to the HECM part of the MMIF portfolio to produce conditional termination rates, timing of assignment, and recovery rates and amounts, by policy year and budget/endorsement year cohort, and by sub-cohort levels defined by policy initiatives and other characteristics. The output deliverables shall be presented in formats specified by the COR and per defined deliverable dates.

Models for projecting loan terminations and performance are described in Appendices B and C. The termination rates are forecasted in quarter steps and aggregated into annual termination rates. The cash flow model is in annual steps with quarterly variables accumulated for annual projection. Cash flow summaries by major category are displayed in the table below and discussed in more detail in Sections II and IV along with a detailed analysis of the cash flow calculations in Appendix D.

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Exhibit SD-1: Projected Cash Flow Summaries ($ Million)

Cash Flow Category	Net Present Value of Cash Flow
Mortgage Insurance Premium	$2,173
Claim Type 1 Loss Incurred	($1,272)
Claim Type 2 Loss Incurred	($35,669)
Recovery (Claim Type 2c and 2p)	$41,389
Note Holding Expense	($314)
Net Present Value	**$6,307**

Deliverable 4: To promote transparency of the Studies' assessments, the Studies should identify methodological vulnerabilities that may occur in its actuarial models or in HUD's analyses of Economic Net Worth. This discussion should evaluate the scope and scale of such vulnerabilities in creating possible forecast risk and suggest possible lines of research in these areas. The Studies should assess and comment upon HUD's own models that estimate Economic Net Worth for methodological vulnerabilities and compare HUD's methodologies with those in the Studies.

The assumptions and judgments underlying the ITDC Studies' estimates are summarized in Appendices A through E of the report. Section IV provides a summary of the Net Present Value (NPV) calculations, which are based on simulated economic scenarios. We have examined the vulnerabilities of our studies and compared the results under various scenarios. We also discuss the economic conditions that could lead to materially adverse changes in the Cash Flow NPV.

The FY 2025 review, documented in Appendix F of the previous report, provided documentation and analysis of HUD's HECM models to support enhanced transparency and completeness of the actuarial review after HUD's model documentation became available. This year's Appendix F focuses on updates and modifications to the models implemented by HUD since that prior review and assesses their potential impact on the actuarial analysis.

Deliverable 5: The Studies should include historical data on changes in program terms as well as relevant loan and borrower characteristics (e.g., credit scores, loan-to-value ratios) by cohort and other sub-populations. Loan performance data (claim rates, prepayment rates, severity, and recovery rates) both historical and projected shall be presented in the "finger-table" formats (arrayed by cohort and policy years for different loan products).

Section I provides historical information on changes in the HECM programs. A review of the risk characteristics of existing MMI loans and commentary of how these risk characteristics have changed are included in Section III.

Appendices B and C show the loan and borrower characteristic variables considered in the termination models and conveyance models, respectively, and Appendix B lists conditional termination rates by cohort and policy year. Historical and projected termination counts and rates for cohorts 2009 through 2026 are provided in Appendix G.

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Deliverable 6: The Contractor should use the President's Economic Assumptions, provided by Office of Risk Management and Regulatory Affairs (ORMRA), for the actuarial central estimates of the Studies. However, in addition to the central single path economic forecast, the Studies shall test alternative economic forecasts for stress-testing and sensitivity analysis to estimate ranges of reasonableness.

ITDC has conducted a comprehensive analysis, based on the President's Economic Assumptions for FY 2027 Mid-Session Review (PEA) provided by the Office of Management and Budget (OMB). Based on our assessment, the Cash Flow Net Present Value (NPV) by September 30, 2026, for cohort years from 2009 to 2026 is a positive $6.307 billion.

In the table below, we estimate that the range of Cash Flow NPV based on the pessimistic downside to optimistic upside and stochastic simulation scenarios is between negative $3.472 billion and positive $9.127 billion. Our Baseline PEA NPV of $6.307 billion stays in the middle of $2.903 billion from the moderate downside and $8.366 billion from the moderate upside scenario.

Exhibit SD-2: Net Present Value of the HECM Fund under Different Economic Scenarios ($ Million)

Scenarios*	Fiscal Year 2026
Baseline**	$6,307
Alternative 1 – Optimistic Upside	$9,127
Alternative 2 – Moderate Upside	$8,366
Alternative 3 – Moderate Downside	$2,903
Alternative 4 – Pessimistic Downside	($3,472)

** Descriptions of these scenarios are in Section IV and Appendix E*
***Baseline is based on the FY 2027 Mid-Session Review for PEA*

The Cash Flow NPV estimate provided by FHA for use in the FHA Annual Report to Congress is $1.355 billion, compared with $6.334 billion in FY 2025, representing a decrease of approximately $4.979 billion, or 78.6%.

ITDC's review indicates that a significant portion of this decline is attributable to the correction of FHA's prior data preparation approach, which excluded note sales from conveyances and payoffs in its property disposition model. The correction of this error reduces the projected proportion of loans terminating through payoff, thereby contributing to the lower NPV estimate.

While FHA's FY 2026 estimate falls outside the range defined by ITDC's moderate upside and downside scenarios, it remains within the broader range of ITDC's stochastic projections. Furthermore, FHA's revised estimate reflects higher projected costs than ITDC's independent estimate, representing a more conservative assessment of the Fund's future financial performance. Accordingly, this difference does not indicate additional risk to the Fund's solvency.

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Based on its review of the underlying model changes, their financial impacts, and the range of projected outcomes, ITDC considers FHA's FY 2026 Cash Flow NPV estimate reasonable. This assessment reflects a high-level reasonableness review of FHA's revised assumptions and their estimated financial impacts; it is not a full independent replication or a cash-flow-level reconciliation of the two valuations.

Deliverable 7: To provide comparability to HUD estimates of Economic Net Worth, the Contractor shall use Federal Credit Reform Act discounting assumptions and procedures.

ITDC has developed estimates of Economic Net Worth using the Federal Credit Reform Act discounting assumptions which include using the cohort specific single effective rates (SERs) supplied by FHA.

Deliverable 8: This Study should use stochastic or Monte Carlo simulations of future economic conditions including for interest rates and house price appreciation. The objective of these requirements is to illustrate the sensitivity of forecasts to economic uncertainty and other forms of forecast error.

As described in Section V, List of Methodological Appendices, and detailed in Appendix E, Stochastic Simulation Models, we generated seven percentile economic scenarios, namely the 1st, 10th, 25th, 50th, 75th, 90th, and 99th percentiles using stochastic simulations, with the 50th percentile replaced by the baseline estimate for each economic variable. The 10th to 90th percentile paths are used in the NPV computation models.

Deliverable 9: Provide econometric appendices to the Study that include variable specifications and statistical output from all regressions in the Studies.

Appendix B shows the predictive model parameters and goodness of fit measures for the Termination model. The termination model was calibrated using HECM loan-level data through June 30, 2026, restricted to the first 21 policy years. Parameters are selected and defined based on empirical termination patterns from life test and various measures of goodness-of-fit. Appendix C shows the parameters and goodness of fit measures for the Claim Type 1 models and Claim Type 2 conveyance model, using claim records since 2010. All the models are validated using an 80% calibration sample and a 20% hold-out validation sample.

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Executive Summary

The Federal Housing Administration (FHA) administers the Home Equity Conversion Mortgage (HECM) program, facilitating senior homeowners' access to cash based on the value of their homes. Initially launched as a pilot program in 1989 and solidified in 1998, the program underwent substantial expansion between 2003 and 2008. This expansion was attributed to increased product awareness, favorable interest rates, rising home values, and augmented FHA mortgage limits. Preceding Fiscal Year 2009, the HECM program was integrated into the General Insurance (GI) Fund. The Housing and Economic Recovery Act of 2008 (HERA)[1] effectively transferred all new HECM program endorsements into the Mutual Mortgage Insurance (MMI) Fund, commencing on October 1, 2008.

The Cranston-Gonzalez National Affordable Housing Act (NAHA) of 1990 introduced capitalization requisites for the MMI Fund.[2] Specifically, it mandated a minimum capital ratio of 1.25% by 1992, increasing to 2.0% by 2000. The capital ratio is the ratio of the capital to unamortized insurance-in-force (IIF). The term 'capital' is the economic net worth of the MMI Fund, which is defined by NAHA as cash available to the Fund plus the net present value of all future cash inflows and outflows expected to result from the outstanding mortgages in the Fund. NAHA stipulated the necessity of an annual independent actuarial study concerning the MMI Fund. Subsequently, HERA expanded these obligations to encompass HECM mortgages within the MMI Fund. Consequently, an actuarial review is now customarily conducted on HECM mortgages within the MMI Fund. This report analyzes the HECM portion of the MMI Fund, explicitly focusing on mortgages endorsed in Fiscal Year 2009 and onward.

A. Status of the MMI HECM Portfolio

To assess the adequacy of the current and future capital resources to meet estimated future liabilities, ITDC analyzed all HECM historical terminations and associated recoveries using loan-level HECM data reported by FHA through September 30, 2026. Based on historical experience, we developed loan level termination and cash flow models to estimate the future loan performance of FY 2009 to FY 2026 books-of-business using various assumptions, including macroeconomic forecasts from the Office of Management and Budget (OMB), Moody's Analytics (Moody), and the expected HECM portfolio characteristics provided by FHA.

Using the President's Economic Assumptions for FY 2027 Mid-Session Review (PEA), including Constant Maturity Treasury (CMT) rates, Secured Overnight Financing Rates (SOFRs), and House Price Appreciation (HPA), ITDC projects the performance of the FY 2009–2026 HECM portfolio and estimates a positive Cash Flow Net Present Value (NPV) of $6.307 billion as of September 30, 2026. Total Capital Resources of the HECM portfolio, as reported by FHA,

[1] HERA was passed by the United States Congress on July 24, 2008, and signed by President George W. Bush on July 30, 2008.
[2] Public Law 101-625, 101st Congress, November 28, 1990, Section 332

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decreased by $7.038 billion, from $9.131 billion in FY 2025 to $2.093 billion in FY 2026, resulting in a decline in Economic Net Worth of the HECM part of the MMI from $16.603 billion to $8.400 billion. Consequently, the HECM standalone capital ratio, calculated by ITDC Economic Net Worth divided by Insurance-in-Force ($8.400 billion / $62.678 billion), declined to 13.40% in FY 2026. This 13.40% ratio represents the standalone capital ratio of the HECM portfolio and is presented for informational purposes; the statutory minimum capital requirement of 2.00% applies to the overall MMI Fund, not separately to the HECM portfolio.

This decline is primarily attributable to the reduction in capital resources, driven by an approximately $10 billion increase in reported liabilities. Given the timing of this year's actuarial review, a detailed analysis of the underlying drivers of the increase in reported liabilities was not available for inclusion in this report. ITDC will continue to work collaboratively with HUD to better understand these changes and their implications for the Fund's Economic Net Worth. While the magnitude of the decline warrants further examination and continued monitoring to determine whether it represents a one-time adjustment or an emerging trend, the HECM portfolio continues to demonstrate a positive financial position, with an Economic Net Worth of $8.400 billion and a standalone HECM capital ratio of 13.40%, as independently calculated by ITDC. As stated before, this HECM-specific ratio calculated by ITDC is presented for informational purposes and should not be confused with HUD's official capital ratio for the overall Mutual Mortgage Insurance (MMI) Fund. These results demonstrate the program's continued financial resilience notwithstanding the significant year-over-year adjustment. Further analysis and ongoing monitoring will be important to identify potential emerging risks and assess the sustainability of the program's financial position over time.

ITDC also estimates that the Net Present Value based on randomly generated economic scenarios is between negative $3.472 billion and positive $9.127 billion. Our Baseline PEA economic net present value of $6.307 billion stays in the middle of $2.903 billion from the moderate downside scenario and $8.366 billion from the moderate upside scenario.

The Cash Flow NPV estimate provided by FHA for use in the FHA Annual Report to Congress is $1.355 billion, compared with $6.334 billion in FY 2025, representing a decrease of approximately $4.979 billion, or 78.6%.

ITDC's review indicates that a significant portion of this decline is attributable to the correction of FHA's prior data preparation approach, which excluded note sales from conveyances and payoffs in its property disposition model. The correction of this error reduces the projected proportion of loans terminating through payoff, thereby contributing to the lower NPV estimate.

Although FHA's FY 2026 estimate falls outside the range defined by ITDC's moderate upside and downside scenarios, it remains within the broader range of ITDC's stochastic projections. Furthermore, FHA's estimate reflects higher projected costs than ITDC's independent estimate, representing a more conservative assessment of the Fund's future financial performance and not indicating any additional risk to the Fund's solvency. Based on its review of the underlying model

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changes, their financial impacts, and the range of projected outcomes, ITDC considers FHA's FY 2026 Cash Flow NPV estimate reasonable. This assessment reflects a high-level reasonableness review of FHA's revised assumptions and their estimated financial impacts; it is not a full independent replication or a cash-flow-level reconciliation of the two valuations.

The insurance-in-force (IIF) is calculated as the total Unpaid Principal Balance (UPB) of all HECMs remaining in the insurance portfolio as of September 30, 2026. New endorsements in 2026 are added to the portfolio and HECM IIF as of September 30, 2026, is $62.7 billion. Exhibit ES-1 provides endorsements, UPB, and maximum claim amount (MCA) of active loans, and the NPV for loans endorsed in FY 2009 through FY 2026. The MCA of all active insured loans represents FHA's maximum insurance payout to lenders under the HECM program.

Exhibit ES-1: Baseline NPV, Insurance-in-Force, and Endorsement for FY 2009 – FY 2026 ($ Million)

$'s in millions		Insurance-in-Force		
Cohort Year*	Endorsement*	(UPB)**	MCA***	Net Present Value
2009-2026, N	941,889	252,818		
2009-2026, $	313,256	$62,678	$111,730	$6,307

**Total loans endorsed from FY 2009 through FY 2026.*
***The UPBs of the active loans endorsed from FY 2009 – FY 2026 in the insurance portfolio.*
****The MCA of the active loans endorsed from FY 2009 – FY 2026 in the insurance portfolio.*

B. Sources of Change in the Status of the HECM Portfolio

The FY 2025 HECM Review reported that the net present value of the HECM portfolio was positive $7.472 billion at the conclusion of FY 2025. In contrast, this year's actuarial review estimates a positive value of $6.307 billion as of September 30, 2026. Exhibit ES-2 compares the Cash Flow NPV and IIF estimate for Fiscal Year 2026 to the estimates in the 2025 Review.

Exhibit ES-2: Estimate of Cash Flow Changes as of September 30, 2026 ($ Million)

Item	Cash Flow NPV	Capital Resources	Economic Net Worth	Insurance-In-Force
2025	$7,472	$9,131	$16,603	$63,740
2026	$6,307	$2,093	$8,400	$62,678
Difference	($1,165)	($7,038)	($8,204)	($1,062)
Percentage	-15.59%	-77.08%	-49.41%	-1.67%

* *Numbers might not sum up exactly due to rounding*

As shown in Exhibit ES-2, the HECM portion of the MMI Fund's Economic Net Worth decreased by approximately $8.204 billion (49.41%), from $16.603 billion in FY 2025 to $8.400 billion in FY 2026. This decline primarily reflects a $7.038 billion (77.08%) reduction in reported capital resources and a $1.165 billion (15.59%) decrease in projected Cash Flow NPV. The NPV change was driven primarily by updated FY 2026 economic assumptions and portfolio experience, partially offset by approximately $212 million from FY 2026 new endorsements. Model

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refinements also contributed, including approximately $366 million from separately modeling T&I and non-T&I Claim Type 1 losses and approximately $69 million from the expanded cash-draw bucket methodology.

C. Impact of Economic Forecasts

The projected economic net worth of the HECM Fund portfolio depends on various economic forecasts and the thereafter projected loan performance. These include the following:

- **House Price Appreciation:** House Price Index (HPI) reflects the relative change in housing prices from period to period. House price appreciation (HPA) impacts the recovery FHA will receive upon mortgage terminations and the termination possibility that borrowers may decide to refinance or move out of their property.

- **Expected Interest Rate:** Interest rates impact the growth of mortgage balances. All the interest rate projections used in this review are based on the PEA baseline estimates. Expected interest rates also determine the unused HECM line of credit growth and how much homeowners can get access to upon refinance, which indirectly impacts voluntary termination of a HECM loan.

- **Termination Rates:** Net present value of the HECM cash flow depends on the crossover loss at termination, that is, when the loan balance exceeds the collateral property value at the time the loan is due and payable. Economic factors are not only driving factors of crossover risk but also impact how long borrowers hold onto their HECM loan before selling their home, moving out, refinancing their loan, or passing away. Refer to Appendix B for the detailed economic variables used in estimating termination rates.

- **Cash Drawdown Rates:** These rates represent the speed at which borrowers draw on their available HECM fund over time, which impacts the growth of the mortgage unpaid balance (UPB). We estimate borrowers' cash draw rates based on past HECM program experience and borrower characteristics and summarize actual borrower draw patterns into twenty-five buckets based on the first month cash draw.

- **House Sale Price Discount:** The sale price of the houses underlying HECM loans tends to be lower than the market price of otherwise identical houses, due to borrowers' failure to maintain their home adequately and expedited sale of the house after borrowers' death or relocation. A deeper discount on the sale price would negatively impact the economic net worth of the Fund.

The projected performance of FHA's current book of business, as measured by economic net worth, depends on future forecasts of these economic drivers. The baseline scenario for the primary economic drivers was developed consistently with the PEA, which is published by the

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Office of Management and Budget in compliance with the requirements of the Federal Credit Reform Act.

In addition to the mandated baseline PEA forecasts, we apply four alternative stochastic simulation scenarios of potential random deviations from the PEA baseline. Stochastic scenarios are simulated using the best fitted GARCH model with mean replaced by the corresponding PEA, to ensure the simulated paths will not drift far away from the PEA while having stochastic volatilities. These alternative scenarios are intended as stress tests to assess the sensitivity of the HECM Fund to potential economic variations and should not be interpreted as forecasts or predictions of future economic conditions.

Four alternative scenarios are based on combinations of selected "percentile" paths of SOFR rates, 1-year CMT rate, 10-year CMT rates and the HPI based on 1,000 simulated paths, representing the combinations of economic drivers that correspond to favorable or unfavorable outcomes for the prospects of the MMI HECM Fund portfolio.

Exhibit ES-3 presents the actuarial central estimate of the HECM cash flow NPV from the projections based on the PEA and four alternative scenarios. The loan performance estimated under each scenario excludes the identified COVID-19 impact[3]. The actuarial central estimate uses the baseline PEA.

Exhibit ES-3: NPV of the HECM Fund under Different Economic Scenarios ($ Million)

Scenarios*	Fiscal Year 2026
Baseline **	$6,307
Alternative 1 – Optimistic Upside	$9,127
Alternative 2 – Moderate Upside	$8,366
Alternative 3 – Moderate Downside	$2,903
Alternative 4 – Pessimistic Downside	($3,472)

** Descriptions of these scenarios are in Section IV and Appendix E*
***Baseline is based on the FY 2027 Mid-Session Review for PEA*

Our Baseline PEA economic NPV of $6.307 billion stays in the middle of positive $2.903 billion from the moderate downside scenario and positive $8.366 billion from the moderate upside scenario. The range of NPV based on the alternative economic scenarios is negative $3.472 billion to positive $9.127 billion.

FHA's FY 2026 Cash Flow NPV estimate of $1.355 billion represents a 78.6% decline from FY 2025, driven in significant part by corrections to its property disposition model. Although this estimate falls below ITDC's moderate scenario range, it remains within the broader stochastic range and is considered reasonable based on ITDC's assessment of the underlying model changes

[3] A dummy variable is added to the termination model for the Covid-19 period.

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and their financial impacts. A detailed discussion of this assessment is provided in the Deliverable 6 description above.

Distribution and Use

ITDC provides this report to the FHA and policymakers for their assessment of the Economic Net Worth of the MMI Fund. Our conclusions are based on various assumptions about future conditions and events, detailed in subsequent sections of this report. These assumptions must be comprehended to contextualize our conclusions properly. Furthermore, our work is subject to inherent limitations, also discussed in this report.

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I. Introduction

A. Actuarial Reviews of the FHA Mutual Mortgage Insurance Fund

The National Housing Act requires an annual independent actuarial review of the Federal Housing Administration's (FHA) Mutual Mortgage Insurance (MMI) Fund.[4] ITDC was engaged by the Department of Housing and Urban Development (HUD) to conduct an independent actuarial review of the MMI Fund for FY 2026.

The FHA Modernization Act within the Housing and Economic Recovery Act of 2008 (HERA)[5] moved all new endorsements for FHA's Home Equity Conversion Mortgage (HECM) program from the General Insurance Fund to the MMI Fund starting in fiscal year (FY) 2009. Therefore, an actuarial review must also be conducted on the HECM portfolio within the MMI Fund. This document reports the HECM portion of the economic net worth and insurance-in-force (IIF) of the MMI portfolios in FY 2026 that can be used to compute the overall MMI Fund capital ratio.

B. HECM Program Overview

The U.S. Department of Housing and Urban Development (HUD), Federal Housing Administration (FHA), insures reverse mortgage loans through the HECM program, which enables senior homeowners to obtain funds by borrowing against the equity in their homes. All the following conditions must be met to be eligible for HECM:

- At least one of the homeowners must be 62 years of age or older.
- If there is an existing mortgage, the outstanding balance must be paid off with the HECM proceeds.
- The borrower(s) must have received FHA-approved reverse mortgage counseling to learn about the program.

HECMs are available from FHA-approved lending institutions. These approved institutions provide homeowners with cash payments or lines of credit secured by the collateral property. There is no required repayment if the borrower continues to live in the home and meets the HUD guidelines on property taxes, homeowners' insurance, and property maintenance. Borrowers use reverse mortgages to access cash for various reasons, including home improvements, medical bills, paying off balances on existing traditional mortgages, or for everyday living. Borrowers also use HECM to purchase a primary residence if they can use cash on hand to pay the difference between the HECM proceeds and the sales price plus closing costs for the property to be purchased. A HECM loan terminates for reasons including death, moving out of the home, and refinance. The existence of negative equity does not require borrowers to pay off the mortgage and does not

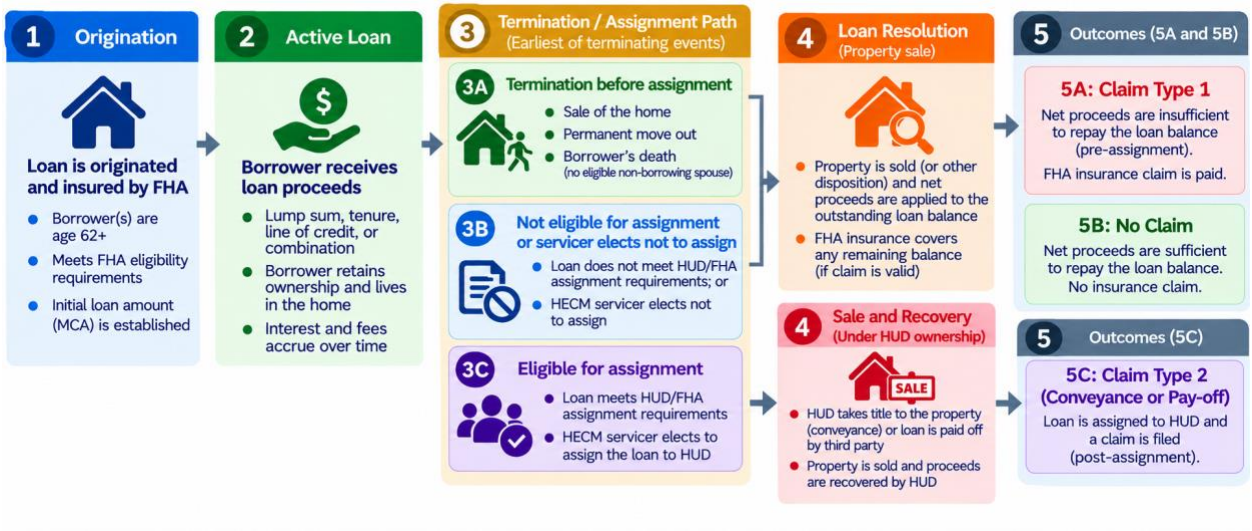
[4] HERA moved the requirement from the 1990 National Affordable Housing Act (NAHA) to the Federal Housing Administration operations within the National Housing Act, 12 USC 1708(a)(4).
[5] HERA was passed by the United States Congress on July 24, 2008, and signed by President George W. Bush on July 30,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

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prevent the borrowers from receiving additional cash draws, if available, based on their HECM contract.

The reverse mortgage insurance provided by FHA through the HECM program protects lenders from losses due to insufficient recovery on terminated mortgages and protects borrowers from lenders' failure to advance funds. When a mortgage terminates and the mortgage balance exceeds the net sale price of the home, the lender can file a claim for loss up to the maximum claim amount (MCA). A lender has the option to assign the mortgage note to FHA if the mortgage meets the eligibility requirements when the mortgage balance reaches 98% of the MCA. On assignment, the lender is reimbursed for the balance of the mortgage (up to the MCA). When note assignment occurs, FHA switches from being the insurer to the holder of the note and controls the servicing of the mortgage until termination. At mortgage termination (post-assignment), FHA attempts to recover the mortgage balance including any expenses, accrued interest, property taxes and insurance premiums. The following are definitions of common HECM terms. In Exhibit I-1, we demonstrate the lifecycle from origination to the final disposition of a HECM loan.

Exhibit I-1: HECM Loan Lifecycle from Origination to Final Outcome



i. Maximum Claim Amount (MCA)

The MCA is the minimum of the appraised value or purchase price of the home and the FHA mortgage limit at the time of origination. It is the maximum HECM insurance claim a lender can receive. The MCA is used together with the Principal Limit Factor (PLF) to calculate the maximum amount of initial credit available to the borrower(s). The MCA is determined at origination and does not change during the life of the mortgage. However, if the home value has appreciated over time, borrowers may access additional credit by refinancing their HECM loan. In the event of

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termination, the entire net sales proceeds[6] can be used to pay off the outstanding mortgage balance, regardless of whether the size of the MCA was capped by the FHA mortgage limit at origination.

ii. Principal Limits (PLs) and Principal Limit Factors (PLFs)

FHA manages its insurance risk by limiting the percentage of equity available to the borrower through a set of Principal Limit Factors (PLFs). Conceptually, the PLF is like the loan-to-value ratio applied to a traditional mortgage. It represents the ratio of the amount of initial available equity to the MCA at origination. The PLF increases with the borrower's age at origination and decreases with the expected mortgage interest rate. The PLF tables have remained unchanged since the last update in Mortgagee Letter (ML) 2017-12. Exhibit I-2 lists an extract of PLFs as of September 2026.

Exhibit I-2: Selected Principal Limit Factors

Expected Mortgage Interest rate	Borrower Age at Origination *		
	65	75	85
5.5%	0.403	0.467	0.570
7.0%	0.333	0.400	0.511
8.5%	0.276	0.343	0.459

**The age of the younger borrower or spouse*

The amount of equity available at origination is known as the initial Principal Limit (PL) and is calculated as

$$PL = MCA \times PLF(\text{age, expected mortgage interest rate})$$

where the PLF is determined from the HUD PLF table (ML 2017-12) corresponding to the youngest borrower's age and the expected mortgage interest rate rounded to the nearest 0.125%.

Over the course of the loan, the principal limit grows with the mortgage interest rate and mortgage insurance premium rate. Once the HECM unpaid loan balance reaches the principal limit, no more cash advances are available to the borrower.

iii. Payment Plans

HECM borrowers access the equity available to them according to the payment plan they select. Borrowers can change their payment plan at any time during the mortgage if they have not exhausted their PL. The payment plans are:

- **Tenure plan:** equal monthly payments as long as at least one borrower lives and continues to occupy the property as a principal residence.
- **Term plan:** equal monthly payments for a fixed period of months selected.

[6] Net sales proceeds are the proceeds from selling the home minus transaction costs.

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- **Line of credit:** unscheduled payments or in installments, at times and in an amount of borrower's choosing until the line of credit is exhausted.
- **Modified Tenure**: combination of line of credit and scheduled monthly payments for as long as borrower remains in the home.
- **Modified Term:** combination of line of credit plus monthly payments for a fixed period of months selected by the borrower.
- **Single Disbursement Lump Sum:** all the available loan proceeds are accessed at closing. Generally, this occurs when the borrower uses the HECM for Purchase program or to pay off a large existing mortgage on the property.

Under the current program, the initial disbursement period limitation is applicable to all payment plans and subsequent payment plan changes that occur during the initial disbursement period.

iv. Unpaid Principal Balance (UPB) and Mortgage Costs

The Unpaid Principal Balance (UPB) is the mortgage balance and represents the amount drawn from the HECM. In general, after the initial cash draw, the mortgage balance continues to grow with additional borrower cash draws and accruals of interest, premiums, and servicing fees until the mortgage terminates.[7]

v. Loan Terminations

When a HECM loan terminates, the current loan balance becomes due. If the net sales proceeds from the home sale exceed the loan balance, the borrower or the estate is entitled to the difference. If the net proceeds from the home sale are insufficient to pay off the full outstanding loan balance and the lender has not assigned the note, the lender can file a claim for the shortfall, up to the amount of the MCA. HECM loans are non-recourse, so the property is the only collateral for the loan; no other assets or the income of the borrowers can be accessed to cover any shortfall.

vi. Assignments and Recoveries

The assignment option is a unique feature of the HECM program. When the balance of a HECM reaches 98% of the MCA and meets other assignment requirements, the lender can choose to terminate the FHA insurance by redeeming the mortgage note with FHA at face value, a transaction referred to as mortgage assignment. FHA will pay an assignment claim in the full amount of the mortgage balance (up to the MCA) and will continue to hold the note until termination. During the note holding period, the mortgage balance will continue to grow by additional draws and unpaid taxes and insurance. Borrowers can continue to draw cash if the mortgage balance is below the current PL. The only exception is that borrowers on scheduled

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

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payments are not constrained by the current PL. At mortgage termination, the borrowers or their estates are required to repay FHA the minimum of the mortgage balance and the net sales proceeds of the home. These repayments are referred to as post-assignment recoveries.

C. HECM Program Developments and Recent Mortgagee Letters

The Home Equity Conversion Mortgage (HECM) program has undergone several policy changes over the years, including changes in insurance premiums, principal limit factors, loan limits, and regulations. The goal of these changes has been to enhance the program's sustainability, protect borrowers, and improve the fiscal safety and soundness of the MMI Fund. FHA publishes the policy changes in Mortgagee Letters (ML), some of which are listed in the references at the end of this report and in footnotes. These changes generally do not affect outstanding HECM contracts. In this section, we highlight significant HECM policy changes and interpret recent mortgagee letters.

i. Principal Limit Factors (PLFs) Reduction

PLFs determine the maximum amount a borrower can access from their home's equity over time, which depends on several factors, including the age of the youngest borrower (or non-borrowing spouse), expected mortgage interest rates, and regulatory changes aimed at ensuring the financial soundness of the MMI Fund. There have been multiple adjustments to the PLFs, as HUD sought to balance the program's attractiveness to potential borrowers with the need to maintain its financial soundness. Exhibit I-3 below illustrates a selected set of PLFs for the standard HECM program.

- Prior to 2013: PLFs were generally higher, allowing borrowers to access a larger portion of their home's equity.
- 2013 Adjustments: Due to increasing default rates and declining home values during the housing crisis, HUD significantly reduced PLFs to improve the health of the MMI Fund.
- 2014 Adjustments: With the financial assessment requirements introduced, PLFs were refined as part of the comprehensive effort to reduce tax and insurance defaults and ensure the long-term sustainability of the program.
- 2017 Adjustments: HUD implemented another significant reduction in PLFs, to reduce program risk and preserve the MMI Fund’s solvency. This change effectively reduced the maximum borrowing amount available to new HECM borrowers.

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Exhibit I-3: Selected Principal Limit Factors for Standard HECMs

		Principal Limit Factors					
Age*	Mortgage Rate	Prior to FY 2010	FY 2010	FY 2011 to FY 2013	9/30/2013 to 8/3/2014	8/4/2014 to 10/1/2017	On or after 10/2/2017
65	5.50%	0.649	0.584	0.569	0.483	0.478	0.403
	7.00%	0.489	0.440	0.428	0.363	0.332	0.333
	8.50%	0.369	0.332	0.326	0.277	0.227	0.276
75	5.50%	0.732	0.659	0.636	0.541	0.553	0.467
	7.00%	0.609	0.548	0.516	0.438	0.410	0.400
	8.50%	0.503	0.453	0.425	0.361	0.304	0.343
85	5.50%	0.819	0.737	0.703	0.597	0.644	0.570
	7.00%	0.738	0.664	0.606	0.515	0.513	0.511
	8.50%	0.660	0.594	0.531	0.451	0.414	0.459

* Age of the younger borrower or spouse at loan origination

The PLF table has remained unchanged since October 2017, despite significant changes in house prices and interest rates. Continued monitoring of HECM portfolio performance and MMIF capital adequacy may inform future evaluations of current PLFs.

ii. Loan Limit Increases

Maximum claim amount (MCA) serves as the loan limit, which is reviewed and potentially adjusted each year based on the housing market conditions. The Department of Housing and Urban Development (HUD) typically reviews and announces any changes to the HECM loan limits towards the end of each calendar year, which then takes effect the following year. On November 28, 2023, Mortgagee Letter (ML) 2023-22 increased the HECM MCA to $1,149,825 for the period of January 1, 2024, through December 31, 2024. Mortgagee Letter 2024-22 set the 2025 FHA HECM MCA at $1,209,750 for the period of January 1, 2025, through December 31, 2025. Mortgagee Letter 2025-22 continued to increase the HECM MCA to $1,249,125, effective for the period of January 1, 2026, through December 31, 2026.

Exhibit I-4 displays the loan limits from 2009 through 2026. The increasing maximum mortgage limits for HECMs align with the conforming loan limits established by the Federal Housing Finance Agency (FHFA) for Freddie Mac and Fannie Mae home mortgages and reflect national House Price Appreciation, Inflation, and Cost of Living Adjustments. With a higher HECM loan limit, borrowers with higher home values can access additional equity.

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Exhibit I-4: Loan Limits from FY 2009-2026

Effective Date	Maximum Mortgage Limit	Percent Change from Previous Limit
Jan-26	$1,249,125	3.25%
Jan-25	$1,209,750	5.21%
Jan-24	$1,149,825	5.56%
Jan-23	$1,089,300	12.21%
Jan-22	$970,800	18.05%
Jan-21	$822,375	7.42%
Jan-20	$765,600	5.38%
Jan-19	$726,525	6.90%
Jan-18	$679,650	6.84%
Dec-16	$636,150	1.70%
Feb-09	$625,500	

The increase in loan limit will not increase the MCA of existing HECMs and only affects new cohorts originating under the higher limit. It will raise FHA's insurance exposure and may increase expected claim losses, placing downward pressure on NPV; however, the magnitude of the impact depends on the proportion of originated loans constrained by the prior loan limit, borrowers' cash drawdown behavior, subsequent house price appreciation, and termination timing.

iii. Mortgage Insurance Premium (MIP) Structure Change

The MIP structure for HECM loans has undergone several changes in response to the evolving needs of the program and its financial health. Mortgagee Letter 2010-34 specified that, effective October 4, 2010, the annual Mortgage Insurance Premium (MIP) for both HECM Standard and HECM Saver loans increased from 0.50% to 1.25% of the outstanding loan balance.

In FY 2014, a more conservative program was implemented through Mortgagee Letter 2013-27, effective September 30, 2013, to improve the financial viability of the HECM program. The new program had lower principal limit factors than the previous Standard program and specified initial disbursement limitations. The annual MIP remained at 1.25% of the outstanding loan balance, while the initial MIP had a tiered structure based on disbursements during the first 12 months. Specifically, the initial MIP is 0.5% of the MCA for disbursements of 60% or less of the principal limit and 2.5% of MCA for disbursements exceeding 60% of the principal limit.

Effective October 2017, to simplify the MIP structure and improve the sustainability of the MMI Fund, HUD standardized the upfront MIP to a flat 2% of the maximum claim amount, irrespective of how much the homeowner drew from the reverse mortgage in the first year. The annual MIP rate was reduced to 0.50% of the outstanding balance.

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To summarize the annual MIP:

- a loan with case number assigned before 10/4/2010 has 0.5% annual MIP.
- a loan with case number assigned between 10/4/2010 and 10/1/2017 has 1.25% annual MIP.
- a loan with case number assigned on and after 10/2/2017 has 0.5% annual MIP.

Changes in the HECM MIP structure affect the MMI Fund's NPV of existing loans through annual premium collections. Loans with FHA case numbers assigned from October 4, 2010, through October 1, 2017, were subject to a relatively high annual MIP rate of 1.25 percent of the outstanding balance, providing greater recurring premium income over the life of the loan. The performance of loans during these cohorts will have a bigger impact on the NPV than other cohorts.

iv. Protection for Non-Borrowing Spouses (NBS)

A non-borrowing spouse refers to a spouse who is not a borrower on the HECM loan but is married to a borrower at the time of loan origination. Given the potential hardships faced by non-borrowing spouses after the death of the borrower, HUD implemented policy changes in 2014 to provide protections and rights of non-borrowing spouses. Mortgagee Letter (ML) 2014-07 amended the regulations and requirements concerning due and payable status where there is a non-borrowing spouse at the time of loan closing. At the same time, it also specified where a HECM mortgagor has identified a non-borrowing spouse, the mortgagee must base the Principal Limit on the age of the youngest mortgagor or non-borrowing spouse. ML 2014-12 published the new Principal Limit Factor (PLF) tables which had been wholly revised and included PLFs for use where there is a non-borrowing spouse younger than 62.

