

**Actuarial Review of the  
Federal Housing Administration  
Mutual Mortgage Insurance Fund (Excluding HECMs)  
for Fiscal Year 2009**

**November 6, 2009**

**Prepared for**



**U.S. Department of Housing and Urban Development**

**By**



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November 6, 2009

The Honorable David H. Stevens  
Assistant Secretary for Housing -- Federal Housing Commissioner  
451 Seventh Street, SW, Room 9100  
Washington, DC 20410

Dear Mr. Stevens:

The Cranston-Gonzalez National Affordable Housing Act requires an annual independent actuarial analysis of the economic net worth and soundness of the Federal Housing Administration's Mutual Mortgage Insurance (MMI) Fund. We have completed the fiscal year 2009 Actuarial Review of the MMI Fund Excluding HECMs (the Fund) and summarize our findings below.

The primary purpose of this study is to estimate

- the *economic value* of the Fund, defined as the sum of existing capital resources plus the net present value of the current books of business, *excluding HECMs*, and
- the total insurance-in-force (IIF) of the Fund, *excluding HECMs*,

to be used by HUD in estimating the aggregated economic value and capital ratio of the entire MMI Fund.

We estimate that the Fund's economic value was \$2.73 billion and the unamortized insurance in force was \$686.26 billion as of the end of fiscal year 2009. We project that at the end of fiscal year 2016 the Fund's economic value will be \$41.07 billion and the unamortized insurance in force will be \$1,664.36 billion. We also estimated that the economic value could be negative in FY 2009 and stay negative until FY 2012 under more pessimistic economic scenarios than those represented by our base-case assumptions.

The financial estimates presented in this Review require projections of events more than 30 years into the future. These projections are dependent upon the validity and robustness of the underlying model and assumptions about future economic environment and loan characteristics. These assumptions include economic forecasts by IHS Global Insight and the assumptions concerning future endorsement portfolios projected by FHA. To the extent that the realized experience deviates from these or other assumptions, the actual results may differ, perhaps significantly, from our current projections. The models used for this Review are, by nature, large and complex. We applied an extensive validation process to assure that the results reported in this Review are accurate and reliable.

The full actuarial report explains these projections and the reasons for the changes since last year's actuarial review.

Very truly yours,

Tyler Yang, Ph.D.  
Chairman and CEO  
Integrated Financial Engineering, Inc.



**Actuarial Review of the  
Federal Housing Administration  
Mutual Mortgage Insurance Fund (Excluding HECMs)  
for Fiscal Year 2009**

I have reviewed the "Actuarial Review of the Federal Housing Administration Mutual Mortgage Insurance Fund (Excluding HECMs) for Fiscal Year 2009," dated November 6, 2009. 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 upon data and information prepared by the Federal Housing Administration (FHA). I have relied upon the FHA for the accuracy and completeness of this data. In addition, I also relied upon the reasonableness of the assumptions used in the economic projections prepared by IHS Global Insight Inc., from which the base case used in the Review was derived.

It is my opinion that on an overall basis the methodology and underlying assumptions used in the Review are reasonable and appropriate in the circumstances. In my opinion the estimates in the Review lie within a reasonable range of probable values as of this time although the actual experience in the future will not unfold as projected.

*Phelim P. Boyle*

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November, 6, 2009



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## Executive Summary

The 1990 Cranston-Gonzalez National Affordable Housing Act (NAHA) requires an independent actuarial analysis of the economic net worth and financial soundness of the Federal Housing Administration's (FHA's) Mutual Mortgage Insurance Fund. This report presents the results of our analysis for fiscal year (FY) 2009.

The Housing and Economic Recovery Act of 2008 (HERA) moved several additional programs into the Mutual Mortgage Insurance Fund. One of them, Home Equity Conversion Mortgages (HECMs, which are reverse mortgages) is analyzed separately by HUD and is excluded from the FY 2009 Actuarial Review reported here. *In the remainder of this Review, the term “the Fund” refers to the MMI Fund excluding HECMs.*

The primary purpose of this study is to estimate

- the *economic value* of the Fund, defined as the sum of existing capital resources plus the net present value of the current books of business, *excluding HECMs*, and
- the total insurance-in-force (IIF) of the Fund, *excluding HECMs*,

to be used by HUD in estimating the aggregated economic value and capital ratio of the entire MMI Fund.

Under our base-case assumptions we estimate that the economic value of the Fund as at the end of FY 2009 is \$2.73 billion. This represents a decline of 82.74 percent from the \$15.82 billion estimated for year-end FY 2009 in the FY 2008 Review. This severe decline is mainly due to the current severe housing market decline and extremely stressful economic conditions. Because the HECM business is excluded from this analysis, we do not report the capital ratio but conclude that the capital ratio of the Fund—excluding HECMs—falls below two percent this year.

We also conclude that the economic value could be negative in FY 2009 and stay negative until FY 2012 under more-pessimistic economic scenarios than those represented by our base-case assumptions.

### A. Status of the Fund

Exhibit ES-1 provides our base case estimates of the Fund's current and future economic value and insurance in force (IIF). Both the economic value and the IIF of the Fund are expected to increase each year over the next seven years.



## Exhibit ES-1

Projected Fund Performance for FYs 2009 to 2016 (\$ Millions)						
Fiscal Year	Economic Value of the Fund <sup>a</sup>	Unamortized Insurance in Force <sup>b</sup>	Amortized Insurance in Force <sup>b</sup>	Economic Value of Each New Book of Business	Volume of New Endorsements <sup>c</sup>	Investment Earnings on Fund Balances
2009	2,732	686,263	656,012	-835	337,436	
2010	7,882	871,892	835,886	5,124	299,954	27
2011	14,171	996,792	952,354	6,084	245,997	204
2012	20,425	1,124,334	1,068,027	5,872	222,320	383
2013	25,650	1,248,181	1,178,519	4,638	223,856	587
2014	30,272	1,392,590	1,306,650	3,822	226,737	800
2015	35,488	1,531,136	1,427,563	4,267	235,490	949
2016	41,068	1,664,357	1,542,385	4,483	243,691	1,097

<sup>a</sup> All values are as of the end of each fiscal year. The economic value for each future year (FYs 2010 through 2016) is equal to the economic value of the Fund at the end of the previous year, plus the current year's interest earned on the previous Fund balance, plus the economic value of the new book of business.

<sup>b</sup> Estimated based on the data extract as of June 30, 2009, HUD projections of new endorsements, and projected loan performance.

<sup>c</sup> Based on HUD September 2009 projection.

In defining the statutory capital ratio, NAHA stipulates the use of unamortized insurance-in-force as the denominator. However, "unamortized insurance-in-force" is defined in the legislation as "the remaining obligation on outstanding mortgages" – which is generally understood to describe amortized IIF. To allow the flexibility of calculating the capital ratio under either definition, both the unamortized and amortized IIFs are reported in this Review. Following the convention of previous Actuarial Reviews, most of our discussion in this Review focuses on the unamortized IIF.

We also projected the performance of the Fund under five alternative future economic scenarios to assess the sensitivity of the results to key assumptions. Under the most adverse scenario, the economic value of the Fund at the end FY 2009 is -\$17.09 billion. Under this scenario, the economic value stays negative through 2011, becoming positive in FY2012 and staying positive thereafter. In two of the other alternative scenarios, the economic value of the Fund is negative in FY 2009 but becomes positive in all future years. Under the remaining two of the alternative scenarios, the economic value of the Fund is positive in FY 2009 and in all future years.



## **B. Sources of Change in the Status of the Fund**

### *Change in Economic Value from FY 2008 to FY 2009*

We estimate that the economic value of the Fund was \$2.73 billion as of the end of FY 2009, which represents a decrease of \$10.18 billion compared to the economic value of \$12.91 billion as of the end of FY 2008 reported in last year's Actuarial Review. This is a 78.9 percent decrease in the estimated economic value of the Fund. On the other hand, there is a 59.7 percent increase in the estimated unamortized IIF from \$429.63 billion to \$686.26 billion.

### *Current Estimate of FY 2009 Economic Value Compared with the Estimate Presented in the FY 2008 Actuarial Review*

Our current estimate of the FY 2009 economic value is \$13.09 billion lower than the economic value projected for FY 2009 in the FY 2008 Actuarial Review. Our current estimate of the FY 2015 economic value is \$35.49 billion which is \$22.02 billion lower than estimated in the FY 2008 Actuarial Review. These differences are attributed to the following changes, with the magnitude of the change in the FY 2009 economic value for each of the changes shown in parentheses:

- using the actual origination volume of the FY 2008 book of business (-\$0.51 billion),
- using the actual capital resources as of the end of FY 2008 (-\$0.08 billion),
- updating HUD's projection of volume and compositions of new books of business (\$4.89 billion),
- updating external economic forecasts (-\$9.78 billion),
- updating discount factors for present value calculations (-\$2.16 billion),
- updating econometric loan performance models (\$0.59 billion),
- implementing a loss severity rate model (-\$6.44 billion), and
- updating insurance premium schedule (\$0.40 billion).

In total, the changes to the FY 2009 economic value compared to its estimate in last year's Review amounted to -\$13.09 billion.



### *Additional Comments*

The estimates presented in this Review reflect projections of events more than 30 years into the future. These projections are dependent upon a number of assumptions, including economic forecasts by IHS Global Insight, future FHA insurance demand forecasts by HUD, and the assumption that FHA does not change its policies regarding refunds, premiums, distributive shares, underwriting rules, and administrative expenses. To the extent that these or other assumptions are subject to change, the actual results will vary, perhaps significantly, from our current projections.

Estimation of the variables in the models used for predicting prepayments and claims requires large amounts of loan-level data, requiring extensive data processing. To complete the Review within the timeframe required by HUD, we continued to adopt the convention of using partial-year data for FY 2009. Although we have not audited the data for accuracy, we have reviewed the data provided by HUD for integrity and consistency and believe it to be reasonable. Moreover, the information contained in this report may not correspond exactly with other published analyses that rely on HUD data compiled at different times or obtained from other systems.

### **C. Impact of Economic Forecasts**

The economic value of the Fund and its pattern of capital accumulation to FY 2016 depend on many factors. One of the most important factors is the nation's future economic condition during the remaining lifetime of the Fund's books of business. We captured the most significant factors in the U.S. economy affecting the performance of the loans insured by the Fund through the use of the following variables in our models:

- 30-year home mortgage commitment rates
- Ten-year Treasury rate
- One-year Treasury rate
- Average growth rate of national house prices
- Dispersion of individual house price appreciation rates from the national average rate

The projected performance of FHA's books of business, measured by their economic value, is affected by changes in these economic variables. The base-case results in this report are based on IHS Global Insight forecasts for interest rates and national average house price appreciation rates as of August 2009. In addition, we applied house price growth rate dispersion estimates provided by the Federal Housing Finance Agency (FHFA), and additional dispersion parameters



that were estimated to account for the variation of individual house price appreciation rates around the average national-level house price growth rate. The actuarial estimates are based on the IHS Global Insight projection that FY 2010 will suffer an additional 6.5 percent decline in national house prices. This significantly increased projected losses for the FY 2006 through the FY 2009 books.

We considered five alternative scenarios to assess the strength of the Fund to withstand a range of future market conditions. The first four scenarios assume the following additional adverse impacts over the base-case economic projections: (1) deeper housing recession, (2) up-interest-rate shock, (3) down-interest-rate shock, and (4) higher loss severity rates. A fifth, less pessimistic, economic scenario assumes the economy will soon begin to recover, with no additional house price decline starting in FY 2010. These five scenarios do not represent the full range of possible experience, but they each represent a significant variant from the base case. They demonstrate the sensitivity of the analysis results to reasonably stressful variations in economic conditions, and hence provide insights into the capability of the Fund to withstand even more difficult economic environments. The results of these sensitivity analyses on the Fund's performance are presented in Exhibit ES-2.

Compared to the base case, the estimated FY 2009 economic value under the most severe alternative scenario is projected to fall to -\$17.09 billion. Under this scenario the economic value of the Fund is projected to remain negative until FY 2012. In contrast, under the early recovery scenario, the economic value for FY 2009 is estimated to be \$10.73 billion, which is \$8 billion higher than the base-case estimate of \$2.73 billion.