ML 2015-03 established the Mortgagee Optional Election (MOE) Assignment for eligible non-borrowing spouses of HECM borrowers with FHA case numbers assigned before August 4, 2014. ML 2015-15 subsequently replaced ML 2015-03 and revised the MOE Assignment requirements, allowing lenders to assign eligible HECM loans to HUD following the death of the last surviving borrower. ML 2021-11 expanded assignment criteria to all existing loans and eliminated the requirement for an eligible non-borrowing spouse to establish marketable title or other legal right to remain in the property.

The introduction and subsequent expansion of MOE assignment generally extend the duration of affected HECM loans by allowing eligible non-borrowing spouses to remain in the property following the death of the borrower. This reduces or delays death-related terminations and shifts some loans from immediate claim resolution to assignment to HUD. The longer duration may increase future loan balances and HUD's exposure while delaying property recovery and claim resolution, which may place downward pressure on NPV. This effect is partially offset by additional MIP collections and potential future property appreciation during the extended period.

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The overall NPV impact therefore depends on the duration of the deferral period, future HPA, loan-balance growth, MIP collections, and eventual property recovery.

v. Financial Assessment for Borrowers

The main goal of the Financial Assessment is to evaluate a borrower's willingness and capacity to meet their financial obligations, including property taxes, homeowner's insurance, homeowners' association (HOA) fees (if applicable), and basic home maintenance costs, due to an increasing number of tax and insurance defaults by HECM borrowers. If a borrower is deemed to be a potential default risk based on financial assessment, the lender is authorized to create a Life Expectancy Set-Aside (LESA) to pay for future tax and insurance charges. By ML 2015-09, HUD introduced the requirement and calculation of the LESA, which is used for the payment of property taxes and hazard and flood insurance premiums. If, based on financial assessment, there's concern about the borrower's ability to meet ongoing property-related expenses, the lender might establish a LESA to cover property taxes and homeowner's insurance for the expected life of the borrower.

The LESA reduces funds immediately available to borrowers and may slow the growth of outstanding loan balances, thereby reducing FHA's insurance exposure. In addition, improved payment of property charges reduces T&I defaults and associated claim losses. These effects generally improve the NPV of the HECM portfolio; however, the improvement may be partially offset by the subsequent disbursement of LESA funds to pay property charges. The overall NPV impact depends on the reduction in T&I default rates, LESA utilization, loan-balance growth, termination timing, and subsequent claim and recovery.

vi. Recent Mortgagee Letters

Several Mortgagee Letters have been published to enhance the HECM program and reaffirm its commitment to serve senior citizens. These policy changes benefit both HECM borrowers and mortgagees and improve marketability and liquidity of HECM loans.

- Mortgagee Letter (ML) 2026-02 formalized requirements governing the sale of beneficial interests in FHA-insured mortgages, including HECM loans, and established standardized Declaration of Trust submission requirements. The policy clarifies ownership, servicing, transfer, and assignment requirements for HECM mortgage pools and is intended to improve transparency, governance, and operational consistency in secondary market transactions involving HECM assets. While ML 2026-02 does not directly change HECM cash flow assumptions, claim structures, or borrower behavior, the improved clarity regarding servicing and ownership requirements may support operational efficiency and secondary-market liquidity for HECM portfolios, and thus modestly reduce operational and counterparty risks associated with HECM securitization.

- Mortgagee Letter 2025-22 continues to increase the 2026 FHA HECM limits and sets the maximum claim amount at $1,249,125 for all areas effective January 1, 2026, through

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December 31, 2026. An increase in MCA raises the cap on principal limit and thus increases potential disbursement and accrual base for new HECM endorsements in 2026, which will expand risk exposure base for cohort 2026.

- Mortgagee Letter 2025-18, Rescission of Outdated and Costly FHA Appraisal Protocols, effective June 27, 2025, eliminates outdated procedural steps required of FHA appraisers, aligning FHA appraisal requirements more closely with industry standards and reducing unnecessary costs and delays.

- Mortgagee Letter (ML) 2024-18 published updates for the payment of debenture interest on HECM claims and established a process for adjusting debenture interest for claims already filed for loans that became due and payable on or after September 19, 2017. The changes made addressed financial hardships faced by mortgagees holding substantial numbers of loans that were already in default before the Home Equity Reverse Mortgage Information Technology (HERMIT) System was changed in January 2024 to use the date of default to determine the payment of debenture interest rates.

- Mortgagee Letter (ML) 2023-23 published revisions to simplify servicing requirements to reduce the cost associated with due and payable servicing and foreclosure actions, incentivize HECM program participants, and enhance the long-term performance of the Mutual Mortgage Insurance Fund. FHA recognized the increased costs to mortgagees participating in the HECM program in the economic cycle of rising interest rates and inflation. Following these revisions, mortgagees are allowed to verbally complete the annual occupancy certification, use corporate funds to pay for all property charges not just outstanding property taxes or insurance payments, and include homeowner and condominium association dues in a borrower's total arrearage when calculating repayment plans.

- Mortgagee Letter (ML) 2023-23 also provided loss mitigation incentives. Mortgagees may offer up to $7,500, plus an additional $5,000 for probate costs, to borrowers who agree to short sales, deeds in lieu, or post foreclosure eviction avoidance loss mitigation options. ML 2023-23 increased the threshold for when a mortgagee must submit a due and payable request to HUD for outstanding property charges from $2,000 to $5,000, to expand a mortgagee's ability to work with borrowers that have fallen behind on taxes, insurance, or other property charges.

- Mortgagee Letter (ML) 2023-15 updated processes and improved FHA's ability to make prompt payments in the event of a mortgagee default and to ensure that HECM borrowers timely receive scheduled or requested funds. The process modification is to build consumer and market confidence in the HECM program.

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- Mortgagee Letter (ML) 2023-10 streamlined early documentation submission for loan assignment at 97% MCA to reduce delays. This procedural update can accelerate cash-flow timing.

- Mortgagee Letter (ML) 2022-23, issued on September 30, 2022, established a special COVID-19 repayment option for HECM borrowers who became delinquent on property charges, including property tax, insurance, and homeowner association fees. Borrowers are allowed up to 60 months to repay their property charges.

Overall, as of September 2026, there have been no changes in the principal limit factors (PLFs), interest accrual rules, annual MIP, or mortgage insurance structure for HECM in a way that would directly alter the cash-flow assumptions in NPV, since last year's actuarial review. The increase in HECM limits (MCA) via ML 2025-22 is the most significant change, since it can raise the scale of cash flow, higher balances, and more insurance exposure, especially in the current lower interest rate environment compared to the 2023 peak, even with the unchanged PLF tables. The new loan limit has been incorporated into this year's model. Improved market transparency regarding servicing and ownership requirements via ML 2026-02 may reduce operational risk and boost secondary-market HECM loan transactions and indirectly impact the HECM portfolio in a positive way.

D. Current and Future Market Environment

Recent Mortgagee Letters fulfilled FHA's commitment to incentivize HECM loan originations, improve securitization capacity of the HECM market, and facilitate market liquidity. Program participants' policy changes collaboratively created a supportive market environment for the development of HECM program. The financial sustainability of the HECM program depends on cost-effective access to financing for senior borrowers, a stable secondary-market infrastructure, and effective loss-mitigation mechanisms.

i. The HMBS Program and Secondary-Market Liquidity

Ginnie Mae's Home Equity Conversion Mortgages (HECM) Mortgage-Backed Securities (HMBS) Program serves as the securitization outlet for FHA-insured HECM and facilitates access to affordable housing financing for these homeowners. Through the HMBS program, Ginnie Mae furthers the financial sustainability of HECM. The HMBS 2.0 program proposed by Ginnie Mae to enable the pooling of active and nonactive buy-outs into new custom, single-issuer pools, is under development. It permits the pooling of HECMs with an outstanding unpaid principal balance (UPB) of no less than 98 percent and no greater than 148 percent of MCA. Access to liquidity under HMBS 2.0 will give issuers time to resolve issues that prevent HECMs from being assigned to FHA. This access will relieve immediate liquidity stress and reduce the likelihood of mortgagee default and portfolio extinguishment, which would help improve investor confidence in the HMBS market and support the HECM program. In November 2024, Ginnie Mae published the final term sheet for HMBS 2.0. As of September 2026, although significant progress has been made in

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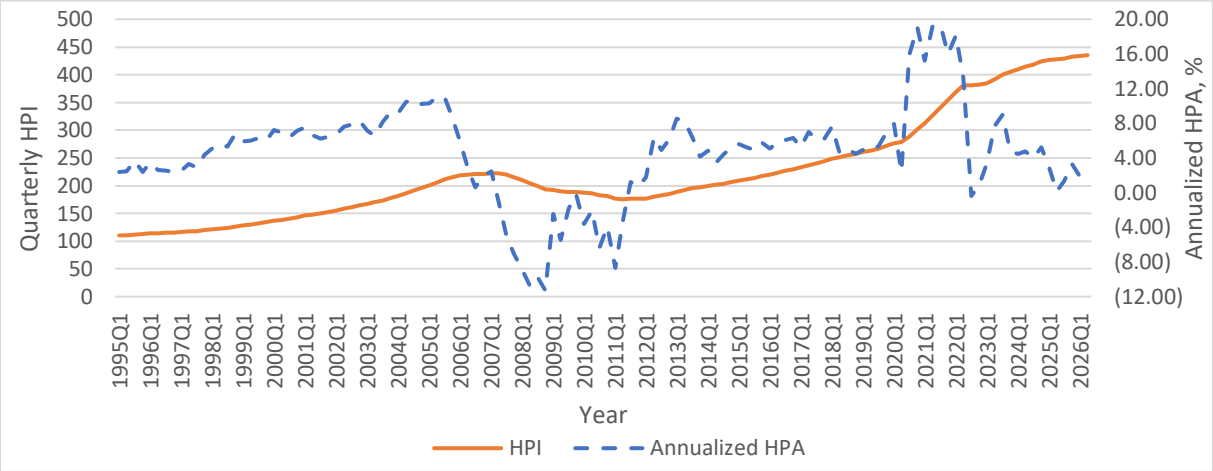
developing the HMBS 2.0 framework, key implementation details remain under review, and no official effective date has been announced. Consequently, the potential impact of HMBS 2.0 is not explicitly reflected in the actuarial projection but remains an important emerging risk and policy consideration. A sensitivity test for the assignment assumption is used to demonstrate and quantify the impact of this policy change.

ii. House Price

The rate of home price growth exerts influence over several key factors: the volume of mortgages endorsed by FHA, the proportion of mortgage defaults, and the eventual cost of mortgage insurance claims. The historical Federal Housing Finance Agency (FHFA) Purchase Only House Price Index for each quarter and annualized house price appreciation (HPA) rate is illustrated in Exhibit I-5.

Between 1992 and 2005, the annual rate of house appreciation experienced a steady increase, peaking at 10.99% in the second quarter of 2005[8]. However, during the housing crisis that commenced in 2006, this rate took a significant downturn, reaching a low point of -11.28% in the fourth quarter of 2008 and remaining in negative territory until the second quarter of 2011. Subsequently, the trend reversed, and this upward trajectory persisted through 2013, fluctuating between 5% and 7% until the second quarter of 2020. Then, starting in the third quarter of 2020, the rate embarked on an upward trajectory, driven by heightened housing demand, and reached its zenith at 19.25% in the first and second quarter of 2021. House appreciation slowed down in 2022, dropping to an average annual rate of 8.45% and continued to drop to an average annual rate of 6.20% in 2023, 4.56% in 2024, 1.95% in 2025, and 1.05% in 2026 Q2[9].

Exhibit I-5: Historical FHFA Purchase-Only House Price Index and Percent Change



[8] Calendar year is used in describing historical economic data.
[9] We use the calendar year and quarter in describing the historical data.

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Recent house price appreciation has slowed down from the usually strong growth during the pandemic period. Although both PEA projection and Moody's forecasts project that house price will continue to appreciate in the long term, future HPA rates will remain subject to significant uncertainty arising from interest rate conditions, housing affordability, and broader macroeconomic environment. Accordingly, projected HPI paths should be viewed as one of the primary drivers of uncertainty in future HECM recoveries and MMIF performance.

iii. Interest Rates

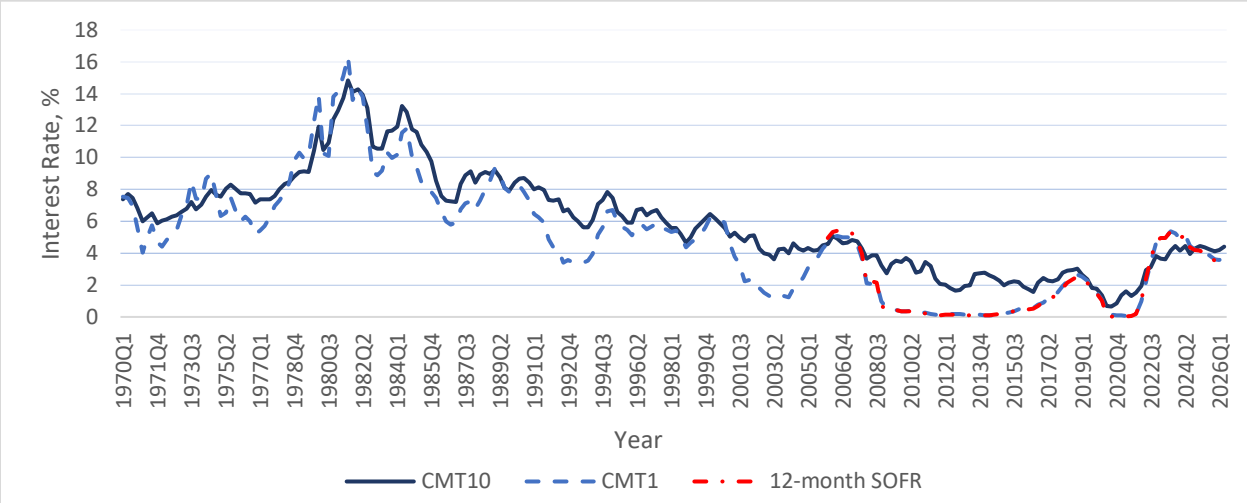
In response to the 2007 financial crisis and subsequent economic recession, the Federal Reserve implemented an expansionary monetary policy, substantially reducing interest rates. At the beginning of 2007, the 1-year Constant Maturity Treasury (CMT) rate was approximately 5%. Over the following seven years, the rate declined to approximately 0.1% in the second quarter of 2014. It subsequently increased, reaching 2.7% in December 2018, before declining again. In response to the economic disruption caused by the COVID-19 pandemic, the Federal Reserve implemented additional monetary easing, contributing to a further decline in Treasury rates. By the second quarter of 2021, the 1-year CMT rate had fallen to 0.06%, its lowest level since the series began in 1953.

Following the COVID-19 pandemic, the Federal Reserve began raising interest rates to combat elevated inflation. The 1-year CMT rate reached a peak of 5.39% in the third quarter of 2023. Since then, the rate has generally declined, reaching 4.25% in the fourth quarter of 2024 and 3.88% in the third quarter of 2025. However, this declining trend reversed during 2026, with the 1-year CMT rate rising to approximately 4.2% in September 2026. The Federal Reserve also increased its target federal funds rate by 25 basis points in September 2026, reflecting renewed concerns about inflation. Despite these movements, interest rates remain substantially above the near-zero levels observed during the pandemic. Looking ahead, continued uncertainty in the interest rate environment may influence HECM borrower demand, loan balance growth, termination behavior, and projected cash flows, potentially affecting the financial performance of the HECM portfolio.

Exhibit I-6 depicts historical 10-year CMT rates, 1-year CMT rates, and Secured Overnight Financing Rates (SOFRs), which have fully replaced London Interbank Offered Rate (LIBOR) for both newly originated and existing adjustable-rate HECM loans.

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Exhibit I-6: Historical 1-Year and 10-Year CMT Rates and 1-Year SOFRs



Moody's provided historical SOFRs dating back to 2006 Q1. We can see from Exhibit I-6 that historical SOFRs closely followed 1-year CMT rates. Future interest rate projections are primarily driven by expected SOFR dynamics rather than LIBOR conversion adjustments.

The 10-year CMT rate exhibits a similar trajectory, although the fluctuations are less pronounced. During 2007, the 10-year CMT rate stood at slightly over 5%. Subsequently, it gradually declined, falling below 2% by 2012. Post-2012, the rate increased but then overturned due to the economic repercussions of COVID-19 to drop to 0.65% by the third quarter of 2020, marking the lowest level in the past three decades. The rate rebounded and significantly increased to 3.8% in 2022 Q4, 4.45% in 2024 Q2, dropped slightly to 4.26% in 2025 Q3, and became 4.42% in 2026 Q2.

Future HECM performance is subject to both short-term benchmark rates and long-term interest rate expectations. Higher rates generally reduce principal limit factors and borrower proceeds for new endorsements, while also affecting loan balance growth, assignment timing, and secondary market liquidity. Consequently, future monetary policy and interest rate conditions remain an important driver of projected MMIF status.

iv. Tax and Insurance Default

CT1 loss severity has been explicitly modeled in the 2026 Actuarial Review and is consistent with the incentive of a higher threshold for due and payable requests and tax and insurance default resolution established through recent FHA loss mitigation initiatives. Mortgagee Letters 2022-23 and 2023-23 expanded repayment options for delinquent property charges and provided borrowers with additional opportunities to cure defaults prior to foreclosure or claim initiation. However, the long-term effects of these policy changes remain uncertain because the available post-implementation experience is limited.

On the other hand, the increased use of LESA accounts, together with ongoing monitoring of tax and insurance obligations, may further reduce the incidence of property-charge defaults. At the

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same time, a recent HUD Office of Inspector General (OIG) report found that a portion of HECM borrowers may exhaust their LESA funds earlier than originally projected due to increases in property taxes and homeowners' insurance premiums. While exhausted LESA balances do not necessarily result in tax and insurance defaults, continued monitoring of LESA exhaustion rates may provide additional insight into future property-charge default behavior.

These factors are reflected, to the extent possible, in historical experience. Therefore, in the 2026 Actuarial Review, we explicitly modeled CT1 with tax-and-insurance (T&I) default separately from CT1 without T&I default. Each projected loan will have a non-T&I CT1 frequency and severity and a T&I CT1 frequency and severity. A loan terminated before assignment that is neither a T&I CT1 nor a non-T&I CT1 is terminated without a claim. This change will create a separate CT1 cost for projected T&I defaults.

E. Structure of this Report

The remainder of this report consists of the following sections:

Section II. Summary of Findings: Presents the economic net worth and insurance-in-force of the HECM portfolio as of September 30, 2026, the end of FY 2026.

Section III. Characteristics of the MMI HECM Book of Business: Presents key characteristics and trends of the HECM portfolio and its books of business.

Section IV. HECM Performance under Alternative Scenarios and Sensitivity Testing: Presents the HECM portfolio economic net worth using alternative economic scenarios.

Section V. List of Methodological Appendices: Provides a summary of the models utilized in the analysis.

Section VI. Qualifications and Limitations: Describes the main assumptions and the limitations of the data and models relevant to the results presented in this Review.

Appendix A. HECM Data Reconciliation: Provides data reconciliation results.

Appendix B. HECM Base Termination Model: Provides a technical description of the loan performance model for the causes of loan termination.

Appendix C. HECM Loan Performance Projections: Provides a technical description of the loan termination projection methodology and the characteristics of the future endorsement cohorts modeled in this Review.

Appendix D. HECM Cash Flow Analysis: Provides a technical description of the cash flow model covering the various sources of cash inflows and cash outflows that HECM loans generate.

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Appendix E. Stochastic Simulation Models: Discusses the simulated economic scenarios that were generated by a Monte Carlo stochastic model to forecast the economic net worth of the MMI HECM portfolio.

Appendix F. Comparison of HUD and ITDC Models and Assessment of Vulnerabilities: As part of the statutory actuarial review process, this report includes an appendix presenting the results of the review of HUD's HECM models. The appendix includes supplemental documentation and analysis necessary to support enhanced transparency and completeness of the actuarial review.

The FY 2025 review, documented in Appendix F of the previous report, provided documentation and analysis of HUD's HECM models to support enhanced transparency and completeness of the actuarial review after HUD's model documentation became available. This year's Appendix F focuses on updates and modifications to the models implemented by HUD since that prior review and assesses their potential impact on actuarial analysis.

Appendix G. Tables of Historical and Projected Loan Termination Rates: Provides tables of conditional and cumulative terminations by endorsement cohort years and policy years for each mortgage product. These are provided in spreadsheet files as a separate addendum to the report.

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II. Summary of Findings

This section presents the projected economic net worth and insurance-in-force of the FY 2026 HECM portfolio in the MMI Fund. An MMI-designated fiscal year portfolio is defined as the set of loans that survive to the end of the fiscal year and were endorsed in FY 2009 or later, when the MMI Fund was responsible for HECM losses. In addition to the capital resources as of the end of the fiscal year, the economic net worth of the HECM part of the MMI Fund depends on the discounted net present value of the future cash flows from the surviving portfolio of loans existing at the start of the valuation forecast (the end of the fiscal year under review).

A fiscal year's economic net worth calculation does not include the effect of endorsements in future fiscal years. According to NAHA, the economic net worth of the Fund is defined as the "cash available to the Fund, plus the net present value of all future cash inflows and outflows expected to result from the outstanding mortgages in the Fund." We estimated the current economic net worth for the HECM portfolio as the sum of the amount of capital resources and the net present value of all expected future cash flows of the active HECM loans as of the end of FY 2026.

A. The FY 2026 Actuarial Review

The FY 2026 Actuarial Review estimates the economic net worth of the HECM portfolio as of September 30, 2026. The objectives of our analysis include:

- Analyze all HECM historical termination experience and the associated claims and recoveries using loan-level HECM data maintained by FHA through September 30, 2026.
- Build Claim Type 1 and no-claim termination frequency models. For Claim Type 1 loss severity, we specifically identify the tax and insurance default and estimate the impact of tax and insurance default and extra cash out flow burden of HECM loans.
- Build the conveyance/payoff frequency and loss severity models for the Claim Type 2 cash flow.
- Construct a model using the economic scenarios of interest rates and house price appreciation rates. These economic scenarios were simulated to center around the baseline macroeconomic forecasts given by the PEA.
- Provide detailed descriptions of the termination model, cash flow model, and economic assumptions used (presented in Appendices A to E). The following is a summary of the major findings in this review, which are also illustrated in Exhibit II-1.

This Review is carried out by examining historical loan performance data supplied by FHA, creating econometric models with the estimation of their parameters, and generating economic scenarios consistent with PEA. Econometric models are employed to forecast the Fund's future

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cash flow, and their present value is compared to the Fund's financial resources to determine the economic worth of the Fund.

Estimation of the loan status transition models utilized loan-level data on the Fund's historical loan performance from the early 1990s through June 30, 2026. The performance of FHA loans through the 2007-2010 mortgage crisis, the period of recovery and declining interest rates that followed the crisis, and the recent COVID-19 emergency have all provided real-world "stress tests" upon which to train our econometric models and develop forecasts of future performance. Further discussion and in-depth descriptions of the individual models, underlying assumptions, and comprehensive econometric outputs are provided in a series of appendices to the report.

B. Economic Net Worth

Exhibit II-1 presents the components of the economic net worth for FY 2026. ITDC projects the Actuarial Central Estimate (ACE) of the HECM portion of the MMI Fund at an estimated economic net worth of positive $8.400 billion at the end of FY 2026.

Exhibit II-1: Estimated Economic Net Worth of the HECM Portfolio for FY 2009-FY 2026 in the MMI Fund at the End of FY 2026 ($ Million)

Item	End of FY 2025	End of FY 2026
Total Capital Resources as of EOY*	$9,131	$2,093
+ NPV of Future Cash Flows on Outstanding Business	$7,472	$6,307
Economic Value	$16,603	$8,400
Insurance-In-Force (UPB)**	$63,740	$62,678

*Source: HUD/FHA Financial Statements
** Insurance-in-force for unassigned portfolio.

Data through September 30, 2026, was used for the total capital resources. The total economic net worth consists of the following components:

- Total Capital Resources represent the Fund's assets less liabilities, as reported in its balance sheet. Total Capital Resources decreased by $7.038 billion (77.08%), from $9.131 billion at the end of FY 2025 to $2.093 billion at the end of FY 2026. The reduction in capital resources is largely associated with an approximately $10 billion increase in reported liabilities. The timing of the FY 2026 actuarial review did not permit a detailed examination of the factors contributing to this increase. ITDC intends to work closely with HUD to further evaluate the underlying components and determine the extent to which the change reflects accounting or valuation adjustments, changes in portfolio experience, or other factors. Understanding these drivers will be particularly important in assessing whether the decline is primarily attributable to current-year developments or could indicate a more persistent pattern requiring attention in future actuarial reviews.

  Despite this substantial adjustment, the HECM portfolio continues to report positive Economic Net Worth of $8.400 billion, supported by a standalone HECM capital ratio of 13.40% (ITDC Economic Net Worth of $8.400 billion divided by IIF of $62.678 billion),

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independently calculated by ITDC for informational purposes and distinct from HUD's official capital ratio for the overall MMI Fund. These measures indicate that the portfolio maintains a positive financial position, although the magnitude of the year-over-year change reinforces the need for continued evaluation of the underlying financial trends. ITDC's ongoing collaboration with HUD will provide an opportunity to strengthen the understanding of these developments and support the long-term financial sustainability of the HECM program.

- Net Present Value of Future Cash Flows on Outstanding Business consists of discounted cash inflows and outflows. HECM cash inflows consist of premiums and recoveries. Cash outflows consist of claims and note-holding expenses. The cash flow model projects annual cash inflows and outflows using economic forecasts and loan performance projections. The net present value of future cash flows is estimated to be positive $6.307 billion as of the end of FY 2026.

C. Changes in the Economic Net Worth

The FY 2025 HECM Review reported that the economic net worth of the HECM portfolio was positive $16.603 billion at the conclusion of FY 2025, contrasting with this year's Review, which estimates a positive economic net worth of $8.400 billion at the end of FY 2026.

Exhibit II-2: Estimate of Cash Flow Changes as of the End of FY 2026 ($ Million)

Item	Cash Flow NPV	Capital Resources	Economic Net Worth	Insurance-In-Force
2025	$7,472	$9,131	$16,603	$63,740
2026	$6,307	$2,093	$8,400	$62,678
Difference	($1,165)	($7,038)	($8,204)	($1,062)
Percent Change	-15.59%	-77.08%	-49.41%	-1.67%

* *Cash Flow NPV and Total Capital Resources might not sum to the Economic Net Worth due to rounding*

A total change of $1.165 billion of the NPV from $7.472 billion in the 2025 Review to $6.307 billion in this year's review can be attributed to the updates in our models, baseline assumptions, and the new PEAs.

To quantify the source of change in NPV, we identify key factors that affect the NPV and discuss total change using the following sources of change in Exhibit II-3.

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Exhibit II-3: Decomposition of Changes in NPV from FY 2025 to FY 2026 ($ Million)

Decomposition Steps	Change in NPV	NPV
FY 2025 NPV in FY 2025 Actuarial Report		$7,472
- New Model Update 1- Cash Draw Down Bucket Update	($69)	$7,403
- New Model Update 2- CT1 Split for T&I and Non-T&I	($366)	$7,037
- Adding FY 2027 PEA Interest Rates	$10	$7,048
- Adding FY 2027 PEA House Prices	($295)	$6,753
- Adding FY 2026 Data (without new originations)	($658)	$6,095
- Adding FY 2026 with new originations	$212	**$6,307**

* *Minor differences in totals and intermediate values may occur due to rounding of individual components.*

- New Model Update 1: Cash Draw Down Bucket Update.
  HECM cash drawdowns have historically remained relatively stable by policy year as a percentage of the Initial Principal Limit. The model projects future draws using historical borrower behavior, categorizing loans based on first-month cash draws and applying draw paths derived from the most recent five years of experience. In FY 2026, ITDC expanded the methodology from 10 to 25 cash-draw buckets. The change results in a decrease in NPV of $69 million. This update provides greater granularity in modeling borrower equity draws and using this granular actual draw behavior also helps capture the effects of future borrower payment-plan changes.

- New Model Update 2: CT1 Split of T&I and Non-T&I CT1.
  In FY 2026, ITDC separated Claim Type 1 (CT1) into T&I and non-T&I components to more accurately capture the impact of uncured T&I defaults and associated Corporate Advances on claim frequency and severity. Both components are modeled separately using historical experience, improving model accuracy. The change decreases the NPV by $366 million.

- The FY 2027 PEA projects higher interest rates in the near future and lower interest rates in the long term than last year's estimates, which positively impacts the NPV, increasing NPV by $10 million.

- The FY 2027 PEA projects lower HPI in the near future than the FY 2026 PEA, which negatively impacts the NPV, decreasing NPV by $295 million.

- Loan performance in FY 2026, excluding new endorsements, decreases NPV by $658 million.

- FY 2026 new endorsements add $212 million to the NPV.

- All the changes together result in a FY 2026 baseline NPV of positive $6.307 billion.

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D. Current Insurance-in-Force of HECM in the MMI Fund

According to NAHA, the insurance-in-force (IIF) is defined as the "obligation on outstanding mortgages", which is generally understood to describe unamortized insurance-in-force. We estimate IIF as the total UPB of all outstanding HECM loans in the insurance portfolio as of the end of FY 2026.

Another potential measure of Insurance-in-Force (IIF) is the Maximum Claim Amount (MCA), which represents the maximum insurance claim payout that FHA could incur for the HECM portfolio. The MCA effectively serves as a cap on the insurance claim FHA will pay to a lender for any unassigned loan at termination. In contrast, the Unpaid Principal Balance (UPB) of active loans typically increases over time due to the accrual of interest, mortgage insurance premiums, servicing fees, and borrower draws. Consequently, the current aggregate UPB may understate FHA's long-term exposure, depending on the age distribution of loans within the portfolio. The MCA is determined at origination and does not change during the life of the mortgage. The aggregate MCA remains relatively stable over time, as it reflects the maximum potential claim FHA could be obligated to pay at loan maturity or assignment though it does not strictly limit the total exposure under all scenarios.

Therefore, in Exhibit II-4 we also list the aggregate MCA to indicate the insurance risk exposure of the HECM MMI Fund. Exhibit II-4 presents the estimated net present value, survival loan count and insurance-in-force and MCA for FY 2009 to FY 2026 active endorsements at the end of FY 2026.

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Exhibit II-4: Estimated Survival Loan Count and Insurance-in-Force

Endorsement Fiscal Year	Net Present Value of Future Cash Flows ($ millions)	Survival Loan Count	Insurance-in-Force	
			UPB ($ millions)	MCA ($ millions)
2009	$186	3,957	$1,390	$1,065
2010	$161	2,290	$893	$664
2011	$137	2,335	$769	$644
2012	$129	1,894	$625	$508
2013	$130	2,392	$702	$616
2014	$165	3,573	$832	$992
2015	$307	4,962	$1,143	$1,430
2016	$470	5,251	$1,207	$1,633
2017	$667	8,558	$2,003	$2,749
2018	$487	13,070	$2,821	$4,188
2019	$352	10,786	$2,185	$3,595
2020	$1,096	18,463	$4,671	$7,020
2021	$1,081	29,684	$8,731	$12,894
2022	$205	50,175	$16,024	$25,059
2023	$304	25,220	$5,872	$12,256
2024	$97	21,369	$4,289	$10,622
2025	$121	25,192	$4,810	$13,278
2026	$212	23,647	$3,713	$12,517
Total	$6,307	252,818	$62,678	$111,730

* *Minor differences in totals and intermediate values may occur due to rounding of individual components.*

The NPV values for each loan cohort under different scenarios represent the net result of multiple income and outgo components, each of which exhibits a different degree of sensitivity to changes in economic variables. Individual loan cohorts have distinct characteristics, including borrower age distributions, geographic concentrations, and other loan-specific risk factors, which may lead to different responses under the same economic scenarios. The overall NPV response reflects the combined effects of these components and their interactions, which may not always be linear. Such outcomes should be evaluated in the context of the underlying cash-flow dynamics, cohort characteristics, and interactions among cash flow components.

Insurance-in-Force (IIF) represents the outstanding UPB of active, unassigned HECM loans as of September 30, 2026. For older cohorts, accumulated interest, mortgage insurance premiums, and other advances may cause UPB to exceed the original MCA. The projected Cash Flow NPV

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includes the full future financial consequences of these loans, including potential assignments, subsequent note-holding expenses, and recoveries following assignment.

The MMI insurance-in-force (IIF) is expressed as the sum of the UPBs of all HECM loans remaining in the insurance portfolio. The estimated IIF reflects the combined, cumulative impacts of loan terminations and new endorsements. The total IIF for 2009 to 2026 cohorts was estimated to be $62.68 billion at the end of FY 2026. The total MMI MCA for 2009 to 2026 cohorts is estimated to be $111.73 billion at the end of FY 2026.

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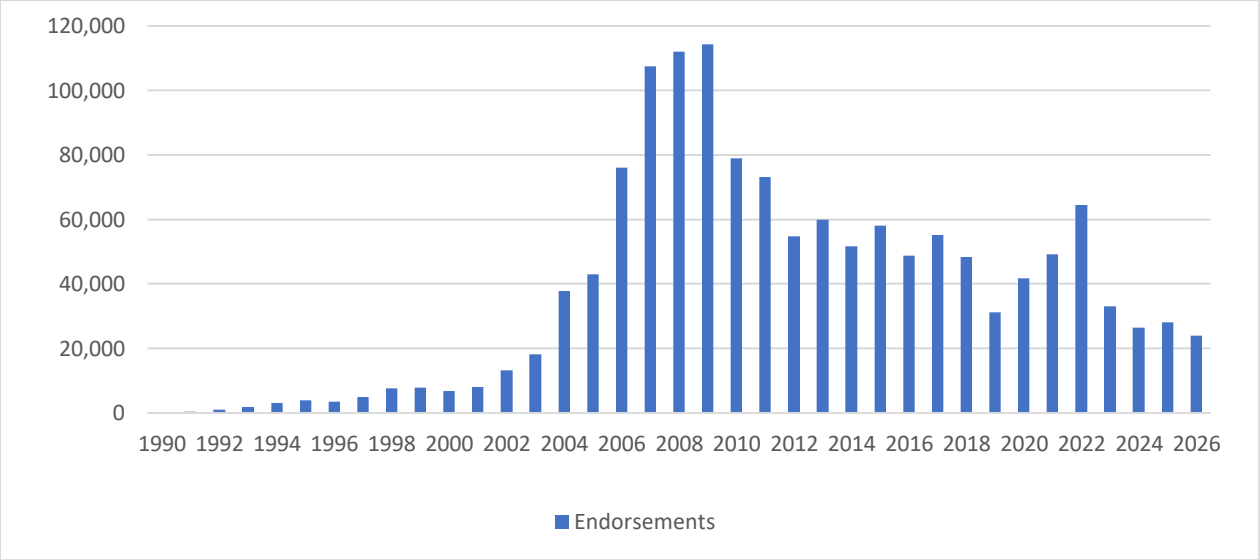
III. Characteristics of the MMI HECM Book of Business

This section presents the characteristics of the HECM portfolio for the HECM loans endorsed from FY 2009 through FY 2026. HECM loans were first included in the MMI Fund in FY 2009. The loans from these books of business that have not been terminated constitute the HECM portfolio as of the end of FY 2026. A review of the characteristics of these cohorts helps define the current risk profile of the HECM Portfolio. Some of the characteristics of previous books are shown as well to demonstrate trends.

A. Volume and Share of Mortgage Originations

FHA endorsed 24,080 HECM loans in Fiscal Year 2026, with approximate MCA of $12.7 billion. The total number of endorsements for Fiscal Years 2009 to 2026 is 941,889 with MCA of $313.26 billion. Since the inception of the HECM program, this program has been the largest reverse mortgage product in the U.S. market, representing most reverse mortgages. Exhibit III-1 presents the count of HECM endorsements by origination Fiscal Year.

Exhibit III-1: Number of HECM Endorsements per Fiscal Year



B. Payment Types

HECM borrowers receive loan proceeds by selecting from term, line of credit, tenure payment, and lump sum plans. Borrowers can also choose a combination of payment plan types. Exhibit III-2 presents the distribution of HECM loans by payment plan. The majority of HECM borrowers select the line of credit option. This option accounted for 94.3% of the total endorsements in Fiscal Year 2026.

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Exhibit III-2: Distribution of FY 2009 - FY 2026 HECM Loans by Payment Type

Fiscal Year	Payment Type						
	Term	Line of Credit	Tenure	Term+ Line of Credit	Tenure+ Line of Credit	Lump Sum	Total, N
2009	0.8%	91.9%	1.4%	3.8%	2.0%	0.0%	114,421
2010	0.5%	94.3%	0.8%	2.8%	1.5%	0.0%	79,052
2011	0.4%	94.5%	0.8%	2.8%	1.4%	0.0%	73,109
2012	0.3%	94.9%	0.8%	2.6%	1.4%	0.0%	54,812
2013	0.4%	95.1%	0.8%	2.4%	1.2%	0.0%	59,923
2014	0.7%	93.6%	1.3%	3.0%	1.5%	0.0%	51,616
2015	0.6%	93.6%	0.9%	2.8%	1.6%	0.5%	57,989
2016	0.6%	89.4%	0.9%	2.9%	1.6%	4.6%	48,868
2017	0.5%	87.1%	0.8%	2.8%	1.6%	7.1%	55,290
2018	0.5%	87.6%	0.7%	2.7%	1.5%	7.0%	48,329
2019	0.5%	90.1%	0.6%	2.5%	1.3%	5.1%	31,272
2020	0.4%	94.5%	0.4%	2.3%	1.0%	1.5%	41,835
2021	0.4%	90.7%	0.3%	2.1%	0.8%	5.8%	49,196
2022	0.4%	93.4%	0.5%	2.1%	0.9%	2.8%	64,472
2023	0.5%	94.1%	0.7%	2.7%	1.3%	0.7%	32,974
2024	0.5%	94.4%	0.8%	2.7%	1.4%	0.1%	26,502
2025	0.8%	94.7%	0.8%	2.1%	1.6%	0.1%	28,149
2026	0.8%	94.3%	0.9%	2.3%	1.6%	0.0%	24,080

C. Interest Rate Type

HECM borrowers can select fixed or adjustable-rate mortgages. Exhibit III-3 shows the distribution of HECM loans by interest rate type. The majority of HECM borrowers selected monthly adjustable-rate mortgages in Fiscal Year 2009. The next year, however, the percentage of fixed-rate endorsements increased sharply to 69%. This was due, in part, to a significant drop in interest rates beginning in the last half of 2008. This percentage persisted in the Fiscal Years 2011 through 2013. Subsequently, the share of fixed-rate HECM loans dropped sharply. In Fiscal Year 2014, the percentage of fixed rate loans dropped to 19%, and as of the end of Fiscal Year 2020 it had dropped to less than 2% of the HECM loans originated.

However, in 2021 the percentage of fixed rate loans increased to over 7% and was at 4.4% of the loans in 2022. Interest rates significantly increased in 2023, which led to a significant drop in fixed rate loans to 0.9% in 2023, about 0.2% in 2024, 0.15% in 2025, and almost none in 2026.

Beginning in 2021, the LIBOR was discontinued. As a result, the SOFR replaced LIBOR as an option for an index for adjustable mortgages. We use LIBOR to represent both in Exhibit III-3.

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Exhibit III-3: Distribution of FY 2009-FY 2026 HECM Loans by Interest Rate Type

Fiscal Year	LIBOR Indexed		Treasury Indexed		Fixed	Total
	Annually Adjusted	Monthly Adjusted	Annually Adjusted	Monthly Adjusted		
2009	23	39,599	746	60,742	13,311	114,421
2010	7	24,174	10	392	54,469	79,052
2011	6	23,319	3	44	49,737	73,109
2012	1	16,697	4	64	38,046	54,812
2013	1	23,574	1	18	36,329	59,923
2014	1,239	40,738	0	1	9,638	51,616
2015	23,180	25,666	7	4	9,132	57,989
2016	36,854	6,793	20	0	5,201	48,868
2017	47,622	1,952	0	0	5,716	55,290
2018	42,742	685	1	0	4,901	48,329
2019	29,313	69	0	0	1,890	31,272
2020	40,988	45	4	0	798	41,835
2021	14,823	53	1,048	29,723	3,549	49,196
2022	12	0	498	61,112	2,850	64,472
2023	5	0	32	32,633	304	32,974
2024	0	0	18	26,433	51	26,502
2025	1	1	13	28,092	42	28,149
2026	0	0	22	24,047	11	24,080

D. Product Type

There are three types of HECM loans: traditional HECM, HECM refinance, and HECM for purchase. Most loans endorsed in Fiscal Years 2009 through 2026 are "traditional" HECMs, where the borrowers had purchased their homes prior to taking out the reverse mortgage. A HECM for Purchase program was introduced in January 2009. This program allows seniors to purchase a new principal residence and obtain a reverse mortgage with a single transaction. However, these HECM for Purchase loans have been a small percentage of HECM endorsements each year as seen in Exhibit III-4. In our analysis, the traditional and for-purchase HECMs are treated the same, as the volume of for-purchase HECMs is small.

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Exhibit III-4: Distribution of FY 2009-FY 2026 HECM Loans by Product Type

Fiscal Year	Product Type				
	Traditional HECMs	Refinance HECMs	HECMs for Purchase		Total, N
			First Month Cash Draw >= 90% of Initial Principal Limit	First Month Cash Draw < 90% of Initial Principal Limit	
2009	91.7%	7.8%	0.4%	0.1%	114,421
2010	92.1%	6.1%	1.6%	0.1%	79,052
2011	94.2%	3.7%	2.1%	0.0%	73,109
2012	94.4%	2.6%	2.9%	0.1%	54,812
2013	93.4%	3.1%	3.4%	0.0%	59,923
2014	91.8%	4.7%	3.5%	0.1%	51,616
2015	86.2%	9.6%	4.0%	0.1%	57,989
2016	84.1%	11.0%	4.5%	0.3%	48,868
2017	80.7%	14.5%	4.4%	0.4%	55,290
2018	82.5%	12.1%	5.0%	0.4%	48,329
2019	87.3%	5.4%	6.8%	0.5%	31,272
2020	73.5%	20.6%	5.5%	0.4%	41,835
2021	53.5%	42.0%	4.2%	0.3%	49,196
2022	51.5%	45.0%	3.2%	0.2%	64,472
2023	81.6%	12.2%	5.6%	0.5%	32,974
2024	85.8%	7.8%	5.8%	0.6%	26,502
2025	83.6%	10.9%	5.0%	0.5%	28,149
2026	83.8%	10.8%	5.0%	0.5%	24,080

E. Loan Counts by State

Among all endorsements in Fiscal Years 2009 through 2026, almost half or more of all loans originated in the top 10 states. California has the highest endorsement volume every year over this period, while Florida has had the second highest endorsement volume in all years except FY 2011-2014. The endorsement breakdown of the top 10 states is shown in Exhibit III-5.

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Exhibit III-5: Percentage of Endorsements by State for FY 2009 - FY 2026 HECM Loans

Top 10 states*	CA	FL	TX	AZ	CO	WA	GA	NC	UT	OR	Total
2009	13.7%	13.2%	6.6%	3.1%	1.8%	2.8%	2.1%	1.8%	1.5%	2.7%	49.3%
2010	14.0%	9.0%	8.0%	2.1%	1.8%	3.0%	2.5%	2.0%	1.3%	2.3%	45.9%
2011	13.5%	6.8%	9.1%	2.0%	1.9%	2.5%	2.4%	2.6%	1.4%	1.8%	43.9%
2012	12.7%	6.1%	8.9%	1.7%	2.0%	2.3%	2.0%	2.8%	1.8%	1.7%	42.1%
2013	14.1%	6.5%	8.6%	2.4%	2.1%	2.3%	2.0%	3.1%	2.0%	1.4%	44.3%
2014	17.5%	6.9%	7.4%	2.9%	2.3%	2.1%	2.0%	2.6%	1.7%	1.4%	46.9%
2015	20.3%	8.3%	7.0%	3.2%	2.4%	2.3%	2.1%	2.4%	1.7%	1.4%	51.2%
2016	21.8%	8.8%	7.6%	3.6%	3.7%	2.7%	2.1%	2.5%	1.8%	1.9%	56.5%
2017	23.7%	8.7%	7.6%	3.7%	5.4%	3.2%	2.0%	2.3%	1.9%	2.4%	61.2%
2018	22.7%	8.4%	7.4%	4.0%	5.9%	4.3%	2.0%	2.5%	2.4%	2.6%	62.1%
2019	21.1%	8.6%	7.4%	4.8%	6.0%	4.0%	2.0%	2.5%	2.8%	2.4%	61.6%
2020	24.7%	8.4%	6.4%	5.6%	7.1%	4.8%	1.9%	2.4%	3.2%	2.8%	67.4%
2021	26.0%	8.2%	6.0%	7.0%	7.0%	5.7%	1.9%	2.1%	4.2%	2.9%	71.0%
2022	23.7%	9.1%	6.6%	8.5%	6.9%	5.2%	2.0%	2.3%	5.4%	3.2%	72.8%
2023	18.5%	10.7%	8.4%	6.3%	5.2%	4.2%	3.1%	3.1%	3.5%	2.6%	65.4%
2024	17.7%	10.9%	7.6%	5.4%	4.6%	4.0%	3.2%	3.2%	2.9%	2.4%	62.1%
2025	18.0%	9.5%	7.2%	4.9%	4.5%	4.2%	3.5%	3.0%	3.1%	2.4%	60.5%
2026	16.5%	8.3%	7.1%	4.5%	4.2%	3.9%	3.7%	2.9%	2.8%	2.3%	56.0%

**Top 10 states of 2026 count of endorsements.*

F. Maximum Claim Amount Distribution

The MCA is the minimum of the FHA HECM loan limit and the appraised value (or, if a HECM for Purchase, the minimum of the purchase price and appraised value, not to exceed the HECM loan limit). It is used as the basis of the initial principal limit determination and the cap on the potential insurance claim amount. Exhibit III-6 shows the distribution of HECM endorsements by the MCA. Approximately 65% of loans endorsed in Fiscal Year 2009 had an MCA of less than or equal to $300,000, and this percentage increased to approximately 72% by Fiscal Year 2012. Since then, the percentage of endorsements less than $300,000 has decreased steadily to approximately 24% in FY 2023, 24.3% in FY 2024, 21.9% in FY 2025, and 23.7% in FY 2026.

The percentage of endorsements with an MCA between $300,000 and $417,000 decreased from 17.6% in 2009 to 12-14% during Fiscal Years 2010 through 2014. Since then, it has been increasing and reached 23.4% in 2024, 22.1% in 2025, and 23% in 2026. As the principal limit has been increasing, the percentage of endorsements with an MCA over $417,000 has increased

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steadily since 2012 and the highest point is 57.9% in 2022. Endorsements with an MCA over $417,000 account for 52.3% in FY 2024, 56.0% in FY 2025, and 53.5% in FY 2026.

Exhibit III-6: Number of HECM Loans by MCA Level in FY 2009-FY 2026

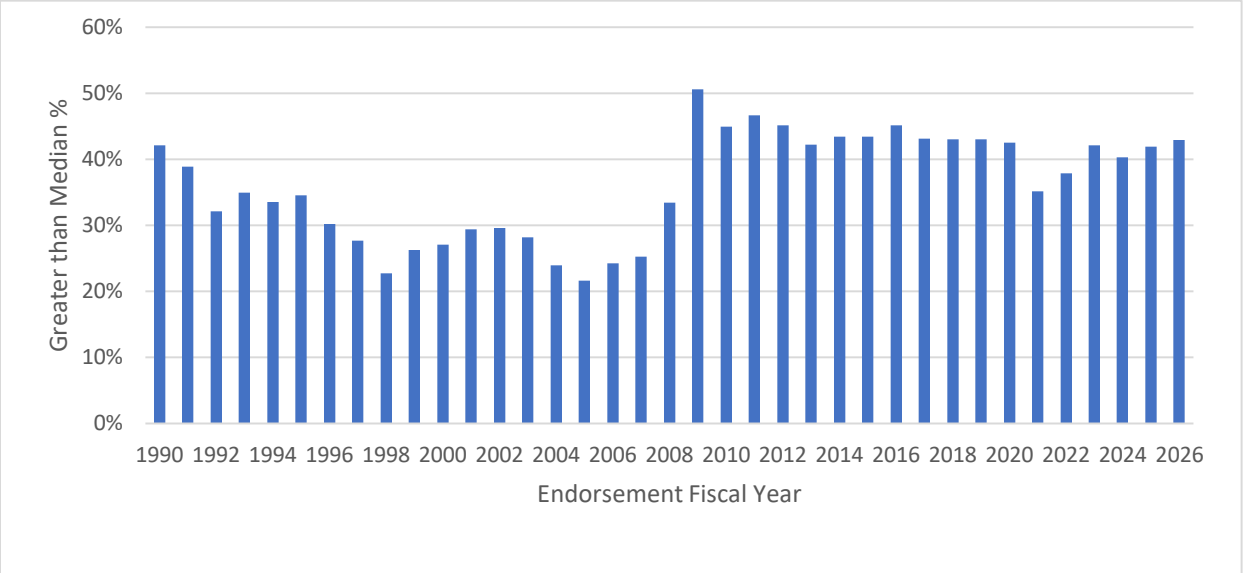
FY	Less Than $100K	$100K to Less Than $200K	$200K to $300K	$300K to $417K	$417K to $600K	$600K to $726.2K	Greater Than $726.2K	Total
2009	10,875	36,504	26,147	20,150	15,151	5,594	-	114,421
2010	9,597	26,836	15,782	10,923	9,099	6,815	-	79,052
2011	10,886	26,097	14,199	9,438	7,232	5,257	-	73,109
2012	8,831	20,264	10,274	6,917	5,046	3,480	-	54,812
2013	9,362	21,748	11,257	7,835	5,581	4,140	-	59,923
2014	6,708	17,649	10,188	7,214	5,662	4,195	-	51,616
2015	6,385	18,193	12,018	8,838	7,254	5,301	-	57,989
2016	3,831	13,814	10,672	8,192	7,124	5,235	-	48,868
2017	3,068	13,689	12,526	10,315	9,175	6,517	-	55,290
2018	1,961	11,011	11,122	9,583	8,196	6,456	-	48,329
2019	967	6,660	7,551	6,339	5,320	3,183	1,252	31,272
2020	700	6,553	9,500	9,034	8,088	3,742	4,218	41,835
2021	404	5,415	9,452	11,150	10,841	5,099	6,835	49,196
2022	221	3,690	9,039	14,204	17,087	8,113	12,118	64,472
2023	138	2,269	5,516	7,777	7,809	3,477	5,988	32,974
2024	90	1,685	4,660	6,205	6,023	2,671	5,168	26,502
2025	62	1,492	4,617	6,216	6,527	2,975	6,260	28,149
2026	81	1,532	4,095	5,488	5,138	2,354	5,392	24,080

G. Appraised House Value

FHA research has found, and our empirical findings reinforce, that loans associated with properties with an appraised value at origination greater than their area median tend to be maintained better than those with appraised value below the area median. Exhibit III-7 shows the percentage of HECM loans with an appraised house value greater than the area median value.

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Exhibit III-7: Percentage of Borrowers with Appraised House Value Greater than Area Median Value



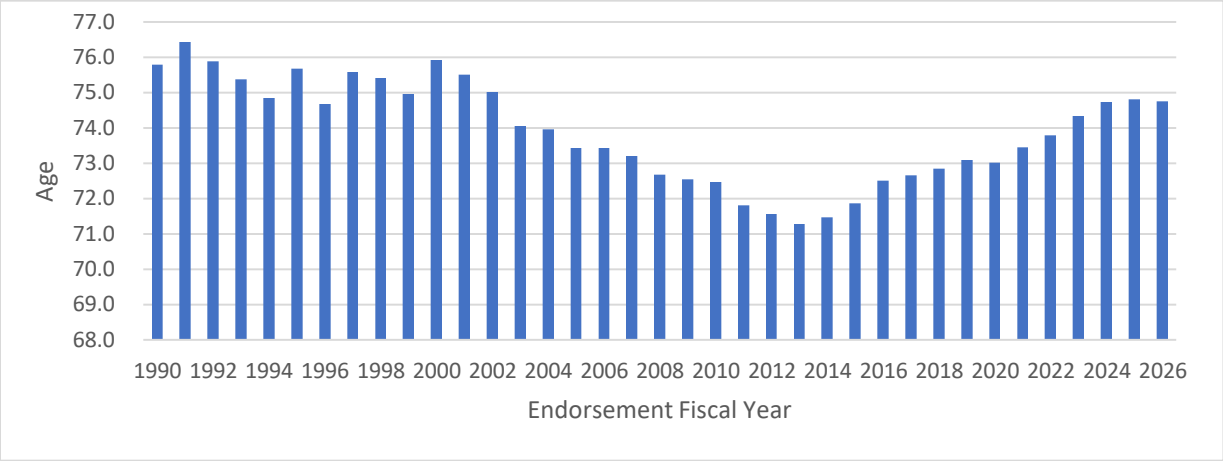
H. Borrower Age Distribution

The borrower age profile of each endorsement year affects loan termination rates and the principal limit (PL) available to borrowers. Exhibit III-8 presents the average borrower age at origination for Fiscal Years 1990 through 2026. Younger borrowers generally represent greater financial risk exposure to FHA due to their longer life expectancy and potentially longer loan duration. The Principal Limit Factors (PLFs) determine the percentage of the Maximum Claim Amount (MCA) available to borrowers based on the age of the youngest borrower or eligible non-borrowing spouse and the expected interest rate.

FHA implemented several revisions to the PLFs, including reductions introduced through Mortgagee Letters 2013-27 and 2017-12 and additional changes under Mortgagee Letter 2014-12, which incorporated the age of younger non-borrowing spouses in determining HECM principal limits and provided higher PLFs for certain older borrowers. The average borrower age continued to decline through FY 2013 but began increasing following the 2014 revisions and continued to rise after the 2017 PLF reduction. This upward trend suggests a possible relationship between the PLF reforms and changes in the age distribution of HECM borrowers, although other program reforms, including disbursement restrictions and Financial Assessment requirements, may also have contributed.

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Exhibit III-8: Average Borrower Age at Origination by Fiscal Year



I. Borrower Gender Distribution

Borrower gender and household composition affect HECM loan termination rates, largely due to differences in mortality experience. Single male borrowers generally have higher mortality rates and tend to terminate their loans faster than single female borrowers, while loans with multiple borrowers generally remain outstanding longer because termination due to mortality depends on the death of the last surviving borrower. Historical HECM termination experience is consistent with these differences (see Szymanoski et al., 2007). Exhibit III-9 shows the gender distribution of HECM endorsements, including those with missing gender information.

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Exhibit III-9: Distribution of FY 2009-FY 2026 HECM Endorsements by Gender

Endorsement Fiscal Year	Male	Female	Couple	Missing
2009	20.6%	40.7%	38.1%	0.6%
2010	20.6%	41.6%	36.3%	1.4%
2011	20.1%	40.0%	38.1%	1.8%
2012	20.3%	38.9%	38.6%	2.3%
2013	20.3%	37.3%	40.1%	2.3%
2014	19.6%	38.3%	40.1%	1.9%
2015	18.6%	37.2%	43.5%	0.6%
2016	18.8%	35.8%	45.0%	0.5%
2017	18.3%	36.1%	44.7%	1.0%
2018	18.1%	35.6%	43.9%	2.3%
2019	18.7%	37.1%	42.3%	1.9%
2020	17.7%	34.2%	43.4%	4.7%
2021	18.7%	35.0%	41.9%	4.5%
2022	17.9%	34.5%	43.3%	4.3%
2023	19.4%	38.6%	36.0%	6.1%
2024	20.4%	40.3%	34.2%	5.1%
2025	21.2%	40.2%	35.3%	3.3%
2026	21.7%	40.7%	35.0%	2.6%

J. Cash Draw Distribution

Cash drawdown is an important factor in understanding the risk of the HECM portfolio. Over the years, FHA has actively managed the competing objectives of maximizing borrower equity and MMI Fund solvency. FHA has sought to manage this risk through careful and deliberate adjustments to the principal limit factor (PLF) table, which is published by FHA. These PLFs dictate the amount of equity the borrower is allowed to consume based on the borrower's age and the interest rate environment.

Over the years, borrowers have become more savvy using HECM proceeds. We see on average all historic cohorts (2009-2022) have drawn approximately 80% or more of their initial principal limit. To identify future HECM cash draws, we have used historical experience, which includes scheduled and unscheduled borrower cash draws. Exhibit III-10 displays historical cash drawn by cohort as a percentage of initial principal limit to give a broad estimate of cash drawn. These numbers are not for presenting the equity available for future cash draws nor used in the model for loan performance or cash flow projection.

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Exhibit III-10: Total Cash Draw by Cohort for FY 2009-2026

MMI Cohort	Total Cash Draw (as a % of initial principal limit)
2009	90%
2010	92%
2011	93%
2012	93%
2013	94%
2014	89%
2015	87%
2016	84%
2017	83%
2018	81%
2019	79%
2020	81%
2021	84%
2022	85%
2023	77%
2024	74%
2025	70%
2026	59%

Data shows that loans which have drawn a higher percentage of the initial amount of equity available tend to have a higher likelihood of refinancing. Exhibit III-11 shows the distribution of the cash draw in the first month as a percentage of the initial PL by age group for HECM endorsements.

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Exhibit III-11: First-Month Borrower Cash Draw of FY 2009 - FY 2026 HECM Endorsements as a Percentage of the Initial Principal Limit

Endorsement Fiscal Year	Age Group	Number of Loans	Variable Rate Loans			Fixed Rate Loans	
			0-40%	40-60%	60%-100%	0-60%	60-100%
2009	<62	-	0.0%	0.0%	0.0%	0.0%	0.0%
	62-65	23,707	11.9%	9.9%	64.6%	0.2%	13.3%
	66-70	28,213	14.5%	10.7%	61.7%	0.1%	13.0%
	71-75	24,935	18.9%	11.4%	58.3%	0.0%	11.4%
	76-85	30,664	25.0%	11.9%	53.1%	0.4%	9.6%
	85+	6,902	37.1%	10.2%	45.2%	3.0%	4.5%
	Total	114,421	19.1%	11.0%	58.3%	0.4%	11.3%
2010	<62	-	0.0%	0.0%	0.0%	0.0%	0.0%
	62-65	17,647	7.3%	4.3%	8.1%	0.2%	80.1%
	66-70	18,819	9.2%	5.3%	9.6%	0.2%	75.7%
	71-75	16,651	13.5%	6.4%	10.8%	0.1%	69.2%
	76-85	20,625	20.2%	7.7%	13.1%	0.2%	58.8%
	85+	5,310	32.8%	8.8%	14.5%	5.0%	39.0%
	Total	79,052	14.2%	6.2%	10.8%	0.5%	68.4%
2011	<62	-	0.0%	0.0%	0.0%	0.0%	0.0%
	62-65	18,801	8.4%	5.0%	9.9%	0.3%	76.4%
	66-70	18,009	10.7%	5.9%	9.5%	0.2%	73.7%
	71-75	14,799	15.4%	6.5%	10.0%	0.1%	68.0%
	76-85	17,014	22.8%	8.0%	10.8%	0.1%	58.4%
	85+	4,486	36.9%	8.1%	10.7%	0.1%	44.3%
	Total	73,109	15.5%	6.4%	10.1%	0.2%	67.9%
2012	<62	-	0.0%	0.0%	0.0%	0.0%	0.0%
	62-65	15,267	8.5%	5.4%	10.4%	0.2%	75.5%
	66-70	13,488	10.9%	5.7%	9.3%	0.1%	74.0%
	71-75	10,529	14.4%	6.5%	9.4%	0.1%	69.7%
	76-85	12,136	20.9%	7.1%	9.9%	0.1%	61.9%
	85+	3,392	34.6%	7.7%	10.0%	0.2%	47.5%
	Total	54,812	14.6%	6.2%	9.8%	0.1%	69.3%
2013	<62	-	0.0%	0.0%	0.0%	0.0%	0.0%
	62-65	16,875	8.0%	5.8%	20.7%	0.2%	65.4%
	66-70	15,414	9.9%	5.8%	20.5%	0.2%	63.6%
	71-75	11,624	13.8%	6.3%	19.2%	0.2%	60.6%
	76-85	12,728	19.6%	7.0%	19.1%	0.2%	54.1%
	85+	3,282	32.3%	7.1%	15.9%	0.3%	44.4%
	Total	59,923	13.4%	6.2%	19.7%	0.2%	60.4%
2014	<62	1	0.0%	0.0%	100.0%	0.0%	0.0%

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Endorsement Fiscal Year	Age Group	Number of Loans	Variable Rate Loans			Fixed Rate Loans	
			0-40%	40-60%	60%-100%	0-60%	60-100%
	62-65	13,602	12.2%	26.5%	38.4%	1.8%	21.1%
	66-70	13,607	15.4%	24.7%	39.2%	1.7%	19.1%
	71-75	10,291	19.1%	25.4%	37.4%	1.7%	16.4%
	76-85	11,035	24.9%	26.0%	35.0%	1.9%	12.2%
	85+	3,080	37.5%	26.7%	26.5%	2.3%	7.1%
	Total	51,616	18.6%	25.7%	37.0%	1.8%	16.9%
2015	<62	2	0.0%	0.0%	100.0%	0.0%	0.0%
	62-65	14,215	12.8%	35.4%	33.0%	0.6%	18.2%
	66-70	14,772	14.9%	32.9%	33.7%	0.6%	17.8%
	71-75	12,053	18.4%	31.6%	33.9%	0.5%	15.6%
	76-85	13,376	24.0%	32.5%	31.8%	0.6%	11.0%
	85+	3,571	34.8%	33.7%	25.0%	1.0%	5.5%
	Total	57,989	18.4%	33.2%	32.6%	0.6%	15.1%
2016	<62	-	0.0%	0.0%	0.0%	0.0%	0.0%
	62-65	9,970	16.9%	34.9%	34.2%	0.8%	13.3%
	66-70	12,708	18.3%	31.4%	37.2%	0.5%	12.7%
	71-75	10,772	19.4%	31.1%	38.5%	0.2%	10.8%
	76-85	12,004	24.4%	31.8%	36.9%	0.4%	6.6%
	85+	3,414	35.6%	32.9%	28.2%	0.6%	2.7%
	Total	48,868	20.9%	32.2%	36.2%	0.5%	10.2%
2017	<62	1	0.0%	0.0%	100.0%	0.0%	0.0%
	62-65	10,663	18.1%	32.2%	36.1%	1.0%	12.6%
	66-70	14,524	17.1%	28.7%	41.6%	0.5%	12.2%
	71-75	12,495	19.3%	27.3%	42.7%	0.4%	10.3%
	76-85	13,804	22.2%	29.3%	41.4%	0.4%	6.7%
	85+	3,803	32.8%	32.2%	32.0%	0.3%	2.7%
	Total	55,290	20.2%	29.5%	40.0%	0.5%	9.8%
2018	<62	-	0.0%	0.0%	0.0%	0.0%	0.0%
	62-65	8,990	18.6%	32.1%	36.8%	0.7%	11.7%
	66-70	12,451	17.4%	28.1%	41.6%	0.5%	12.4%
	71-75	11,168	20.1%	27.6%	41.9%	0.3%	10.1%
	76-85	12,294	22.2%	30.2%	40.3%	0.4%	6.9%
	85+	3,426	33.3%	31.7%	31.6%	0.3%	3.0%
	Total	48,329	20.6%	29.5%	39.7%	0.5%	9.7%
2019	<62	-	0.0%	0.0%	0.0%	0.0%	0.0%
	62-65	5,470	17.7%	29.5%	45.4%	0.4%	6.9%
	66-70	7,912	17.6%	27.3%	48.2%	0.2%	6.7%
	71-75	7,267	20.0%	27.0%	46.3%	0.2%	6.5%

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Endorsement Fiscal Year	Age Group	Number of Loans	Variable Rate Loans			Fixed Rate Loans	
			0-40%	40-60%	60%-100%	0-60%	60-100%
	76-85	8,191	24.2%	30.4%	40.7%	0.3%	4.5%
	85+	2,432	33.9%	32.4%	31.0%	0.6%	2.1%
	Total	31,272	21.2%	28.8%	44.0%	0.3%	5.8%
2020	<62	-	0.0%	0.0%	0.0%	0.0%	0.0%
	62-65	6,850	15.9%	25.8%	56.3%	0.1%	2.0%
	66-70	10,614	13.9%	24.0%	59.6%	0.1%	2.5%
	71-75	10,376	14.9%	23.7%	59.6%	0.1%	1.7%
	76-85	11,209	18.5%	26.3%	53.6%	0.2%	1.4%
	85+	2,786	30.4%	30.2%	38.2%	0.4%	0.8%
	Total	41,835	16.8%	25.3%	56.0%	0.1%	1.8%
2021	<62	-	0.0%	0.0%	0.0%	0.0%	0.0%
	62-65	6,746	12.7%	26.2%	53.2%	0.4%	7.5%
	66-70	12,150	11.1%	20.7%	60.0%	0.3%	7.9%
	71-75	12,977	10.9%	18.8%	62.4%	0.3%	7.7%
	76-85	14,107	12.6%	19.6%	61.6%	0.3%	5.9%
	85+	3,216	23.2%	23.0%	50.3%	0.2%	3.4%
	Total	49,196	12.5%	20.8%	59.5%	0.3%	6.9%
2022	<62	-	0.0%	0.0%	0.0%	0.0%	0.0%
	62-65	7,815	13.6%	25.9%	55.3%	0.2%	5.0%
	66-70	15,553	11.5%	20.6%	63.0%	0.2%	4.7%
	71-75	17,226	11.1%	18.1%	66.0%	0.2%	4.7%
	76-85	19,656	11.3%	18.1%	66.9%	0.2%	3.4%
	85+	4,222	19.5%	19.0%	59.0%	0.4%	2.2%
	Total	64,472	12.1%	19.7%	63.8%	0.2%	4.2%
2023	<62	-	0.0%	0.0%	0.0%	0.0%	0.0%
	62-65	4,435	20.6%	33.7%	44.8%	0.1%	0.8%
	66-70	7,285	19.3%	30.7%	48.8%	0.2%	1.0%
	71-75	7,880	19.7%	30.4%	48.8%	0.2%	0.7%
	76-85	10,273	22.0%	28.3%	49.0%	0.2%	0.6%
	85+	3,101	30.9%	24.9%	43.4%	0.2%	0.5%
	Total	32,974	21.5%	29.7%	47.8%	0.2%	0.7%
2024	<62	-	0.0%	0.0%	0.0%	0.0%	0.0%
	62-65	3,293	21.3%	38.3%	40.4%	0.0%	0.1%
	66-70	5,640	19.3%	34.9%	45.6%	0.0%	0.1%
	71-75	6,061	21.6%	32.4%	45.8%	0.0%	0.1%
	76-85	8,851	22.0%	30.1%	47.7%	0.1%	0.1%
	85+	2,657	31.3%	30.1%	38.3%	0.2%	0.1%
	Total	26,502	22.2%	32.7%	45.0%	0.1%	0.1%

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Endorsement Fiscal Year	Age Group	Number of Loans	Variable Rate Loans			Fixed Rate Loans	
			0-40%	40-60%	60%-100%	0-60%	60-100%
2025	<62	-	0.0%	0.0%	0.0%	0.0%	0.0%
	62-65	3,359	20.9%	36.1%	42.9%	0.0%	0.1%
	66-70	5,894	20.2%	33.3%	46.4%	0.0%	0.2%
	71-75	6,542	19.8%	31.6%	48.4%	0.0%	0.1%
	76-85	9,557	21.4%	30.5%	47.9%	0.0%	0.1%
	85+	2,797	32.8%	27.8%	39.3%	0.0%	0.1%
	Total	28,149	21.9%	31.7%	46.2%	0.0%	0.1%
2026	<62	-	0.0%	0.0%	0.0%	0.0%	0.0%
	62-65	2,985	24.2%	37.1%	38.7%	0.0%	0.0%
	66-70	5,091	23.2%	33.6%	43.1%	0.0%	0.0%
	71-75	5,440	23.1%	33.8%	43.1%	0.0%	0.0%
	76-85	8,171	23.3%	31.3%	45.4%	0.0%	0.0%
	85+	2,393	33.3%	29.3%	37.4%	0.0%	0.0%
	Total	24,080	24.3%	32.8%	42.8%	0.0%	0.0%

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IV. HECM Performance under Alternative Scenarios and Sensitivity Testing

The HECMs' economic net worth for FY 2026 will depend on the economic conditions expected to prevail over the next 50 years and, most critically, during the next 10 years. The baseline scenario for the primary economic drivers was developed consistently with the President's Economic Assumptions (PEA) for the FY 2027 Mid-Session Review, published by the Office of Management and Budget (OMB) in compliance with the requirements of the Federal Credit Reform Act. The realized economic net worth will vary from the baseline estimate if the economic conditions deviate from the baseline projections.

We have captured the most significant factors in the U.S. economy that affect the performance of the HECM loans insured by the MMI Fund and use the following variables in our models:

- 1-year constant maturity Treasury rates
- 10-year constant maturity Treasury rates
- One-year SOFR
- National and local house price indices

The PEA forecast developed by OMB provided all the economic drivers in our model, including one-year SOFR. Alternative scenarios are generated by simulating stochastic variations around the PEA assumptions.

A. FHFA House Price Indices

House price appreciation increases borrowers' home equity, reducing both the likelihood of mortgage default and the loss severity when a claim occurs, and therefore is positively associated with Economic Net Worth. The actuarial central estimates are based on the PEA for the quarterly future performance of the FHFA Purchase Only (PO) seasonally adjusted HPI for the period FY 2027 FQ1 to FY 2036 FQ4 and 3% annualized HPA for years after FY 2036.

FHFA publishes both purchase-only (PO) and all-transactions (AT) versions of their HPIs. Some prior reviews have expressed the view that the HPI PO version is necessarily more accurate than the HPI AT version due to the reliance of the latter on appraisal valuations in addition to observed sale prices. We use the national FHFA Purchase Only (PO) seasonally adjusted HPI and have applied the AT version of the FHFA HPIs in model estimation for deriving local and state HPI, due to the significantly broader regional coverage provided by the AT version of the HPI, including more than 300 additional Metropolitan Statistical Area (MSA) level HPIs.

Calhoun (1991) first noted the benefits of incorporating appraisal-based data into HPIs, particularly during periods of limited sales activity or in areas with few transactions. Relying solely on sales transactions may introduce sample-selection bias because properties that are sold may not

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be representative of the overall housing market. Homeowners may be willing to refinance at appraised values below their reservation prices for selling, potentially causing sales-based HPIs to disproportionately reflect properties with higher valuations or price appreciation. In our view, geographic aggregation bias far outweighs concerns about appraisal bias, particularly given the overall consistency between AT and PO versions of the HPI at the same level of geography. Subsequent research by Calhoun, Dreiman, and Vandergoot (1999) and Leventis (2006) suggests that evidence of systematic appraisal bias is mixed or inconclusive. In contrast, substituting state-level purchase-only HPIs for unavailable MSA-level indices may introduce geographic aggregation bias by failing to capture local housing market conditions. Therefore, we favor the all-transactions HPI for its broader geographic coverage at the MSA level, despite the potential for appraisal-related bias.

Nevertheless, we were required to use the PEA for the national FHFA PO HPI in developing our baseline forecast of portfolio economic net worth. To meet this requirement, we applied the following two-step procedure to obtain regional (MSA/State) HPI forecasts from the PEA national forecasts: (1) compute the period-by-period (FYFQ) differentials between the FHFA AT national forecast HPI appreciation rates and the corresponding appreciation rates for each regional HPI from the same FHFA AT forecast; and then (2) apply these differential appreciation rates to the PEA national PO HPI forecast to obtain regional HPI forecasts consistent with the PEA national PO forecast. So as the PEA PO national forecast varies period-by-period, our regional HPIs (the newly created PEA MSA/State PO forecast) vary in a consistent manner and enable us to retain the broader geographic coverage of the AT version of the FHFA HPIs (over 300 individual MSAs).

To be clear, we are not applying Moody's FHFA forecasts in place of the mandated PEA national HPI PO forecast. The local forecasts reflect the PEA national HPA forecast adjusted by regional differentials derived from Moody's baseline forecasts of regional and national HPA rates, thereby preserving projected geographic variations in house price appreciation. Moody's AT and PO version national forecasts are quite consistent in terms of projected appreciation rates at both the national and regional levels, and Moody's baseline national forecasts are quite similar to the PEA. As described in Appendix E, alternative scenarios for sensitivity analysis based on our stochastic simulation models use a similar approach to go from the simulated national PO version HPI forecasts to the corresponding simulated regional forecasts. The same procedure for developing regional forecasts from PEA national HPI forecasts was applied for both Single Family and HECM Fund performance.

B. Secured Overnight Financing Rate (SOFR)

Mortgage interest rates govern the growth of a HECM loan's unpaid balance, thereby influencing the duration of FHA insurance, future premium collections, and ultimately Economic Net Worth. Mortgagee Letter (ML) 2023-09 required that the Secured Overnight Financing Rate (SOFR) replace LIBOR for both new and existing adjustable-rate HECM loans indexed to LIBOR to phase out LIBOR.

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The Alternative Reference Rates Committee (ARRC) noted that regardless of what rate was chosen as a LIBOR alternative, there would need to be an adjustment for the difference between LIBOR and the fallback rate. Market participants preferred the 'historical mean/median approach,' which is based on the 5-year historical median difference between USD LIBOR and SOFR for the spread adjustment. Exhibit IV-1 shows historical recommended long-term spread adjustments used to facilitate the conversion of LIBOR-indexed loans, based on historical 5-year median spreads between USD LIBOR and compounded averages of SOFR:

Exhibit IV-1: Historical Median Difference between USD LIBOR and SOFR

LIBOR tenor being replaced	Spread applied to SOFR based rate (bps)
1-week USD LIBOR	3.839
1-month USD LIBOR	11.448
2-month USD LIBOR	18.456
3-month USD LIBOR	26.161
6-month USD LIBOR	42.826
1-year USD LIBOR	71.513

Source: Bloomberg, as reproduced by ARRC[10]

The ARRC's initial consultation demonstrated that a static spread adjustment based on the five-year historical median difference between USD LIBOR and SOFR could produce results as accurate as, or more accurate than, a potentially dynamic spread adjustment. For a loan with five years remaining to maturity, the static-spread approach produced a mean absolute error of 0.08 percentage points, compared with 0.11 percentage points under the dynamic-spread approach. Based on this evidence, this review applies a fixed spread adjustment to one-year SOFR in developing a rate intended to approximate one-year LIBOR. We assume one-year SOFR plus a fixed 71.513 bps spread adjustment, to be consistent with the ARRC-recommended fallback spread for one-year USD LIBOR. This fixed spread is applied to all loans with a LIBOR index. ITDC adopted this single fixed spread as a simplification because the effect on portfolio NPV is expected to be marginal. HUD notes that ML 2023-09 specifies spread-adjusted replacement rates by adjustment frequency (monthly and annual); ITDC will review the mapping by adjustment frequency in the next review cycle.