#### Exhibit ES-2

Projected Fund's Economic Value Under Alternative Economic Scenarios (\$million)						
Fiscal Year	Base Case	Deeper Recession	Up Rate Shock	Down Rate Shock	High Loss Severity Rate	Earlier Recovery
FY 2009 Economic Value	\$2,732	-\$3,344	\$10,528	-\$17,089	-\$2,036	\$10,727
FY 2016 Economic Value	\$41,068	\$32,768	\$29,952	\$21,483	\$28,933	\$54,533

The passage of HERA prohibits FHA's endorsement of seller-financed downpayment assistance loans on or after October 1, 2008. These loans experienced claim rates that are considerably



higher than otherwise comparable non-assisted loans. The share of loans with downpayment assistance from non-profit organizations declined significantly after the passage of HERA. It is expected that there will be no more of these loans going forward. This will help improve the credit quality of the FHA portfolio, particularly the new books of business to be endorsed in the coming years. The significance of eliminating this program is highlighted by our estimate that if non-profit assisted loans had been excluded, the economic value of the Fund would have been \$13.15 billion in FY 2009.



**Section I: Introduction**

The 1990 Cranston-Gonzalez National Affordable Housing Act (NAHA) mandated that the Federal Housing Administration's (FHA's) Mutual Mortgage Insurance (MMI) Fund maintain a capital ratio of 2 percent from October 1, 2000 forward. The capital ratio is defined by NAHA as the ratio of the Fund's economic value to its unamortized insurance-in-force (IIF). NAHA also established the requirement for the MMI fund to undergo an annual independent actuarial review.

IFE Group was engaged by the Department of Housing and Urban Development (HUD) to conduct the independent actuarial review to estimate the economic value and IIF of the MMI Fund for FY 2009. The Housing and Economic Recovery Act of 2008 (HERA) moved several additional programs into the Mutual Mortgage Insurance Fund. One of these programs, Home Equity Conversion Mortgages (HECMs), is to be analyzed separately by HUD and is excluded from the FY 2009 Actuarial Review reported here. HUD will combine the results in this Review with the corresponding measures of the HECM program to generate the economic value and capital ratio of the entire MMI Fund. The combined economic value and capital ratio of the entire MMI Fund are the measures to be used by the Secretary of HUD to assess whether the MMI Fund meets the capital standards set forth in NAHA. We will refer to the portfolio excluding HECMs as "the Fund" for this report.

The analysis in this review relies on information provided by HUD, such as the historical performance of the existing loans in the Fund, projected future economic conditions from IHS Global Insight and projected future mortgage originations.

**A. Implementation of NAHA**

Following the issuance of the FY 1989 Actuarial Review and the ensuing debate, Congress mandated various changes to the MMI Fund. The required revisions to the MMI Fund focused on five major issues: 1) the development of an actuarial standard of financial soundness; 2) modification of the minimum borrower downpayment requirement; 3) changes in insurance premiums; 4) distributive shares; and 5) modification of underwriting standards and data requirements.

The changes called for in the Act were specifically designed to remedy the financial difficulties encountered by the Fund during the 1980s. Each change was intended either to reduce the risks inherent in new books of business or to adjust premiums to more adequately compensate for the risks.



The NAHA legislation required that the Fund be operated on an actuarially sound basis by providing specific capital standards for the Fund and timeframes over which these standards should be met. It also defined the actuarial standard measure as the ratio of the Fund's capital, or economic value, to its unamortized IIF.

To further strengthen the capital position of the Fund, the NAHA legislation linked FHA's ability to pay distributive shares to the actuarial soundness of the entire MMI Fund (as defined in the legislation), rather than solely considering the performance of the loans endorsed during a particular year as had been done in years prior to 1990. This amendment sought to ensure that distributive share payments would not be made if the Fund did not achieve the capital standard established by the legislation or at the discretion of the Secretary of HUD when the capital ratio is above 2 percent. No distributive shares have been paid since the passage of NAHA. In all our estimates of Fund performance, we have assumed continuation of the current HUD policy that no distributive shares will be paid.

## **B. FHA Policy Developments and Underwriting Changes**

Since the mid-1990's, FHA has implemented several policy changes that affected the financial strength of the MMI Fund. Some of the major changes have included revised underwriting guidelines, changes to homeownership counseling requirements, implementation of automated underwriting systems, changes of upfront and annual mortgage insurance premiums schedules, change of loan limits, and most recently, elimination of seller-financed downpayment assistance. Each of these developments is summarized below.

### **1. Revised Underwriting Guidelines and Other Policy Issues**

In 1995, FHA introduced several changes in their underwriting guidelines to eliminate unnecessary barriers to homeownership, provide the flexibility to underwrite creditworthy non-traditional and underserved borrowers, and clarify certain underwriting requirements so that they are not applied in a discriminatory manner. Some of the changes were as follows:

- Instead of using the previous five-year period to determine the borrower's stable income, the revised policy allowed that if the income can be expected to continue for the first three years of the mortgage, it can be used in qualifying the borrower.
- Overtime and/or bonus income received for less than two years became acceptable, where the lender determines there are reasonable prospects of its continuance.
- Part-time income was recognized, where part-time income refers to income generated by jobs taken in addition to the normal, regular employment to supplement the borrower's



income. The lender must determine that the continuance of this income is reliable and provide a strong explanation for including such income as effective income in qualifying the borrower.

- Only debts extending ten or more months are required to be included in the calculations of debt-to-income ratios. Childcare costs are no longer to be considered in the computation of the debt-to-income ratio, except for court-ordered or voluntary child support payments.
- Borrowers who have saved cash (not deposited in a depository institution) and are able to adequately demonstrate the ability to continue to do so are permitted to have this money included as an acceptable source of funds to close the mortgages. Borrowers who have demonstrated the capacity for monthly savings are permitted to use their current savings as an acceptable source of funds to close the mortgage (i.e., there is no requirement for borrowers to demonstrate additional borrower reserves after closing).
- HUD permits, under most circumstances, a Three Repository Merged Credit Report (TRMCR) rather than a more comprehensive Residential Mortgage Credit Report (RMCR). HUD also permits alternative underwriting with nontraditional means of establishing credit or credit worthiness through acceptance of a Non-Traditional Mortgage Credit Report (NTMCR).

While these modifications enabled many additional households to become homeowners, the relaxation of the underwriting rules also contributed to an increase in FHA claim rates of loans originated after 1995.

Changes were made in 1998 to underwriting guidelines for adjustable rate mortgages (ARMs). These policy revisions addressed the high losses of ARMs that FHA was experiencing. Based on FHA's study of ARM claim rates, it was deemed necessary to change the credit policy to maintain MMI Fund actuarial soundness. ARM borrowers now must qualify using a mortgage payment level based on the maximum second-year interest rate. Also, any form of temporary interest rate buy down for ARMs is no longer acceptable.

## **2. Changes to Homeownership Counseling**

Another focus of the 1998 revisions was homeownership counseling. Previously, first-time homebuyers receiving counseling were eligible for a reduced upfront FHA insurance premium. While FHA permitted funding for approved homeownership counseling programs, unacceptable practices were observed, such as borrowers simply being asked to complete homeownership workbooks without any additional interaction with the counseling program. The new rule required that the type of homeownership counseling obtained by the first-time homebuyer must be examined by FHA's quality assurance staff as part of its regular reviews of lenders. FHA



required that counseling be delivered in a classroom setting, face-to-face or via electronic media, and involve 15 to 20 hours of instruction. The homebuyer counseling programs accepted by Freddie Mac or Fannie Mae also meet this requirement. When the upfront premium was reduced in 2001 for all FHA borrowers, there was no longer a separate discount for borrowers who went through homeownership counseling programs.

### **3. Automated Underwriting Systems**

In 1998, FHA approved Freddie Mac's Loan Prospector (LP) for underwriting FHA-insured mortgages. At the same time, FHA made a substantial number of revisions to its credit policies and reduced documentation requirements for LP-assessed loans, as described in the LP User Guide. This was the first time that FHA incorporated an automatic underwriting system (AUS) in its insurance endorsement process. Fannie Mae's Desktop Underwriter (DU) and PMI Mortgage Services' pmiAURA were approved to underwrite FHA mortgages in 1999, followed soon after by Countrywide Funding Corporation's CLUES and JP Morgan-Chase's Zippy. Beginning in May 2004, all of these AUSs apply FHA's Technology Open To Approved Lenders (TOTAL) mortgage scorecard to evaluate loan applications for possible automated approval for FHA insurance. More than two-thirds of loans submitted generally receive automated approval, eliminating the need for manual underwriting reviews. HUD changed its acceptance threshold in July 2008 and expects more than 90 percent of all future applicants to receive automated approval. HUD also notified lenders that all loans must be submitted through FHA's TOTAL scorecard.

### **4. Changes in Upfront Mortgage Insurance Premiums**

In 2000, in recognition of the continued financial strength and increase in the size of the MMI Fund, FHA revised its Upfront Mortgage Insurance Premium (UFMIP) policy for all loans closed on or after January 1, 2001. The revised UFMIP was 1.50 percent for all borrowers. The eligibility period for UFMIP refunds was shortened to five years for loans endorsed prior to December 8, 2004, and eliminated for loans endorsed after that date, except for borrowers who refinance with a new FHA-insured mortgage. In the latter case, when the refund can be applied toward the UFMIP of the new FHA-insured loan, the refund eligibility expires after 3 years.

The Housing and Economic Recovery Act (HERA) of 2008 provided for a one-year moratorium on the implementation of FHA's risk-based premiums beginning October 1, 2008. For case numbers assigned on or after October 1, 2008, the UFMIP was raised to 1.75 percent for purchase-money mortgages and full-credit qualifying refinance loans, while the UFMIP for streamline refinance loans remained at 1.50 percent.<sup>1</sup>

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<sup>1</sup> Mortgagee Letter 2008-22, September 4, 2008



In the past, some FHA borrowers needed to pay annual mortgage insurance premiums throughout the life of the mortgage. The current rule specified that annual mortgage insurance premiums will be automatically canceled for all loans closed on or after January 1, 2001 under the following conditions:

- For mortgages with terms of more than 15 years, the annual mortgage insurance premiums will be canceled when the loan balance reaches 78 percent of the original house price. The mortgagor has to pay the annual mortgage insurance premium for at least five years.
- For mortgages with terms equal to or less than 15 years and having a loan-to-value ratio of 90 percent or greater, the annual mortgage insurance premiums will be canceled when the loan balance reaches 78 percent of the original house price, regardless of the length of time the mortgagor has paid the annual mortgage premium.
- For mortgages with terms equal to or less than 15 years and a loan-to-value ratio based on the original house price of less than 90 percent, no annual mortgage insurance premium will be charged.

## **5. FHA Single-Family Loan Limits**

In early March 2008, FHA announced a temporary loan limit increase as a result of the enactment of the Economic Stimulus Act of 2008 (ESA). ESA provides that the mortgage limit for any given area shall be set at 125% of the median house price in that area, except that the FHA mortgage limit in any given area cannot exceed 175 percent of the 2008 Government Sponsored Enterprise (GSE)<sup>2</sup> conforming loan limit of \$417,000, nor be lower than 65 percent of the same 2008 GSE conforming loan limit for a residence of applicable size. FHA's single-family national loan limit ceiling and floor for 2008 were revised to \$729,750 and \$271,050 respectively. These loan limit increases are effective for mortgages endorsed for FHA insurance on or after March 6, 2008 and remain in effect for mortgages receiving credit approval on or before December 31, 2008.<sup>3</sup>

Under HERA, the Federal Housing Finance Agency (FHFA) was established and directed to set GSE conforming loan limits each year for the nation as a whole, as well as for high-cost areas. HERA stipulated that the national loan limit for the GSEs during 2009 will remain at \$417,000. Effective January 1, 2009, the FHA mortgage limit for any given area is to be set at 115 percent of the area median house price with a ceiling of 150 percent of the GSE conforming loan limit, or \$625,000, and a floor of 65 percent of the GSE conforming loan, or \$271,050.<sup>4</sup>

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<sup>2</sup> Include Fannie Mae, Freddie Mac, and the Federal Home Loan Banks.

<sup>3</sup> Mortgagee Letter 2008-06, March 6, 2008, Temporary Loan Limit Increase for FHA

<sup>4</sup> Mortgagee Letter 2008-36, November 7, 2008, 2009 FHA Maximum Mortgage Limits



In February 2009, FHA single family loan limits changed as a result of the American Recovery and Reinvestment Act of 2009 (ARRA), which was signed into law on February 17, 2009. These limits are effective for those loans for which the credit is approved in calendar year 2009 and will remain in effect until December 31, 2009.<sup>5</sup> Under ARRA, the revised FHA loan limits for 2009 will be set at the higher of the loan limits established for 2008 under ESA and those established for 2009 under HERA. FHA's single-family national loan limit ceiling and floor for 2009 are \$729,750 and \$271,050, respectively.