At the same time, the residual impact of LIBOR transition is expected to decrease as legacy LIBOR-indexed loans continue to terminate and are replaced by SOFR-indexed originations. Benchmark transition risk is no longer considered a material source of model vulnerability. Uncertainties in SOFR projections are incorporated by alternative stochastic scenarios of future SOFRs that are simulated using the best-fitted GARCH models calibrated to the historical data.

[10] Alternative Reference Rates Committee (ARRC). 2021. *Summary of the ARRC's Fallback Recommendations*. Federal Reserve Bank of New York, October 6, 2021. https://www.newyorkfed.org/medialibrary/Microsites/arrc/files/2021/spread-adjustments-narrative-oct-6-2021, retrieved on September 1, 2026

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C. Stochastic Scenarios

Our additional source of historical data on economic factors is Moody's Economy.com. Moody's has developed data from original sources, including the Federal Reserve, Bureau of Labor Statistics, Bureau of the Census, Bureau of Economic Analysis, Federal Housing Finance Agency, The Conference Board, Dow Jones, National Association of Realtors, and Freddie Mac. Depending on the data series, information is provided at the national, state, county, metropolitan area, and ZIP code level. Moody's data are combined with historical loan-level data from HUD's Single-Family Data Warehouse (SFDW) to build out loan-level panel data and event histories (defaults, cures, claims, prepayments) for use in estimating statistical models of loan performance. The estimated loan performance models are then combined with the forecasts of economic drivers based on the PEA to produce our baseline forecast.

Interest rate and house price appreciation (HPA) paths affect HECM performance through multiple components of the projection model. Each combination of interest rate and HPA paths must be incorporated into both the loan termination and cash flow models, as changes in these economic assumptions affect termination rates, UPB growth, the timing of loan balance crossing over the property value, and recoveries upon termination. Consequently, evaluating the HECM NPV under each stochastic scenario requires a complete projection of termination and cashflow models, making a full simulation across all generated economic scenarios computationally impractical.

To balance computational feasibility with the need to assess economic uncertainty, four representative alternative scenarios are selected using different combinations of percentile paths for interest rates and HPA. Four scenarios for which we report estimates of economic net worth are:

- Optimistic Upside Scenario in Simulation: the path that is most favorable of the five selected paths to the Single-Family (SF) HECM MMI Fund.
- Moderate Upside Scenario in Simulation: the path that is moderately favorable to the SF HECM MMI Fund.
- Moderate Downside Scenario in Simulation: the path that is moderately unfavorable to the SF HECM MMI Fund.
- Pessimistic Downside Scenario in Simulation: the path that is most unfavorable of the five selected paths to the SF HECM MMI Fund.

Each simulated scenario is constructed using combinations of selected percentile paths for the economic drivers, representing relatively favorable or unfavorable economic conditions for the HECM portfolio. The two upside scenarios combine lower interest rates with higher house price appreciation (HPA), while the two downside scenarios combine higher interest rates with lower HPA. Lower interest rates and rising house prices are generally favorable because they reduce UPB growth and lower crossover risk, which occurs when the outstanding loan balance exceeds

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the value of the underlying property. Conversely, higher interest rates and declining house prices generally increase UPB growth and crossover risk, potentially resulting in higher claim costs to FHA.

The combinations of selected percentile paths comprising each of the alternative scenarios described above are summarized here:

Scenario 1 – Optimistic Upside Scenario

CMT 1-Year Rate:	10th percentile path
CMT 10-Year Rate:	10th percentile path
SOFR:	10th percentile path
HPA Rate:	90th percentile path

Scenario 2 – Moderate Upside Scenario

CMT 1-Year Rate:	25th percentile path
CMT 10-Year Rate:	25th percentile path
SOFR:	25th percentile path
HPA Rate:	75th percentile path

Scenario 3 – Moderate Downside Scenario

CMT 1-Year Rate:	75th percentile path
CMT 10-Year Rate:	75th percentile path
SOFR:	75th percentile path
HPA Rate:	25th percentile path

Scenario 4 – Pessimistic Downside Scenario

CMT 1-Year Rate:	90th percentile path
CMT 10-Year Rate:	90th percentile path
SOFR:	90th percentile path
HPA Rate:	10th percentile path

D. NPV Values

The estimated Actuarial Central Estimate (ACE) NPV of the Fund as of the end of FY 2026 is positive $6.307 billion. These projections constitute the baseline against which the projections from the alternative scenarios are compared. The Fund's NPV for FY 2026 under the alternative

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scenarios are presented in Exhibit IV-2. Each alternative scenario is based on a single specified path of HPA, 10-year CMT rate, 1-year CMT rate, and one-year SOFR.

Exhibit IV-2: NPV of HECM under Different Economic Scenarios ($ Million)

Scenarios*	Fiscal Year 2026
Baseline PEA	$6,307
Alternative 1 – Optimistic Upside	$9,127
Alternative 2 – Moderate Upside	$8,366
Alternative 3 – Moderate Downside	$2,903
Alternative 4 – Pessimistic Downside	($3,472)

**Detailed description of these scenarios is in Appendix E.*

The range of NPV based on the alternative economic scenarios is negative $3.472 billion to positive $9.127 billion. The NPV from the moderate downside is $2.903 billion and the moderate upside is $8.366 billion. The Baseline NPV stays between these two numbers from moderate upside and downside scenarios.

The Cash Flow NPV estimate provided by FHA for use in the FHA Annual Report to Congress is $1.355 billion, compared with $6.334 billion in FY 2025, representing a decrease of approximately $4.979 billion, or 78.6%. ITDC's review indicates that a significant portion of this decline is attributable to the correction of FHA's prior data preparation approach, which excluded note sales from conveyances and payoffs in its property disposition model. The correction of this error reduces the projected proportion of loans terminating through payoff, thereby contributing to the lower NPV estimate.

Although FHA's FY 2026 estimate falls outside the range defined by ITDC's moderate upside and downside scenarios, it remains within the broader range of ITDC's stochastic projections. Furthermore, FHA's estimate reflects higher projected costs than ITDC's independent estimate, representing a more conservative assessment of the Fund's future financial performance and not indicating any additional risk to the Fund's solvency. Based on its review of the underlying model changes, their financial impacts, and the range of projected outcomes, ITDC considers FHA's FY 2026 Cash Flow NPV estimate reasonable. This assessment reflects a high-level reasonableness review of FHA's revised assumptions and their estimated financial impacts; it is not a full independent replication or a cash-flow-level reconciliation of the two valuations. Exhibit IV-3 presents the breakdown of the estimated NPV by endorsement cohort under the baseline and each alternative scenario.

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Exhibit IV-3: Breakdown of Estimated NPV by Cohort Year for Each Scenario

	Net Present Value of Future Cash Flows ($ Million)				
Endorsement Fiscal Year	Baseline	Alternative 1 - Optimistic Upside	Alternative 2 - Moderate Upside	Alternative 3 - Moderate Downside	Alternative 4 - Pessimistic Downside
2009	$186	$210	$200	$177	$147
2010	$161	$199	$183	$149	$118
2011	$137	$165	$155	$128	$101
2012	$129	$161	$148	$117	$92
2013	$130	$167	$152	$116	$84
2014	$165	$168	$175	$160	$117
2015	$307	$343	$323	$281	$209
2016	$470	$547	$492	$421	$322
2017	$667	$875	$753	$553	$362
2018	$487	$650	$537	$368	$140
2019	$352	$373	$332	$273	$92
2020	$1,096	$1,573	$1,308	$782	$270
2021	$1,081	$1,575	$1,484	$516	($414)
2022	$205	$1,238	$1,159	($943)	($2,755)
2023	$304	$362	$427	($63)	($780)
2024	$97	$155	$158	($104)	($551)
2025	$121	$177	$177	($84)	($586)
2026	$212	$190	$206	$57	($440)
Total	**$6,307**	**$9,127**	**$8,366**	**$2,903**	**($3,472)**

**Fiscal Year NPVs might not sum to the Total NPV due to rounding*

Note that the relationship between economic conditions and HECM NPV is complex and not necessarily monotonic. Interest rates and house price appreciation affect loan performance through multiple, sometimes offsetting, mechanisms. For example, lower interest rates may reduce UPB growth and improve property value coverage, thereby lowering potential claim costs. However, they may also reduce mortgage insurance premium income and increase refinancing and early termination rates, affecting future cash flows and claim costs. Similarly, higher HPA generally improves property recoveries but may also influence borrower termination behavior. As a result, the moderate upside scenario could produce a higher NPV than the optimistic upside scenario, despite having less favorable economic assumptions.

This scenario-based approach provides a reasonable assessment of HECM NPV sensitivity under selected economic conditions while substantially reducing computational requirements. Nevertheless, we acknowledge that the four scenarios do not capture the full range of possible economic outcomes or the joint distribution of interest rates and house price appreciation. Furthermore, the selected economic percentile paths do not necessarily correspond to the same percentiles of the resulting HECM NPV distribution. Therefore, the scenario results should be interpreted as illustrative range estimates rather than statistical confidence intervals or percentile estimates of HECM NPV.

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E. Sensitivity Tests for Economic Variables and Important Assumptions

The scenario test results revealed that HPI and Interest rates are important economic assumptions driving the NPV. Therefore, sensitivity tests are conducted to demonstrate the magnitude of the impact on the NPV of these two key assumptions: HPA and Interest rates. Exhibit IV-4 demonstrates sensitivity test results.

Each sensitivity test uses a 10% up/down assumption, meaning the baseline assumption vectors for interest rates and house price appreciation are increased and decreased by 10%. For example, if a given HPA is 5% for a specific period, the HPA 10% up scenario would have 5.50% and the HPA 10% down scenario would be 4.50% for the same period; the same process applies to interest rates.

Exhibit IV-4: NPV Change under Different Variable Changes ($ Million)

Description	Down 10%		Baseline	Up 10%	
FY 2026 HECM NPV (Baseline)			**$6,307**		
House Price Appreciation	$5,126	*-18.7%*		$7,428	*17.8%*
Interest Rates	$6,226	*-1.3%*		$6,339	*0.5%*
Cash Draw Down	$6,312	*0.1%*		$6,302	*-0.1%*
Claim Type 1	$6,364	*0.9%*		$6,245	*-1.0%*
Eligible but not Assigned	$6,453	*2.3%*		$6,158	*-2.4%*

A 10% increase in HPA rate leads to slightly lower expected CT1 claim cost and higher expected recoveries on projected assignments. The expected acquisition cost, annual premiums and note holding expenses all remained relatively consistent for this sensitivity test. As a result, a 10% increase raises NPV by 17.8% to $7.428 billion, while a 10% decrease in house price appreciation (HPA) reduces NPV by 18.7% to $5.126 billion. This significant sensitivity reflects the cumulative effect of changes in property values over the projection period, which directly affects recoveries and insurance losses.

A decrease in interest rates generally slows the growth of unpaid principal balances (UPB), resulting in lower premium collections. Lower interest rates may also increase refinancing activity and accelerate loan terminations. The combined effects reduce projected NPV. A 10% decrease in interest rates reduces NPV by 1.3% to $6.226 billion, while a 10% increase raises NPV by 0.5% to $6.339 billion.

Furthermore, HPA and interest rate assumptions are interrelated. Higher interest rates may suppress house price appreciation, and their combined effects could significantly influence projected NPV beyond the individual sensitivities presented.

A 10% decrease in cash drawdowns increases NPV by 0.1% to $6.312 billion, while a 10% increase reduces NPV by 0.1% to $6.302 billion, indicating relatively limited sensitivity to this assumption.

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A 10% decrease in Claim Type 1 activity increases NPV by 0.9% to $6.364 billion, while a 10% increase reduces NPV by 1.0% to $6.245 billion, reflecting the impact of claim frequency on projected insurance losses.

When more loans are eligible to assign but do not assign, the CT1 claim cost increases as more loans remain in IIF with greater expected CT1 loss. Net recoveries are decreased as more loans are not assigned while eligible, since the CT2 claim cost decreases with fewer assignments but recoveries also decrease. As a result, a 10% increase in the probability of being eligible but not assigned reduces NPV by 2.4% to $6.158 billion, while a 10% decrease increases NPV by 2.3% to $6.453 billion, reflecting the impact of assignment activity on projected cash flows and insurance costs.

Overall, the sensitivity analysis indicates that HECM NPV is most sensitive to changes in house price appreciation, followed by assignments. Interest rates and Claim Type 1 activity have relatively smaller direct impacts, while cash drawdowns have minimal impact under the tested scenarios. These results highlight the importance of future property values in determining HECM financial performance and the potential for interactions among economic assumptions to amplify changes in projected MMI Fund outcomes.

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V. List of Methodological Appendices

This section describes the analytical approach implemented in this Review. Detailed descriptions of the component models for HECMs are provided in Appendices A through G. The following briefly summarizes how we process the data and develop component models in appendices.

Data Reconciliation (Appendix A)

To reconcile the data processed in this review with FHA-provided data, ITDC compared key portfolio measures against FHA control totals. The reconciliation shows close agreement for active loans, assignments, and historical claim counts, with aggregate differences below 0.1%, and a 1.17% difference in IIF/UPB. Larger differences remain in certain cohort-level Claim Type 1 severity estimates, although aggregate severity differs by only 1 percentage point. Based on the reconciliation and model validation performed, ITDC does not expect these differences to materially impact the actuarial estimates or overall conclusions of this review. Detailed reconciliation results are presented in Appendix A.

HECM Base Termination Model (Appendix B)

No repayment of principal is required on a HECM loan when the loan is active. Termination of a HECM loan typically occurs due to death, relocation, or voluntary termination via refinance or payoff. The termination model estimates the probabilities of three mutually exclusive HECM termination events: mobility, refinance, and mortality. Multinomial logit regression modeling is adopted to capture the competing-risk structure of the different termination events. This is consistent with literature, HECM experience, and the FHA Single Family forward mortgage actuarial review.

Following Szymanoski, DiVenti, and Chow (2000) and Yuen-Reed and Szymanoski (2007), and previous years' Actuarial Review of HECM loans, a competing risk logistic regression or logit model approach is used to estimate the probability of HECM loan termination events. We test the significance of parameters to achieve a parsimonious model that provides goodness-of-fit.

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

The termination model adopts four main categories of explanatory variables:

- Fixed initial borrower characteristics: borrower age at origination and gender.

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

For each termination event, a separate logit model is estimated based on economic indicators and loan level historical HECM data. The three logit models are then aggregated to estimate the overall termination probabilities for the HECM program, following the Begg and Gray approach (see Begg and Gray, 1984), in which separate logistic regression models are fitted for each termination event relative to the reference group of loans that remain active. The estimated event-specific odds are then normalized to obtain mutually exclusive termination probabilities, with the probability of remaining active calculated so that all probabilities sum to 100%. The logit model for each termination event, the variables that impact the occurrence of that event, and aggregation method are presented in Appendix B.

Mortality Model (Appendix B)

The mortality model estimates the probability that a HECM loan terminates due to the death of the borrower. Social Security Administration mortality data obtained by FHA indicates the date of death of HECM borrowers. The most updated mortality data available for this Review are up to September 2026. Termination dates were matched against borrower death records using a window extending from one year before to two years after the recorded date of death. This matching window accommodates potential differences between the recorded dates of death and loan termination and is used to identify mortality-related terminations.

Cash Draw-Down Model

For estimating future borrowers' expected cash draws, the HECM model captures each borrower's initial cash draw-down (cash draws within the first month of endorsement) as a proxy for future cash draw patterns. Since cash draw patterns can vary due to an individual borrower's need and payment plan, the historical HECM cash draws in the past five years are used to summarize actual borrower draw patterns based on the first month cash draw. The first-month cash draw percentage is divided into 25 buckets with equal width (on an increment of 4%), and the draw patterns by policy year are summarized for each of the 25 buckets. The 25-bucket methodology represents how HECM borrowers are drawing the HECM proceeds over policy years. Borrowers who draw a large percentage of their principal limit in their first year tend to draw less in future years. On

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the other hand, borrowers who draw a small percentage of their principal limit in their first year tend to draw more in future years. When the current UPB reaches the current principal limit, a borrower who is not on a scheduled payment plan is no longer eligible to draw cash, and the cash drawdown equals zero (0).

The HECM program started to ramp up in 2004, so there is limited empirical data for borrower's cash draws and payment plan changes in out years. To estimate borrower's future cash draws, in addition to the cash draw table, we assume that any remaining drawable equity is drawn in policy year 20 and that no further draws occur thereafter. A sensitivity test on cash draw-down was performed to quantify how alternative draw patterns affect the NPV.

Loan Performance Projections (Appendix C)

The multinomial logit termination model is fitted to the historical data from all endorsed HECM loans from FY 1990 to FY 2026 books-of-business. The termination models were calibrated using historical loan-level data through June 30, 2026.

Parameters estimated using historical data up to June 30, 2026, are used for projected termination rates for active loans as of September 30, 2026. Loan-level historical experience obtained from FHA is used to align with key economic predictors of HECM terminations such as changes in house prices and interest rates. The PEA baseline estimates are used for the actuarial central estimate. The Federal Housing Finance Agency (FHFA) Metropolitan Statistical Area (MSA)-level house price appreciation rates and volatility parameters are used when available; otherwise, state-level FHFA data is used.

Using the estimated multinomial logit termination model, we forecast future termination rates for all the loans currently in force as of September 30, 2026, based on all characteristics of the surviving portfolio and the forecasted economic variables in the future. Actual data used in forecast is between the time of origination and the end of FY 2026, and forecasted data is from the beginning of FY 2027. For future house price appreciation, MSA level forecasts are used for house price appreciation with state level forecasts being used if the MSA level data is not available.

Tax-and-Insurance Default Model (Appendix C)

In the HECM NPV projection, non-cured tax-and-insurance (T&I) defaults represent an additional potential liability to FHA because corporate advances for unpaid property taxes and insurance premiums increase the loan's unpaid principal balance (UPB), potentially resulting in higher claim costs.

Unlike the three competing termination events, T&I default is not modeled as a separate termination event. Instead, once a loan terminates before assignment, it is classified into one of three mutually exclusive outcomes: T&I CT1 claim, non-T&I CT1 claim, or no-claim termination. Two separate models, T&I CT1 versus no-claim termination and non-T&I CT1 versus no-claim termination, are used to estimate the probabilities of these outcomes. These probabilities are then

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applied to the projected terminations before assignment, conditional on the loan surviving to the corresponding projection period. The probabilities of three exit modes (non-T&I CT1, T&I CT1, and non-claim termination) sum to 1. Separate claim severities are applied to T&I and non-T&I CT1 claims to estimate their respective costs, which are incorporated into the HECM NPV calculation.

HECM Cash Flow Analysis (Appendix D)

The cash flow model estimates the HECM economic net worth for the FY 2009 to FY 2026 books of business. It projects the net present value of future cash flows for these books-of-business in the FHA insurance portfolio. For existing books-of-business, it estimates cash flows for all surviving loans at the time of this review.

The HECM annual cash flow model consists of four components: premiums, claims, note holding expenses, and recoveries on projected notes in inventory. Cash flows are discounted using the cohort specific single effective rates (SERs) supplied by the FHA.

Stochastic Economic Scenarios (Appendix E)

The assumptions regarding future interest rates and house price growth rates are the fundamental economic factors that drive future termination rates and HECM loans. To forecast the economic net worth of the MMI HECM portfolio, we use the OMB economic assumptions released in April 2026 as the baseline economic scenario. To illustrate the sensitivity of forecasts to economic uncertainty and other forms of forecast error, stochastic simulations are conducted to provide the range of the projected economic net worth due to the variations in the economic assumptions.

Comparison of HUD and ITDC Models and Assessment of Vulnerabilities (Appendix F)

As part of the statutory actuarial review process, this report includes an incremental review of changes made by HUD to its HECM models since the prior year's actuarial review. The appendix provides supplemental documentation and analysis building upon the detailed review presented in Appendix F of the prior year's report and summarizes updates and modifications to the models implemented by HUD during the current review period to support continued transparency and completeness of the actuarial review.

Tables of Historical and Projected Loan Termination Rates (Appendix G)

Historical and projected Claim Type 1 and Claim Type 2 claim counts and rates, CT1 loss rates, and CT2 recovery rates by endorsement cohort and policy year, provided in a separate spreadsheet file.

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VI. Qualifications and Limitations

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

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

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

A. Fundamental Data Limitations

HECM has a relatively short program history. The pilot program began in 1989 and became permanent in 1998 after endorsing only 20,000 loans. Endorsements exceeded 10,000 loans per year in 2002 and reached 100,000 per year in 2007. Unlike the MMI Single Family forward mortgage program, only a limited number of HECM loans of long standing have remained in FHA's portfolio. The lack of long-run performance data potentially limits the robustness of the models' predictive capacity for later years. In addition to these inherent historical data limitations, ITDC relies on data furnished by FHA and FHA's representations regarding data quality and completeness. ITDC independently reconciles key data elements and evaluates known material data limitations for their potential effects on the models and actuarial NPV. Specific identified limitations, affected analyses, mitigation procedures, and any determinable directional impact on NPV are discussed in Appendix A and the applicable modeling appendices.

B. Model Sensitivity to Economic Projections

The financial estimates presented in this review require economic forecasts 50 years into the future. The economic forecasts, including house price appreciation and interest rate trends, are from the PEA. The extent to which the realized experience differs from these model assumptions will affect how close our current estimates will be to the realized results in the future. At the same time, the

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projected future cash flows are discounted at the cohort specific single effective rates (SERs), which are critical assumptions in computing the NPV of future cash flows.

Due to the long-term nature of HECM cash flows, the estimates of economic net worth are very sensitive to future economic projection assumptions. Unlike the MMI Single Family forward mortgages, whose claim and recovery cash flows typically occur within the first seven years following loan origination, the majority of HECM cash flows occur in later policy years. Hence, the present value of HECM cash flows is particularly sensitive to long-term assumptions. As the interest rate environment changes, the uncertainty in the future economic environment will have a dramatic impact on the future cash flows.

C. Changing Reverse Mortgage Market Landscape

Regulatory updates, evolving demographics, economic conditions, and consumer preferences, and uncertain interest rate and housing market conditions will contribute to the changing landscape of the HECM market. Changes in financial markets, retirement needs, and long-term care needs will affect borrowers' participation in the HECM program, how they use HECM loans, and the innovation in product design. This will affect the loan termination and performance of current loans.

On August 4, 2014, HUD adjusted the HECM program by allowing non-borrowing spouses younger than 62 years old. This adjustment was accompanied by reductions in the PLFs for this younger age group, while extending the eligibility of the HECM program to a larger clientele population. LESA, announced in 2015, introduced additional guidelines and assumptions for handling T&I defaults. In 2017, the MIP structure was simplified to have an annual MIP rate of 0.5 percent regardless of the amount of the mortgagor's initial draw at loan closing.

Lastly, under the statutory framework established by Congress, HUD has updated the national HECM loan limit annually since 2017, and the current loan limit has been raised to $1,249,125 in 2026. The continuation of the higher loan limit might attract current borrowers to refinance their current HECM to get access to home equity. As a result, the actual loan termination rates might be different from the estimate presented in this review.

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Appendix A. HECM Data Reconciliation

ITDC reconciles key portfolio measures, including active loans, IIF/UPB, assignments, and claims, to FHA-provided control totals as of September 30, 2026. The reconciliation shows close agreement for active loans, assignments, and historical claim counts, with aggregate differences below 0.1%, and a 1.17% difference in IIF/UPB. Historical claim counts are closely aligned, with a difference of only six claims out of 298,984 (less than 0.01%). Larger differences remain in certain cohort-level Claim Type 1 severity estimates, although aggregate severity differs by only 1 percentage point. These differences may reflect variations in data availability, reporting, and limited historical experience. Known data limitations include missing borrower information and limited experience for longer-duration HECM loans. Based on the reconciliation and model validation performed, ITDC has not identified evidence that these differences materially bias the FY 2026 actuarial central estimate, although remaining discrepancies warrant continued evaluation.

Exhibit A-1: Data Reconciliation for Number of Active Loans

Credit Subsidy Cohort	Federal Housing Administration	Data Reconciliation: Independent Actuary	Difference (Actuary - FHA)	Percent Difference (Actuary - FHA) / FHA
2009	27,748	27,772	24	0.09%
2010	21,866	21,917	51	0.23%
2011	22,244	22,262	18	0.08%
2012	17,779	17,798	19	0.11%
2013	20,471	20,475	4	0.02%
2014	14,732	14,735	3	0.02%
2015	17,636	17,637	1	0.01%
2016	16,001	16,006	5	0.03%
2017	20,083	20,084	1	0.00%
2018	16,866	16,866	0	0.00%
2019	10,818	10,818	0	0.00%
2020	18,548	18,550	2	0.01%
2021	29,799	29,800	1	0.00%
2022	50,252	50,252	0	0.00%
2023	25,222	25,222	0	0.00%
2024	21,369	21,369	0	0.00%
2025	25,192	25,192	0	0.00%
2026	23,647	23,647	0	0.00%
Total	400,273	400,402	129	0.03%

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Exhibit A-2: Data Reconciliation for Insurance-in-Force (based on UPB) ($ Million)

Credit Subsidy Cohort	Federal Housing Administration	Independent Actuary	Difference (Actuary - FHA)	Percent Difference (Actuary - FHA) / FHA
2009	$1,389	$1,390	$0	0.02%
2010	$890	$893	$3	0.32%
2011	$768	$769	$1	0.11%
2012	$623	$625	$2	0.39%
2013	$702	$702	$0	0.07%
2014	$831	$832	$0	0.04%
2015	$1,146	$1,143	($2)	-0.20%
2016	$1,246	$1,207	($40)	-3.17%
2017	$2,071	$2,003	($68)	-3.27%
2018	$2,893	$2,821	($72)	-2.48%
2019	$2,234	$2,185	($49)	-2.20%
2020	$4,746	$4,671	($75)	-1.57%
2021	$8,827	$8,731	($96)	-1.09%
2022	$16,175	$16,024	($151)	-0.94%
2023	$5,958	$5,872	($87)	-1.45%
2024	$4,343	$4,289	($54)	-1.24%
2025	$4,853	$4,810	($43)	-0.89%
2026	$3,726	$3,713	($13)	-0.35%
Total	$63,420	$62,678	($742)	-1.17%

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Exhibit A-3: Data Reconciliation for Number of Active Assignments

Credit Subsidy Cohort	Federal Housing Administration	Independent Actuary	Difference (Actuary - FHA)	Percent Difference (Actuary - FHA) / FHA
2009	23,794	23,815	21	0.09%
2010	19,594	19,627	33	0.17%
2011	19,912	19,927	15	0.08%
2012	15,895	15,904	9	0.06%
2013	18,081	18,083	2	0.01%
2014	11,161	11,162	1	0.01%
2015	12,674	12,675	1	0.01%
2016	10,755	10,755	0	0.00%
2017	11,526	11,526	0	0.00%
2018	3,796	3,796	0	0.00%
2019	32	32	0	0.00%
2020	87	87	0	0.00%
2021	116	116	0	0.00%
2022	77	77	0	0.00%
2023	2	2	0	0.00%
2024	-	-	0	0.00%
2025	-	-	0	0.00%
2026	-	-	0	0.00%
Total	147,502	147,584	82	0.06%

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Exhibit A-4: Data Reconciliation for Number of Claims to Date

Credit Subsidy Cohort	Federal Housing Administration	Independent Actuary	Difference (Actuary - FHA)	Percent Difference (Actuary - FHA) / FHA
2009	70,484	70,483	-1	0.0%
2010	51,217	51,218	1	0.0%
2011	44,414	44,412	-2	0.0%
2012	32,816	32,815	-1	0.0%
2013	33,827	33,827	0	0.0%
2014	16,395	16,391	-4	0.0%
2015	17,101	17,101	0	0.0%
2016	13,654	13,656	2	0.0%
2017	13,747	13,746	-1	0.0%
2018	4,549	4,550	1	0.0%
2019	105	105	0	0.0%
2020	150	149	-1	-0.7%
2021	224	224	0	0.0%
2022	245	245	0	0.0%
2023	43	43	0	0.0%
2024	13	13	0	0.0%
2025	-	-	-	-
2026	-	-	-	-
Total	298,984	298,978	-6	0.0%

Differences between FHA and the Independent Actuary's historical claim counts for individual cohorts are minimal and may reflect minor variations in data availability, reporting, and claim classification. At the aggregate portfolio level, the Independent Actuary reports 298,978 historical claims compared with FHA's 298,984, representing a difference of only six claims (less than 0.01%). The close alignment of historical claim counts, together with the consistency of the starting Insurance-in-Force (IIF), measured by both loan count and dollar amount, provides further support for the reconciliation of the underlying data. Accordingly, ITDC does not expect these minor differences to have a material impact on projected cash flows, NPV estimates, or overall actuarial conclusions.

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Exhibit A-5: Data Reconciliation for Historical Average Claim Type 1 Severity

Credit Subsidy Cohort	Federal Housing Administration	Independent Actuary	Difference (Actuary - FHA)	Percent Difference (Actuary - FHA) / FHA
2009	43%	45%	2%	6%
2010	44%	43%	-1%	-3%
2011	43%	40%	-2%	-6%
2012	42%	39%	-3%	-7%
2013	40%	39%	-1%	-2%
2014	35%	38%	3%	7%
2015	33%	36%	4%	11%
2016	30%	33%	3%	9%
2017	28%	32%	4%	13%
2018	24%	28%	4%	15%
2019	27%	37%	11%	40%
2020	17%	21%	4%	25%
2021	20%	25%	4%	20%
2022	16%	19%	4%	22%
2023	18%	24%	6%	34%
2024	12%	18%	5%	41%
2025	-	-	0%	0%
2026	-	-	0%	0%
Total	42%	43%	1%	3%

* *Numbers might not sum up exactly due to rounding*

Differences between FHA and the Independent Actuary's estimates for individual cohorts may be more pronounced due to limited historical data and variations in cohort-level experience. However, these differences are minimal at the aggregate portfolio level, with an overall difference of approximately 1 percentage point (3% relative), indicating broad consistency between the two estimates.

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Appendix B. HECM Base Termination Model

This appendix describes the base termination model used to estimate the historical and future performance of HECM loans. Each loan can terminate for one of three reasons: mobility, refinance, and mortality. A multinomial logit model was created for these competing risks. Each type of termination is modeled by a separate logit model. The probability of termination from each model was then aggregated to estimate the probability that a particular loan would terminate in any policy year.

The base termination model is estimated based on the recent 21 years of HECM termination and survivorship data, which includes HECM mortgages that were endorsed under the General Insurance (GI) Fund between Fiscal Years 1990 and 2008, and mortgages endorsed under the MMI Fund from Fiscal Year 2009 through June 30, 2026. The change from the GI Fund to MMI Fund has been a transparent process to the lenders and borrowers and we assume it has no impact on loan termination behavior.

B1. The Multinomial Logistic Model

Begg and Gray (1984) showed that it is statistically equivalent to model a multinomial logit regression model as an aggregation of individually estimated binomial logit regression models. Specifically, the parameters are first determined in individual binomial logit regression models for each risk. The models are then aggregated to estimate the total likelihood of termination. This methodology requires that all risk outcomes are compared to the reference outcome in separate logit models.

For HECM termination modeling, this means that mobility terminations, refinance terminations, and mortality terminations are compared to active loans to create three individual model specifications. These risks are then combined to create a single competing risk model. This approach allows us to effectively account for the censoring effect of one termination outcome on the other two potential outcomes. For example, when a loan was terminated due to a relocation, we can account for its censoring effect of the other two termination outcomes, which are refinance and death.

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

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

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

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

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The constant terms α_D, α_R, and α_M as well as the coefficient vectors β_D, β_R, and β_M are the unknown parameters that are estimated by the multinomial logit model. The subscripts "D", "R" and "M" denote mortality, refinance, and mobility, respectively. The vectors of independent variables for predicting the conditional probability of termination due to mortality, refinance, and mobility are represented by $X_D(t)$, $X_R(t)$and $X_M(t)$, respectively. There are several economic, loan, and borrower characteristics used in each vector to predict HECM terminations. Some of these components are held constant over the life of the loan while others may vary over time *(t)*.

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

B2. Death Termination Model

B2.1. Model Specification

The death termination model estimates the probability that a HECM loan terminates due to the death of the borrower. Social Security Administration mortality data obtained by FHA indicates the date of death of HECM borrowers and co-borrowers. We obtained the most updated mortality data up to September 2026 from the Social Security Administration provided by FHA to determine the date of death for HECM borrowers. Death dates were aligned with termination dates to determine which loans terminated due to death.

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

The *GenderSpecificMortality* variable is used as the base mortality. It is based on the Pri-2012 Life Table, the most recent available gender-specific private retirement plan mortality table published in 2019. The IRS, in a Federal Register publication, suggests the use of the Pri-2012 Life Table for defined benefit pension plans. HECM borrowers' mortality is lower than that of the general population, and a HECM loan is similar to a post-retirement benefit product.

The Pri-2012 mortality table has a base year of 2012, so we use the most recently released mortality improvement scales published by the Society of Actuaries to project it to CY 2019 to consider mortality improvement and longevity risk. At the same time, CDC provisional 2024 data analysis and peer-reviewed research, for example, Murphy et al. (2024), show that the U.S. age-adjusted death rate declined substantially from the 2021 peak but remains somewhat above the pre-pandemic baseline. We therefore apply mortality improvement scales up to CY 2019. This application follows Actuarial Standard of Practice (ASOP) No. 35. The overall mortality rates

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used in this Review are still lower than the Decennial Life Table 1999-2001 used in previous annual review reports.

GenderSpecificMortality based on the baseline mortality table is computed as the conditional mortality rate for single life and joint lives in the case of co-borrowers. Gender and age specific mortality rate in the reference mortality tables is used. In the case of a couple, the conditional gender and age specific mortality rate is computed as the deferred failure rate of last survivor status. Mathematically,

$$GenderSpecificMortality = \begin{cases} {}_{t|}q_x & , \quad for\ a\ single\ borrower, age\ x\ at\ origination \\ {}_{t|}q_{\overline{xy}} & , \quad for\ coupled\ borrowers, age\ x\ and\ y\ \ at\ origination' \end{cases}$$

where ${}_{t|}q_x = {}_{t+1}q_x - {}_tq_x = \frac{l_{x+t} - l_{x+t+1}}{l_x}$, and l_x is life index in the age specific life table constructed using the reference mortality table. ${}_{t|}q_{\overline{xy}} = {}_{t+1}q_{\overline{xy}} - {}_tq_{\overline{xy}}$, and ${}_tq_{\overline{xy}} = {}_tq_x\ {}_tq_y$ assuming coupled lives are independent of each other.

In FY 2026 Actuarial Review, we use logit transform of $GenderSpecificMortality$ as one of the independent variables in logit regression of mortality termination to be consistent with the regression model used for mortality, that is,

$$\boldsymbol{mortality_rate_specific = log\left(\frac{GenderSpecificMortality}{1 - GenderSpecificMortality}\right)}$$

This change improves the goodness-of-fit of the mortality model, especially in early policy years.

The last survivor mortality rate for a couple might be different from the mortality under independence assumptions for joint lives. The dummy variable *Gender_Couple* for couples is included to capture the unique characteristics for loans with more than one borrower.

After implementing the new formula for coupled borrowers, a dummy variable for whether the younger borrower or coborrower is male in previous Actuarial Review is removed after being tested for insignificance, and the age difference variable is also removed due to insignificance. The Gender_Couple dummy variable is intended to capture the possible discrepancy between the last survivor mortality rate and the mortality rate that we use as the base mortality rate for a couple.

The spline variables Pol_yr_di for i =1, 2,…, 5, are used to account for the effect of loan age on the mortality termination. HECM loans have been endorsed since FY 1990, but most of the loans were endorsed in the last 22 years. Due to the limited number of loan observations in late policy years, the estimation sample was restricted to observations up to policy year 21 to avoid overfitting of the model.

$$\text{Pol_yr_d1} = \begin{cases} Loan\ age, & if\ Loan\ age \le K_1 \\ K_1 & , \quad if\ Loan\ age > K_1 \end{cases}'$$

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$$\text{Pol_yr_d2} = \begin{cases} 0 & , \quad if\ Loan\ age\ \leq K_1 \\ Loan\ age\ - K_1 & , \quad if\ K_1 < Loan\ age\ \leq K_2, \\ K_2 - K_1 & , \quad if\ Loan\ age\ > K_2 \end{cases}$$

$$\text{Pol_yr_d3} = \begin{cases} 0 & , \quad if\ Loan\ age\ \leq K_2 \\ Loan\ age\ - K_2 & , \quad if\ K_2 < Loan\ age\ \leq K_3, \\ K_3 - K_2 & , \quad if\ Loan\ age\ > K_3 \end{cases}$$

$$\text{Pol_yr_d4} = \begin{cases} 0 & , \quad if\ Loan\ age\ \leq K_3 \\ Loan\ age\ - K_3 & , \quad if\ K_3 < Loan\ age\ \leq K_4, \\ K_4 - K_3 & , \quad if\ Loan\ age\ > K_4 \end{cases}$$

$$\text{Pol_yr_d5} = \begin{cases} 0 & , \quad if\ Loan\ age\ \leq K_4 \\ Loan\ age - K_4 & , \quad if\ Loan\ age\ > K_4 \end{cases},$$

where $K_1 = 2$, $K_2 = 4$, $K_3 = 11$, and $K_4 = 19$. These kinks are selected based on empirical mortality termination rates by loan age.