## **6. Foreclosure Avoidance and Loss Mitigation Program**

One of the consequences of the severe housing recession is the incidence of high foreclosure rates. FHA took actions to help families avoid foreclosure through loan modification and partial claim initiatives as well as default counseling provided by HUD-approved counseling agencies.

Since being introduced as a national program in 1994,<sup>6</sup> the pre-foreclosure sale (PFS) program has allowed mortgagors in default to sell their homes and use the sales proceeds in satisfaction of the mortgage debts when the proceeds are less than the amount owed.<sup>7</sup>

On May 20, 2009, President Obama signed into law the Helping Families Save Their Homes Act of 2009. The law permits FHA lenders to offer families more substantial loan modifications and provides FHA with additional loss mitigation authority to assist FHA mortgagors under the Home Affordable Program. The Mortgagee letter 2009-23, effective August 15, 2009, announced a new FHA Loss Mitigation option, the FHA-Home Affordable Modification Program (FHA-HAMP). FHA-HAMP provides homeowners in default a greater opportunity to reduce their mortgage payments to a sustainable level. It allows the use of a partial claim up to 30 percent of the unpaid principal balance as of the date of default combined with a loan modification.<sup>8</sup>

These programs are intended to reduce claim rates and are expected to improve the economic value of the Fund. Adequate data is not yet available to assess the programs' effects. Thus, the potential impacts of these programs are not incorporated in this Review.

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<sup>5</sup> Mortgage Letter 2009-07, February 24, 2009 Loan Limit Increases for FHA

<sup>6</sup> The regulations for the PFS Program are codified in 24 CFR 203.370.

<sup>7</sup> Mortgagee Letter 2008-43, December 24, 2008, Utilizing the PFS Loss Mitigation Option

<sup>8</sup> Mortgagee Letter 2009-23, July 30, 2009, FHA's Home Affordable Modification Loss Mitigation Option



## C. Current and Future Market Environment

### 1. Interest Rates

According to Federal Reserve Board statistics, the one-year constant-maturity Treasury yield declined from 2.28 percent in July 2008 to 0.48 percent in July 2009. Similarly, the ten-year Treasury yield declined from 4.01 percent in July 2008 to 3.56 percent in July 2009. Mortgage interest rates also decreased by more than one percent over this period. The average conventional 30-year fixed-rate mortgage commitment rate posted by Freddie Mac declined from 6.43 percent to 5.22 percent between July 2008 and July 2009. These realized rates were ultimately much lower than those forecast by IHS Global Insight in July 2008 and used in last year's Review.

Based on this market-wide trend, in August 2009 IHS Global Insight forecasted that the mortgage rates will stay below 5.5 percent through the third quarter of FY 2011. After that, rates are projected to rise steadily up to the third quarter of FY 2014 and stabilize at 4.85, 5.49, and 7.11 percent for the 1-year Treasury, 10-year Treasury, and 30-year mortgage rates, respectively. During the period FY 2010 to FY 2013, the interest rates forecasted by IHS Global Insight are substantially lower than those forecasted one year ago. The lower forecasted rate environment during the next several years implies higher projected prepayment rates for FHA-insured loans compared to the corresponding prepayment rates in last year's Review.

### 2. House Price Growth Rate

Projections of future national average home price growth rates are obtained from the IHS Global Insight August 2009 long-range forecast.<sup>9</sup> The realized annual national average house price growth rate during FY 2008 was *negative* 3.66 percent, compared to the *negative* 6.69 percent projected by IHS Global Insight in July 2008 and applied in last year's Review. Due largely to this better-than-predicted house price experience, the claim experience during FY 2008 and the early part of FY 2009 was much lower than what was projected in last year's Review.

However, the forecasted growth rate for FY 2009 is *negative* 3.87 percent, which is worse than last year's forecast of *negative* 2.88 percent for the same time period. Furthermore, the national house price growth rate is projected to be *negative* 6.51 percent for FY 2010, much worse than the *negative* 1.5 percent in July 2008's forecast. The house price growth rates for FY 2011 to FY 2014 in the current IHS Global Insight forecast range from 0.90 to 2.10 percent below those forecasted a year ago. Under the current forecast, the most severe four-quarter rate reaches a *negative* 8.67 percent for the period ending in the third quarter of FY 2010. Thus, the forecast for the national housing market is much worse than the forecast applied in last year's review,

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<sup>9</sup> The 10-year forecasts are from the August, 2009 release, and the long-range forecasts beyond 10 years are from the June, 2009 release.



which indicates that claim rates of FHA insured loans are estimated to rise even higher during the next few years. Furthermore, most loans originated in FY 2006 through FY 2009 have, or will, experience price declines, putting many borrowers into negative equity positions. The cumulative claim rates of these loans are thus projected to be substantially higher than in any of the previous books since 1990. Furthermore, IHS Global Insight has also reduced the forecast of long-term house price growth rates after 2019. This tends to increase claims and losses in the later years. However, their forecast of the long-term future housing market is basically consistent with that of last year and is not expected to cause significant changes in the projected Fund performance.

### **3. Mortgage Demand**

FHA's market share increased dramatically during FY 2008 and FY 2009. The market share had dropped significantly following FY 2002 as the subprime mortgage market expanded. Since late 2007, the subprime mortgage market contracted, followed by the scaling back by all private mortgage insurers. Thus, FHA has become the primary source of financing for high LTV borrowers. As of end of June 2009, the Fund origination volume during FY 2009 already exceeds \$300 billion, which is more than double the size of previous books. FHA's market share is estimated to be about 20 percent of the entire market in FY 2009.

HUD projects that the endorsement volume will remain above \$200 billion for FY 2010 through FY 2016. The larger origination volume for new books of business will lead to faster growth in IIF. Meanwhile, most mortgages will experience their peak claim rates 4 to 7 years after origination. This indicates that the average conditional claim rate of the whole portfolio may steadily increase over the next few years as these larger books of business move through their peak claim periods.

### **4. Implications of Recent Problems in the Subprime Mortgage Market**

The explosive growth and subsequent decline in the U.S. subprime and Alt-A mortgage markets have had serious consequences for financial markets in the U.S. and across the world. Many of the initial problems in the subprime market were attributable to the special characteristics of subprime mortgage contracts, differences in underwriting standards for subprime mortgages and a prevalence of higher-risk borrowers with impaired credit and/or unverified income and employment. Many of the subprime mortgages were securitized and these securities were sold to investors in the U.S. and across the world. As long as house prices continued to increase, this system worked. But when house prices began to decline and defaults on these mortgages started to increase, this translated into a very negative impact on the prices of these securities. The fall in the prices of these securities had a strong negative impact on other financial markets and on credit conditions in general. The deterioration of the housing market triggered a severe downturn in other financial markets whose full implications are still evolving.



Although the financing of subprime loans has been largely discontinued, the fallout continues to have far-reaching and profound consequences for credit markets, mortgage markets and housing finance. The market for conventional mortgages has tightened considerably. Many lenders and mortgage providers have experienced financial difficulties and have scaled back their lending activities. Private mortgage insurers have experienced high claim rates on their subprime and Alt-A exposures, and have had their credit ratings reduced. Fannie Mae and Freddie Mac have both experienced substantial financial losses and are presently under the conservatorship of the Federal government. Under these conditions, the volume of FHA business has increased and is projected to remain high for the next several years. The current FY 2009 volume of new business is more than double that of any previous books of business. At the same time, house prices have declined significantly and are projected to continue declining over the next year.

Although FHA did not participate directly in the subprime or the Alt-A markets, the consequences of the collapse of these markets has had a significant impact on key determinants of FHA's risk exposure. These impacts are incorporated in the assumptions used in this Review, especially in assumptions concerning the volume and composition of new business and the projection of future interest rate and house price changes.

#### **D. Concentration of Loans with Downpayment Assistance in Recent Books**

The share of FHA-insured loans receiving downpayment assistance from non-profit organizations has declined substantially in the FY 2009 book of business. Non-profit organization assisted mortgages represented over twenty percent of the entire FY 2005, FY 2006, and FY 2007 books of business. It remained over fifteen percent in FY 2008. The incidence of such loans declined to under 4 percent in FY 2009. FHA guidelines allow a borrower to use outright gifts of cash as downpayment assistance. Eligible gift sources include: relatives, employers or labor unions, tax-exempt charitable organizations, governmental agencies, public entities that have programs to provide homeownership assistance to low- and moderate-income families or first-time homebuyers, or close friends with a clearly defined and documented interest in the borrower. A 2005 report by the Government Accountability Office (GAO) documented that many downpayment gifts provided by non-profit organizations were contributed by the home sellers involved in the specific transactions, and possibly financed by inflated house values.<sup>10</sup> The FY 2005 Review documented that loans with gift assistance, especially from non-profit organizations which included those channeling the seller contributions, experienced significantly higher-than-average claim rates. On May 22, 2006, the Internal Revenue Service (IRS) issued a ruling that non-profit organizations that fund downpayment assistance programs with contributions from the property sellers will no longer

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<sup>10</sup> "Mortgage Finance Additional Action Needed to Manage Risks of FHA-Insured Loans with Downpayment Assistance," Government Accountability Office, November 2005.



meet the legal requirements for tax-exempt status.<sup>11</sup> However, high volumes of these loans were still endorsed following the IRS announcement. The passage of HERA on July 30, 2008 finally terminated seller-funded downpayment assistance effective October 1, 2008. However, a surge of these loans were observed immediately prior to the effective date.

Following HERA, there was a rapid decrease in the endorsement of these seller-funded downpayment assistance loans. By the second quarter of FY 2009, these loans accounted for less than 1 percent of total endorsements. The steep decline in seller-financed downpayment assistance in FY 2009 and later years will have a significant effect in reducing losses on future FHA loans.

#### E. Recently Announced New Plans and Initiatives

In early September, 2007, HUD announced the *FHASecure* initiative, a temporary program designed to provide refinancing opportunities to homeowners and to increase liquidity in the mortgage market.<sup>12</sup> Under this program non-FHA ARM borrowers who are delinquent on their current mortgage payments as a result of the reset of their interest rate will be permitted to refinance into an FHA-insured mortgage.

In May 2008, *FHASecure* was expanded, with effective date of July 14, 2008, to enable a wider range of borrowers to qualify to refinance to FHA-insured loans if they had acceptable payment histories prior to the reset of their interest rate. All conventional-to-FHA rate-and-term refinances are now considered part of the *FHASecure*, regardless of whether the borrower is delinquent or current. Cash-out refinance transactions are not acceptable under this program.<sup>13</sup> As of December 31, 2008, FHA no longer issued any new case numbers for lenders seeking to refinance borrowers into *FHASecure* loans.<sup>14</sup> FHA has retained its standard rate-and-term refinance program, as well as cash-out and streamlined refinance products. The standard rate-and-term refinance product is available to borrowers who are current on their existing mortgages.

#### F. Data Sources and Future Projections

The estimates presented in this Review require projections of events more than 30 years into the future. These projections are dependent upon a number of assumptions, including economic forecasts by IHS Global Insight, future book volume and composition projections by HUD, and the assumption that FHA does not change its refund and premium policies. Since these

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<sup>11</sup> Internal Revenue Bulletin: 2006-21, Internal Revenue Service.

<sup>12</sup> Mortgagee Letter 2007-11, September 4, 2007, The *FHASecure* Initiative

<sup>13</sup> Mortgagee Letter 2008-13, May 7, 2008, Expansion of *FHASecure*

<sup>14</sup> Mortgagee Letter 2008-41, December 19, 2008, Termination of *FHASecure*



assumptions are estimates, the actual outcomes may vary, perhaps significantly, from our current projections.

We based our analysis on FHA historical prepayment and claim data through March 31, 2009 and endorsement composition and volume through June 30, 2009. While we have reviewed the integrity and consistency of these data and believe them to be reliable, we have not audited them for accuracy. The information contained in this Review may not correspond exactly with other published analyses that rely on FHA data compiled at a different time or obtained from other data sources.

## **G. Structure of this Report**

We again remind the reader that the results reported in this Review pertain to the MMI Fund performance excluding HECMs.

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

**Section II. Summary of Findings and Comparison with FY 2008 Actuarial Review** – presents the Fund's estimated economic value and insurance-in-force for FY 2009 through FY 2016. This section also provides a reconciliation and explanation of the major differences between the FY 2008 and the FY 2009 Reviews concerning the key variables.

**Section III. Current Status of the Fund** – presents the estimated economic value and IIF for the Fund at the end of FY 2009 and provides an analysis of the performance of the FY 1980 through FY 2009 books of business.

**Section IV. Characteristics of the FY 2009 Book of Business** – describes the FY 2009 book of business and compares the risk characteristics of the current book to those of previous books.

**Section V. Fund Sensitivities** – presents sensitivity analyses of the Fund using alternative economic and actuarial assumptions.

**Section VI. Summary of Methodology** – presents an overview of the econometric and cash flow models used in the Review.

**Section VII. Qualifications and Limitations** – describes the main assumptions and the limitations of the data and models relevant to the results presented in this Review.

**Section VIII. Conclusions** – provides a summary of the report's results and the conclusions we draw from those results.



**Appendix A. Econometric Analysis of Mortgage Terminations** – provides a technical description of our econometric models of claim and prepayment behaviors for individual mortgage product types.

**Appendix B. Cash Flow Analysis** – provides a technical description of our cash flow model.

**Appendix C. Data for Loan Performance Simulations** – explains the procedures used to transform the raw data into the data used to simulate future mortgage and Fund performance.

**Appendix D. Economic Forecasts** – describes the forecast of future economic factors that affect the performance of the Fund and the alternative economic scenarios underlying the selected sensitivity analyses.

**Appendix E. Loss Rate Analysis** – provides a technical description of our econometric model for individual mortgage loss severity rates.

**Appendix F. Econometric Results** – contains claim and prepayment rates estimated from the econometric model.



## **Section II: Summary of Findings and Comparison with FY 2008 Actuarial Review**

This section presents the economic value and insurance in force of the Fund<sup>15</sup> for FY 2009 and provides an explanation of how the economic values of this year's Review compare with those of the FY 2008 Review.

### **A. The FY 2009 Actuarial Review**

The FY 2009 Actuarial Review estimated the economic value of the Fund as of the end of FY 2009 (projected to September 30, 2009) and projected the status of the Fund through FY 2016. The objectives of our analysis included:

- evaluating the historical experience of the Fund, including loan termination experience due to claims and prepayments, and losses associated with these terminations;
- projecting future loan termination rates and their corresponding losses and projecting future cash flows of the existing Fund portfolio and of future books of business; and
- estimating the economic value and the insurance in force of the Fund.

We conducted this review by analyzing the historical loan performance using data provided by FHA, developing an econometric model and estimating its parameters using this data, and using independent forecasts of future macroeconomic conditions published by IHS Global Insight to project the future cash flows in the Fund. These future cash flows were discounted back to FY 2009 to assess the soundness of the Fund.

The econometric models are similar in most respects to those of the FY 2008 Review, with some enhancements implemented for the current Review. The analysis utilizes loan-level data on the Fund's experience reported by HUD through March 2009. These models also incorporate a set of economic assumptions and forecasts for future years. To estimate future claim loss rates, a separate econometric model of loss severity was developed for this year's Review. The model applies the historical loan-level realized loss rates and associates them with the loan characteristics, underlying property location, and macroeconomic conditions. Appendices A through F describe the individual models, assumptions and econometric results. Our main findings are as follows:

- As of the end of FY 2009, the Fund is projected to have an estimated economic value of **\$2.73 billion** and an unamortized insurance-in-force of **\$686.26 billion**.

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<sup>15</sup> The Fund in this Review refers to the MMI Fund excluding HECMs.



- The FY 2009 book of business is projected to contribute an estimated **negative \$0.84 billion** in present value to the economic value of the Fund.

Our current projections indicate that the Fund's economic value will increase in the future, rising by an average of 47.28 percent per year through FY 2016. With the expected slower prepayment rates of the existing books of business implied by the rising interest rate environment projected during and after FY 2009, and HUD's projection of high endorsement volume of future books of business, the IIF will increase by an average rate of 13.49 percent per year through FY 2016. The economic value is expected to grow at a faster rate than that of the IIF. Exhibit II-1 provides estimates of the Fund's economic value and IIF through the end of FY 2016. In summary, the economic value is projected to steadily increase over the next 7 years to reach \$41.07 billion by the end of FY 2016.

### Exhibit II-1

Projected Fund Performance for FY 2009 to FY 2016 (\$ Millions)						
Fiscal Year	Economic Value of the Fund <sup>a</sup>	Unamortized Insurance in Force <sup>b</sup>	Amortized Insurance in Force <sup>b</sup>	Economic Value of Each New Book of Business	Volume of New Endorsements <sup>c</sup>	Investment Earnings on Fund Balances
2009	2,732	686,263	656,012	-835	337,436	
2010	7,882	871,892	835,886	5,124	299,954	27
2011	14,171	996,792	952,354	6,084	245,997	204
2012	20,425	1,124,334	1,068,027	5,872	222,320	383
2013	25,650	1,248,181	1,178,519	4,638	223,856	587
2014	30,272	1,392,590	1,306,650	3,822	226,737	800
2015	35,488	1,531,136	1,427,563	4,267	235,490	949
2016	41,068	1,664,357	1,542,385	4,483	243,691	1,097

<sup>a</sup> All values are as of the end of each fiscal year. The economic value for future years (FY 2010 through FY 2016) is equal to the economic value of the Fund at the end of the previous year, plus the current year's interest earned on the previous fund economic value, plus the economic value of the new book of business.

<sup>b</sup> Estimated based on the data extract as of June 30, 2009, HUD projections of new endorsements, and projected loan performance.

<sup>c</sup> Based on HUD September 2009 projection.



## B. Change in the Economic Value of the Fund

Exhibit II-2 displays the components of the Fund's current economic value, with comparisons between values in the FY 2008 and FY 2009 Reviews. The FY 2008 Review estimated that the Fund had \$12.91 billion in economic value at the end of FY 2008 to cover future unexpected claim losses.

We estimate that the Fund has total capital resources of \$30.10 billion at the end of FY 2009. The present value of future cash flows is estimated to be negative \$27.37 billion. Thus, as of the end of FY 2009, the Fund has \$2.73 billion in economic value that can be used to cover unanticipated future claim losses on the existing portfolio.

### Exhibit II-2

Estimates of Fund Economic Value as End of FY 2009 (\$ Millions)		
Item	End of FY 2008 <sup>a</sup>	End of FY 2009
Cash	\$ 9,210	
Investments	19,244	
Properties and Mortgages	2,261	
Other Assets and Receivables	127	
Total Assets	\$ 30,842	
Liabilities	3,639	
Total Capital Resources	\$ 27,203	
Net Gain from Investments		386 <sup>b</sup>
Net Insurance Income in FY 2009		2,516
<b>Total Capital Resources</b>		<b>30,105</b>
PV of Future Cash Flows on Outstanding Business		(27,373)
<b>Economic Value</b>	<b>\$ 12,908<sup>c</sup></b>	<b>2,732</b>
Unamortized Insurance-In-Force	429,634 <sup>c</sup>	686,263
Amortized Insurance-In-Force	401,461 <sup>c</sup>	656,012

<sup>a</sup> Source: Audited Financial Statements for FY 2008.

<sup>b</sup> Estimated by assuming the total capital resources as of the end of FY 2008 earns a total investment return equal to 1-year Treasury Constant-Maturity Rate, which averaged 1.42 percent during FY 2009. (Source: Board of Governors of the Federal Reserve System).

<sup>c</sup> From the FY 2008 Actuarial Review.



As seen in Exhibit II-2, the economic value of the Fund decreased by 78.85 percent from the level reported in last year's Review – from \$12.91 billion to \$2.73 billion. This decrease is driven mainly by a much more pessimistic national housing market forecast. The forecasted negative 9.37 percent national house price change from FY 2009 to FY 2010, and the slower projected subsequent recovery rate, significantly lowered the present value of future cash flows of all existing books. Exhibit II-3 compares the FY 2008 and FY 2009 Reviews by annual books of business to highlight how the value of each book has changed.

Exhibit II-3 shows that the present value of future cash flows of all recent books of business declined considerably from the FY 2008 projection. This deterioration in Fund performance is mainly due to the more pessimistic house price appreciation rates projected by IHS Global Insight. In July 2008 IHS Global Insight projected national average house price appreciation of negative 2.11 percent during the two-year period from 2009 through 2010. However, in their August 2009 forecast, IHS Global Insight revised the projection of the national average house price appreciation rate during the same two-year period to negative 9.37 percent. The severe negative house price appreciation rate means that many newly originated loans soon attain a negative equity position, leading to higher projected claim rates. As a result, the total present value of future cash flows on outstanding books of business has dropped from negative \$14.37 billion in last year's Review to negative \$20.03 billion in this year's Review.



## Exhibit II-3

Present Value of Future Cash Flows By Book of Business, FY 2008 Review, FY 2009 Review, and Difference (\$ Millions)			
Book of Business	FY 2008 Review <sup>a</sup>	FY 2009 Review <sup>b</sup>	Difference <sup>c</sup>
1980	0	0	0
1981	1	0	-1
1982	1	0	-1
1983	3	0	-3
1984	0	0	0
1985	-1	-1	0
1986	-2	-2	0
1987	-3	-3	-1
1988	-2	-2	0
1989	-2	-2	0
1990	-3	-3	0
1991	-3	-3	0
1992	-3	-3	0
1993	10	4	-7
1994	15	5	-10
1995	9	6	-3
1996	4	-1	-6
1997	2	-7	-10
1998	9	-15	-24
1999	23	-29	-52
2000	-35	-59	-24
2001	-76	-183	-106
2002	-167	-341	-174
2003	-433	-916	-483
2004	-850	-1,401	-551
2005	-1,259	-1,750	-491
2006	-1,998	-2,492	-495
2007	-3,297	-3,704	-407
2008	-6,318	-9,129	-2,811
<b>Total</b>	<b>-14,374</b>	<b>-20,031</b>	<b>-5,657</b>

<sup>a</sup>Values as of the end of FY 2008.<sup>b</sup>Values as of the end of FY 2009.<sup>c</sup>Numbers do not add due to rounding for this and some subsequent Exhibits.



### **C. Sources of Change from the FY 2008 Review to the FY 2009 Review**

This section describes the sources of change in estimates between the FY 2008 Review and the FY 2009 Review for the FY 2009 and FY 2015 economic values. Separating out the specific impacts of interrelated approaches and assumptions can be done only up to a certain degree of accuracy. The interdependency among the various components of the analysis prevents us from identifying and analyzing these as purely independent effects. However, this section presents a reasonable decomposition of differences from the FY 2008 Review estimates by source of change. The purpose of this decomposition is twofold. First, it traces the change in the economic value from FY 2008 to FY 2009 to their sources. Second, it explains changes between the current estimate of the economic value in FY 2015 and the estimated economic value for FY 2015 that was presented in the FY 2008 Review.

#### **1. Change in Economic Value from FY 2008 to FY 2009**

The FY 2008 Review estimated the economic value of the Fund as of the end of FY 2008 to be \$12.91 billion, and the projected FY 2015 economic value to be \$57.51 billion. In this Review, we estimate the end-of-FY 2009 economic value for the Fund to be \$2.73 billion, which represents a decrease of \$10.18 billion from the FY 2008 economic value reported in the FY 2008 Review. This is a 78.85 percent decrease in the estimated economic value of the Fund. Accompanying this decrease in economic value is an increase in the unamortized IIF of 59.7 percent due to the larger-than-projected endorsement volumes in FY 2008 and FY 2009. The combined impact of these changes will contribute to a reduction in the final capital ratio that will be computed by the Secretary of HUD and reported to Congress.

#### **2. Current Estimate of FY 2009 Economic Value Compared with the Estimate Presented in the FY 2008 Actuarial Review**

The FY 2008 Review projected that the FY 2009 book of business and investment earnings on Fund balances would add \$2.38 billion and \$0.53 billion, respectively, to the economic value of the Fund, resulting in a projected FY 2009 economic value of \$15.82 billion. With the updated data extract, we now estimate the economic value of the FY 2009 book of business to be *negative* \$0.84 billion and the investment earnings in FY 2009 to be \$0.39 billion. This year's estimate of FY 2009 economic value is \$13.09 billion lower than the economic value projected for FY 2009 in last year's Review, as shown in Exhibit II-4.