Historical HECM experience suggests that borrowers who experience heavier mortality than the baseline actuarial table seem to have a higher first month draw-down of their total eligible draw amount. We did empirical life test analysis of death termination by the variable first month cash draw-down. At the same time, we define spline variables *FM_cashdd_D i* for i =1, 2, 3, and 4, to capture borrowers' self-selection at different first month cash draw-down levels. The kinks for the spline function are chosen following the empirical data analysis. In this year's review, the model estimation results show the spline variables do not significantly perform better than the direct first month draw down value. Therefore, we use the first month cash draw-down variable instead of the spline variables defined in last year's review.

One dummy variable *TermLOC_Loan* is for the Term product to reflect additional self-selection effect. Another dummy variable is included to consider the impact of COVID-19 on mortality during the pandemic. 2020 and 2021 are identified as the pandemic period according to the sharp increase in mortality termination as shown in the termination finger tables.

B2.2. Model Estimation

Exhibit B-1 presents the estimated parameters of the binomial logit regression model for death termination and the model performance measures.

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Exhibit B-1: Death Termination Model Estimation

Analysis of Maximum Likelihood Estimates					
Description	**Parameter**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
	Intercept	-0.9244	0.00867	11359.327	<.0001
	Pol_yr_d2	0.2759	0.00359	5922.5746	<.0001
	Pol_yr_d3	-0.00716	0.001	50.9651	<.0001
	Pol_yr_d4	-0.0156	0.00123	159.8692	<.0001
	Pol_yr_d5	0.1942	0.0127	232.3452	<.0001
1st Month Cash Draw	**FM_pct_cashdd**	-0.3261	0.00605	2900.4073	<.0001
Mortality Rates	**mortality_rate_speci**	0.8228	0.00212	149939.246	<.0001
Term Product with Line of Credit	**TermLOC_Loan**	0.0825	0.00841	96.2156	<.0001
Coupled borrowers	**Gender_Couple**	-0.2747	0.00491	3127.7791	<.0001
COVID-19 Period	**Covid_Yr**	0.0565	0.00597	89.6233	<.0001

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	77.1	Somers' D	0.558
Percent Discordant	21.3	Gamma	0.567
Percent Tied	1.6	Tau-a	0.03
Pairs	2.94E+12	c	0.779

High concordance (77.1% well above 50%) suggests good discriminative ability. Somers' D = 0.558 indicates a moderately strong positive association between predictions and actual outcomes. Gamma = 0.567 confirms good predictive ordering. The c-statistic of 0.779 (AUC score) confirms the model has solid predictive power. All these criteria are slightly better than last year's scores, supporting the changes we made in this year's mortality model.

B3. Refinance Model

B3.1. Model Specification

The refinance logit regression model incorporates loan age, borrower-related variables, economic variables, and other variables that are tested to be significant.

B3.1.1. Loan Age Variables for the Refinance Model

Prior HECM experience shows that most refinances occur after the first few years of the loan. The variable $PolicyYear\ is\ represented\ by$ the following series of piece-wise linear spline functions for loan age.

$$Pol_{_yr1} = \begin{cases} Loan\ age, & if\ Loan\ age \leq K_1 \\ K_1\ , & if\ Loan\ age > K_1 \end{cases},$$

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$$Pol_yr2 = \begin{cases} 0 & , \quad if\ Loan\ age\ \leq K_1 \\ Loan\ age\ - K_1 & , \quad if\ K_1 < Loan\ age\ \leq K_2, \\ K_2 - K_1 & , \quad if\ Loan\ age\ > K_2 \end{cases}$$

$$Pol_yr3 = \begin{cases} 0 & , \quad if\ Loan\ age\ \leq K_2 \\ Loan\ age\ - K_2 & , \quad if\ K_2 < Loan\ age\ \leq K_3, \\ K_3 - K_2 & , \quad if\ Loan\ age\ > K_3 \end{cases}$$

$$Pol_yr4 = \begin{cases} 0 & , \quad if\ Loan\ age\ \leq K_3 \\ Loan\ age\ - K_3 & , \quad if\ K_3 < Loan\ age\ \leq K_4, \\ K_4 - K_3 & , \quad if\ Loan\ age\ > K_4 \end{cases}$$

$$Pol_yr5 = \begin{cases} 0 & , \quad if\ Loan\ age\ \leq K_4 \\ Loan\ age - K_4 & , \quad if\ Loan\ age\ > K_4 \end{cases},$$

where $K_1 = 4$, $K_2 = 8$, $K_3 = 13$, and $K_4 = 18$. These kinks match the empirical refinance termination curve along policy years.

Coefficient estimates for each variable are the slopes of the line segments between individual knot points. The overall generic *PolicyYear* function for the five *Pol_yr* segments is given by:

$$PolicyYear = \beta_1 \times Pol_yr1 + \beta_2 \times Pol_yr2 + \beta_3 \times Pol_yr3 + \beta_4 \times Pol_yr4 + \beta_5 \times Pol_yr5$$

B3.1.2. Borrower-Related Variables for the Refinance Model

The variables *OriginationAge* and Gender are the two borrower characteristics in the refinance model. *OriginationAge* is the borrower's age at endorsement and is held constant for the life of the loan, because historical experience suggests that older borrowers are less likely to refinance. *We use the following piece-wise linear spline functions for OriginationAge.*

$$Orig_Age_1 = min(\ OriginationAge, aK_1),$$

$$Orig_Age_2 = \begin{cases} 0 & , \quad if\ OriginationAge\ \leq aK_1 \\ OriginationAge\ - aK_1 & , \quad if\ aK_1 < OriginationAge\ \leq aK_2, \\ aK_2 - aK_1 & , \quad if\ \ OriginationAge\ > aK_2 \end{cases}$$

$$Orig_Age_3 = \begin{cases} 0 & , \quad if\ OriginationAge\ \leq aK_2 \\ OriginationAge\ - aK_2 & , \quad if\ aK_2\ < OriginationAge\ \leq aK_3\ , \\ aK_3 - aK_2 & , \quad if\ \ OriginationAge\ > aK_3 \end{cases}$$

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$$Orig_Age_4 = \begin{cases} 0 & , \quad if\ OriginationAge \le aK_3 \\ OriginationAge - aK_3 & , \quad if\ aK_3 < OriginationAge \le aK_4, \\ aK_4 - aK_3 & , \quad if\ OriginationAge > aK_4 \end{cases}$$

$$Orig_Age_5 = \begin{cases} 0 & , if\ OriginationAge \le aK_4 \\ OriginationAge - aK_4 & , if\ OriginationAge > aK_4, \end{cases}$$

where $aK_1 = 62$, $aK_2 = 64$, $aK_3 = 85$, and $aK_4 = 95$. The first $Orig_Age_1$ has a correlation coefficient close to 1 with the intercept, and the last spline variable $Orig_Age_5$ is not significant. Therefore, these two variables are removed from the regression.

Current loan to value CLTV also affects the refinance decision. The following spline functions are used.

$$CLTV_1 = \begin{cases} CLTV, & if\ CLTV \le 0.5 \\ 0.5 & , \quad if\ CLTV > 0.5 \end{cases},$$

$$CLTV_2 = \begin{cases} 0 & , \quad if\ CLTV \le 0.5 \\ CLTV - 0.5 & , \quad if\ 0.5 < CLTV \le 0.8, \\ 0.3 & , \quad if\ CLTV > 0.8 \end{cases}$$

$$CLTV_3 = \begin{cases} 0 & , \quad if\ CLTV \le 0.8 \\ CLTV - 0.8 & , \quad if\ CLTV > 0.8 \end{cases}$$

The likelihood of refinancing is also affected by the cash draw utilization of the borrower and type of loan. An analysis of the data suggests that the cash draw is a positive predictor of the likelihood of future refinances. One dummy variable *LOC_Loan* for the line of credit product is used to reflect additional self-selection effect. *Cdd_bucket* is an indicator variable for whether the first month cash draw-down is greater than 0.85. The estimated result indicates that borrowers with a high first month cash draw-down are more likely to refinance their HECM loan.

B3.1.3. Economic Variables for the Refinance Model

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

$$rft_t = \frac{\min(MCA_0 * \Delta H, LoanLimit_t) * PLF_t - C - PL_t}{C}$$

where MCA_0 = Original maximum claim amount for loan at time 0; $\Delta H = \frac{HPI_t}{HPI_O}$ where HPI is the FHFA house price index per MSA (or state if loans are outside of an MSA); $LoanLimit_t$= FHA

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loan limit for time t; PLF_t= New principal limit factor for the borrower's age and the current interest rate at time t; C = Transaction cost to originate the refinanced loan; PL_t= Gross principal limit on the original HECM loan at time t. Two spline variables are defined in the model based on rft_t.

$$RFT_1 = \min(rft_t, 0) \text{ and } RFT_2 = \max(rft_t, 0)$$

Change in 10-year CMT rate is identified to be a significant factor in refinance termination. $TenYr_chg$ measures the percentage of change in 10-year CMT rate, that is, $TenYr_chg_t = \frac{current\ 10\text{-}year\ CMT\ rate}{last\ year\ 10\text{-}year\ CMT\ rate} - 1$, and the corresponding two spline functions are defined as

$$TenYr_chg1 = min(TenYr_chg_t, 0) \text{ and } TenYr_{chg2} = max\left(TenYr_{chg_t}, 0\right).$$

B3.1.4. Other Variables for the Refinance Model

Three new variables introduced in the 2024 Actuarial Review to the termination model are kept: age difference between borrower and coborrower, a dummy variable for whether the younger borrower or coborrower is male, and a dummy variable for the COVID-19 pandemic period. The significance of these three variables is verified based on the AIC, BIC, and likelihood ratio test results.

B3.2. Model Estimation

Exhibit B-2 presents the estimated parameters of the binomial logit regression model for refinance termination and the model performance measures.

Exhibit B-2: Refinance Termination Model Estimation

Analysis of Maximum Likelihood Estimates					
Description	**Parameter**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
	Intercept	-5.4569	0.0179	92694.3527	<.0001
Policy Year	**Pol_yr_r1**	0.3982	0.00306	16909.4713	<.0001
	Pol_yr_r2	-0.3067	0.00245	15710.5536	<.0001
	Pol_yr_r3	-0.1115	0.00299	1391.8759	<.0001
	Pol_yr_r4	0.1934	0.00471	1686.8468	<.0001
	Pol_yr_r5	0.2266	0.0183	152.7703	<.0001
Origination age	**Orig_R_Age2**	0.0572	0.00495	133.3186	<.0001
	Orig_R_Age3	0.0158	0.000481	1080.9413	<.0001
	Orig_R_Age4	0.0147	0.00299	24.1182	<.0001
Borrower's gender	**Gender_Couple**	-0.2588	0.00888	848.671	<.0001
	Gender_Female	-0.0989	0.00707	195.6623	<.0001
Indicator of high first month cash drawdown percentage	**cdd_bucket**	0.4915	0.00602	6669.7879	<.0001
Line of Credit	**LOC_Loan**	0.0759	0.00837	82.1506	<.0001

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Analysis of Maximum Likelihood Estimates					
Description	**Parameter**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Current LTV	**CLTVR1**	1.3926	0.0256	2951.8345	<.0001
	CLTVR2	-7.4445	0.0411	32799.5947	<.0001
	CLTVR3	-3.764	0.1622	538.2358	<.0001
Refinance Incentive	**RFI_1**	0.0309	0.000715	1868.9052	<.0001
	RFI_2	0.2143	0.00185	13462.4379	<.0001
Change in 10-Year CMT Rate	**TenYr_chg1**	0.3633	0.0179	413.4661	<.0001
	TenYr_chg2	0.438	0.00702	3892.531	<.0001
COVID-19 Period	**Covid_Yr**	0.2816	0.00794	1256.839	<.0001
Age Difference	**FMAd**	0.00718	0.000908	62.4286	<.0001
Younger male borrower	**MYID**	0.0789	0.00756	108.9879	<.0001

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	76.7	**Somers' D**	0.561
Percent Discordant	20.6	**Gamma**	0.576
Percent Tied	2.7	**Tau-a**	0.019
Pairs	1.77E+12	**C**	0.78

High concordance (76.7% well above 50%) suggests good discrimination ability. Somers' D = 0.561 indicates a moderately strong positive association between predictions and actual outcomes. Gamma = 0.576 confirms good predictive ordering. The c-statistic of 0.78 (AUC score) confirms the model has solid predictive power.

B4. Mobility Model

B4.1. Model Specification

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

B4.1.1. Loan Age Variables for the Mobility Model

As before, the *PolicyYear* is a series of piece-wise linear functions for loan age, but with different knot points in this mobility model, to make the model better fit the data. For mobility models, k1=3, k2=11, and k3=16.

B4.1.2 Borrower-Related Variables for the Mobility Model

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

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The *Mortality* variable is used to capture the borrower's mobility based on age-related issues, including health reasons, moving to a nursing home or to an assisted-living facility, or to live with their children. *Mortality_rate_specific* is the same variable as in the mortality model, redefined as the logit function of gender specific mortality for a single borrower and coupled borrowers.

Using the new definition of *Mortality_rate_specific*, the *Gender* categorical variable is included to reflect the observation that couples and females are more likely to move-out than males.

In addition, after replacing gender specific mortality by the logit function of gender specific mortality, there is a strong correlation among the origination age variables and the transformed mortality. Therefore, in this year's mobility model, the *Orig_age* variables, which used to be a series of piece-wise linear functions for borrowers' age at origination, are removed from the model.

A loan-type dummy variable *Term_loan* is included. The pure Term loans seem to have mobility rates greater than for the Term loans with a LOC, which may indicate a self-selection effect for borrowers with different mobility preferences.

B4.1.3 Economic Variables for the Mobility Model

Historical experience suggests that faster house price appreciation increases the likelihood of relocation. Moreover, move-out is more likely when the one-year Treasury rate increases, which accelerates the rate of loan balance growth. Quarterly house price appreciation data is from Moody's Analytics (Moody) house price Index (HPI) at the MSA (or state if the loan is located outside of an MSA) level. *Marginal_HPI_Change* variable captures the change in the home value that motivates move-out.

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

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

Historical data on interest rates is obtained from Moody's. *OneYrCmt_bucket1* and *OneYrCmt_bucket3* are defined based on the change in one-year CMT rate.

$$OneYrCMT_Change = (curr_OneYrRate - last_OneYrRate)/last_OneYrRate*100$$

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OneYrCmt_bucket1 indicates if *OneYrCMT_Change* is less than -10 and *OneYrCmt_bucket3* indicates if *OneYrCMT_Change* is greater than 10.

After implementing the new mortality rates for coupled lives, the new variable FMAd, which is the age difference between borrower and coborrower, is kept based on its significance and collinearity with other variables.

B4.2. Model Estimation

Exhibit B-3 presents the estimated parameters of the binomial logit regression model for mobility termination and the model performance measures.

Exhibit B-3: Mobility Termination Model Estimation

Analysis of Maximum Likelihood Estimates					
Description	**Parameter**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
	Intercept	-4.0254	0.0163	61010.6647	<.0001
Policy Year	**Pol_yr_nr1**	0.6122	0.00456	18027.2778	<.0001
	Pol_yr_nr2	0.0126	0.000815	238.9968	<.0001
	Pol_yr_nr3	-0.0755	0.00171	1941.1274	<.0001
	Pol_yr_nr4	0.0902	0.00411	482.1232	<.0001
Term Loan	**Term_Loan**	0.195	0.0167	136.8061	<.0001
Borrower Gender	**Gender_Couple**	0.4221	0.00702	3620.0206	<.0001
	Gender_Female	0.0961	0.00525	335.5447	<.0001
1-Year HPI Change	**Marginal_HPI_Change**	1.8388	0.0283	4217.6813	<.0001
One Year CMT rate	**OneYrCmt_bucket1**	-0.0446	0.00636	49.0981	<.0001
	OneYrCmt_bucket3	0.2043	0.00615	1102.3246	<.0001
	mortality_rate_speci	0.3345	0.00177	35753.2757	<.0001
Current LTV	**CLTVNR1**	-0.5823	0.0194	899.9748	<.0001
	CLTVNR2	-1.9543	0.0185	11124.6352	<.0001
First Month Cash Draw Percentage	**FM_pct_cashdd**	0.296	0.00735	1621.1013	<.0001
Appraised Value to Area Median House Price at Origination	**hp_above_med**	0.0779	0.00359	471.5432	<.0001
Loans before 2004	**Pre2004_Loan**	0.7768	0.00622	15579.2853	<.0001
COVID-19 Period	**Covid_Yr**	0.2021	0.00622	1054.6129	<.0001
Age Difference	**FMAd**	-0.00557	0.000647	73.9173	<.0001
Younger male borrower	**MYID**	-0.0213	0.00533	15.9212	<.0001

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	67.5	**Somers' D**	0.376
Percent Discordant	30	**Gamma**	0.385
Percent Tied	2.5	**Tau-a**	0.024

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Analysis of Maximum Likelihood Estimates					
Description	**Parameter**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Pairs	3.53E+12	**c**	0.688		

The logistic regression model predicting mobility termination demonstrated fair discriminative ability, with 67.5% concordant pairs and a c-statistic (AUC) of 0.69. Somers' D (0.38) indicated a moderate positive association between predicted probabilities and observed outcomes. Overall, the predictive accuracy is moderate, which is reasonable given that the decision to permanently move out can be influenced by subjective, individual-specific factors that are difficult to capture in quantitative models.

B5. Model Validation

The data is randomly split into two sets: 80% of the data becomes the training data and 20% of the data is used as validation data. A uniform random variable between 0 and 1 is generated, and a case is put into the training dataset if a number less than 0.8 is generated and goes to the validation dataset otherwise. Model validation was accomplished by estimating the models using the training data set and applying the fitted model to the validation dataset.

Model validation is required to comply with Actuarial Standards of Practice 23 (Data Quality) and 56 (Modeling). ASOP 23 applies when an actuary is selecting, using, or relying on data provided by others, all of which are relevant to our review of MMI Fund performance. ASOP 56 provides guidance on designing, developing, selecting, modifying, and using models when performing actuarial services. We have employed models that are used for actuarial review of HECM since 2010. As such, the models we use are the culmination of a multi-year process of model design, development, and application that contributes meaningfully to the current validation process. Nevertheless, we are not simply relying on prior models and experience. We have undertaken an expansive and fresh look at data and model development to support the FY 2026 review.

The primary data source for our analysis is the FHA Single-Family Data Warehouse (SFDW). We consider that SFDW is compliant with ASOP 23 regarding the appropriateness, availability of current information, internal consistency of the data, and comprehensive coverage of current and past FHA mortgages. The data are well documented by the SFDW Meta Data workbook that ITDC requested from HUD to better understand the available data. The SFDW is an appropriate and sufficient source of FHA loan data.

ASOP 23 instructs us to consider known data limitations. Historically, data limitations specifically impacting HECM performance model development efforts include: (1) missing borrower gender; (2) not enough data for long-age loans; and (3) missing underwriting information on HECM refinance. We code missing gender as missing in the coding so that this issue must still be addressed in modeling. The second issue will have faded as concerns over time, and we use the loan's information up to 21 policy years to calibrate the model for this review.

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Decile charts are created for each termination model using the validation dataset. All records are sorted, or ranked, by the predicted conditional termination probabilities. Ten equal sized decile groups are created with 10% of the records in each group. The sum of the actual result and the sum of the predicted result within each decile is calculated for comparison. The validation charts for three competing termination modes are shown in Exhibits B-4 through B-6. Based on the validation result, we confirm that the model outputs reasonably mimic empirical termination modes shown in the data.

Exhibit B-4: Death Termination Model Validation – Decile chart

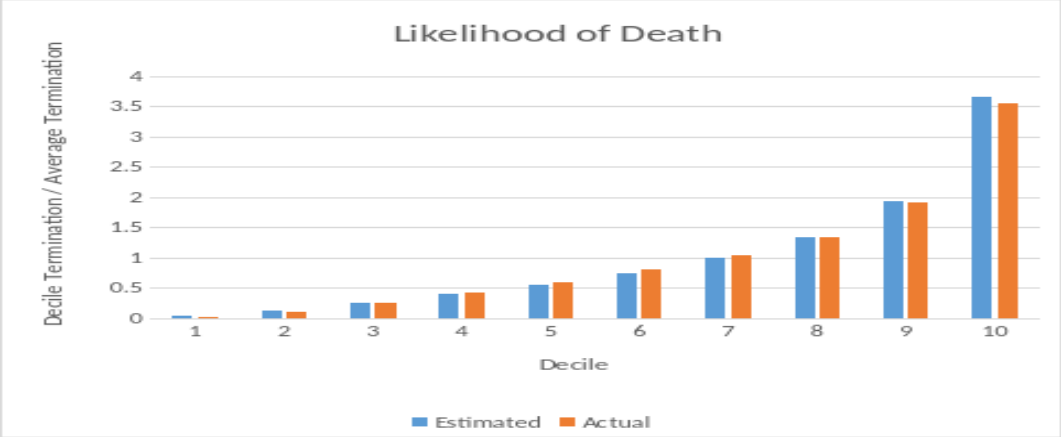
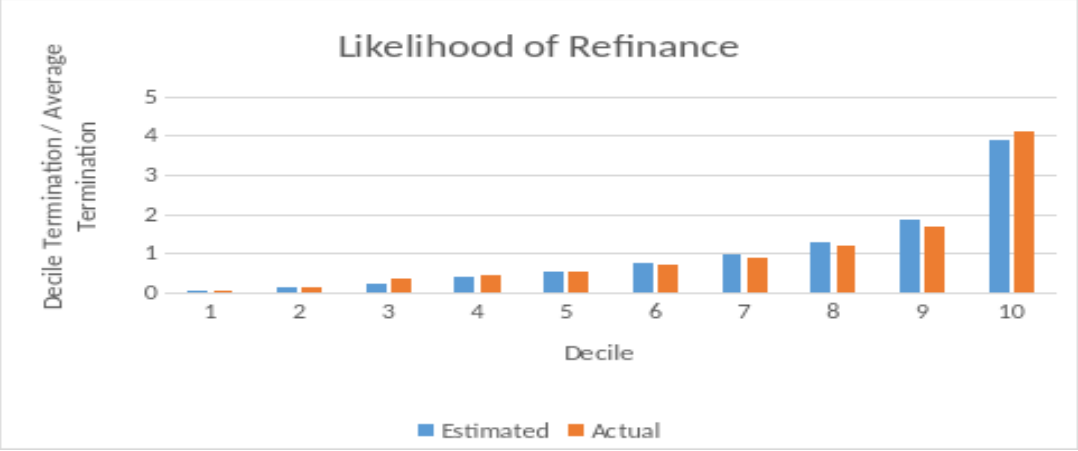
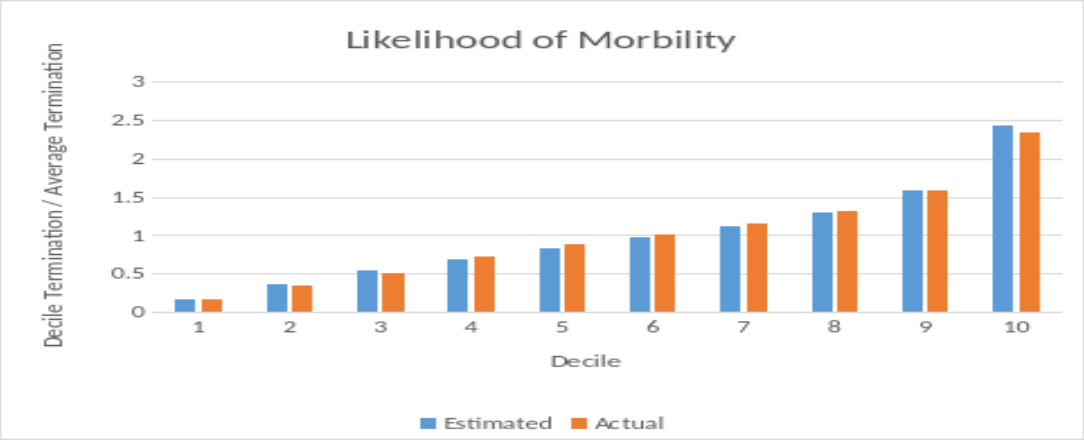


Exhibit B-5: Refinance Termination Model Validation – Decile chart



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Exhibit B-6: Mobility Termination Model Validation – Decile chart



The primary ASOP 56 requirement for model output validation is that the model output reasonably represents that which is being modeled. For termination model validation[11], the validation should include testing the model output against observed historical results and evaluating whether the model output applied to hold-out data is reasonably consistent with model output developed without using the hold-out data. ASOP 56 also raises the issue of potential model over-fitting, defined as a situation where the model fits the data used to develop the model so closely that prediction accuracy materially decreases when the model is applied to different data. For example, over-fitting may occur when an excessively flexible function form is applied to a relatively small number of data points, such that the model explains those data almost perfectly, while failing to conform to other data from the same process. The voluminous data available from the SFDW substantially reduces the risk of over-fitting, even for models with large numbers of explanatory variables, although sample size alone does not eliminate over-fitting, selection bias, source-system error or model misspecification.

We use the life table estimation to obtain empirical conditional termination rate (conditional on surviving to the beginning of the policy year) and use the obtained parameters for the logit model to estimate the historical termination rates for loans with policy years less than or equal to 15. We compare the empirical termination rate from the life table test with the estimated termination rates from the model. The models used in this review are the standard models used in HECM termination analysis. In-sample comparison verifies the goodness-of-fit.

Out-of-sample validation is performed to verify whether our termination models trained by the training dataset still produce comparable outputs based on the validation dataset, that is, whether the estimated loan termination functions can reasonably represent observed average loan transition frequencies in the validation dataset.

[11] Both termination model and severity model for property disposition are well established models. Methodology for property disposition is in Appendix D.

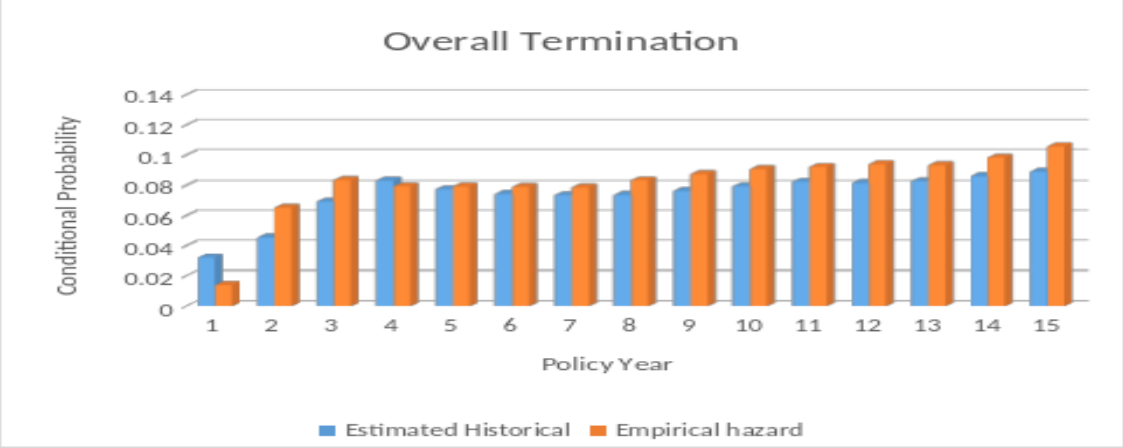
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We present the out-of-sample comparisons for each termination type and the overall termination probabilities in Exhibits B-7 through B-10. These comparisons appear reasonable, as the overall estimated termination rates align with the empirical rates. Notably, the logit regression model for mortality termination produces more conservative estimates compared with the actual mortality termination observed in the validation dataset.

This result is expected, as we included a COVID-19 period dummy variable to exclude short-term pandemic effects on mortality. For HECM loan performance, longevity risk is a concern, so adopting conservative assumptions about mortality is appropriate for liability valuation. The elevated mortality rates experienced during the pandemic should not be extrapolated into future projections.

Mobility termination is more vulnerable to borrowers' personal information and therefore more challenging to be fully explained by available variables. Our model performs very well in mobility projection. The overall model validation results confirm that termination probabilities are modeled as required by ASOP 56.

Exhibit B-7: Overall Termination Model Validation – Hazard Rate Comparison for Loans up to 15 Years



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Exhibit B-8: Death Termination Model Validation – Hazard Rate Comparison for Loans up to 15 Years

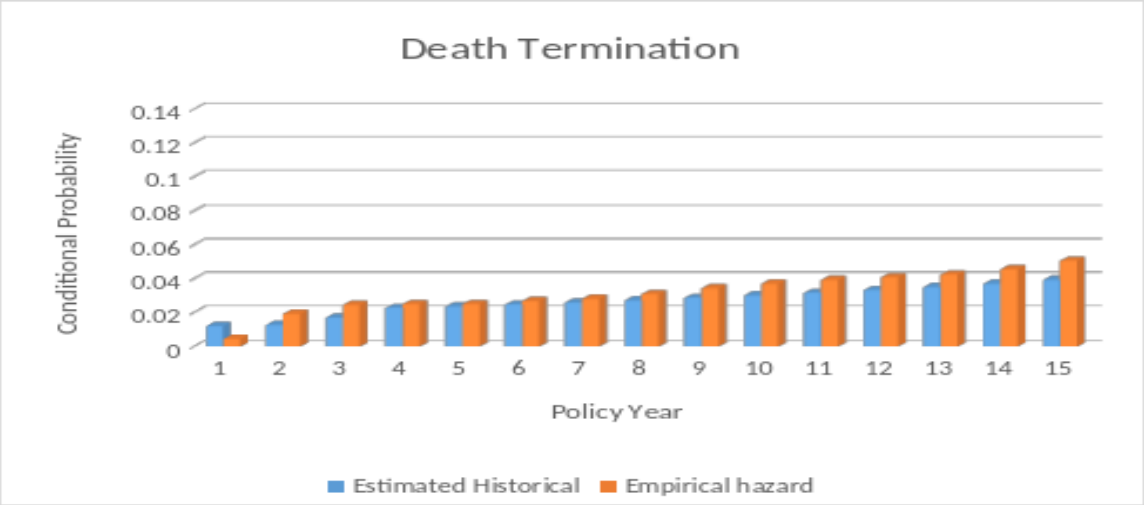
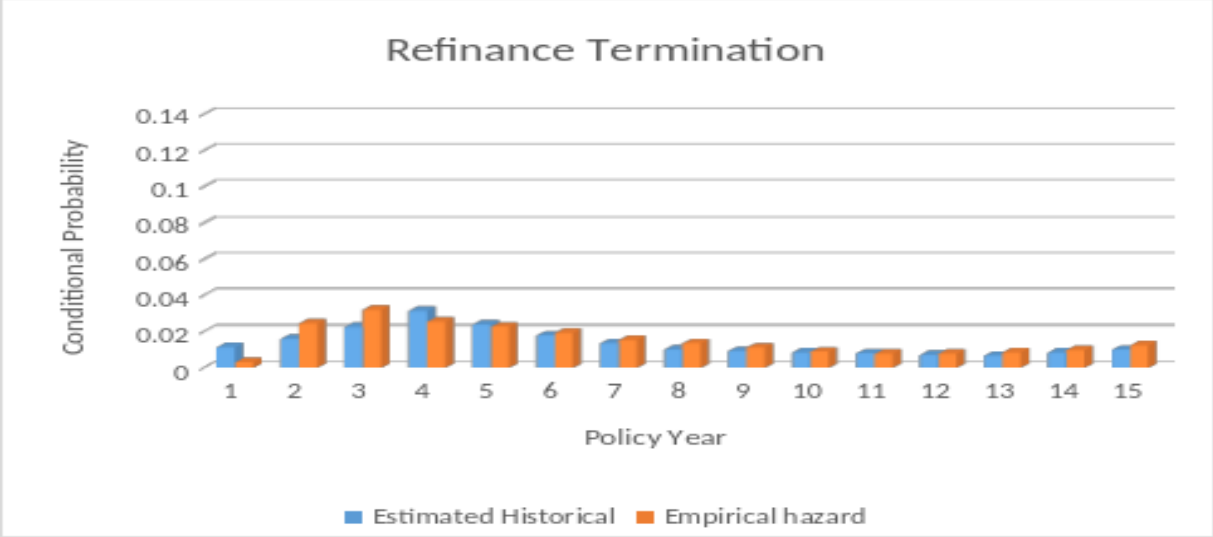
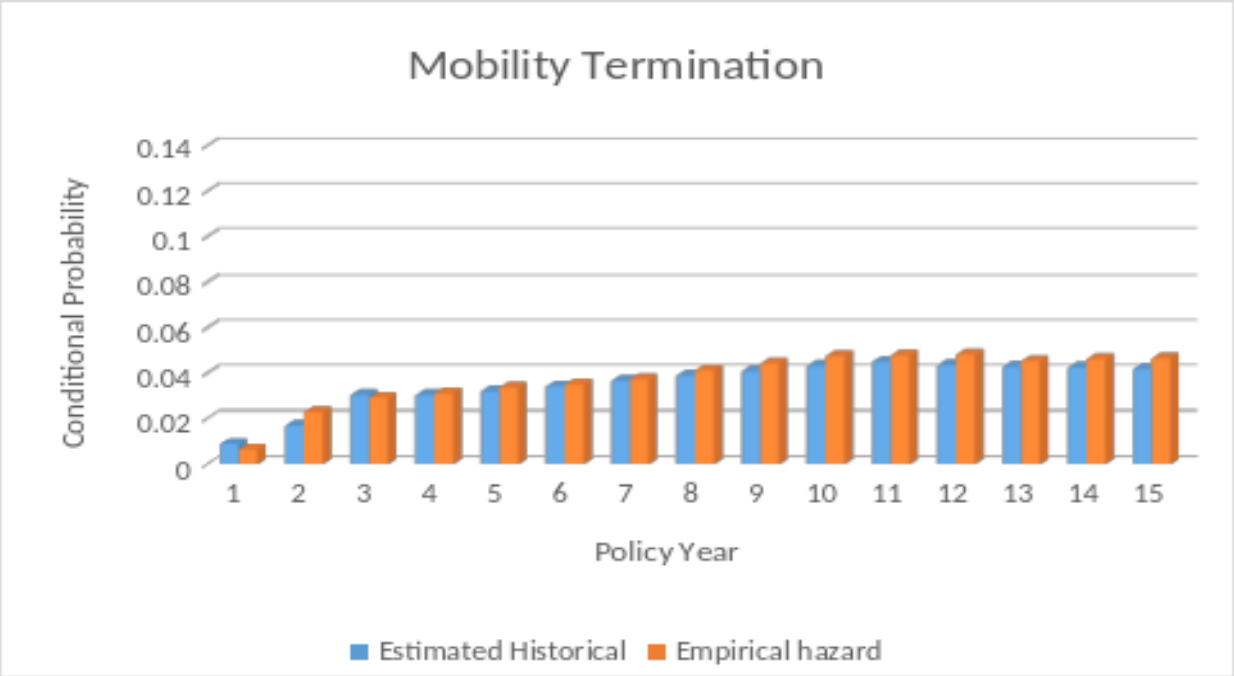


Exhibit B-9: Refinance Termination Model Validation – Hazard Rate Comparison for Loans up to 15 Years



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Exhibit B-10: Mobility Termination Model Validation – Hazard Rate Comparison for Loans up to 15 Years



B6. Combine the Three Risks

The joint termination hazard rate can be defined as

$$P(t) = P_D(t) + P_R(t) + P_M(t)$$

Where $P_j(t)$ for $j = D, R,$ or M is defined in Section B1.

Representing the combined hazard rate, Exhibit B-11 below shows the average conditional HECM termination rates projected by our simulation models by policy year (loan age) and the endorsement fiscal year. In Exhibit B-11, the shaded cells represent policy years that had already elapsed as of the end of FY 2026 (historically observed experience, provided in Appendix G); the unshaded cells are projected conditional termination rates.

Following these conditional termination rates in Exhibit B-11, the cumulative termination rates are close to 1 after Policy Year 35. There are limited number of surviving loans after 35 policy years. Conditional termination rates are extrapolated to high loan ages based on the parametric models. For demonstration purposes, 50 years of conditional termination rates are displayed as the projection horizon is 50 years. Exhibit B-11 displays the FY 2009 through FY 2026 cohorts; the FY 2025 and FY 2026 cohorts have little or no completed policy-year experience as of the valuation date.