Exhibit II-4 also provides a summary of the decomposition of changes in the current economic value of the Fund as of the end-of-FY 2015 from the FY 2008 Review as compared to the FY 2009 Review. The net change is primarily driven by four factors: the change in the forecasted volume and composition of new books of business; the change in the economic



forecast from last year; the change in OMB discount rates; and the modifications made to the loss severity model. The better credit quality of new books of business improves the projected performance of the Fund. The more pessimistic housing market forecast in FY 2009 through FY 2010 makes the FY 2007 through FY 2009 books the worst-performing in the past 20 years. The lower discount rates reduce the economic value by increasing the present value of future claim losses. Finally, the newly implemented loss severity rate model more accurately captures the higher loss severity rates realized during the current housing recession and leads to a decrease in the economic value. We now provide a more detailed discussion of the individual sources of change.



**Exhibit II-4**

<b>Summary of Changes in Fund Estimated Economic Value Between FY 2008 and FY 2009 (\$ Millions)</b>				
	Change in FY 2009 Economic Value	FY 2009 Economic Value	Change in FY 2015 Economic Value	Corresponding FY 2015 Economic Value <sup>b</sup>
FY 2008 Economic Value Presented in the FY 2008 Review		\$12,908 <sup>a</sup>		
FY 2009 Economic Value Presented in the FY 2008 Review, Excluding the FY 2009 Book of Business:	\$532	\$13,440		
Plus: Forecasted Economic Value of FY 2009 Book of Business Presented in the FY 2008 Review	\$2,384			
Equals: FY 2009 Economic Value Presented in the FY 2008 Actuarial Review		<b>\$15,823</b>		<b>\$57,512</b>
Plus: a. Update Origination Volume in the FY 2008	-\$514	\$15,309	-\$714	\$56,798
Plus: b. Update Actual Capital Resources as of the End of FY 2008	-\$78	\$15,231	-\$107	\$56,691
Plus: c. Update Forecast of Future Book Volume and Compositions	\$4,890	\$20,121	-\$4,647	\$52,044
Plus: d. Update to IHS Global Insights August 2009 Economic Forecasts	-\$9,777	\$10,344	-\$10,292	\$41,752
Plus: e. Update to FY 2010 OMB Discount Factor	-\$2,155	\$8,189	-\$5,746	\$36,006
Plus: f. Update Claim and Prepayment Rates Econometric Models	\$588	\$8,777	\$1,129	\$37,135
Plus: g. Implement Loss Severity Rate Econometric Model	-\$6,443	\$2,334	-\$1,143	\$35,992
Plus: h. Incorporate New Insurance Premium Schedule	\$398	\$2,732	-\$504	\$35,488
Equals: Estimate of FY 2009 Economic Value	-\$13,091	\$2,732	-\$22,024	\$35,488

<sup>a</sup> Economic value as the end of FY 2008.<sup>b</sup> The FY 2015 economic values are the latest year that can be directly compared between the FY 2008 and FY 2009 Reviews.



### **3. Decomposition of the Differences in Economic Value of the Current Review versus the FY 2008 Review**

We now present a step-by-step analysis of the differences in the FY 2008 and FY 2009 Reviews.

#### **a. Updated Origination Volume of FY 2008**

The first component of change depicted in Exhibit II-4 relates to the updated origination volume for FY 2008. The actual realized origination volume of the FY 2008 book is 14.1 percent greater than the forecasted volume reported in the FY 2008 Review. The larger size results in a larger negative initial economic value of the FY 2008 book. This change caused a reduction of \$0.51 billion in the FY 2009 economic value.

#### **b. Updated Actual Capital Resources as of the End of FY 2008**

The second element of change in Exhibit II-4 is the impact of actual capital resources realized as of the end of the FY 2008. Since the FY 2008 Actuarial Review was prepared before the availability of the FY 2008 year-end financial statement, the capital resources of the Fund as of the end of FY 2008 were estimated from the capital resources as of the end of FY 2007. The actual capital resources reported in the audited financial statements indicate the capital resources of the Fund to be \$27.20 billion, which is \$0.08 billion less than that estimated figure of \$21.28 billion in the FY 2008 Actuarial Review.

#### **c. Updated Forecast of Future Book Volume and Composition**

This component reflects the changes in the economic value for FY 2009 due to changes in HUD forecasts of the volume and the composition of future books of business across product types, credit scores, loan-to-value ratios, and loans with downpayment assistance from non-profit organizations.

Changes in the eligibility of loans with seller-funded downpayment assistance alter the projected composition of future FHA endorsements. As summarized in Section I of this Review, it is assumed that there will be no seller-related non-profit organization funded downpayment assistance loans endorsed by the Fund going forward. Updated data show that the volume of these loans fell sharply in late FY 2008 and early FY 2009. It is assumed that there will be no seller-funded downpayment assistance loans endorsed after the second quarter of FY 2009.

The composition of credit quality in terms of LTV, borrower credit score, and loan size improved during the past few quarters. Due to capital limitations and rising credit losses, most private mortgage insurers have tightened their underwriting standards. Without private mortgage insurance, borrowers seeking to make low downpayments are unable to finance through Fannie



Mae and Freddie Mac. As a result, FHA has become the primary source of housing finance for loans with greater than 80 percent LTV. These market conditions have improved the quality composition of the FY 2008 and FY 2009 books of business. FHA forecasts that the quality of the loan portfolio will gradually revert back to the pre-housing-recession period by FY 2012. FHA also projects the FICO-LTV combinations for future fully underwritten mortgages. Details of the projected composition of future books of business are described in Appendix C.

The changes in the expected composition of future books had a positive impact on the Fund by increasing the FY 2009 economic value by \$4.89 billion and decreasing the FY 2015 economic value by \$4.65 billion.

#### **d. Changes in the Economic Projections**

The housing recession experienced during the past four quarters turned out to be less severe than forecasted by IHS Global Insight back in July 2008. As a result, the Fund experienced fewer actual claims than were projected in last year's Review. However, the U.S. economy is still in its worst recession in recent history. In March 2009, the major stock market indices were down 50 percent from their peaks in October 2007. Unemployment rates rose steadily and rapidly during the last year. National housing sales remain slow and mortgage delinquency rates continue rising. These weak economic conditions are reflected in the August 2009 severe house price forecast by IHS Global Insight. Specifically, IHS Global Insight has forecast that the national house price growth rates will be negative 3.87 percent in FY 2009 and negative 6.51 percent in FY 2010. The recovery after FY 2010 will be at a slower pace. The annual growth rate for house prices will remain below 4 percent through the end of FY 2014. This forecast is much more pessimistic than the July 2008 forecast for the same periods applied in last year's Review. Due to this severe housing market recession, the performance of newer books of business, especially those of FY 2006 to FY 2009, are expected to be much worse than projected in the FY 2008 Review. The very weak housing market implies that many newly originated loans will quickly fall into a negative equity position, thereby resulting in higher projected claim rates relative to those estimated in the FY 2008 Review.

The IHS Global Insight August 2009 forecast projects three key interest rates that were used in this Review. The three series declined at a faster rate during 2008 than was forecasted a year ago. In July 2008 IHS Global Insight forecasted that the rates would rise to their long-term stable levels by the end of FY 2010. In the new forecast all three rates will rise at a much slower rate and reach the long-term stable levels only by FY 2014. Lower mortgage interest rates imply that the FY 2006 through FY 2008 books will experience faster prepayment rates than were previously estimated for the FY 2008 Review. The higher prepayment rates imply that these loans are exposed to claim risk for shorter periods of time, thereby reducing realized claims and increasing economic value.



Exhibit II-4 shows that the economic value for FY 2009 has decreased by \$9.78 billion due to the change in economic forecasts, and the FY 2015 economic value has decreased by \$10.29 billion.

#### **e. Updated FY 2010 OMB Discount Factors**

The Office of Management and Budget (OMB) discount factors are used to discount the projected cash flows to their present values. Current OMB FY 2010 discount factors reflect substantially lower interest rates than last year's discount factors. Based on this year's lower discount rates, the value of one dollar to be received five years in the future has a higher present value than the corresponding value using last year's discount rates. Correspondently, a negative cash flow realized five years in the future has a greater negative present value based on this year's discount rates than had the corresponding present value based on last year's discount rates. In general, FHA charges a 1.75 percent upfront insurance premium to offset the negative net cash flows in the future. The larger FY 2010 discount factors are equivalent to lower discount rates. When the same future negative cash flows are discounted by the lower discount rates, they yield greater negative present value. On the other hand, the discount rate has no impact on the present value of the upfront insurance premium. As a result, the total present value of all existing books of business is negatively impacted by this change, resulting in the FY 2009 economic value decreasing by \$2.16 billion.

#### **f. Updated Econometric Models of Claim and Prepayment Rates**

In this year's Review, we applied similar econometric and discounted cash flow models as in previous years, with some changes in model specification. Appendix A describes the changes in claim and prepayment model specification. The main enhancement of the econometric claim and prepayment models was to capture the abnormal market activities during the subprime mortgage period. Aggressive marketing activities by subprime lenders during the FY 2004 through FY 2006 period changed the prepayment and claim behavior of FHA insured mortgages relative to performance in other time periods. With the contraction in subprime mortgage lending, any impact on FHA prepayment and claim rates will dissipate. The revised econometric claim and prepayment models include additional variables to account for this unique market period. The model enhancements, and use of updated performance data through March 31, 2009, caused the economic value of FY 2009 to increase by \$0.59 billion and the FY 2015 economic value increased by \$1.13 billion relative to the values reported for the same periods in the FY 2008 Review.

#### **g. Implement Loss Severity Rate Econometric Model**

In last year's Review, loss severity rates were assumed to be constant over time and were estimated based on the level of the FY 2006 claim experience. Due to the substantial change in loss severity rates experienced during the current housing recession, an econometric model that



allows the loss severity rates to vary with the market environment better reflects actual financial performance. A loan-level-based loss severity rate regression model was estimated using the observed loss experience of loans claimed during the FY 1999 through FY 2008 period. This model captures the different impacts of loan characteristics, property location, borrower credit history, and the macroeconomic environment. Appendix E provides a detailed description of the loss severity rate regression model. The loss rates are projected to be higher than their historical average during the next several quarters when the house price growth rates are forecasted to be negative or low. Implementing the loss severity rates based on the econometric model has a substantially negative impact of \$6.44 billion on the FY 2009 economic value. As the housing market recovers from the current recession, projected future loss severity rates will decrease, but still result in a decrease in the FY 2015 economic value of \$1.14 billion.

#### **h. Updated Insurance Premium Structure**

In its proposal for risk-based pricing that would have become effective July 14, 2008, FHA established a minimum FICO score of 500 for borrowers making less than ten percent downpayment. The policy also announced FHA's plan to charge different upfront and annual premiums according to the credit risks of individual loans, based on LTV, credit score, and product type. The passage of HERA placed a 12-month moratorium on HUD's implementation of the risk-based premiums and voided the proposed risk-based premium schedule. In their place FHA introduced modified upfront and annual mortgage insurance premium rates effective starting October 1, 2008. Switching from the proposed risk-based premium structure that was applied in the FY 2008 Review to the new premium schedule led to an increase in the FY 2009 economic value of \$0.40 billion, and a decrease of the FY 2015 economic value of \$0.50 billion.



**Section III: Current Status of the Fund<sup>16</sup>**

As of the end of FY 2009, the Fund has an estimated economic value of \$2.73 billion. The corresponding economic value at the end of FY 2008 was \$12.91 billion. The current economic value is 78.85 percent lower than what it was at the end of FY 2008. Two main factors contributed to this significant reduction in economic value. First, the continued weakening of the housing market since FY 2007 along with the forecasted further decrease in house prices through FY 2010 and FY 2011 caused claim rates currently forecasted for future years to be much higher than those previously estimated based on the July 2008 IHS Global Insight economic forecasts. Second, the loss rates on claims in recent years are much higher than the previous several years. The high loss severity rates associated with the weak economic environment led to further reductions in the economic value of the Fund. At the same time, the IIF of the Fund increased 59.73 percent, from \$429.63 billion in FY 2008 to \$686.26 billion for FY 2009, mainly due to the record high endorsement volume of FY 2009 book of business.

In the remainder of this section, we present an analysis of the Fund's current status. The analysis examines the status of the Fund at the end of FY 2009 and the projected future performance of new books of business through FY 2016. This section describes the basic components of the Fund's economic value and how they are expected to change through FY 2016.

**A. Estimating the Current Economic Value of the Fund**

According to the NAHA legislation, the economic value of the Fund is defined as the "cash available to the Fund, plus the net present value of all future cash inflows and outflows expected to result from the outstanding mortgages in the Fund." We base our estimate of this value on the level of capital resources projected to the end of FY 2009, plus the present value of expected future cash flows of the existing loan portfolio as estimated by our financial models.

The Fund assets comprise cash, Treasury investments, properties and mortgages held by HUD, and other assets and receivables. Capital resources are the total assets net of the liabilities of the Fund. Due to the schedule required for delivery of this Actuarial Review, the actual amount of the capital resources as of the end of FY 2009 was not available at the time this Review was prepared. Hence, we projected the end-of-FY 2009 capital resources based on the audited capital resources as of the beginning of the year, to which we added an estimate of the net cash flows occurring during the year.

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<sup>16</sup> The MMI Fund in this Review refers to MMI Fund excluding HECMs.



The present value of expected future cash flows is calculated with a financial model that uses the most current information available to estimate future cash flows. Cash inflows include upfront premiums, annual premiums, and investment returns. Cash outflows include claim loss payments, premium refunds, administrative expenses, and distributive shares.<sup>17</sup> These calculations include all cash flows that occur from mortgage origination to the year of the scheduled maturity (*e.g.*, 30 years for 30-year mortgages).

## **1. Capital Resources**

Capital resources are the net assets of the Fund that, if necessary, could be converted into cash to meet the Fund's obligations, including payment of claims as they arise. They are computed by subtracting total liabilities from total assets. The assets consist of cash, Treasury investments, properties and mortgages, other assets and miscellaneous receivables net of payables. Exhibit III-1 reports the audited Fund's capital resources at the end of FY 2008 at \$27.20 billion.

The next step in estimating the capital resources as of the end of FY 2009 is to estimate the sources and uses of funds generated by the Fund portfolio. Two sources of cash flows are estimated: (1) the net gain/loss from investment of the capital resources available at the beginning of FY 2009, and (2) the net cash income from the mortgage insurance policies. The net total return on the beginning capital resources was estimated to be \$0.39 billion during FY 2009. This figure was estimated by assuming the total capital resources as of the end of FY 2008 earn an investment return equal to the 1-year Treasury Constant-Maturity Rate, which averaged 1.42 percent during FY 2009 based on data from the Board of Governors of the Federal Reserve System.

Based on the econometric models and IHS Global Insight economic forecasts, we estimated the cash flows generated during FY 2009 by all books of business from FY 1980 through FY 2009. These cash flows and any interest earned from reinvestment become part of the total assets of the Fund. Exhibit III-2 shows the results of this analysis. The net cash flow received during FY 2009 was estimated to be \$2.52 billion. The projected FY 2009 year-end capital resources are computed to be \$30.10 billion as shown in Exhibit III-1.

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<sup>17</sup> The administrative expense was discontinued since the FY 2002 Actuarial Review according to the federal credit reform requirement. The distributive share has been suspended since 1990. There is no indication that it would be resumed in the foreseeable future.



## Exhibit III-1

Estimates of Fund Economic Value for FYs 2008 and 2009 (\$ Millions)		
Item	End of FY 2008 <sup>a</sup>	End of FY 2009
Cash	\$ 9,210	
Investments	19,244	
Properties and Mortgages	2,261	
Other Assets and Receivables	127	
Total Assets	\$ 30,842	
Liabilities	3,639	
Total Capital Resources	\$ 27,203	
Net Gain from Investments		386 <sup>b</sup>
Net Insurance Income in FY 2009		2,516
<b>Total Capital Resources</b>		<b>30,105</b>
PV of Future Cash Flows on Outstanding Business		(27,373)
<b>Economic Value</b>	<b>\$ 12,908<sup>c</sup></b>	<b>2,732</b>
Unamortized Insurance-In-Force	429,634 <sup>c</sup>	686,263
Amortized Insurance-In-Force	406,461 <sup>c</sup>	656,012

<sup>a</sup> Source: Audited Financial Statements for FY 2008.<sup>b</sup> Estimated by assuming the total capital resources as of the end of FY 2008 earns an investment return equal to 1-year Treasury Constant-maturity Rate, which averaged 1.42 percent during FY 2009. (Source: Board of Governors of the Federal Reserve System).<sup>c</sup> From the FY 2008 Actuarial Review.



## Exhibit III-2

Net Cash Flow During FY 2009 by Origination Fiscal Year and Mortgage Type <sup>a</sup> (\$ Millions)							
Fiscal Year	FRM 30	FRM 15	ARM	SR 30	SR 15	SR ARM	Total
1980	0						0
1981	0						0
1982	0						0
1983	0						0
1984	0						0
1985	-1		0	0			-1
1986	-1		0	0			-1
1987	-2		0	0		0	-2
1988	-1		0	0		0	-1
1989	-2		0	0		0	-2
1990	-2		0	0			-2
1991	-2		0	0		0	-2
1992	-2		0	0	0	0	-2
1993	0		0	-1	0	0	-1
1994	1	0	0	-2	0	0	-2
1995	-1	0	0	0	0	0	-1
1996	-6	0	-2	-1	0	0	-9
1997	-10	0	-4	0	0	0	-14
1998	-16	0	-3	-3	0	0	-22
1999	-29	0	-2	-6	0	0	-38
2000	-44	0	-6	-1	0	0	-52
2001	-85	0	-3	-6	0	-1	-95
2002	-118	-1	-21	-10	0	-7	-157
2003	-232	-2	-31	-52	-2	-18	-336
2004	-398	-2	-83	-45	-1	-30	-560
2005	-442	-6	-88	-66	-1	-26	-629
2006	-739	-11	-31	-57	0	-2	-841
2007	-905	-16	-10	-46	0	-1	-978
2008	-187	-14	6	-45	0	-2	-242
2009 <sup>b</sup>	5,208	88	98	1,085	15	12	6,507
Total	1,985	35	-183	743	11	-76	2,516

<sup>a</sup> See Section IV for description of loans included in each loan type category<sup>b</sup> Based on the volume and composition distribution of the September 2009 HUD forecast..



## **2. Present Value of Future Cash Flows in FY 2010 and Future Years**

The present value of future cash flows of the Fund is aggregated from separate estimates of the present value of future cash flows from each book of business and for each of the six major mortgage product types. Exhibit III-3 shows the present values of future cash flows for each of the six mortgage product types from the FY 1980 through the FY 2009 books of business. The present values are computed from the projected cash flows occurring during FY 2010 and future years. This exhibit is offered to facilitate comparison among books of business and mortgage types based on cash flows that have not yet been realized as of the end of FY 2009. From Exhibit III-3, the total present value of future cash flows is a negative \$27.37 billion dollars. Compared to the same number estimated in the FY 2008 Review, this amount deteriorated by \$13.00 billion.

This reduction in economic value is mainly a consequence of the realized negative house price growth rate during FY 2009 and the more adverse house price growth rates currently projected for FY 2010 through FY 2015. The projected negative house price growth rates during FY 2009 and FY 2010 suggest that most mortgages originated during the past three years will experience negative equity and high claim rates during the next few years. Together with the high concentration of loans with downpayment assistance from non-profit organizations, the FY 2007 book may turn out to be the one of the worst performing books over the past 30 years, and the FY 2008 and FY 2009 books will be even worse due to their much larger origination volume. Exhibit III-3 indicates that, if the economy follows the IHS Global Insight August 2009 forecast, both the FY 2008 and FY 2009 books will experience the largest ever negative present values, negative \$9.13 billion and negative \$7.34 billion, respectively.



**Exhibit III-3**

<b>Present Value of Future Cash Flows as of the End of FY 2009</b>							
<b>By Origination Fiscal Year &amp; Mortgage Type (\$ Millions)</b>							
<b>Fiscal Year</b>	<b>FRM 30</b>	<b>FRM 15</b>	<b>ARM</b>	<b>SR 30</b>	<b>SR 15</b>	<b>SR ARM</b>	<b>Total</b>
1980	0						0
1981	0						0
1982	0						0
1983	0						0
1984	0						0
1985	-1		0	0			-1
1986	-2		0	0			-2
1987	-3		0	-1		0	-3
1988	-2		0	0		0	-2
1989	-2		0	0		0	-2
1990	-2		0	0			-3
1991	-3		0	0		0	-3
1992	-2		-1	0		0	-3
1993	4		2	-3	0	0	4
1994	7	0	3	-4	0	0	5
1995	3	0	3	0	0	0	6
1996	0	0	1	-2	0	0	-1
1997	-7	0	0	0	0	0	-7
1998	-11	0	-1	-4	0	0	-15
1999	-17	0	-1	-11	0	0	-29
2000	-54	0	-4	-1	0	0	-59
2001	-159	0	-4	-18	0	-1	-183
2002	-262	-1	-30	-40	-1	-8	-341
2003	-616	-2	-44	-229	-2	-22	-916
2004	-1,048	-3	-131	-170	-2	-48	-1,401
2005	-1,302	-7	-174	-215	-2	-49	-1,750
2006	-2,205	-18	-74	-188	-2	-6	-2,492
2007	-3,406	-39	-58	-195	-1	-5	-3,704
2008	-8,096	-157	-144	-689	-3	-40	-9,129
2009 <sup>a</sup>	-3,838	-134	-105	-3,166	-10	-90	-7,342
<b>Total</b>	<b>-21,023</b>	<b>-361</b>	<b>-761</b>	<b>-4,936</b>	<b>-22</b>	<b>-270</b>	<b>-27,373</b>

<sup>a</sup> Based on the volume and composition distribution of the September 2009 HUD forecast.



### **3. Amortization of Current Books of Business**

The other information required for computing the capital ratio is the IIF of the Fund. Both the unamortized and the amortized IIF are estimated in this Review to permit HUD to combine the results of this Review with the separate HECM analysis in computing the MMI Fund capital ratio. Exhibit III-4 shows the total volume of new mortgage endorsements for all types of mortgages for each book of business, and the unamortized IIF and the amortized IIF, as of the end of FY 2009.

As can be inferred from Exhibit III-4, the FY 2009 book of business constitutes approximately 47.78 percent of the Fund's total unamortized IIF. In addition, the FY 2008 book of business contributes 19.95 percent of the unamortized IIF. Mortgage endorsements previously declined significantly after FY 2003 as the subprime market expanded. FHA endorsements subsequently ramped up rapidly during FY 2008 and FY 2009, as the housing market deteriorated, mortgage default rates skyrocketed, and most private lenders tightened their underwriting standards. Loans endorsed over the past four years are expected to suffer the most from the recent national housing recession. Since about two-thirds of the entire Fund is now concentrated in mortgages originated in FY 2008 and FY 2009, the Fund is expected to realize high claim losses during FY 2012 through FY 2014 as these two books of business enter their peak default periods.

The endorsement volume of the FY 2009 book has grown rapidly and will be the largest book in FHA's history to date. Despite its better-than-usual credit quality composition, as the housing market is forecasted to continue to deteriorate through 2010, this book of business still has a negative economic value.



Exhibit III-4

Endorsements and Insurance-in-Force of the Fund As of End of FY 2009 (in \$ Millions)			
Book of Business <sup>a</sup>	Mortgage Endorsements	Unamortized Insurance in Force <sup>b</sup>	Amortized Insurance in Force <sup>b</sup>
1980	14,875	95	6
1981	10,266	53	8
1982	7,317	8.6	2
1983	26,819	144	51
1984	15,931	287	126
1985	24,086	422	209
1986	57,747	1589	783
1987	70,230	2642	1,342
1988	37,433	1146	655
1989	39,764	1021	630
1990	47,127	872	557
1991	44,067	794	536
1992	45,093	936	637
1993	73,799	2,025	1,421
1994	79,692	2,675	1,912
1995	41,534	1,421	1,046
1996	61,696	2,441	1,816
1997	65,469	2,539	1,991
1998	88,593	4,452	3,536
1999	110,067	7,245	5,869
2000	86,805	3,365	2,907
2001	119,891	6,589	5,768
2002	128,891	12,674	11,099
2003	150,582	39,959	35,277
2004	92,897	32,620	29,540
2005	57,710	30,102	27,960
2006	50,128	28,816	27,412
2007	57,598	34,469	33,366
2008	176,009	136,938	134,349
2009 <sup>c</sup>	337,436	327,925	325,200
Total	2,219,554	686,263	656,012

<sup>a</sup> End of year insurance-in-force<sup>b</sup> Based on June 30, 2009 data extract from HUD and the performance of outstanding loans projected by the econometric model for the last two quarters of fiscal year 2009<sup>c</sup> Based on the HUD September 2009 projection.



## B. Projected Future Economic Values

In this section both the future economic value of the Fund is projected based on: (a) HUD's forecast of future endorsement volumes and compositions, (b) IHS Global Insight economic forecasts, and (c) cash flow projections based on the econometric and cash flow models. The initial economic values of individual future books of business are first projected, and then combined to estimate the economic values of the Fund.