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Exhibit B-11: HECM Termination Rates Conditional on Surviving to the Beginning of the Policy Year

Policy Year	Endorsement Fiscal Year																	
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
1																		
2																		5.3%
3																	8.3%	8.5%
4																10.3%	10.6%	10.7%
5															9.0%	9.7%	9.9%	10.1%
6														7.1%	8.7%	9.3%	9.5%	9.7%
7													7.5%	7.2%	8.5%	9.2%	9.3%	9.4%
8												8.0%	7.6%	7.3%	8.5%	9.1%	9.2%	9.3%
9											8.9%	8.2%	7.8%	7.6%	8.7%	9.2%	9.4%	9.5%
10										8.5%	9.3%	8.4%	8.0%	7.8%	8.9%	9.5%	9.6%	9.7%
11									8.3%	8.8%	9.5%	8.6%	8.3%	8.1%	9.1%	9.7%	9.9%	9.9%
12								8.3%	8.2%	8.7%	9.4%	8.4%	8.1%	8.1%	9.0%	9.6%	9.8%	9.8%
13							8.0%	8.2%	8.1%	8.6%	9.2%	8.2%	8.1%	8.1%	8.9%	9.5%	9.7%	9.8%
14						8.2%	8.1%	8.2%	8.1%	8.6%	9.2%	8.2%	8.2%	8.2%	9.0%	9.6%	9.8%	9.9%
15					7.8%	8.4%	8.2%	8.3%	8.1%	8.7%	9.3%	8.2%	8.3%	8.4%	9.1%	9.7%	10.0%	10.0%
16				8.2%	8.0%	8.5%	8.3%	8.3%	8.2%	8.8%	9.4%	8.3%	8.5%	8.6%	9.3%	9.9%	10.1%	10.2%
17			9.3%	8.9%	8.6%	9.1%	8.8%	8.8%	8.7%	9.3%	10.0%	8.9%	9.1%	9.2%	9.9%	10.6%	10.8%	10.9%
18		9.9%	10.0%	9.5%	9.2%	9.7%	9.3%	9.3%	9.3%	10.0%	10.6%	9.5%	9.8%	9.9%	10.6%	11.3%	11.6%	11.6%
19	11.4%	10.7%	10.8%	10.3%	9.9%	10.3%	9.9%	9.9%	9.9%	10.7%	11.3%	10.2%	10.6%	10.7%	11.3%	12.0%	12.4%	12.5%
20	13.5%	12.6%	12.7%	12.0%	11.6%	12.0%	11.6%	11.8%	11.8%	12.6%	13.3%	12.2%	12.7%	12.8%	13.5%	14.2%	14.6%	14.7%
21	15.8%	14.8%	14.8%	14.0%	13.6%	14.0%	13.6%	14.0%	14.1%	14.9%	15.7%	14.5%	15.1%	15.3%	15.9%	16.8%	17.2%	17.2%
22	18.4%	17.2%	17.1%	16.4%	16.0%	16.4%	16.0%	16.5%	16.8%	17.5%	18.3%	17.1%	17.8%	18.1%	18.7%	19.6%	20.0%	20.1%
23	21.3%	19.9%	19.8%	19.1%	18.8%	19.1%	18.8%	19.5%	19.8%	20.5%	21.3%	20.2%	21.0%	21.3%	21.9%	22.8%	23.3%	23.4%
24	24.4%	23.1%	22.9%	22.3%	22.0%	22.3%	22.1%	22.8%	23.2%	23.9%	24.7%	23.6%	24.5%	24.8%	25.4%	26.4%	26.8%	26.9%
25	28.0%	26.7%	26.5%	25.9%	25.7%	26.0%	25.7%	26.6%	26.9%	27.6%	28.5%	27.4%	28.4%	28.7%	29.3%	30.3%	30.7%	30.8%
26	31.9%	30.6%	30.5%	29.9%	29.9%	30.0%	29.7%	30.6%	31.0%	31.7%	32.6%	31.5%	32.6%	32.9%	33.4%	34.4%	34.9%	35.0%
27	36.1%	35.0%	34.9%	34.4%	34.4%	34.4%	34.0%	35.0%	35.4%	36.0%	36.9%	35.9%	37.0%	37.3%	37.8%	38.8%	39.2%	39.4%
28	40.5%	39.6%	39.6%	39.2%	39.2%	39.0%	38.6%	39.5%	40.0%	40.5%	41.5%	40.4%	41.6%	41.8%	42.5%	43.4%	43.8%	44.0%
29	45.0%	44.4%	44.5%	44.1%	44.1%	43.7%	43.3%	44.1%	44.6%	45.1%	46.2%	45.0%	46.2%	46.3%	47.1%	48.1%	48.3%	48.6%
30	49.3%	49.1%	49.3%	48.9%	49.0%	48.2%	47.9%	48.5%	49.1%	49.5%	50.8%	49.5%	50.6%	50.6%	51.8%	52.7%	52.9%	53.2%

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Policy Year	Endorsement Fiscal Year																	
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
31	53.0%	53.4%	53.7%	53.4%	53.4%	52.0%	52.2%	52.6%	53.3%	53.6%	55.2%	53.6%	54.8%	54.6%	56.3%	57.0%	57.2%	69.2%
32	55.8%	57.1%	57.4%	57.1%	57.0%	54.8%	55.9%	56.2%	56.9%	57.3%	59.1%	57.2%	58.5%	58.1%	60.5%	61.1%	71.9%	69.7%
33	57.3%	59.5%	59.9%	59.5%	59.2%	55.9%	58.8%	59.0%	59.8%	60.3%	62.4%	59.9%	61.6%	60.7%	64.2%	73.8%	71.2%	65.9%
34	57.4%	60.4%	60.6%	60.1%	59.4%	55.1%	60.7%	61.0%	61.9%	62.6%	64.9%	61.4%	63.9%	62.5%	75.0%	73.4%	68.7%	69.5%
35	56.6%	59.7%	59.4%	58.6%	57.8%	52.7%	61.4%	62.2%	63.1%	64.0%	66.5%	61.7%	65.5%	69.3%	74.0%	70.8%	71.5%	72.5%
36	56.1%	58.0%	56.9%	55.8%	55.2%	49.8%	61.1%	62.9%	63.6%	64.5%	66.9%	60.6%	72.3%	68.1%	72.5%	72.4%	72.6%	74.5%
37	56.5%	56.2%	54.2%	53.2%	53.3%	47.7%	60.4%	63.4%	63.9%	64.9%	66.5%	67.5%	67.6%	64.1%	74.5%	73.7%	73.7%	76.8%
38	57.9%	54.7%	52.4%	51.5%	52.8%	46.7%	60.3%	64.2%	64.5%	65.5%	85.9%	61.0%	66.6%	64.4%	75.9%	74.9%	74.2%	79.2%
39	60.0%	53.6%	51.9%	50.7%	53.5%	46.5%	61.4%	65.8%	65.6%	70.3%	74.7%	60.4%	67.9%	65.7%	77.2%	76.2%	74.8%	81.5%
40	62.3%	53.0%	52.9%	50.9%	55.2%	47.5%	64.0%	68.3%	72.0%	76.8%	74.7%	63.0%	69.9%	68.3%	78.2%	77.9%	76.1%	83.8%
41	64.9%	53.6%	55.4%	52.2%	57.8%	49.7%	67.8%	75.1%	70.3%	73.3%	76.4%	67.2%	72.6%	71.7%	79.1%	80.0%	78.5%	86.0%
42	67.7%	55.9%	59.1%	54.6%	61.3%	53.0%	77.4%	75.8%	73.0%	77.9%	79.0%	71.9%	75.9%	75.6%	80.2%	82.5%	81.5%	88.2%
43	70.7%	59.7%	63.5%	58.1%	65.3%	58.8%	75.7%	78.6%	76.4%	81.6%	82.2%	76.6%	79.4%	79.5%	81.9%	85.0%	84.7%	90.2%
44	74.1%	64.5%	68.4%	62.1%	85.0%	71.6%	79.7%	82.3%	80.1%	85.1%	85.4%	81.0%	82.7%	83.1%	84.2%	87.5%	87.7%	92.1%
45	77.6%	69.5%	73.2%	68.7%	74.4%	64.7%	83.5%	85.7%	83.6%	88.1%	88.4%	84.8%	85.8%	86.4%	86.8%	89.8%	90.3%	93.6%
46	81.2%	74.4%	92.6%	70.7%	77.4%	70.1%	86.7%	88.6%	86.8%	90.6%	90.9%	88.0%	88.6%	89.1%	89.3%	91.8%	92.5%	94.9%
47	84.6%	79.3%	83.0%	75.3%	81.2%	74.2%	89.4%	91.1%	89.6%	92.7%	93.0%	90.6%	90.9%	91.4%	91.5%	93.5%	94.2%	96.0%
48	87.7%	84.8%	86.6%	79.4%	84.6%	78.1%	91.6%	93.1%	91.9%	94.4%	94.6%	92.8%	92.9%	93.3%	93.4%	94.9%	95.6%	96.9%
49	97.6%	85.9%	89.3%	83.1%	87.6%	81.6%	93.5%	94.7%	93.7%	95.7%	95.9%	94.4%	94.5%	94.8%	94.9%	96.1%	96.6%	97.6%
50	92.4%	89.1%	91.6%	86.3%	90.1%	84.7%	94.9%	95.9%	95.2%	96.7%	96.9%	95.8%	95.7%	96.0%	96.1%	97.0%	97.4%	98.1%

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Appendix C. HECM Loan Performance Projections

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

C1. General Approach to Loan Termination Projections

Estimated terminations are developed for all future policy years for each active loan as of September 30, 2026. For example, in this review, for a loan endorsed in FY 2024 we estimate termination rates beginning in policy year three since the first two policy years have already elapsed by the end of FY 2026 and the termination behavior is included in actual experience. For each of these years, macroeconomic variables are derived based on loan characteristics and economic forecasts; these variables include loan duration, loan characteristics, and other economic assumptions. The PEA, the Moody's October 2026 forecast, and our simulated future paths of interest rates and house price appreciation are used to develop termination specifications. MSA level forecasts are used for house price appreciation and state level forecasts are used if the MSA level data is unavailable.

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

C2. Economic Scenarios

We use the baseline assumption plus four alternative stochastic simulation scenarios to obtain NPV estimates ranging from the most pessimistic to the most optimistic. The following four alternative scenarios, each of which combines one of the seven simulated percentile paths for each economic variable, are those for which we report economic net worth estimates:

- Optimistic Upside Scenario in Simulation, the path that is most favorable to the HECM MMI Fund.
- Moderate Upside Scenario in Simulation, the path that is moderately favorable to the HECM MMI Fund.
- Moderate Downside Scenario in Simulation, the path that is moderately unfavorable to the HECM MMI Fund.
- Pessimistic Downside Scenario in Simulation, the path that is most unfavorable to the HECM MMI Fund.

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Consistent with Section IV, the Optimistic Upside scenario combines the 10th percentile paths for interest rates (1-year CMT, 10-year CMT, and SOFR) with the 90th percentile HPA path. The Moderate Upside scenario combines the 25th percentile interest rate paths with the 75th percentile HPA path. The Moderate Downside scenario combines the 75th percentile interest rate paths with the 25th percentile HPA path, while the Pessimistic Downside scenario combines the 90th percentile interest rate paths with the 10th percentile HPA path.

Explanatory Variables

The following is a complete list of explanatory variables used in the loan performance models in Appendix C.

Pol_Yr	Policy year
Age	Age of borrower or younger age of borrower and coborrower
Cumulative_HPI_Change	Percentage of HPI change between termination and origination
Marginal_HPI_Change	Percentage of change between current HPI and previous HPI
HP_Med_log	Log value of median house price
OneYrCMT_Change	Percentage of change between current one-year CMT and previous one-year CMT
TenYrCMT_Change	Percentage of change between current ten-year CMT and previous ten-year CMT
CLTV_cnvy1	min (CLTV, 0.85), where CLTV is the ratio of used UPB to house value
CLTV_cnvy2	min (max (CLTV, 0.85),1.5)-0.85
Orig_MCA_log	Log value of MCA at origination
curr_hpi_log	Log value of current HPI
endrsmnt_fy	Endorsement year
cdd_bucket	Indicator variable for first month cash draw-down greater than 0.85
Gender_Couple	Indicator variable for a loan having coupled borrowers
Gender_Male	Indicator variable for a loan having a male borrower
Before2022	Indicator variable for a loan originated before FY 2022
Covid_Yr	COVID-19 period
Scale	Scale parameter of a Gamma distribution

C3. Claim Type 1 Frequency Model

Beginning in FY 2026, ITDC separately models Claim Type 1 (CT1) claims associated with Tax and Insurance (T&I) defaults and non-T&I terminations. A CT1 claim occurs when a HECM loan terminates prior to assignment and the net proceeds from the property sale are insufficient to repay the outstanding loan balance. For non-T&I CT1 claims, the claim represents the shortfall between the loan balance and net sale proceeds. For T&I CT1 claims, uncured T&I defaults may result in

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Corporate Advances for unpaid taxes and insurance, increasing the loan balance and potential CT1 claim amount. Borrowers who repay the T&I Corporate Advance are considered cured and have no additional T&I default impact on projected NPV. Separating the two components allows the model to more directly capture their distinct historical claim experience and impact on projected losses.

This T&I and non-T&I CT1 termination frequencies are projected separately using binomial logistic regression models fitted to their respective historical experience. This modeling approach is analogous to the multinomial logistic regression framework, in which each termination type is modeled relative to a common reference outcome. Specifically, T&I and non-T&I CT1 termination probabilities are estimated separately, with non-claim termination serving as the reference category in both models.

The projected CT1 frequency is then combined with the corresponding loss severity estimates to determine projected CT1 losses. Note that the T&I CT1 is Claim Type 1 with unresolved tax and insurance default. It is not necessary to have a termination caused by T&I default.

C3.1 Non-T&I Claim Type 1 Model

For the CT1 frequency model, we used HECM non-assigned terminated loans, including loans terminated as CT1s, from FY 2010 through FY 2026 to model the borrower's probability of terminating as a CT1 and the associated CT1 cost. A binomial logistic model is estimated based on an indicator variable that is 1 for a non-assigned CT1 and 0 for a non-assigned non-claim termination. Total observations were split into training (80%) and validation dataset (20%). Exhibit C-1 shows the estimation and model performance measures.

Exhibit C-1: Parameter Estimation of Non-T&I CT1 Frequency Model

Analysis of Maximum Likelihood Estimates					
Parameter	**status**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept	CT1_nonTI	2.3973	0.1946	151.785	<.0001
Before2022	CT1_nonTI	0.9133	0.1073	72.4861	<.0001
CLTV_cnvy1	CT1_nonTI	5.6252	0.0604	8675.3781	<.0001
CLTV_cnvy2	CT1_nonTI	5.1824	0.0912	3226.4589	<.0001
Covid_Yr	CT1_nonTI	-1.9124	0.0406	2223.9373	<.0001
Cumulative_HPI_Change	CT1_nonTI	-3.3276	0.0407	6670.4217	<.0001
FM_cashdd_D3	CT1_nonTI	0.9566	0.0773	153.0763	<.0001
Gender_Male	CT1_nonTI	0.259	0.016	263.3973	<.0001
HP_Med_log	CT1_nonTI	-0.6765	0.0192	1235.0269	<.0001
Marginal_HPI_Change	CT1_nonTI	5.1449	0.1149	2003.3372	<.0001
Orig_MCA_log	CT1_nonTI	-0.5456	0.0158	1199.2486	<.0001
Pol_Yr	CT1_nonTI	0.1268	0.0021	3627.754	<.0001
TenYrCMT_Change	CT1_nonTI	-0.4475	0.0232	371.0277	<.0001

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Association of Predicted Probabilities and Observed Responses			
Percent Concordant	92.3	**Somers' D**	0.846
Percent Discordant	7.7	**Gamma**	0.846
Percent Tied	0	**Tau-a**	0.115
Pairs	19101173819	**C**	0.923

The binomial logit regression model achieves 92.33% concordance and a c-statistic (AUC) of 0.923, with Somers' D and Gamma both at 0.846. These results indicate exceptionally strong alignment between predicted probabilities and observed outcomes, confirming the model's high reliability in distinguishing claim type 1 from no claim.

We use the estimated non-T&I claim type 1 model to project claim type 1 and no claim in the holdout 20% validation sample. Exhibit C-2 shows the confusion matrix of model validation result.

Exhibit C-2: Non-T&I CT1 Frequency Model Validation Confusion Matrix

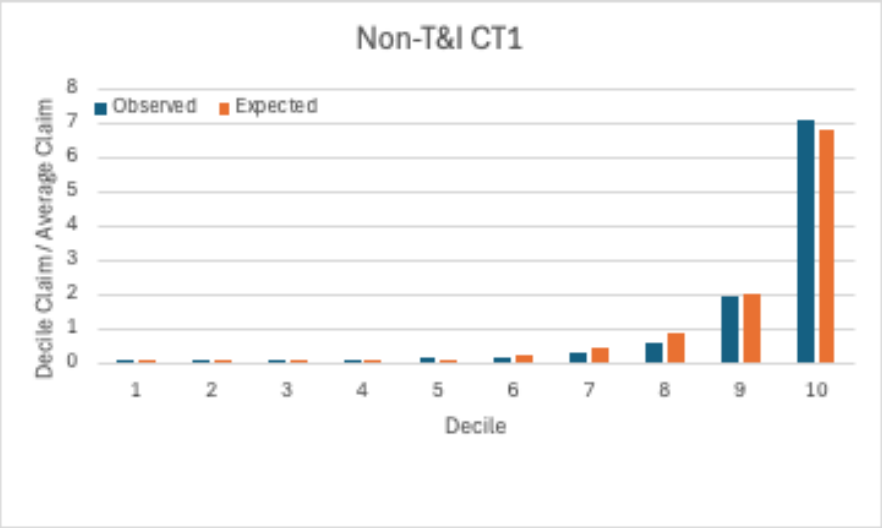
Actual \ Predicted	P_ CT1_nTI	P_ nClm	Total
CT1_nTI	3,203 (2.42% of total, 35.25% of row, 63.96% of column)	5,883 (4.45% of total, 64.75% of row, 4.63% of column)	9,086 (6.87% of total)
nClm	1,805 (1.37% of total, 1.47% of row, 36.04% of column)	121,283 (91.76% of total, 98.53% of row, 95.37% of column)	123,088 (93.13% of total)
Total	5,008 (3.79% of total)	127,166 (96.21% of total)	132,174

The 20% hold-out validation indicates that the model predicting non-T&I CT1 versus No Claim provides strong discrimination, with an overall accuracy of 94.2% and a c-statistic of 0.923. The model achieved high specificity (98.5%) and reasonable precision (64.0%), indicating that most cases predicted as non-T&I default CT1 are actual outcomes. Sensitivity was lower at 35.3%, indicating that the maximum-probability classification does not identify a substantial portion of actual CT1 cases.

Overall, the model demonstrates strong discrimination, while the maximum-probability classification favors No Claim and is less effective at identifying non-T&I CT1 cases. In-sample Decile plot in Exhibit C-3 confirms that the model outputs reasonably mimic empirical CT1 non-T&I observations in the data.

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Exhibit C-3: Non-T&I CT1 Frequency Model Validation – Decile chart



C3.2 T&I Claim Type 1 Model

Same as Non-T&I CT1 model, a binomial logistic model is estimated based on an indicator variable that is 1 for a non-assigned CT1 and 0 for a non-assigned non-claim termination. Total observations were split into a training (80%) and validation dataset (20%). Exhibit C-4 shows the estimation and model performance measures.

Exhibit C-4: Parameter Estimation of T&I CT1 Frequency Model

Analysis of Maximum Likelihood Estimates					
Parameter	**status**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept	**CT1_TI**	-2.5766	0.1927	178.701	<.0001
CLTV_cnvy1	**CT1_TI**	9.9343	0.0709	19660.1217	<.0001
CLTV_cnvy2	**CT1_TI**	5.9491	0.0964	3804.5208	<.0001
Covid_Yr	**CT1_TI**	-1.5391	0.0287	2881.1646	<.0001
FM_cashdd_D1	**CT1_TI**	1.1631	0.092	159.7897	<.0001
FM_cashdd_D3	**CT1_TI**	2.9639	0.103	827.8898	<.0001
Gender_Couple	**CT1_TI**	-0.3239	0.0149	470.0312	<.0001
HP_Med_log	**CT1_TI**	-0.8575	0.0219	1529.7185	<.0001
Marginal_HPI_Change	**CT1_TI**	6.2463	0.1375	2063.5742	<.0001
OneYrCMT_Change	**CT1_TI**	-0.00024	0.000017	198.1122	<.0001
Orig_Age_borr	**CT1_TI**	-0.0282	0.00106	707.0922	<.0001
Orig_MCA_log	**CT1_TI**	-0.3003	0.0155	374.6823	<.0001
Pol_Yr	**CT1_TI**	0.1294	0.00198	4261.5089	<.0001
TenYrCMT_Change	**CT1_TI**	-0.4768	0.0232	423.1209	<.0001
curr_hpi_log	**CT1_TI**	0.3121	0.0244	163.0609	<.0001

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Association of Predicted Probabilities and Observed Responses			
Percent Concordant	93.5	**Somers' D**	0.871
Percent Discordant	6.5	**Gamma**	0.871
Percent Tied	0	**Tau-a**	0.113
Pairs	1.8047E+10	**C**	0.935

The binomial logit regression model achieves 93.5% concordance and a c-statistic (AUC) of 0.935, with Somers' D and Gamma both at 0.871. These results indicate exceptionally strong alignment between predicted probabilities and observed outcomes, confirming the model's high reliability in distinguishing claim type 1 from no claim.

We use the estimated T&I claim type 1 model to project claim type 1 with tax and insurance default and no claim in the holdout 20% validation sample. Exhibit C-5 shows the confusion matrix of model validation result.

Exhibit C-5: T&I CT1 Frequency Model Validation Confusion Matrix

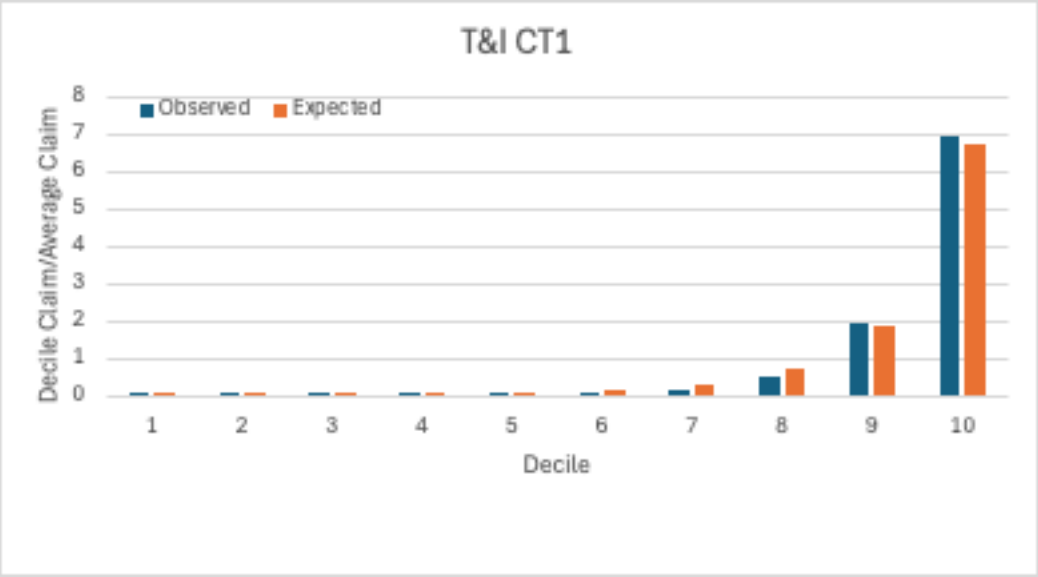
Actual \ Predicted	P_ CT1_TI	P_ nClm	Total
CT1_TI	3,533 (2.66% of total, 35.42% of row, 70.29% of column)	6,441 (4.85% of total, 64.58% of row, 5.04% of column)	9,974 (7.51% of total)
nClm	1,493 (1.12% of total, 1.22% of row, 29.71% of column)	121,303 (91.36% of total, 98.78% of row, 94.96% of column)	122,796 (92.49% of total)
Total	5,026 (3.79% of total)	127,744 (96.21% of total)	132,770

The 20% hold-out validation indicates that the model predicting T&I CT1 versus No Claim performs reasonably well, with an overall accuracy of 94.0% and a reported c-statistic of 0.935. The model achieved high specificity (98.8%) and reasonable precision (70.3%), indicating that most cases predicted as CT1 are true CT1 outcomes. Sensitivity was more modest at 35.4%, indicating that the model misses a substantial portion of CT1 cases.

Overall, the model provides strong discrimination based on the reported c-statistic, while the maximum-probability classification favors correct identification of No Claim and is less effective at identifying CT1 cases. In-sample Decile plot in Exhibit C-6 confirms that the model outputs reasonably mimic empirical T&I CT1 observations in the data.

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Exhibit C-6: T&I CT1 Frequency Model Validation – Decile chart



C4. Claim Type 1 Loss Severity Model

Consistent with the FY 2026 CT1 frequency methodology, loss severity is modeled separately for T&I and non-T&I CT1 claims. The T&I severity calculation captures the additional Corporate Advances associated with uncured T&I defaults, while non-T&I severity reflects the shortfall associated with other pre-assignment terminations. The separately projected CT1 components are combined in the cash flow model to estimate total CT1 losses.

The claim type 1 loss severity is modeled by a Generalized Linear Model. The dataset was split into training (80%) and validation (20%) samples to support model development and evaluation.

C4.1 Non-T&I CT1 Loss Severity Model

A generalized linear model is developed to model the Claim Type 1 loss severity amount. The variables defined in termination models are selected and the estimation results are presented in Exhibit C-7.

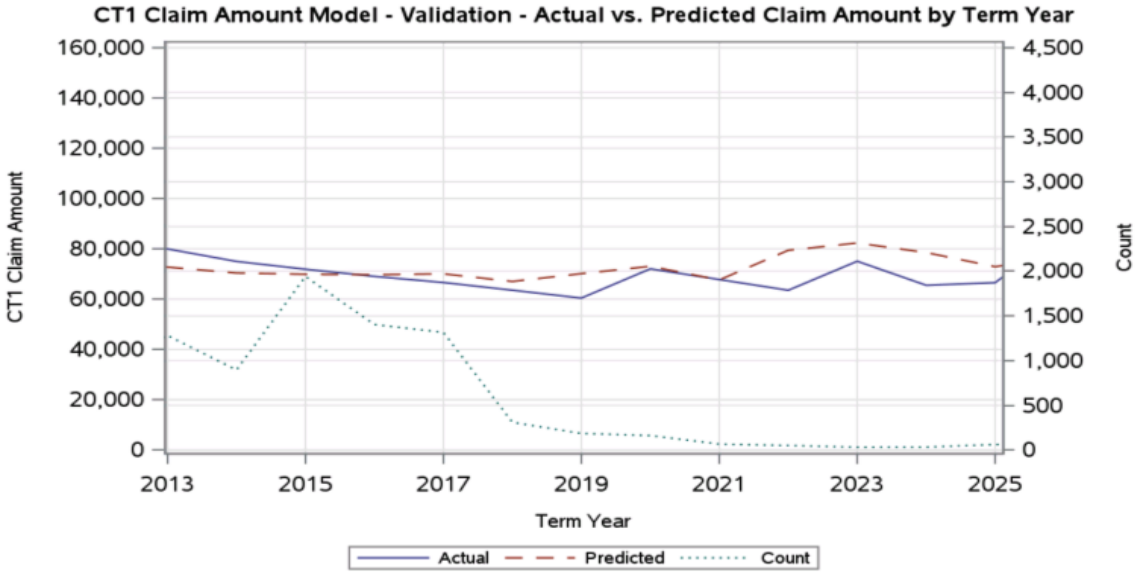
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Exhibit C-7: Parameter Estimations of Non-T&I CT1 Loss Severity Model

Analysis Of Maximum Likelihood Parameter Estimates						
Parameter	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1.3786	0.1038	1.1752	1.5819	176.53	<.0001
Gender_Couple	-0.0406	0.0066	-0.0536	-0.0276	37.29	<.0001
Gender_Male	0.0283	0.001	0.0263	0.0304	731.18	<.0001
Pol_Yr	0.0056	0.0004	0.0048	0.0064	172.1	<.0001
Age	0.2336	0.03	0.1748	0.2924	60.62	<.0001
cdd_bucket	0.5156	0.063	0.3922	0.639	67.03	<.0001
Cumulative_HPI_Change	0.2699	0.0764	0.1202	0.4195	12.49	0.0004
Before2022	0.4974	0.0625	0.375	0.6198	63.42	<.0001
CLTV_cnvy1	0.4524	0.0191	0.4149	0.4898	559.7	<.0001
CLTV_cnvy2	1.16	0.0194	1.1219	1.198	3574.73	<.0001

Using the 20% holdout sample, we compare the projected Claim Type 1 payment with the actual payment. In Exhibit C-8, we present the projected average non-T&I CT1 claim amount and observed average non-T&I CT1 claim amount from FY 2013 to FY 2026. We can see that the Claim Type 1 payments align closely with the actual pay outs. The mean absolute error (MAE) of projection is $8,275.53, roughly 11% of observed average non-T&I default CT1 claim amount.

Exhibit C-8: Non-T&I Default Claim Type 1 Loss Validation



C4.2 T&I CT1 Loss Severity Model

Similarly, a generalized linear model is developed to model the T&I Claim Type 1 loss severity amount. The variables defined in termination models are selected and the estimation results are presented in Exhibit C-9.

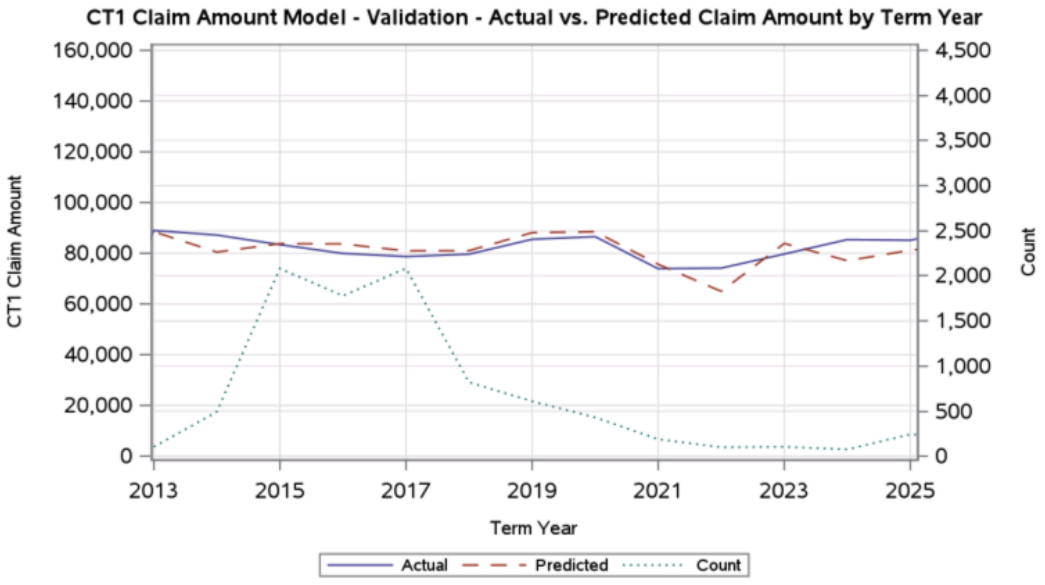
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Exhibit C-9: Parameter Estimations of T&I CT1 Loss Severity Model

Analysis Of Maximum Likelihood Parameter Estimates						
Parameter	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1.3985	0.1423	1.1195	1.6774	96.52	<.0001
Gender_Couple	-0.055	0.0069	-0.0685	-0.0414	63.08	<.0001
Gender_Male	0.0406	0.0075	0.026	0.0553	29.73	<.0001
Pol_Yr	0.0199	0.0012	0.0176	0.0222	286.12	<.0001
Age	0.0027	0.0004	0.0018	0.0036	36.08	<.0001
Cumulative_HPI_Change	-0.0564	0.0153	-0.0864	-0.0265	13.65	0.0002
Marginal_HPI_Change	-1.6526	0.0874	-1.8238	-1.4813	357.85	<.0001
TenYrCMT_Change	0.04	0.0098	0.0208	0.0593	16.64	<.0001
FM_cashdd_D1	0.1005	0.0424	0.0175	0.1835	5.63	0.0177
FM_cashdd_D3	0.6527	0.0454	0.5637	0.7416	206.86	<.0001
Before2022	0.6218	0.1137	0.399	0.8446	29.92	<.0001
CLTV_cnvy1	0.5559	0.0229	0.511	0.6009	588.31	<.0001
CLTV_cnvy2	1.2595	0.028	1.2046	1.3145	2020.3	<.0001
Covid_Yr	0.0877	0.0137	0.0608	0.1146	40.91	<.0001
Orig_MCA_log	0.6912	0.0063	0.6788	0.7036	11971.1	<.0001
HP_Med_log	-0.0481	0.0101	-0.0679	-0.0282	22.43	<.0001
curr_hpi_log	0.0412	0.0116	0.0185	0.0638	12.69	0.0004

Using the 20% holdout sample, we compare the projected Claim Type 1 payment with the actual payment. In Exhibit C-10, we present the projected average CT1 claim amount and observed average CT1 claim amount from FY 2013 to FY 2026. We can see that the Claim Type 1 payments align closely with the actual pay outs. The mean absolute error (MAE) of projection is $4,373.96, roughly 5% of observed average T&I default CT1 claim amount.

Exhibit C-10: T&I Default Claim Type 1 Loss Validation



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C5. Conveyance and Payoff Selection Model in Post-Assignment

C5.1 Model Specification

For loans terminated with Claim Type 2, borrowers or their heirs can pay off the HECM loan for the lesser of the outstanding loan balance or the appraised house value (95 percent of the appraised value if the loan is due and payable) or convey the mortgaged house to HUD. In the latter case, HUD will sell the conveyed property to recover up to the outstanding loan balance. Delay between post-assignment termination and the disposition of home equity is built in the structure of the cash flow. Such delay can have Incurred but Not Reported (IBNR) claims; however, it is not essential in actuarial review of HECM, as the review focuses on long-term provisions for future liabilities rather than addressing short-term volatility in the NPV. In addition, extensive termination rates based on a large volume of data are forecasted with greater accuracy, which diminishes the need for an additional buffer for an IBNR reserve.

In this year's Review, we used HECM loans terminated with payoff and conveyance types from FY 2004 through FY 2026 to model the borrower's conveyance and payoff selection choice and the associated Maintenance and Operations (M&O) Expenses for Conveyed properties. This is aggregated by the year of termination. There are 83,881 observations in the 80% training dataset for the logistic model. A binomial logistic model is estimated based on an indicator variable that is 1 for a conveyance and 0 for a payoff. Exhibit C-11 shows the estimation results.

Exhibit C-11: HECM Conveyance Model - Frequency (Payoff vs. Conveyance)

Analysis of Maximum Likelihood Estimates (80% Training Dataset)					
Parameter	**Status**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept	**CT2c**	-0.4934	0.2488	3.9315	0.0474
Age	**CT2c**	0.0609	0.0022	765.7664	<.0001
CLTV_cnvy1	**CT2c**	-1.7938	0.0561	1023.8911	<.0001
CLTV_cnvy2	**CT2c**	3.9687	0.1541	663.3312	<.0001
Covid_Yr	**CT2c**	0.3745	0.0395	89.7412	<.0001
Cumulative_HPI_Change	**CT2c**	-2.4987	0.0412	3684.157	<.0001
FM_cashdd_D1	**CT2c**	-0.6455	0.091	50.2624	<.0001
FM_cashdd_D4	**CT2c**	5.935	0.2255	692.967	<.0001
Gender_Couple	**CT2c**	0.1022	0.0233	19.2344	<.0001
HP_Med_log	**CT2c**	-1.5021	0.0298	2532.818	<.0001
Marginal_HPI_Change	**CT2c**	-2.9759	0.2424	150.7046	<.0001
Orig_R_Age4	**CT2c**	-0.0446	0.0111	16.0145	<.0001
Pol_Yr	**CT2c**	0.1068	0.00403	703.8182	<.0001
TenYr_chg1	**CT2c**	-0.4429	0.0724	37.4667	<.0001

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Association of Predicted Probabilities and Observed Responses			
Percent Concordant	82.8	**Somers' D**	0.656
Percent Discordant	17.2	**Gamma**	0.656
Percent Tied	0	**Tau-a**	0.162
Pairs	8.66E+08	**c**	0.828

The logistic regression model demonstrated excellent discriminative ability, with 82.8% concordant pairs and a c-statistic (AUC) of 0.828. Somers' D and Gamma (both 0.656) indicated a strong positive association between predicted probabilities and observed outcomes. The absence of tied pairs further highlights the model's clear separation between cases. Overall, the model reliably distinguishes choices between conveyance and payoff.

C5.2 Model Validation

We use the estimated conveyance model to project the conveyance and payoff events in the holdout 20% validation sample. Exhibit C-12 shows the confusion matrix of validation.

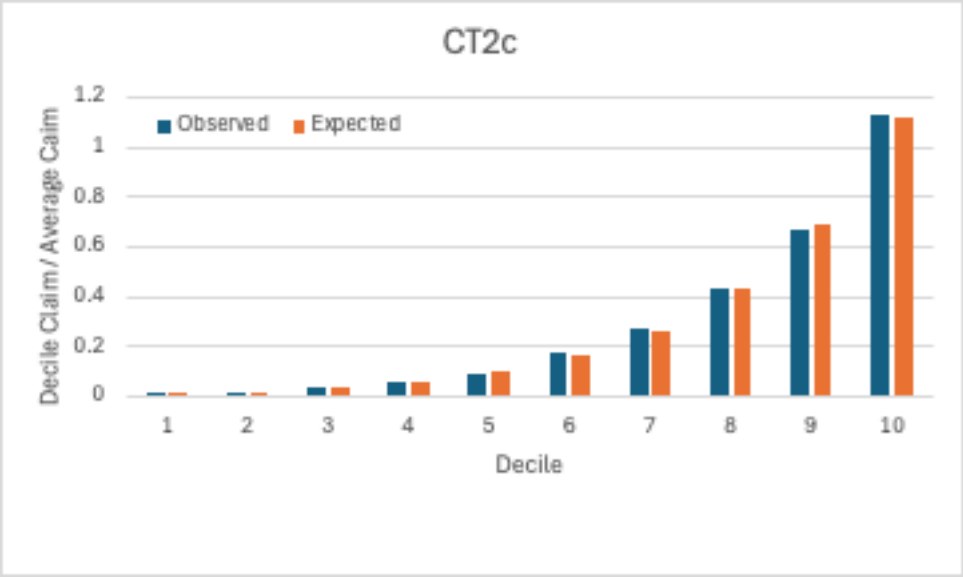
Exhibit C-12: HECM Conveyance Model Validation Confusion Matrix

Predicted / **Actual**	P_CT2c	P_CT2p	Total
CT2c	860 (4.05% of total, 28.06% of row, 62.36% of column)	2,205 (10.38% of total, 71.94% of row, 11.09% of column)	3,065 (14.42% of total)
CT2p	519 (2.44% of total, 2.85% of row, 37.64% of column)	17,669 (83.14% of total, 97.15% of row, 88.91% of column)	18,188 (85.58% of total)
Total	1,379 (6.49% of total)	19,874 (93.51% of total)	21,253 (100.00% of total)

The 20% hold-out validation sample indicates that the logistic regression model generalizes reasonably well to unseen data. The model achieved an overall accuracy of 87.2% and strong specificity of 97.2%, indicating that it reliably identifies CT2p cases. However, sensitivity was lower at 28.1%, suggesting that the model under-predicts CT2c cases and misses a portion of true CT2c outcomes. This tradeoff is consistent with the prior-year validation results and indicates that the model continues to favor CT2p classifications at the expense of detecting all CT2c outcomes. Overall, the classification performance remains stable and consistent with the prior year. In-sample Decile plot in Exhibit C-13 confirms that the model outputs reasonably mimic empirical CT2c observations in the data.