### 1. Present Values of Future Books

The present values of future books discounted to the end of each corresponding future fiscal year (through FY 2016) are presented in Exhibit III-5. We observe that these are all positive. Due to the withdrawal of private mortgage lending activities, FHA has become the primary source of housing finance for loans with high LTVs. With reduced competition from the private market, HUD projects that the credit quality of the FY 2010 through FY 2012 mortgages will be better than those estimated last year for the same books of business. The high-claim-rate downpayment assistance loans diminished during FY 2009 and are assumed to disappear in the future, as they are now prohibited by HERA. This has a positive impact on the expected present values of the future books.

#### Exhibit III-5

Present Value of Future Books of Business <sup>a</sup> by Origination Year & Mortgage Type (in \$ Million)							
Fiscal Year	FRM 30	FRM 15	ARM	SR 30	SR 15	SR ARM	Total
2010	5,446	7	96	-415	10	-20	5,124
2011	5,576	-19	82	439	7	-1	6,084
2012	5,179	-17	94	609	5	2	5,872
2013	3,804	-81	60	845	7	3	4,638
2014	2,933	-68	69	877	7	4	3,822
2015	3,310	-73	78	939	8	5	4,267
2016	3,460	-55	83	982	8	5	4,483

<sup>a</sup> Present values are estimated as of the end of each corresponding fiscal years.



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## **Section IV: Characteristics of the Fiscal Year 2009 Insurance Portfolio**

This section analyzes the characteristics of the loan portfolio insured by the Fund<sup>18</sup> at the end of FY 2009. The characteristic descriptions cover the following three areas: (1) analysis of the volume and composition of loan originations; (2) comparison of new purchase versus refinancing; and (3) the distribution of loans by relative loan size, loan-to-value ratios, and borrower credit scores. This section also examines and compares the FY 2009 book with previous books in order to gain insights into how the FY 2009 book is likely to influence the future performance of the Fund. Because the data used for this analysis is an extract as of June 30, 2009, the characteristics for the FY 2009 book reflect only loans originated in the first three quarters, between October 1, 2008 and June 30, 2009. The year-end portfolio size was estimated by HUD.

### **A. Volume and Share of Mortgage Originations**

FHA is projected to insure \$337.44 billion<sup>19</sup> in single-family mortgages through the Fund in FY 2009, bringing the Fund's total unamortized IIF to \$686.26 billion. Exhibit IV-1 shows the annual FHA origination counts as of June 30, 2009 for fully underwritten purchase and refinance loans and for streamline refinancing loans, for FY 1979 through FY 2009.

Exhibit IV-1 shows that FHA's business volume, which had dropped significantly from its peak in FY 2003 to FY 2006, has increased dramatically in the last two years. As private mortgage insurers have tightened their underwriting rules due to the subprime mortgage crisis, FHA-insured mortgages have become a primary form of mortgages originated throughout the country. This phenomenon is reflected in the data by a clear reversal of the declining volume trend starting in the second quarter of FY 2007. Most private mortgage insurance companies dramatically scaled back their lending activities in FY 2008 and FY 2009 as a reaction to the current housing recession and constraints on capital. In the absence of private mortgage insurance, the GSEs are unable to purchase or guarantee loans with less than 20 percent downpayment. Thus, FHA has become the primary source of higher LTV mortgage loans during the past two years. Since FY 2007, the volume of new insurance has steadily and rapidly increased every quarter. This increasing trend was further enhanced by the enactment of the Economic Stimulus Act of 2008 and the Housing and Economic Recovery Act of 2008, which raised the FHA-insured loan limits and allowed FHA to serve more borrowers.

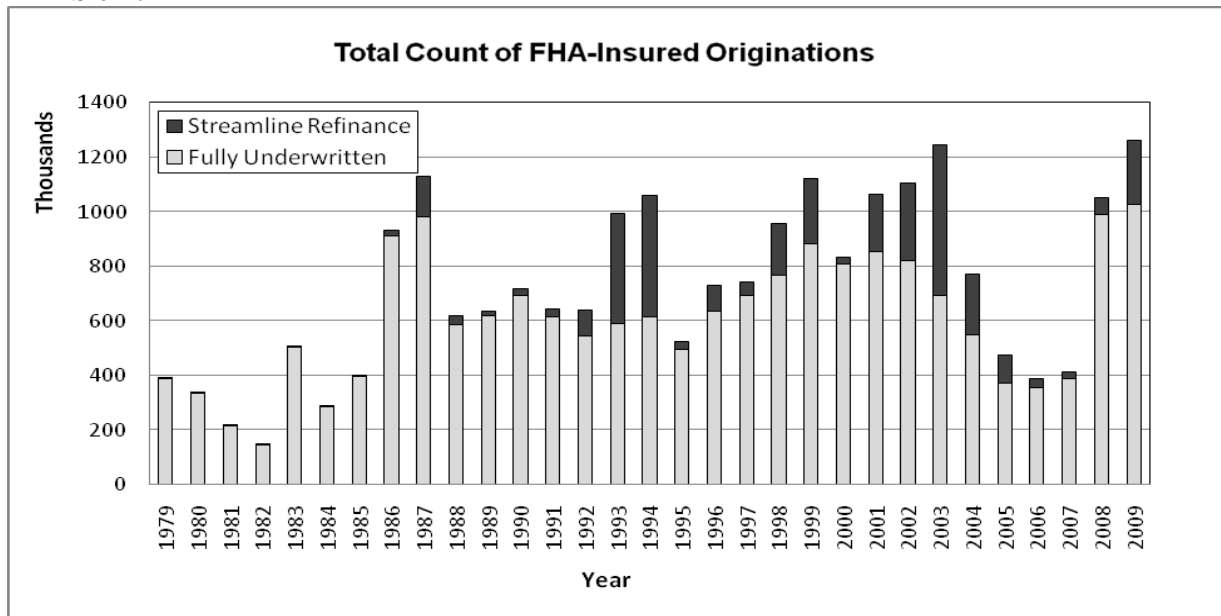
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<sup>18</sup> The Fund in this Review refers to MMI Fund excluding HECMs.

<sup>19</sup> According to the September 2009 projection by HUD.



Exhibit IV-1



Source: FHA data warehouse, June 30, 2009 extract.

Exhibit IV-2 shows FHA's mortgage origination volume and market share from FY 1993 through FY 2009. FHA's market share, which had averaged about 13 percent during the period from FY 1993 through FY 2002, declined to a low of 3.77 percent in FY 2006. This trend has been reversed during the past several years and by FY 2008 FHA's market share was back to 1990's levels. FHA's share by loan count increased from 4.12 percent in FY 2007 to 17.96 percent in FY 2009, and its share by dollar volume increased from 2.04 percent in FY 2007 to 13.68 percent in FY 2009.



**Exhibit IV-2**

FHA's Market Share of New Insurance Counts and Volumes National Home Purchase Market						
Fiscal Year	Number of Mortgages Originated (000)			Volume of Mortgages Originated (billions, current dollars)		
	FHA <sup>a</sup>	Market <sup>b</sup>	FHA Share (%)	FHA	Market	FHA Share (%)
1993	639	4,554	14.04	48	613	7.91
1994	652	4,987	13.07	52	696	7.42
1995	556	4,845	11.48	45	689	6.46
1996	686	5,289	12.97	58	784	7.43
1997	751	5,467	13.73	66	854	7.73
1998	789	6,084	12.96	71	1,004	7.12
1999	909	6,463	14.06	89	1,124	7.96
2000	856	6,335	13.52	89	1,157	7.71
2001	869	6,405	13.57	96	1,221	7.87
2002	806	6,615	12.18	94	1,356	6.93
2003	655	7,148	9.16	80	1,578	5.09
2004	505	7,901	6.40	63	1,914	3.28
2005	345	8,454	4.08	43	2,247	1.89
2006	301	7,979	3.77	39	2,201	1.75
2007	288	6,992	4.12	39	1,920	2.04
2008	718	5,688	12.62	118	1,453	8.14
2009 <sup>c</sup>	480	2,673	17.96	81	595	13.68

Sources: Existing Home Sales are from the National Association of Realtors; FHA numbers are from HUD.

<sup>a</sup> Home purchase loans endorsed by FHA under either the General Insurance Fund or the MMI Fund.

<sup>b</sup> Total number of home sales in the nation.

<sup>c</sup> FY 2009 numbers are through April 30, 2009.

In the rest of this section, we examine FHA's business concentration profile to determine if there are adverse quality indicators that could have significance for the FY 2009 Actuarial Review.

**B. Originations by Location**

FHA insures loans in all regions of the U.S., but about half of FHA's total dollar volume is concentrated in only ten states. Exhibit IV-3 illustrates the percentage of FHA's total dollar volume originated in these ten states from FY 2005 through FY 2009. The table is based on the top 10 states by dollar volume during FY 2009.



**Exhibit IV-3**

<b>Percentage of FHA Dollar Volume Originated Between FY 2005 and FY 2009</b>					
<b>State Location<sup>a</sup></b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
California	2.33	1.52	1.83	7.51	12.44
Texas	13.53	12.56	11.02	7.12	5.38
New Jersey	3.99	3.58	4.37	4.35	4.53
Maryland	2.64	2.40	3.10	4.27	4.30
Virginia	2.81	2.78	2.96	3.89	4.23
Illinois	4.40	4.08	4.15	4.08	4.18
Florida	4.34	3.91	4.73	4.92	3.90
Georgia	6.22	6.11	6.17	4.66	3.61
New York	2.88	3.33	3.40	3.38	3.43
Pennsylvania	2.33	2.84	3.14	3.28	3.36

Source: FHA data warehouse, June 30, 2009 extract.

<sup>a</sup> States are sorted according to their share of FY 2009 origination volume in the Fund.

The percentage share of FHA loans originated in California increased almost sevenfold from 1.83 percent in FY 2007 to 12.44 percent in FY 2009, due in part to the increase in the FHA loan size limits and the decrease in average house prices in most parts of California. Currently California comprises the largest percentage of all FHA loans in dollar volume.

Historical house price levels and growth rates in the local housing markets are captured by our econometric model through the variables measuring relative house price level and the probability of negative equity, and the geographical concentration of the Fund and projected values of these variables in the various locations have been reflected in the actuarial simulation model.

### **C. Originations by Mortgage Type**

Exhibit IV-4 shows that the 30-year fixed-rate fully underwritten mortgage (FRM) generally comprised the majority of FHA's single-family business, representing an average share of 78 percent of the business over the period 1980-2009. The share of total mortgages represented by 30-year FRMs began to change in the early 1990s when FHA started insuring the adjustable-rate mortgage (ARM) and the streamline-refinancing mortgage (SR). For the next few years, ARM and SR mortgages gradually took on a bigger share of annual loan originations, and the 30-year FRM share decreased, with FY 1993, FY 1994, and FY 2003 recording the lowest shares of these loans. An opposite trend has emerged as market interest rates recently stabilized. From FY 2005 through FY 2008, 30-year FRM endorsements increased from 69.55 percent to 90.79



percent, while 30-year SR endorsements dropped from 16.30 percent to 5.80 percent. However, the share of 30-year FRMs endorsed in FY 2009 dropped to 76.55 percent, while the share of 30-year SRs increased to 20.44 percent, due to the historically low market mortgage rates. The ARM share of the portfolio (including both ARMs and ARM SRs) also shrank dramatically from 8.67 percent in FY 2005 to 0.57 percent in FY 2009. As ARMs are more vulnerable to economic downturns, the smaller concentration in ARMs of the most recent books of business will help the performance of the Fund portfolio during the next few years. Meanwhile, 15-year FRMs and 15-year SRs continue to be relatively minor product types in the total Fund portfolio.

The dynamics of the Fund product-type concentrations are captured by our econometric models with separate models fitted to the historical performance of the six individual product types.