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Exhibit C-13: CT2c Frequency Model Validation – Decile chart



C6. Conveyance Maintenance and Operation Expense Model

The M&O expense for loans projected to terminate as a conveyance is modeled by a Generalized Linear Model based on 14,072 observations. The dataset was split into training (80%) and validation (20%) samples to support model development and evaluation.

C6.1 Model Specification

The M&O expense is modeled as the ratio of maintenance and operation expenses to the value of the conveyed house property. The estimation results are presented in Exhibit C-14.

Exhibit C-14: Conveyance Maintenance and Operation Expense Rate

Analysis Of Maximum Likelihood Parameter Estimates						
Parameter	Estimate	Standard Error	95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1.1166	0.0199	1.0776	1.1557	3146.21	<.0001
Pol_Yr	0.0007	0.0003	0.0001	0.0012	5.15	0.0233
Cumulative_HPI_Change	-0.026	0.0027	-0.0313	-0.0208	93.69	<.0001
Marginal_HPI_Change	-0.1879	0.0147	-0.2167	-0.159	162.76	<.0001
TenYrCMT_Change1	0.0476	0.011	0.026	0.0692	18.65	<.0001
CLTV_cnvy1	0.0211	0.0041	0.0131	0.0291	26.54	<.0001
Orig_MCA_log	-0.0401	0.0027	-0.0454	-0.0348	220.61	<.0001
curr_hpi_log	-0.088	0.0016	-0.0912	-0.0848	2917.98	<.0001
Scale	0.0886	0.0006	0.0875	0.0898		

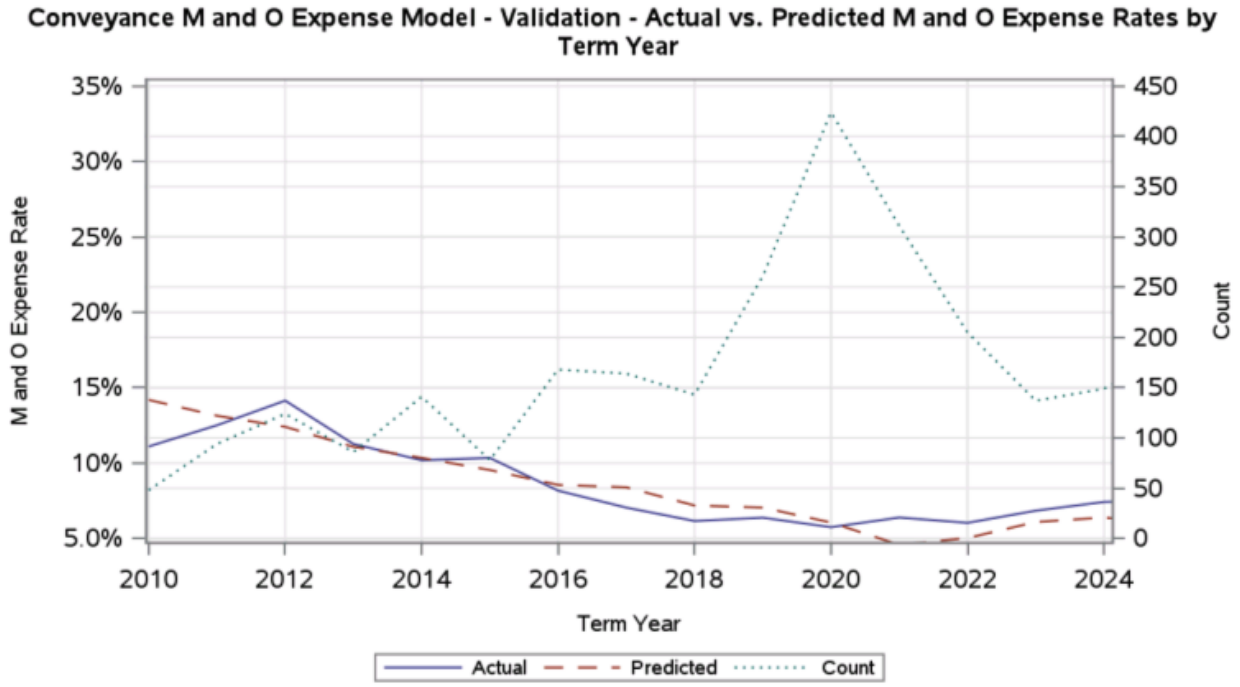
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The scale parameter of Gamma GLM is automatically estimated during model fitting. The scale parameter of 0.0886 indicates mild skew and tight dispersion. A relatively low level of dispersion around the fitted values suggests that the model explains most of the variability in the response variable.

C6.2 Model Validation

Using the 20% holdout sample, we compare the projected M&O expenses with the actual expenses. In Exhibit C-15, we present the projected and observed M&O Operation Expense rates for FY 2010 to 2026. We can see that the projected M&O expenses align closely with the actual M&O expenses. The mean absolute error (MAE) of projection is 0.01.

Exhibit C-15: Conveyance Maintenance and Operation Expense Rate Validation



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Appendix D. HECM Cash Flow Analysis

This Appendix describes the calculation of the present value of future cash flows. Future cash flow calculations are based on forecasted variables, such as house price appreciation and interest rates, in addition to individual loan characteristics and borrower behavior assumptions. There are four major components of HECM cash flows: insurance premiums, claims, note holding expenses and recoveries on notes in inventory (after assignment). HECM cash flows are discounted according to the cohort specific single effective rates (SERs) provided by FHA. These elements of cash flow and the present value calculations are described in this Appendix.

D1. Definition

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

Maximum Claim Amount (MCA): Maximum claim amounts are calculated as the minimum of three amounts: the HECM property's appraised value at the time of loan application, the purchase price of the property, and the national HECM FHA loan limit ($1,249,125 for 2026).

Insurance-In-Force (IIF): Refers to the active loans in the FHA insurance portfolio (prior to loan assignment) and calculated as the total of their UPB.

Conditional Claim Type 1 Rate (CC1R): Among loans that terminated without note assignment, the number of such loans that had a shortfall divided by the total number of loans active as of the beginning of the same policy year. The shortfalls are labeled as Claim Type 1. The other terminations before assignment have zero claim amounts, corresponding to when the property value exceeds the outstanding loan balance by more than the sales transactions cost.

Claim Type 2 (Assignment): If certain conditions are met, a lender can (but is not required to) assign the promissory note to FHA. FHA pays the UPB at the time of assignment to take ownership of the note. Such assignment events are labeled as Claim Type 2. One of the conditions for the promissory note to be eligible for assignment is that the outstanding UPB of a HECM reaches 98 percent of the MCA. FHA also imposes other conditions as noted in Section I.B.

Note Holding Period: The length of time from note assignment to loan termination. During this period, FHA takes possession of the loan, now called an assigned note, and services it (through assigned private servicers) until loan termination.

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

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D2. Cash Flow Components

HECM cash flows are comprised of premiums, claims, note expenses and recoveries. Premiums consist of upfront and annual mortgage insurance premiums, which are inflows to the HECM program. Recovery after assignment, a cash inflow, represents cash recovered from the sale of the underlying property once the loan terminates. Claim Type 1 payments are cash outflows paid to the lender when the net proceeds of a property sale is insufficient to cover the balance of the loan. Assignment claims and note holding payments are additional outflows. Exhibit D-1 summarizes the HECM inflows and outflows.

Exhibit D-1: HECM Cash Flows

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

D3. Loan Balance

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

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

The UPB for each period *t* consists of the previous loan balance plus any new borrower cash drawn and accruals. The accruals include interest, mortgage insurance payments, and service fees. Future borrower draws are estimated by assigning draw patterns to loans based upon the first-month draw.

For FY 2026, the cash draw methodology was refined by expanding first-month cash draw categories from 10 to 25 buckets. Future cash draws are projected using bucket-specific draw paths based on the most recent five years of historical borrower experience, providing greater granularity in borrower equity draws and better reflecting changes in borrower payment behavior.

D4. Premiums

Upfront and annual mortgage insurance premiums, along with recoveries, are the sources of FHA revenue from the HECM program. Borrowers typically finance the upfront premium when taking out a HECM loan. Similarly, the recurring annual premiums are added to the balance of the loan.

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D4.1. Upfront Premiums

The Upfront premium is due to FHA at the time of closing, equal to a percentage of the MCA. For FY 2009 and FY 2010 books-of-business, the upfront premium rate is two percent of the MCA. For FYs 2011 through 2013 endorsements the upfront premium rate for the standard option and the saver option is two percent and 0.01 percent (1 basis point), respectively. The HECM Saver program was discontinued in 2013. In FY 2014, the upfront premium rate is 0.5 percent of the MCA if the first-year cash draw is less than or equal to 60% of the initial principal limit, and 2.5 percent of MCA if the first-year cash draw is more than 60% of the initial principal limit.

Effective October 2017, to simplify the MIP structure and improve the sustainability of the MMI Fund, HUD standardized the upfront MIP to a flat 2% of the maximum claim amount, irrespective of how much the homeowner drew from the reverse mortgage in the first year. Typically, the upfront premium is paid in full to FHA as a positive cash flow at the loan closing and financed by the HECM loan and hence added to the loan balance.

D4.2. Annual Premium

The annual mortgage insurance premium (MIP) is calculated as a percentage of the outstanding loan balance. The applicable annual MIP rate is 0.5% for FHA case numbers assigned before October 4, 2010; 1.25% for case numbers assigned from October 4, 2010, through October 1, 2017; and 0.5% for case numbers assigned on or after October 2, 2017.

Effective October 2017, HUD standardized the upfront MIP to a flat 2% of the maximum claim amount, irrespective of how much the homeowner drew from the reverse mortgage in the first year, and annual MIP was reduced to 0.5%.

To summarize the annual MIP:

- a loan with case number assigned before 10/4/2010 has 0.5% annual MIP.
- a loan with case number assigned from 10/4/2010 through 10/1/2017 has 1.25% annual MIP.
- a loan with case number assigned on and after 10/2/2017 has 0.5% annual MIP.

D5. Claims

HECM claims consist of Claim Types 1 and 2. Claim Type 1 occurs when a HECM lender is reimbursed 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. Claim Type 2 occurs when a lender assigns a loan to HUD with certain criteria met.

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D5.1. Claim Type 1

Claim Type 1 factors into HECM cash flows as payments to the lender when a property is sold and the net proceeds from the sale are insufficient to cover the balance of the loan at termination. Claim Type 1 claims are projected using a binomial logistic model for loss frequency (the probability model) and GLM for loss severity respectively. Detailed models are described in Appendix C, Sections C3 and C4.

For FY 2026, ITDC refined the CT1 methodology by separately modeling T&I and non-T&I claims. T&I CT1 captures the additional Corporate Advances associated with uncured T&I defaults, while non-T&I CT1 captures other pre-assignment shortfall claims. Frequency and severity are projected separately for each component, improving model accuracy.

D5.2. Claim Type 2 (Assignment)

Lenders can assign the loan to HUD when the UPB reaches 98 percent of the MCA. HUD acquires the note resulting in acquisition costs equal to the balance (up to the MCA).

Under FHA guidelines, when the UPB reaches 98% of the MCA, the lender has the option to assign the loan to HUD for claim payment. This process transfers the loan from the private investor or servicer to HUD, at which point HUD assumes responsibility for future payments and recoveries.

In the FY 2024 Review, the model treated assignments as theoretically occurring when the projected UPB reached 98 percent of the MCA. Historical Claim Type 1 frequency and loss severity were then used to adjust CT1 losses to account for the loans that are not assigned, including loans that are not eligible for assignment and due-and-payable loans.

In this year's review, we examined HECM loan assignments and found that 10.97% of loans with a UPB greater than or equal to 105 percent of MCA were not assigned. Optional loan assignment is available once the HECM loan's UPB reaches 98% of the MCA, established at loan endorsement. Once the servicer/investor files the assignment claim, the timing between assignment claim filing and final claim payout can take additional time; during which the borrower can still use drawable equity, if available, and the UPB continues to grow. ITDC accounted for this timing delay by using the total loans eligible to assign and not assign with UPB over 105 percent of MCA.

Some Servicers with HECM loans that have UPB above 98% of MCA may choose not to exercise optional assignment. The non-assignment of an eligible loan can occur under various circumstances specific to servicers/investors that may not be captured by a quantitative model without servicer specific data and financial statements. Therefore, at the portfolio level, we account for this by randomly designating 10.97 percent of loans eligible to assign as not assigned.

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D6. Note Holding Expenses after Assignment

The note holding expenses include the additional cash drawn by the borrower after the loan has been assigned to HUD. Additional cash drawn by the borrowers could occur under the contract after FHA takes ownership of the note only if the total cash drawn by the borrower has not reached the maximum principal limit upon the assignment date.

D7. Recoveries from Assigned Loans

At note termination, HECM loans that are not paid off will become due and payable to FHA. The timing of loan terminations depends on the results of the termination model. The details of the termination projections are discussed in Appendix B and Appendix C. The amount of recovery is estimated as the minimum of the loan balance and the net sales proceeds at termination, where net sales proceeds are estimated as the projected property value less property holding and selling expenses.

A discount or haircut is applied to the projected house sale price for the reduction in price that a HECM property would sell compared to an otherwise identical property on the market. Two spline functions are defined depending on whether the appraisal price at origination is below or above the local median house price, based on empirical data analysis. Specifically, future house price discounts are calculated in the following way:

If the Appraisal Price at origination is below the Local Median House Price:

$$Haircut = \begin{cases} 0.2 - 0.3 * \exp(-0.2 * \min(6, loan\ age)), & if\ loan\ age < 10 \\ 0.25 - 0.9 * \exp(-0.2 * loan\ age) \quad , & if\ loan\ age \geq 10 \end{cases}.$$

If the Appraisal Price at origination is above the Local Median House Price:

$$Haircut = \begin{cases} 0.13 - 0.25 * \exp(-0.35 * \min(4, loan\ age)), & if\ loan\ age < 10 \\ 0.2 - 0.8 * \exp(-0.2 * loan\ age) \quad , & if\ loan\ age \geq 10 \end{cases}.$$

The haircut functions were developed in the FY 2015 HECM Actuarial Review and depend on loan age and on whether the appraised value at origination is above or below the local median house price, which is supported by the related research. In addition to the haircut, the cash flow model explicitly projects maintenance and operating (M&O) expenses for property disposition; together they account for the reduction in the sale price in determining net property recovery, and the M&O model validation (Exhibit C-15) supports the projected recoveries. Model fit statistics specific to the haircut functions are not presented in this report. ITDC proposes to reassess the haircut methodology jointly with HUD as a research item in the FY 2027 actuarial review.

The 2026 model continues to assume traditional REO disposition for all conveyed loans. Accordingly, all holding and disposition costs, including sales expenses, are estimated based on

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the traditional REO disposition. Loans that are not conveyed to HUD are classified as payoffs. We acknowledge that this classification may result in an overestimation of payoff terminations, as some non-conveyed loans may instead be resolved through HUD note sales. Consequently, the model does not explicitly distinguish note sales from traditional payoffs, which may affect the estimated recovery amounts and associated disposition costs.

FHA has conducted regular HECM Vacant Loan Sales (HVLS) since 2017. According to the post-sale reports published by HUD, we list in Exhibit D-2 HECM note sales since 2017[12]. Recent transactions have consistently generated sales proceeds equal to approximately 54% to 62% of the updated loan balance.

Exhibit D-2: HECM Note Sale Records

Sale ID	Sales Date	Settled Loans	Updated Balance ($ MM)	Aggregate Sales Price ($ MM)	Recovery Percentage
HVLS 2026-1	12/09/2025	1,061	321.3	192.8	60.0%
HVLS 2025-3	09/24/2025	1,874	546.1	292.6	53.6%
HVLS 2025-2	08/06/2025	1,548	446.5	249.5	55.9%
HVLS 2025-1	12/11/2024	780	321.3	190.0	59.1%
HVLS 2024-2	05/07/2024	1,180	324.1	196.9	60.8%
HVLS 2024-1	12/05/2023	1,465	366.1	226.9	62.0%
HVLS 2022-2 Part 2	07/27/2022	668	136.8	84.5	61.8%
HVLS 2022-2 Part 1	06/08/2022	687	187.0	130.7	69.9%
HVLS 2022-1	12/01/2021	1,587	393.3	210.8	53.6%
HVLS 2020-1	06/24/2020	627	143.5	62.5	43.6%
HVLS 2019-2	07/24/2019	1,375	310.0	135.5	43.7%
HVLS 2019-1	12/12/2018	920	192.1	87.1	45.3%
HVLS 2018-1	04/11/2018	511	108.8	55.7	51.2%
HVLS 2017-2	06/21/2017	805	158.7	64.4	40.6%
HVLS 2017-1	11/30/2016	1,567	316.9	120.1	37.9%

Being consistent with the pricing of the non-recourse guarantee embedded in HECM loans, we do not include non-vacant note sales information in our review.

In September 2026, HUD announced HVLS 2027-1, with approximately 4,200 loans and an approximate loan balance of $1.3 billion. By FY 2026, HVLS has become a viable alternative disposition channel for assigned HECM loans. The success of the HVLS program demonstrates active investor participation and market interest.

[12] Report to the Commissioner on Post-Sale Report, March 2026, retrieved as of September 2026 from https://www.hud.gov/sites/default/files/Housing/documents/HVLS-HNVLS-CReport-March-2026-Final-v3.pdf

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The existence of an active secondary market may provide opportunities to reduce holding periods and disposition costs of HECM properties. However, unlike conveyance versus payoff outcomes, the choice between note sale and traditional REO is influenced by discretionary decisions, investor participation, and market conditions. Because note sales are initiated at HUD's discretion, their future timing, frequency, and selection criteria are not sufficiently predictable to support reliable long-term projections of their financial impact on the HECM program. ITDC acknowledges HUD's identification of note-sale transaction data in the SFDW (claims_601_case_data) and plans to incorporate a more detailed analysis of note-sale experience, financial outcomes, and potential modeling enhancements into its research plan for the next actuarial review cycle.

D8. Net Future Cash Flows

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

$$Net\ Cash\ Flow_t = Upfront\ Premium_t + Annual\ Premium_t + Recoveries_t - Claim\ Type1_t - Claim\ Type2_t - Note\ Holding\ Expense_t$$

Note that a negative net cash flow indicates that outflows have exceeded inflows, and a positive cash flow indicates the HECM program is generating a net income. To obtain the present value of cash flows, the cash flows are discounted for each policy year and cohort using the cohort specific single effective rates (SERs) supplied by FHA.

The NPV of net cash flow depends on termination probabilities (timing of termination), discount factors, and amount of net cash flow. Economic factors that drive the net cash flow and the crossover risk are modeled by the GARCH models in Appendix E. Given the nature of long-term HECM claims, other factors that impact claim severity, including note holding expenses and house sale expenses, can be estimated from historical data with less variability and uncertainty than short-term lines of insurance. Non-parametric models and empirical assumptions with implicit margin for uncertainty are an appropriate methodology for the valuation. In future research, we can investigate parametric models for these factors.

D9. Tax and Insurance Default

HECM loans with uncured T&I defaults are generally not eligible for assignment and may result in a Claim Type 1 (CT1) when the loan terminates with the UPB exceeding net property sale proceeds. The associated Corporate Advances for unpaid taxes and insurance increase the loan balance and potential CT1 loss. Beginning in FY 2026, ITDC separately models T&I CT1 frequency and severity from non-T&I CT1 claims, allowing the cash flow model to more directly capture the incremental claim risk associated with T&I defaults. Borrowers that repay the T&I Corporate Advance are considered cured and have no additional T&I default impact on NPV.

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Appendix E. Stochastic Simulation Models

This Appendix describes the stochastic models used to generate economic variables used in the Monte Carlo simulations of the FHA HECM Actuarial Review 2026. Based on the best fitted stochastic model, we use Monte Carlo simulation technique to simulate 1,000 paths of future economic variables and obtain the 1st, 10th, 25th, 50th, 75th, 90th, and 99th percentiles of the simulated paths.

This year's review updates the simulation models to obtain percentile paths. Each quarterly point of a percentile path is the percentile value across all simulation paths at that quarter used as the percentile reference path. Whichever real simulated path that is closest to the percentile reference path is identified as the obtained percentile path. This method uses the real simulated trajectory and represents the overall percentile profile among all the simulated paths. At the same time, in our Monte Carlo simulation, the simulated paths are centered on the baseline economic assumptions, that is, the 50th percentile of the simulated path is close to the baseline PEA and replaced by the PEA baseline assumption.

The estimated simulation models are identical for the Single-Family Forward Mortgages and HECM with respect to Treasury rates, SOFRs, and national and regional HPIs. Additional forecast models for 30-year mortgage rates and unemployment rates are applied to Single-Family Forward mortgages.

The simulated scenarios of the U.S. economy used as the components of the forecast include:

- 1-month CMT rate,
- 1-year CMT rate,
- 10-year CMT rate,
- 1-month Secured Overnight Financing Rate (SOFR),
- 12-month SOFR, and
- FHFA national Purchase Only house price appreciation rate (HPI-PO).

The stochastic models are calibrated to historical data and are chosen based on the Augmented Dickey–Fuller (ADF) test and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test for stationarity in time series; Box-Ljung (BL) for autocorrelation in residuals after model fitting; likelihood, AIC, and BIC values for parameter selection; and a one-step rollover forecast test. Model adequacy is further evaluated using the weighted ARCH-LM test for remaining conditional heteroskedasticity, the Nyblom tests for parameter stability, sign-bias tests for asymmetric shock effects, and the Pearson goodness-of-fit test for the assumed residual distribution.

At the same time, since all status transition probabilities are estimated and projected using a series of historically observed and projected interest rates with different maturity terms, the stochastic interest rate models are internally consistent in model calibration and forecasting. This approach

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is appropriate for the Actuarial Review as we are computing the present value of projected future cash flows for liability valuation.

In addition, the methodology to identify percentile paths in the FY 2026 Actuarial Review is changed to improve the representation of percentile paths in the variation of economic variables in early years of forecast, except the HPA percentile paths identification. The new percentile paths identification method equally weights the dispersions in simulated paths in early simulation years and the dispersions in long horizon. This new method is in line with the demonstration of optimistic and pessimistic scenarios.

E1. Historical Data

E1.1. Interest Rates

With the high inflation rate caused by the global oil crisis in the late 1970's, interest rates rose to a historically high level in the early 1980's. Then the Federal Reserve shifted its monetary policy from managing interest rates to managing the money supply, at least until inflation, and consequently interest rates receded. Exhibit E-1 shows historical 1-year and 10-year CMT rates from 1970 Q1[13] to 2026 Q2. The one-year Treasury rate (CMT1) fluctuated around 6% in the early 1970s and increased steadily to its peak of 16.31% in CY 1981 Q3. After that, it followed a decreasing trend and reached a low of around 1.2% in 2004. From then on, rates started a slow upward trend until the 2007 financial crisis and rates started a sharp downward trend reaching a historic low of 0.06% in CY 2021 Q2. Inflation turned up dramatically because of the COVID-19 pandemic. Monetary policy initiatives aimed to overturn the post-pandemic inflation, and we saw the Federal Reserve tightening where the one-year rate has been increasing up to the 5.39% in 2023 Q3 and then turning down. The one-year CMT rate is 3.88% in 2025 Q3, and 3.80% in 2026 Q2.

The ten-year Treasury rate (CMT10) generally followed a similar long-run pattern, though with less volatility. It rose from around 7% in the early 1970s to a peak of nearly 15% in 1981 and then declined steadily over the next four decades. The 10-year CMT fell below 1% in 2020 before rising in the post-pandemic period. As inflation accelerated in the post-pandemic period, long-term rates moved upward again, reaching about 4.45% in 2024 Q2 before easing slightly. The ten-year CMT rate is 4.26% in 2025 Q3 and reaches 4.42% in 2026 Q2.

Also shown in Exhibit E-1 is the 1-year SOFR curve. Historical SOFR data date back to 2006 Q1. The SOFRs reflect Treasury-backed short-term funding costs and are closely tied to Federal Reserve policy, showing a similar cyclical pattern to the 1-year CMT but with smaller term premium. In the mid-2000s, 1-year SOFR peaked near 5.4%, fell to near 0.1% during the zero-interest-rate era, and then climbed to around 2.5%–2.7% during the 2018–2019 tightening cycle. Pandemic relief drove SOFR to record lows of 0.04–0.11% in 2020–2021 before it surged

[13] Calendar year is used in demonstrating historical economic data.

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alongside policy rates, reaching 5.38% in 2023 Q3. It declined to 3.81% in 2025 Q3 and stayed at 3.81% in 2026 Q2, maintaining a tight alignment with the 1-year CMT.

Exhibit E-1: Historical Interest Rate

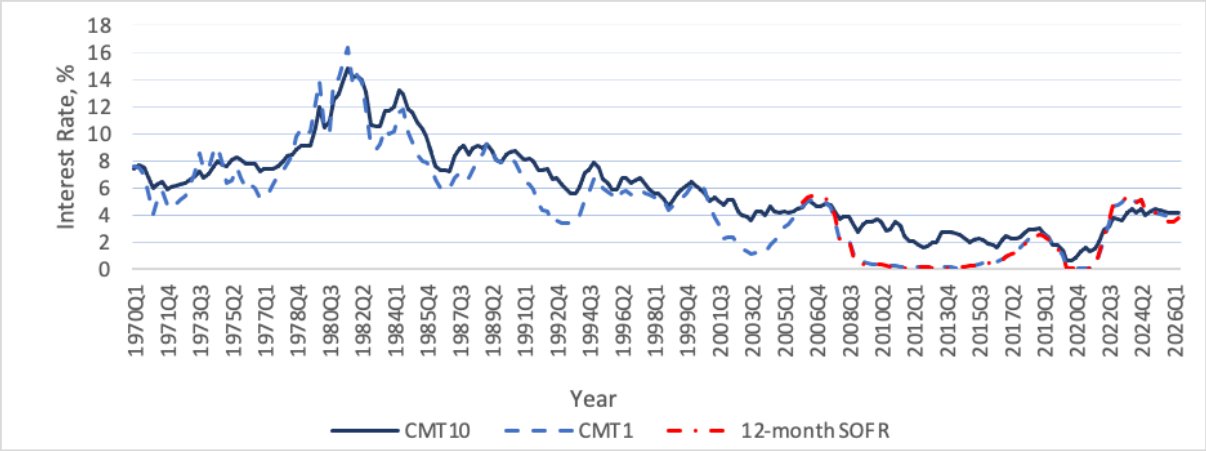


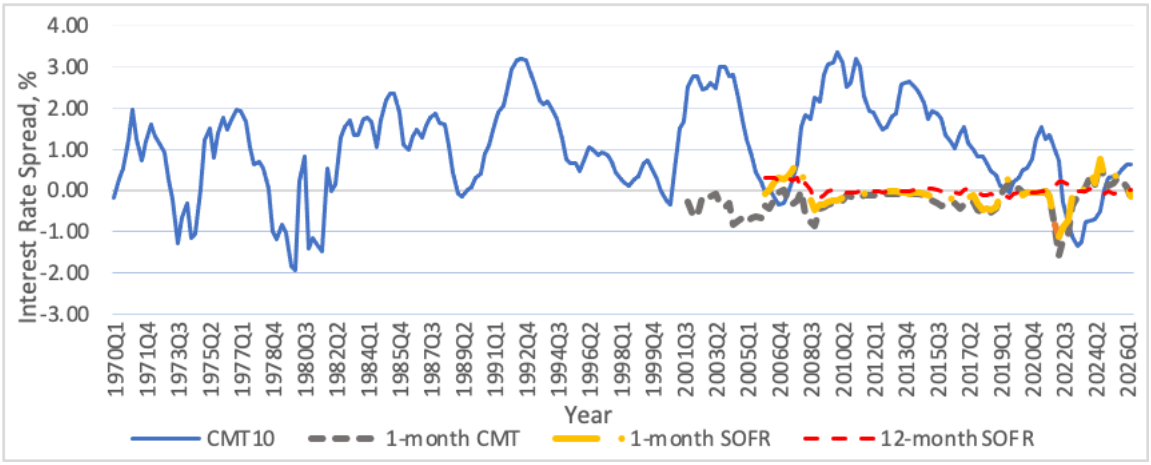
Exhibit E-2 shows historical interest rate spreads for the 10-year CMT, 1-month CMT, and SOFR tenors (1-year and 1-month). The spread between the 10-year and 1-year Treasury rates appears to have cycles above and below zero and high volatility. Historically, the spread has turned negative (yield curve inversion) before recessions, for example, in the late 1970s, early 1980s, 2000, 2006–2007, and again in 2022–2023. The most recent inversion saw the spread reach –1.35% in 2023 Q2. The spread normalized to a positive 0.38% in 2025 Q3 and 0.54% in 2026 Q2, suggesting some easing in monetary policy and reduced recession concerns.

The spread between the 1-month CMT rate and 1-year CMT rate is typically negative (–0.1 to –1.5) having liquidity premium price incorporated. Episodes when the spread narrowed toward zero or briefly turned positive during the late 1970s–early 1980s, mid-2000s, and 2022–2023 correspond to aggressive Federal Reserve rate hikes. During easing cycles and crisis periods, including the early 1990s, post-2008, and pandemic years, the spread widened.

SOFRs are tied to secured funding markets and policy expectations, and their spread over the 1-year CMT rate fluctuates around zero with much smaller variation than Treasury spreads at comparable maturities. The ARMA-GARCH models are identified for the 1-year CMT rate and interest rate spreads.

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Exhibit E-2: Historical Interest Rate Spread (%) with the 1-Year CMT



E1.2. House Price Appreciation Rates

The national house price appreciation rate (HPA) is derived from the FHFA repeat sales seasonally adjusted purchase-only (PO) house price indices (HPIs). The PO HPI is used for national HPA simulation as it provides a reliable measure of housing market conditions since it is based on repeat sales at market prices and does not use any appraised values. The All Transaction (AT) version of HPI is used for deriving geographic dispersion factors as it retains significantly broader regional coverage. At the national level, the AT HPI is very close to the PO HPI.

The HPA at time t is defined as:

$$HPA_t = \frac{HPI_t}{HPI_{t-1}} - 1$$

Exhibit E-3 shows the quarterly national HPI and annualized HPA from CY 1995 Q1 to CY 2026 Q2. The long-term average quarterly HPA is around 1.085% (4.41% annual rate). The HPI increased steadily before 2004 with an annual appreciation rate of about 4.64%. Then house prices rose sharply starting in 2004. The house price appreciation rate was around 10% annually during the subprime mortgage expansion period from 2004 to 2005 and reached its peak at an annual rate of 10.99% in the second quarter of CY 2005. The house price appreciation slowed down in 2006. The overturn started in the second quarter of 2007 and the average growth rate of house prices became negative in 2011. Since then, house price appreciation has stabilized for 10 years. During the COVID-19 pandemic period of 2021 to 2022, house prices increased at a much higher appreciation rate due to the economic stimulation policy and then slowed down after the pandemic was over. The house appreciation rate started upward in the third quarter of 2020 and reached 19.25% in the second quarter of 2021. House appreciation reversed after the second quarter of 2022, dropping to an average annual rate of 6.20% in 2023, 4.56% in 2024, and continued to drop to an average annual rate of 1.95% in 2025 and 1.05% in 2026 Q2. Exhibit E-4 shows the average annual HPA for selected historical time periods.

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Exhibit E-3: Historical National HPI and Annualized HPA

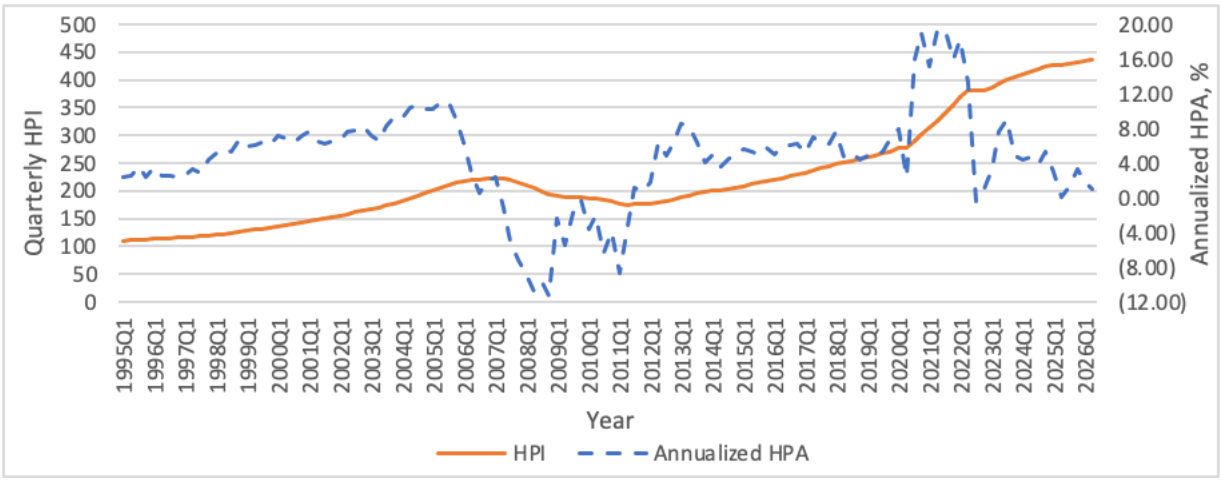


Exhibit E-4: Average Annual HPA by Time Span

Period	Average Annual HPA
1991 – 1997	2.65%
1997 – 2001	6.24%
2002 – 2006	8.95%
2007 – 2011	-3.18%
2012 – 2020 Q2	5.53%
2020 Q3 – 2022 Q2	17.02%
2022 Q3 – 2025 Q1	4.26%
2025 Q2 – 2026 Q2	1.59%

E2. Stochastic Models and the Simulated Scenarios

Economic variables, either monetary policy-driven or credit conditions driven, exhibit high jumps in volatility around regime shifts. Stochastic models need to account for heteroskedastic volatilities in these economic indicators caused by high economic instability and uncertainty. For these reasons, an Autoregressive Moving Average (ARMA) - Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model is chosen for each economic variable.

ARMA-GARCH models combine two types of time series models: Autoregressive Moving Average (ARMA) models for the mean and Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models for the variance. This approach is used when dealing with time series data that exhibits both autocorrelation (dependence of a value on its past values) and volatility clustering (periods of high volatility followed by periods of low volatility).

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Stationarity is very important in forecasting. It enables the use of simpler and more accurate models to provide a solid foundation for forecasting future values. Non-stationary data, on the other hand, can lead to misleading results and inaccurate predictions because its statistical properties change over time, making it difficult to identify true trends and patterns. Therefore, ADF and KPSS tests for stationarity were performed on all variables before specifying GARCH candidate models for the velocities.

Ljung-Box (LB) tests are performed on the residuals of candidate models to identify the presence of autocorrelation (serial correlation) in the residuals of a fitted model. It assesses the overall autocorrelation up to a specified lag, rather than individual lags, to identify the best model.

Weighted ARCH-LM test results are checked to ensure whether there is any remaining ARCH effect present in the standardized residuals. A non-significant result suggests that the volatility model adequately captures conditional heteroskedasticity.

The Nyblom stability test is used to evaluate whether the estimated model parameters remain stable over time. It provides both joint and individual parameter stability tests. In addition, sign-bias tests examine whether the model adequately captures asymmetric volatility responses to positive and negative shocks. Both individual and joint tests are reported. The Pearson goodness-of-fit test is reported to show whether the assumed innovation distribution (e.g., normal, Student-t, or skewed Student-t) provides an adequate fit to the standardized residuals.

The following is the detailed description of the chosen univariate ARMA-GARCH model for each economic variable:

E2.1. 1-Year Treasury Rate

Several Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models are tested using historical 1-year CMT rates from fiscal year 1970 Q1 to CY 2026 Q2. Expanding the sample introduces additional historical volatility regimes and worsens parameter instability, while substantially shortening the sample reduces estimation reliability and leaves residual autocorrelation. The selected intermediate sample provides the best balance among residual adequacy, sample relevance, and parameter stability, although it does not eliminate the near-integrated volatility behavior.

An ARMA(3,5)–sGARCH(1,1) model with Student-t innovations was selected to generate stochastic deviations around the externally specified baseline PEA interest-rate. The specification adequately captures the serial dependence and conditional heteroskedasticity in the selected estimation sample. The weighted Ljung–Box tests indicate no remaining autocorrelation in either the standardized residuals or the squared standardized residuals. The ARCH-LM, sign-bias, and adjusted Pearson goodness-of-fit tests are also satisfactory. The estimated Student-t shape parameter indicates heavy-tailed innovations, allowing the simulations to reflect historically plausible extreme movements. In addition, the model is used to produce stochastic deviations

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around the prescribed baseline rather than to determine the long-run central interest-rate forecast independently.

Let $r_{1,t}$ be the one-year Treasury rate at time t. The stochastic process takes the following form:

$$\Delta r_{1,t} = \sum_{i=1}^{3} a_{1,i}\Delta r_{1,t-i} + \sum_{i=1}^{5} b_{1,i}e_{1,t-i} + \varepsilon_t$$

where $\varepsilon_t = \sigma_t z_t$. $z_t = \sqrt{\frac{v-2}{v}}T_v$, where T_v follows a Student's t-distribution with degrees of freedom $v > 2$, and variance ${\sigma_t}^2$ follows a GARCH (1, 1) model,

$${\sigma_t}^2 = \omega + \alpha{\varepsilon_{t-1}}^2 + \beta{\sigma_{t-1}}^2$$

with the usual stationary constraints $\omega > 0, \alpha \geq 0, \beta > 0$ and $\alpha + \beta < 1$. The estimated results are presented in Exhibit E-5.

Exhibit E-5: Estimation Results for 1-Year CMT Model

Parameter	Estimate	Std. Error	t value	Pr(>|t|)
$a_{1,1}$	0.79938	0.165516	4.82962	0.000001
$a_{1,2}$	0.568118	0.178981	3.17419	0.001503
$a_{1,3}$	-0.504418	0.126456	-3.98887	0.000066
$b_{1,1}$	-0.2625	0.17087	-1.53626	0.124475
$b_{1,2}$	-0.92163	0.144767	-6.36628	0
$b_{1,3}$	0.416372	0.115433	3.60705	0.00031
$b_{1,4}$	0.270862	0.086144	3.14431	0.001665
$b_{1,5}$	-0.233424	0.076092	-3.06766	0.002157
ω	0.000443	0.000493	0.89908	0.36861
α	0.324362	0.063609	5.09931	0
β	0.674638	0.045561	14.80739	0
v	5.392487	1.180447	4.56817	0.000005

The estimated GARCH persistence ($\alpha + \beta$ =0.999) indicates that volatility shocks decay extremely slowly. Consequently, shocks occurring early in a simulation can materially affect dispersion throughout the long forecast horizon. The ARCH and GARCH coefficients are sensitive to historical interest-rate regimes. The long-term tail paths should therefore be interpreted as stress-oriented scenarios rather than precise probability forecasts.

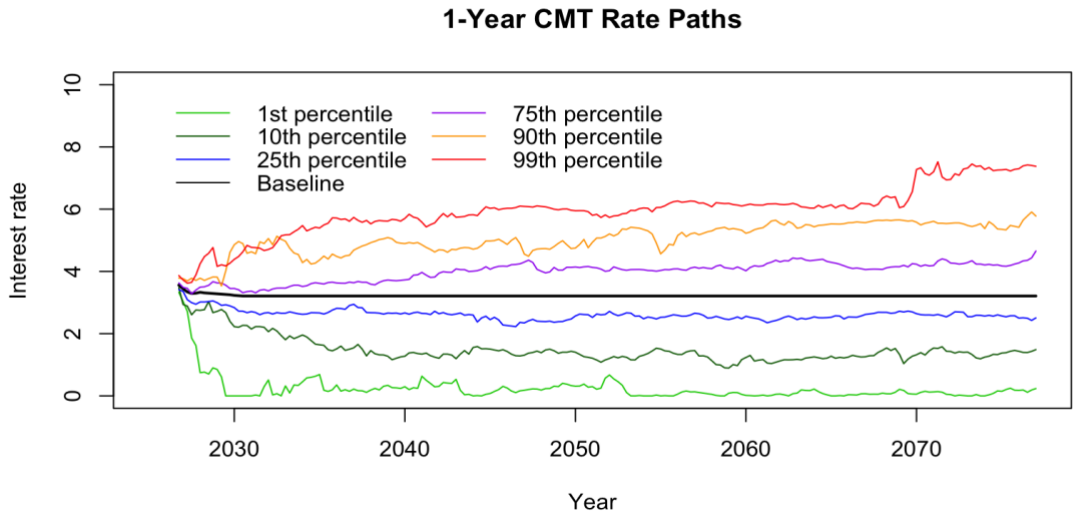
The model based on these parameters is used to simulate the one-year Treasury rates for the forecast period starting in FY 2027 Q1. When conducting simulation, the conditional mean is replaced by the PEA baseline forecast to ensure stochastic deviations around the PEA interest-rate

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baseline forecast. We applied the same procedure for the conditional mean in the simulations for all the other economic variables.

1,000 paths of the future 50 years of 1-year Treasury rates are simulated. The 1st, 10th, 25th, 75th, 90th, and 99th percentile paths are displayed. The 50th percentile path is close to the baseline forecast and is replaced by the PEA baseline assumption. The resulting forecasts for the one-year Treasury rates are shown in the following chart for the baseline PEA and the six stochastic percentile paths.

Exhibit E-6: Simulated 1-Year CMT Rate Percentile Paths



E2.2. 10-Year Treasury Rate

The 10-year Treasury rate is modeled by adding a stochastic spread term to the simulated 1-year Treasury rate. We estimate the dynamics of the spread between the 10-year Treasury rate and 1-year Treasury rate from historical data.

An AR(2)–sGARCH(1,1) model with normally distributed innovations was selected to model the spread between the 1-year and 10-year CMT rates. Both autoregressive coefficients and the ARCH and GARCH parameters are statistically significant under robust standard errors. The estimated volatility persistence indicates persistent but mean-reverting volatility. The weighted Ljung–Box and ARCH-LM tests indicate no remaining residual autocorrelation or ARCH effects. The joint Nyblom test supports overall parameter stability, while the sign-bias tests show no significant asymmetric volatility response. The adjusted Pearson tests also support the normal distribution, although some p-values are moderately close to 5%. Overall, the model provides an adequate and relatively stable framework for simulating the spread, but tail projections should still be interpreted cautiously because normal innovations may understate unusually large interest-rate movements.

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Let $s_{10,t}$ be the spread between the 10-year and one-year Treasury rates at time t. Mathematically, the model for $s_{10,t}$ is as follows.

$$s_{10,t} = a_{10,0} + \sum_{i=1}^{2} a_{10,i} s_{10,t-i} + \varepsilon_t,$$

where ε_t is a normal innovation with mean 0 and variance ${\sigma_t}^2$ following a GARCH (1, 1) model,

$${\sigma_t}^2 = \omega + \alpha {\varepsilon_{t-1}}^2 + \beta {\sigma_{t-1}}^2$$

The model is estimated based on historic spread data from CY 1970 Q1 to CY 2026 Q2. The parameters are shown in the following Exhibit E-7.

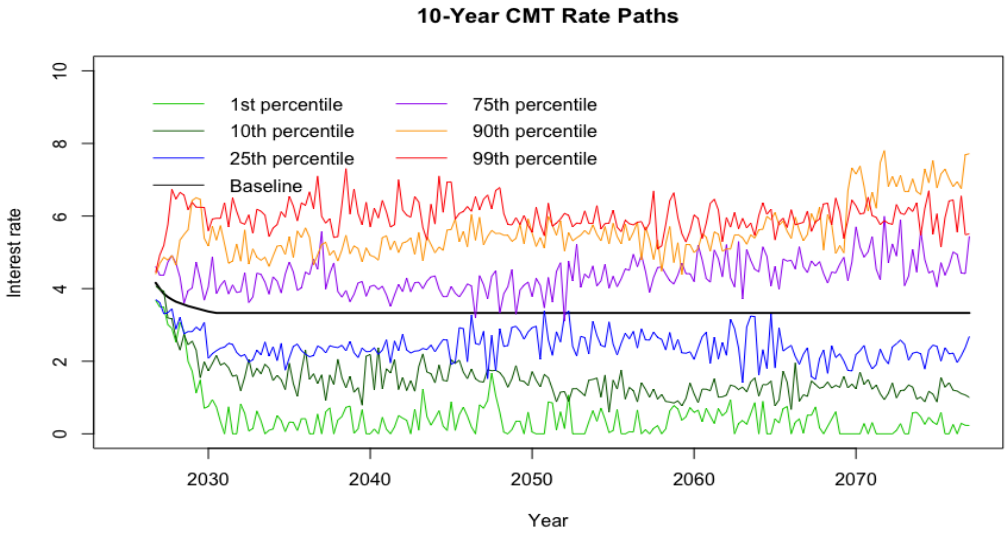
Exhibit E-7: Estimation Results for 10-Year CMT Rate Spread Model

	Estimate	Std. Error	t value	Pr(>|t|)
$a_{10,1}$	1.38789	0.072066	19.2585	0
$a_{10,2}$	-0.4281	0.069676	-6.1441	0
ω	0.01063	0.005291	2.0089	0.045
α	0.2242	0.073494	3.0506	0.002
β	0.72707	0.07467	9.7371	0

We used the estimated parameters to simulate the spread between the 10-year and 1-year Treasury rates with the conditional mean equal to the PEA baseline forecast, such that the 1,000 simulated paths are centered on the baseline estimation. The simulated spread percentile paths are added to the corresponding 1-year CMT percentile paths. Percentile paths are obtained therein. The 1st, 10th, 25th, 75th, 90th, and 99th percentile paths, together with the PEA baseline assumption for the ten-year Treasury rates are shown in the following chart.

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Exhibit E-8: Simulated 10-Year CMT Rate Percentile Paths



E2.3. 1-Month Treasury Rate

The best model, chosen based on stationarity, the Ljung-Box test on standardized residuals, and the Ljung-Box test on standardized squared residuals, is an ARMA(2,0)-GARCH(1,1) model with normally distributed innovations.

The weighted Ljung–Box, ARCH-LM, Nyblom stability, and sign-bias tests indicate no remaining residual autocorrelation or ARCH effects, stable parameters, and no significant asymmetric volatility response. The estimated volatility persistence indicates reasonable long-term mean reversion. The normal specification was selected for innovations because it produces more stable and economically plausible long-term paths.

Let $s_{1m,t}$ be the spread between the 1-month and one-year Treasury rates at time t. Mathematically, the model for $s_{1\mathrm{m},t}$ is as follows

$$s_{1m,t} = a_{1m,0} + \sum_{i=1}^{2} a_{1m,i} s_{1m,t-i} + \varepsilon_t$$

where ε_t is a normal innovation with mean 0 and variance ${\sigma_t}^2$ follows a GARCH (1, 1) model,

$${\sigma_t}^2 = \omega + \alpha {\varepsilon_{t-1}}^2 + \beta {\sigma_{t-1}}^2$$

The model is estimated based on historic spread data from CY 2001 Q3 to CY 2026 Q2. The parameters are shown in the following Exhibit E-9.

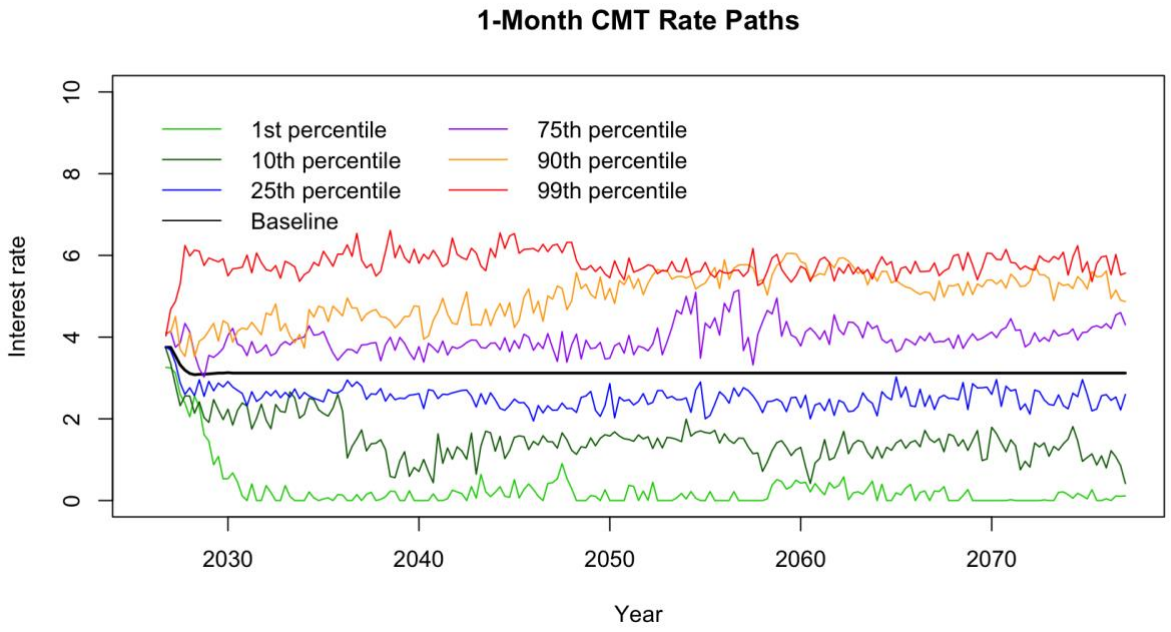
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Exhibit E-9: Estimation Results for 1-Month CMT Rate Spread Model

	Estimate	Std. Error	t value	Pr(>|t|)
$a_{1m,0}$	-0.286154	0.066465	-4.3053	0.000017
$a_{1m,1}$	0.944783	0.122597	7.7064	0
$a_{1m,2}$	-0.179533	0.1245	-1.442	0.149292
ω	0.002601	0.001935	1.3445	0.178802
α	0.129971	0.065724	1.9775	0.047984
β	0.810566	0.082204	9.8604	0

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Exhibit E-10: Simulated 1-Month CMT Rate Percentile Paths



E2.4. 12-Month SOFR

The 12-Month SOFR is modeled by simulating a spread percentile path added to the simulated 1-year Treasury rate. The dynamics of the 12-Month SOFR spread from historic data fails the ADF test for stationarity, as do the 6-Month SOFR spread and 1-Month SOFR spread. The first order of difference is taken to get a stationary time series.

The AR(0)-sGARCH(1,1) model with Student-t innovations and no constant mean was selected for the 12-month SOFR spread-change process. The model provides a parsimonious fit with significant GARCH parameters and captures the heavy-tailed and highly persistent volatility observed in the data. Residual, ARCH, sign-bias, and goodness-of-fit diagnostics are generally satisfactory, supporting its use for stochastic simulation.

Let $\Delta s_{s12,t}$ be the first order of difference of the spread between the 12-Month SOFR and 1-year CMT rates at time t and $r_{1,t}$ 1-year CMT rate at time t, the best fitted model for 12-Month SOFR spread rate is a GARCH (1,1) model with Student's t-distribution innovations:

$$\Delta s_{s12,t} = \varepsilon_{s12,t}$$

where $\varepsilon_{s12,t} = \sigma_t z_t$ and innovations $z_t = \sqrt{\frac{v-2}{v}} T_v$, where T_v follows a student's distribution and variance ${\sigma_t}^2$ follows a GARCH (1, 1) model,

$${\sigma_t}^2 = \omega + \alpha {\varepsilon_{s12,t-1}}^2 + \beta {\sigma_{t-1}}^2$$

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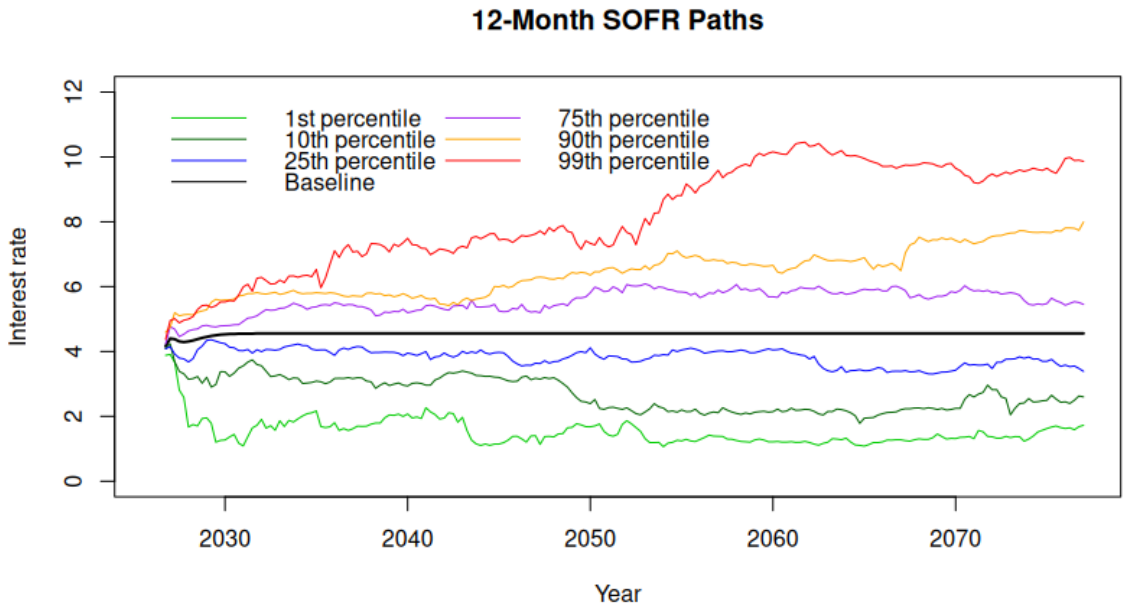
Moody's historical 12-Month SOFR data date back to 2006 Q1. Using historical data from CY 2006 Q1 to CY 2026 Q2, the estimated parameters are shown in Exhibit E-11.

Exhibit E-11: Estimation Results for the 12-Month SOFR Spread Model

	Estimate	Std. Error	t value	Pr(>|t|)
ω	0.000744	0.000716	1.0393	0.298663
α	0.574039	0.271593	2.1136	0.03455
β	0.424961	0.148332	2.8649	0.004171
v	3.440164	0.629055	5.4688	0

We used the estimated parameters to simulate the 12-Month SOFR spread rate with the conditional mean equal to the baseline spread. The simulated spread percentile paths are added to the simulated 1-year CMT percentile paths. The 12-Month SOFR percentile paths are obtained therein as shown in the following chart.

Exhibit E-12: Simulated 12-Month SOFR Rate Percentile Paths



E2.5. 1-Month SOFR

The first order of difference is taken to ensure stationarity in time series. An AR(1)-sGARCH(1,1) model with Student t-innovations was selected to model quarterly changes in the spread between the one-month SOFR and one-year rate. The AR coefficient is significant under robust standard errors, and the model passes the residual Ljung–Box, squared-residual Ljung–Box, ARCH-LM, sign-bias, adjusted Pearson goodness-of-fit, and joint Nyblom stability tests. The Student t-distribution appropriately captures the heavy-tailed movements observed in the spread. The estimated volatility persistence is very high implying that volatility shocks dissipate extremely

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slowly. Because the estimation sample contains fewer than 100 observations, long-term forecasts and extreme percentile paths should be interpreted cautiously.

Let $\Delta s_{s1,t}$ be the first-order difference of the spread between the 1-Month SOFR and 1-year CMT rates at time t and $r_{1,t}$ 1-year CMT rate at time t, the best-fitted model for the 1-Month SOFR spread rate is an AR(1)-GARCH (1,1) model with Student's t-distribution innovations:

$$\Delta s_{s1,t} = a_{s1,1}\Delta s_{s1,t-1} + \varepsilon_{s1,t}$$

where $\varepsilon_{s1,t} = \sigma_t z_t$ and innovations $z_t = \sqrt{\frac{v-2}{v}}T_v$, where T_v follows a Student's t-distribution and variance ${\sigma_t}^2$ follows a GARCH (1, 1) model,

$${\sigma_t}^2 = \omega + \alpha{\varepsilon_{s1,t-1}}^2 + \beta{\sigma_{t-1}}^2$$

Moody's historical 1-Month SOFR data date back to 2006 Q1. Using historical data from CY 2006 Q1 to CY 2026 Q2, the best fitted GARCH model is chosen based on Ljung-Box test on standardized residuals, Ljung-Box test on standardized squared residuals, the AIC, BIC, and likelihood values. The estimated parameters are shown in Exhibit E-13.

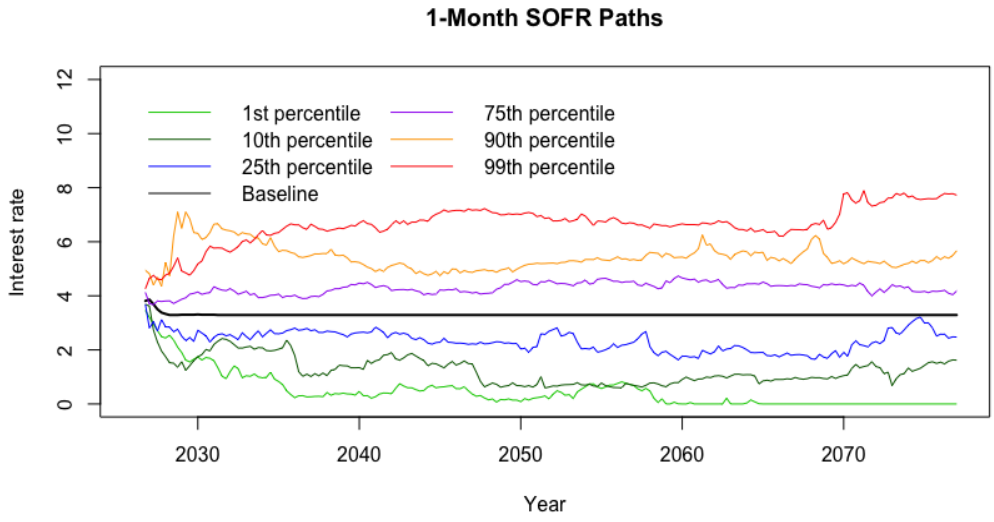
Exhibit E-13: Estimation Results for the 1-Month SOFR Spread Model

	Estimate	Std. Error	t value	Pr(>|t|)
$a_{s1,1}$	0.22274	0.11570	1.92508	0.05422
ω	0.00060	0.00066	0.91101	0.36229
α	0.41478	0.15039	2.75797	0.00582
β	0.58422	0.12263	4.76406	0.00000
v	3.73749	0.88602	4.21830	0.00003

AR (1) coefficient has p-value of 0.05422 showing marginal significance, while reducing this term will leave autocorrelation in residuals. Therefore. AR(1)-sGARCH (1,1) is chosen. We used the estimated parameters to simulate the 1-Month SOFR spread rate with the conditional mean equal to the baseline spread. The simulated spread percentile paths are added to the simulated 1-year CMT percentile paths. The 1-Month SOFR percentile paths are obtained therein, as shown in Exhibit E-14.

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Exhibit E-14: Simulated 1-Month SOFR Percentile Paths



E2.6. House Price Appreciation Rates

E2.6.1. National HPA

Several GARCH models are fitted to the historical house appreciation rates, and its first order of difference and one-year rollover forecast tests are conducted to evaluate the models. An AR(2)–sGARCH(1,1) model with skewed Student-t innovations and variance targeting was selected to model the house-price appreciation rate. Both autoregressive coefficients and the ARCH and GARCH parameters are statistically significant under robust standard errors. The estimated GARCH persistence indicates persistent but mean-reverting volatility. The weighted Ljung–Box, ARCH-LM, Nyblom stability, sign-bias, and adjusted Pearson goodness-of-fit tests are all satisfactory. The skewed, heavy-tailed innovation distribution also captures asymmetric and extreme HPA movements.

Let HPA_t denote quarterly house price appreciation rate. The selected AR(2)–sGARCH(1,1) model with skewed Student-t innovations and variance targeting model is

$$HPA_t = a_{h,1}HPA_{t-1} + a_{h,2}HPA_{t-2} + \varepsilon_{h,t}$$

where $\varepsilon_{h,t}$ is a skewed t-distributed innovation with variance ${\sigma_t}^2$ modelled by a GARCH (1, 1) model,

$${\sigma_t}^2 = \omega + \alpha {\varepsilon_{h,t-1}}^2 + \beta {\sigma_{t-1}}^2$$

The GARCH (1,1) model with skewed t-distributed innovations performs much better than the one with normal innovations in this model. Using the historic data from 1991 Q1 to 2026 Q2, we estimate the model and have the results as shown in Exhibit E-15.

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Exhibit E-15: Estimation Results for the National HPA Model

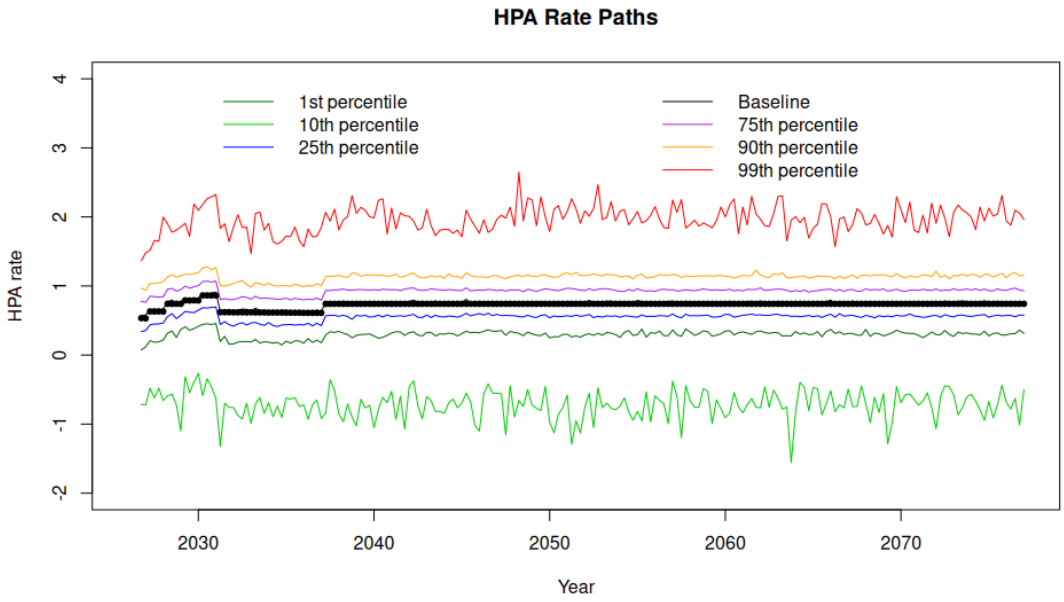
	Estimate	Std. Error	t value	Pr(>|t|)
$a_{h,1}$	0.81737	0.07496	10.90400	0.00000
$a_{h,2}$	0.18200	0.07758	2.34600	0.01897
α	0.39891	0.07912	5.04200	0.00000
β	0.55638	0.08828	6.30240	0.00000
skew	0.83704	0.08294	10.09180	0.00000
shape	4.44409	1.10345	4.02740	0.00006
ω	0.01871	-	-	-

Variance targeting was applied by setting the GARCH intercept so that the model-implied unconditional variance equaled the historical variance of the mean-adjusted HPA series, assuming that the historical sample variance is a reasonable estimate of future long-run variance. It may be inappropriate if the sample contains major structural breaks or if future HPA volatility is expected to differ materially from historical volatility. This variance targeting reduces the number of freely estimated variance parameters and avoids the near-unit volatility persistence produced by the unrestricted specification. The resulting model retained statistically significant ARCH and GARCH effects, passed the parameter-stability and residual diagnostic tests, and produced more credible mean-reverting volatility for long-term simulation.

Due to the high volatility of house price appreciation (HPA) rates, the selected simulated percentile paths may cross one another. Under the original approach, each percentile path is identified as the simulated path closest to the corresponding quantile path, where the quantile path is constructed from the specified percentile of simulated HPA rates at each quarter. Because the selected paths are individual simulated trajectories, their relative rankings may change over time, resulting in crossings. To eliminate these crossings, the HPA percentile paths are instead constructed using the corresponding percentile of simulated HPA rates independently at each quarter, as illustrated in the following chart.

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Exhibit E-16: Simulated Quarterly HPA Rate Percentile Paths



E2.6.2. Geographic Dispersion

The MSA-level HPA forecasts were based on Moody's forecast of local and the national HPA forecasts. Specifically, at each time t, there is a dispersion of HPAs between the ith MSA and the national forecast:

$$Disp_{i,t}^{Base} = (HPA_{i,t}^{Base} - HPA_{national,t}^{Base})$$

This dispersion forecast under Moody's baseline estimates was preserved for all local house price forecasts under individual future economic paths. That is, for economic path j, the HPA of the ith MSA at time t was computed as:

$$HPA_{i,t}^{j} = (HPA_{national,t}^{j} + Disp_{i,t}^{Base})$$

This approach retains the relative current housing market cycle among different geographic locations, and it allows us to capture the geographical concentration of FHA's current endorsement portfolio. This approach is also consistent with Moody's logic in creating local market HPA forecasts relative to the national HPA forecast under alternative economic scenario forecasts. We understand this approach is equivalent to assuming perfect correlation of dispersions among different locations across simulated national HPA paths, which creates systematic house price decreases during economic downturns and vice versa during booms. Due to Jensen's Inequality, this tends to generate a more conservative estimate of claim losses.

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E3. COVID-19 Pandemic Consideration

The 2022 HECM Actuarial Review reported that there were no changes in portfolio composition or borrower behavior evident in the recent data; therefore, based on the information available at that time, no adjustments were undertaken to account for potential COVID-19 impacts.

As more data is available, the impacts of the COVID-19 pandemic on economic indicators are noticeable and dramatic, causing higher volatility in these economic variables. Abrupt changes in the recent historic data of these economic measures present additional challenges when fitting stochastic models, especially the unemployment rates which had abnormal outliers during pandemic period. Moving average method is used to smooth unemployment rates when fitting the GARCH model.

At the same time, because of the historic nature of this event and the changing economic environment before and after the pandemic, it is difficult to ascertain which impacts might be attributed solely to the pandemic, and whether these changes will persist in the future or revert to pre-pandemic conditions. Rather than apply different models including and excluding the pandemic period to interpret COVID-19 impacts, we use customized GARCH models for the individual economic variables to capture the high volatility of the COVID-19 period and subsequent economic changes in the data and to develop the simulated diversions from the PEA baseline assumptions.

In the FY 2026 Actuarial Review, the best fitted GARCH models have similar structures to the corresponding models used in the 2023 to 2025 Actuarial Reviews, with slight modification in the selected structure and corresponding changes in parameters based on model validation and rigorous test results. This provides evidence that GARCH models can capture the volatility in various economic variables, including the impact of COVID-19.

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Appendix F. Comparison of HUD and ITDC Models and Assessment of Vulnerabilities

Scope and relationship to the FY 2025 assessment

The FY 2025 Appendix F addendum, dated January 27, 2026, provides the complete comparison of HUD/Summit-Milliman-IFE (S-M-I) and ITDC HECM modeling approaches and the assessment of potential vulnerabilities. That study remains the reference for the underlying model framework. This FY 2026 appendix focuses on material updates to HUD's model: recalibration of note sale classification and weighting, and revisions to the conditioning of assignment probabilities.

In HUD's model change memo dated September 15, 2026, these two updates reduce NPV by approximately $1.299 billion and $1.263 billion, respectively. Their combined impact of approximately $2.562 billion accounts for approximately 51.5% of the $4.979 billion year-over-year decline in FHA's NPV from FY 2025 to FY 2026. ITDC conducted independent analysis by attempting to replicate comparable assumptions within its own models and determined that the dollar impacts of the changes are reasonable.

Exhibit F-1: Sensitivity of the FY 2026 Baseline NPV to the Share of Eligible Loans Not Assigned ($ Million)

Assumptions	Description	NPV ($million)	Percentage of change
sto50	**FY26 Baseline Run**	**$6,307**	
sto50_35% NoA	FY26 Baseline with an assumption of 35% of eligible loans not being assigned	$3,270	(48.2%)
sto50_50% NoA	FY26 Baseline with an assumption of 50% of eligible loans not being assigned	$1,391	(77.9%)

That finding addresses the magnitude of the impacts under the assumptions tested; it does not, by itself, establish that the assumptions are appropriate throughout a 50-year projection horizon. The following sections assess that distinction.

1. Note sale classification and weighting

HUD updated the CT2 conveyance-versus-payoff model to classify note sales as conveyance outcomes, aligning the probability model with the definition used for the note sale volume assumption. HUD states that the prior implementation assigned greater weight to payoff outcomes than observed in historical experience. The revised approach reduces the relative share of payoffs from 80% to 68% and increases the representation of conveyances and note sales, which generally produces lower recoveries than payoffs. HUD reports an approximately $1.299 billion reduction in NPV from this step.

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Using consistent outcome definitions across the probability model and recovery calculations has a sound conceptual basis. HUD's previous data preparation for the conveyance and payoff model excluded note sales from the data, which caused overstated payoff frequency. Revising the outcome weights can address an upward bias in projected recoveries. ITDC's replication analysis supports the reasonableness of the reported dollar impact under the assumptions tested.

HUD's revised classification corrects the previous omission of note sales from its property disposition model. However, the Actual-to-Expected (A/E) test presented in the technical report indicates a slight overestimation of conveyance rates at early and advanced loan ages, potentially due to limited data in these periods. This indicates a conservative estimate of the NPV.

Furthermore, the revised classification does not eliminate uncertainties associated with the volume, representativeness, and changing composition of note sale transactions, as well as variability in bidding activity and sale outcomes. Therefore, it is important to assess whether the historical experience and modeling assumptions adequately reflect current operational practices and the characteristics of the projected loan portfolio. Changes in projected recoveries should be evaluated by distinguishing the impact of revised disposition probabilities from changes in note sale pricing and other claim severity assumptions. Continued monitoring of disposition experience is necessary to assess the stability and reliability of the projected results.

Unlike conveyance versus payoff outcomes, the choice for note sale is influenced by discretionary decisions, investor participation, and market conditions. Because note sales are initiated at HUD's discretion, their future timing, frequency, and selection criteria are not sufficiently predictable to support a separate long-term model for note sale dispositions. ITDC's independent modeling framework does not separately project note sales, instead relying on traditional conveyance and payoff disposition assumptions.

ITDC acknowledges that the treatment of historical note-sale transactions could potentially result in an overestimation of payoff terminations and influence the estimated disposition probabilities. As part of the FY 2027 actuarial review, ITDC will examine the historical classification of note-sale transactions using the data identified by HUD in SFDW (claims_601_case_data) to assess whether these transactions are appropriately reflected within the existing conveyance and payoff categories or whether a separate note-sale disposition model or other methodological refinements are warranted.

2. Assignment conditioning and related cash flows

HUD revised the assignment framework so that each period's assignment probability and associated cash flows account for the loan remaining unassigned through all prior periods. HUD states that the earlier cash flow implementation conditioned assignments on survival from termination but did not fully account for prior assignment. The change is to the application of probabilities in cash flow projections, rather than a redesign of the underlying assignment regression. HUD reports a reduction in projected assignments from approximately 106,000 to 89,000, or 16.0 percent, and an approximately $1.263 billion adverse NPV effect in the memo's sequential analysis.

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The conceptual correction is supported by the one-time nature of assignment: a loan that has already been assigned should not generate another assignment event. ITDC's replication supports the magnitude of the impact under the assumptions tested. However, the technical report states the cumulative assignment probability is applied to claim counts rather than to the projected population of active, eligible, and unassigned loans. If the claim counts do not represent eligible loans, new assignments, or cumulative assignments, the number of assigned loans will be underestimated.

Let $a_t = Pr(assignment\ during\ quarter\ t|active, unassigned)$, and

$$q_t = Pr(termination\ during\ quarter\ t|active).$$

There are four outcomes of an unassigned active loan: unassigned-active (U), assigned-active(A), unassigned-terminated (UT), and assigned-terminated (AT).

Using states (U, A, UT, AT), the quarterly transition matrix is

$$P_t = \begin{pmatrix} (1-a_t)(1-q_t) & a_t(1-q_t) & (1-a_t)\,q_t & a_t q_t \\ 0 & 1-q_t & 0 & q_t \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Starting at eligibility,

$$\pi_0 = (1,0,0,0),$$

and forecast recursively:

$$\pi_{t+1} = \pi_t P_t.$$

This recursive equation is helpful to validate the correct application of HUD's new definition of conditional assignment probabilities. HUD's assignment probability validation plot shows that projected assignment probabilities are slightly lower than actual probabilities in the first two quarters, indicating a conservative estimate of the NPV.

In addition, the revised probabilities should not change the allocation of loans consistently among unassigned, assigned, and terminated states. The associated cash flows, including mortgage insurance premiums, CT1 claims, CT2 assignment payments, post-assignment advances, and recoveries, should follow consistent state transitions and timing assumptions.

HUD attributes the negative NPV impact primarily to lower recoveries resulting from fewer assignments under current house price conditions. While this explanation is plausible, fewer assignments also reduce CT2 assignment payments and affect other projected cash flows. Therefore, the reduction in projected assignments from 106,000 to 89,000, accompanied by an approximately $74,000 decrease in NPV per unassigned loan, warrants further reconciliation.

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Further assessment is also needed to determine whether the underlying unconditional assignment probabilities and associated cash flows remain appropriate as economic conditions and loan characteristics evolve.

Overall Assessment

Both changes have reasonable conceptual justifications, and ITDC's replication analysis supports their estimated financial impacts under the assumptions tested. However, ITDC's assessment distinguishes the reasonableness of the tested dollar impacts from the suitability of the assumptions for long-term projections. Note sale frequency, pricing, and the resulting weight shift in payoff need continued monitoring. While the assignment probability correction is conceptually appropriate, its application requires further validation. Nevertheless, these limitations do not necessarily indicate that FHA's overall NPV estimate is unreasonable.

Appendix G. Tables of Historical and Projected Loan Termination Rates

Note: The tables referenced in this appendix are provided separately as accompanying attachments.

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