**Exhibit IV-4**

<b>FHA-Insured Originations By Mortgage Type</b> <b>(Percentage of FHA-Insured Mortgages by Dollar Volume)</b>						
Fiscal Year	Fully-written Mortgages			Streamline Refinancings		
	30-Year	15-Year	ARMs	30-Year	15-Year	ARMs SRs
	FRMs	FRMs		SRs	SRs	
1980	99.90	0.10	0.00	0.00	0.00	0.00
1981	99.84	0.15	0.00	0.00	0.00	0.00
1982	99.62	0.38	0.00	0.00	0.00	0.00
1983	93.71	6.28	0.00	0.01	0.00	0.00
1984	94.28	5.67	0.01	0.02	0.01	0.00
1985	92.00	7.75	0.14	0.08	0.03	0.00
1986	88.93	8.07	0.74	1.90	0.36	0.00
1987	80.44	4.97	1.47	11.22	1.84	0.06
1988	86.30	3.59	4.98	4.64	0.45	0.04
1989	92.95	2.69	1.52	2.64	0.19	0.00
1990	93.09	2.77	0.80	3.09	0.25	0.00
1991	88.20	3.14	4.43	3.63	0.57	0.04
1992	66.79	2.51	16.35	10.84	2.17	1.34
1993	45.78	2.25	12.14	29.96	7.75	2.13
1994	42.50	1.80	16.98	27.95	8.05	2.72
1995	65.10	1.28	29.25	2.78	0.94	0.65
1996	61.09	1.29	25.42	8.65	1.72	1.83
1997	57.18	1.10	35.06	3.62	0.69	2.35
1998	65.56	1.15	11.94	17.78	1.39	2.18
1999	73.57	1.13	4.24	18.35	1.74	0.98
2000	85.36	0.71	11.04	2.06	0.26	0.57
2001	75.84	0.94	2.08	19.77	0.65	0.73
2002	66.96	1.21	6.05	21.11	1.57	3.09
2003	51.42	1.34	3.89	36.95	3.12	3.29
2004	63.62	1.36	8.70	19.53	2.43	4.36
2005	69.55	1.26	8.67	16.30	1.37	2.85
2006	88.66	1.35	2.65	6.66	0.48	0.21
2007	92.14	1.22	1.34	5.12	0.11	0.07
2008	90.79	1.59	1.53	5.80	0.14	0.15
2009 <sup>a</sup>	76.55	2.02	0.57	20.44	0.31	0.11

Source: FHA data warehouse, June 30, 2009 extract.

<sup>a</sup> Based on partial year data.



#### **D. Initial Loan-to-Value Distributions**

Based on previous econometric studies of mortgage behavior, a borrower's equity position in the mortgaged house is one of the most important drivers of default behavior. The larger the equity position a borrower has, the greater the incentive to avoid default on the loan. The initial LTV is an inverse measure of the borrower's equity at origination. Exhibit IV-5 shows the distribution of mortgage originations by initial LTV categories for the period from FY 1980 through FY 2009.

As Exhibit IV-5 indicates, the distribution among initial LTV categories shifted significantly after FY 1999. More than half of the loans insured during the period of FY 2000 to FY 2005 are concentrated in the category of LTVs greater than or equal to 97 percent. This concentration in the highest risk category gradually declined during the past four years. In 2008, HERA placed a firm limit of 96.5 percent on LTV, with no additional allowance for the financing of closing costs. During FY 2009, 27.96 percent of mortgages have LTV ratios of 97 percent or more. This is a 50 percent reduction from FY 2005, when over 55.5 percent of that book of business was concentrated in this highest LTV category. This recent shift in LTV concentration should help the Fund to some extent in weathering the current housing market slowdown.

The LTV concentration of individual books of business affects the econometric models in two ways. First, it serves as the starting position for updating the probability of negative equity variable. Holding everything else constant, loans with higher initial LTV will experience higher probability of negative equity in future years. Second, the initial LTV itself is also included in the model to capture potential behavioral differences among borrowers who self-select into different initial LTV categories.



**Exhibit IV-5**

<b>Distribution of Originations by Initial LTV Category (Percentage of FHA-Insured Mortgages by Dollar Volume)</b>						
Books of Business	Unknown LTV	≤ 80%	> 80% ≤ 90%	> 90% ≤ 95%	> 95% < 97%	≥ 97%
1980	11.45	12.75	27.86	26.91	18.96	2.07
1981	26.96	11.87	26.88	18.43	14.71	1.15
1982	16.54	19.14	26.68	22.49	14.32	0.83
1983	20.42	19.04	24.39	21.52	13.37	1.25
1984	2.78	16.19	26.17	26.32	21.51	7.03
1985	1.11	16.19	31.22	27.14	21.69	2.64
1986	0.56	18.26	30.33	27.35	20.51	3.00
1987	0.18	15.57	27.26	29.84	24.02	3.13
1988	0.13	8.01	19.72	35.57	31.87	4.71
1989	8.91	6.78	16.86	33.13	29.89	4.43
1990	11.92	6.15	16.20	32.21	29.13	4.40
1991	1.79	5.59	15.74	29.7	30.07	17.11
1992	1.76	4.39	13.99	28.03	38.26	13.57
1993	0.31	3.65	12.85	25.76	32.72	24.73
1994	0.24	3.46	11.69	24.44	32.77	27.40
1995	0.07	2.75	10.36	24.46	34.31	28.05
1996	0.03	2.84	11.10	25.5	34.72	25.81
1997	0.01	3.26	11.42	26.19	34.67	24.45
1998	0.01	3.55	12.23	26.46	34.86	22.91
1999	0.00	3.17	9.10	13.29	30.59	43.84
2000	0.00	2.34	6.23	6.81	32.54	52.07
2001	0.00	3.27	7.56	6.85	25.33	57.00
2002	0.00	3.88	8.09	6.84	24.23	56.96
2003	0.00	5.47	9.61	7.11	24.18	53.63
2004	0.01	5.56	9.17	7.23	23.66	54.38
2005	0.01	5.80	9.22	6.81	22.65	55.52
2006	0.01	6.81	10.06	13.88	19.91	49.34
2007	0.01	7.34	11.46	20.91	18.05	42.24
2008	0.02	6.17	12.05	24.04	13.41	44.32
2009 <sup>a</sup>	0.01	5.50	13.55	22.65	30.34	27.96

Source: FHA data warehouse, June 30, 2009 extract

<sup>a</sup> Based on partial year data.



## **E. Borrower Credit History Distributions**

Credit score data were collected through two different channels. The first channel includes credit scores collected for a sample of FHA applications from FY 1992, FY 1994, and FY 1996; and subsequently extended to loan applications during FY 1997 through FY 2004. This set of credit score data is particularly useful because these loans have existed for many years and provide valuable historical claim and prepayment performance records. The limitation of this data source is that it covers only a limited sample of FHA loans. In addition, the sample was originally collected for policy research purposes and represents a choice-based sample. For example, there was over-sampling of early-default loans during the FY 1997-to-2003 application period.

Since May 2004, all lenders originating loans for FHA insurance are required to report borrower credit scores directly to HUD if the credit scores were ordered as part of the underwriting process. In any event, all loans going through the FHA TOTAL scorecard have credit scores obtained electronically by the affiliated automated underwriting systems (AUS). This is the second source of credit score data. As there are no exceptions to this requirement, the credit scores collected through this channel are considered to be comprehensive and unbiased. However, these loans are still relatively new and just starting to enter the peak default ages. Nevertheless, these loans will eventually grow to become the dominant source of credit score information, and they already have had a significant impact on the econometric estimates.

Exhibit IV-6 shows the distributions of fully underwritten FHA mortgage loans by borrower credit score categories and origination years. The distribution among credit score categories remained stable during the FY 2005 through FY 2008 books. For loans originated in FY 2009, the FICO score distribution show significant improvement over the previous year. About 44 percent of the FY 2009 loans have FICO scores above 680. Loans with FICO scores below 600 are less than 10 percent of the loans originated in FY 2009, which is a substantial decline from the FY 2008 book, where close to 25 percent of the loans had FICO scores below 600. In the econometric models, we also controlled for missing and uncollected credit scores. In Exhibit IV-6, the category “Missing” refers to loans with insufficient borrower credit history to generate a FICO score, and the category “Not Collected” refers to loans where no attempt was made to obtain the FICO score. Referring to statistical results presented in Appendix A, loans that lack credit scores exhibit claim and prepayment patterns similar to the loans with about 580 FICO scores.



**Exhibit IV-6**

<b>Distribution of Originations by Credit Score Category<sup>a</sup></b> <b>(Percentage of Fully Underwritten FHA-Insured Mortgages by Dollar Volume)</b>								
Books of Business	Missing	300-499	500-559	560-599	600-639	640-679	680-850	Not Collected
1994	3.66	0.01	0.25	0.82	2.01	2.83	6.30	84.11
1995	3.25	0.01	0.32	0.76	1.46	1.77	3.51	88.91
1996	3.92	0.03	0.71	1.89	3.81	4.50	8.24	76.90
1997	1.99	0.19	1.35	2.45	3.95	3.74	5.42	80.91
1998	1.80	0.24	1.84	3.18	5.23	4.70	5.52	77.50
1999	1.71	0.22	1.83	3.32	5.40	4.66	4.99	77.86
2000	1.89	0.33	2.44	3.47	5.00	4.01	4.01	78.85
2001	1.37	0.27	2.14	3.31	4.64	3.77	3.92	80.58
2002	1.33	0.31	2.33	3.58	5.09	4.21	4.57	78.58
2003	1.45	0.32	2.69	4.29	6.18	5.18	5.63	74.27
2004 <sup>c</sup>	3.03	0.51	4.94	8.65	12.59	10.44	11.71	48.14
2005 <sup>c</sup>	4.89	0.93	9.34	16.97	24.59	20.27	23.01	
2006 <sup>b</sup>	4.51	0.92	8.71	16.58	24.42	20.73	24.14	
2007 <sup>b</sup>	4.21	1.44	11.68	19.48	24.87	18.85	19.46	
2008 <sup>b</sup>	1.90	0.81	7.15	14.82	24.73	22.48	28.10	
2009 <sup>b</sup>	0.41	0.06	1.54	7.27	21.26	25.33	44.14	

<sup>a</sup> Most FICO score data are obtained from the previous HUD special data collection project. Problematic loans were over-sampled during the years 1997 to part of 2004.

<sup>b</sup> Starting May 2004, lenders are required to report FICO data directly to HUD.

<sup>c</sup> Mixture of the above two sources of data.

As the amount of credit score information collected via the new standard channel increases, and as the loans with available scores age further, the ability to differentiate loan credit quality by borrower credit history will continue to improve.

## **F. Initial Relative House Price Distributions**

In last year's Review we introduced a variable measuring the relative house price level within the local market. The relative house price variable is computed by comparing the original purchase price of the house underlying a particular mortgage with the median house value in the same time period and location. Census median house price data at the county and metropolitan Core Based Statistical Area (CBSA) levels for the years 1980, 1990, 2000, and 2006 were



provided by HUD. Quarterly median price estimates for all time periods from 1975 to 2009 were derived through linear interpolation or extrapolation of these official estimates. The CBSA median price estimates were applied to FHA loans with properties located in metropolitan areas. Estimates of state-level median prices for non-metro areas were developed using the Census non-metro county median price estimates. The state-level non-metro median estimates were then applied to FHA loans secured by properties not located in a CBSA.

The relative house price variable improves on the previous relative loan size variable in two ways: (1) it enables the model to account for the impact of changes in FHA loan limits on the distribution of FHA property values; and (2) it provides a broader-based approach by applying a market-wide estimate of median property values, rather than an FHA-specific estimate of median loan size. This improves on the ability of the models to account for the position of FHA loans within the broader market, which may be changing rapidly in view of recent market developments, with the expansion in FHA endorsements and the contraction in conventional mortgage originations. For streamline refinance mortgages, the house price is not available, so we continued to use the relative loan size variable applied in previous years.

Exhibit IV-7 shows the percentage of new originations within each relative house price category. The distribution has been reasonably stable over time with the largest share in the 50-to-100 percent categories, as would be expected based on FHA lending limits. Since FY 2002, there is a trend of increasing concentration in the highest house price category, but not the rapid expansion of this category one might have anticipated with the recent temporary increases in FHA lending limits. In FY 2009 the concentration in the lowest house price category also rose substantially.

FHA experience indicates that larger houses tend to perform better compared with smaller houses in the same geographical area, all else being equal. The average houses in the marketplace, which have been the larger houses having FHA-insured mortgages, incur claims at a lower rate than smaller houses. Since the average quality housing market is relatively more liquid and there are a relatively large number of these similar-quality homes in the area, the price volatility of these houses tends to be smaller in comparison to the house-price volatility of the extremely low- and high-priced houses.



**Exhibit IV-7**

<b>Distribution of Originations by Relative House Price Category (Percentage of Fully Underwritten FHA Insured Mortgages by Dollar Volume)</b>						
<b>Books of Business</b>	<b>0-50% of Median House Price</b>	<b>50-75% of Median House Price</b>	<b>75-100% of Median House Price</b>	<b>100-125% of Median House Price</b>	<b>125-150% of Median House Price</b>	<b>&gt;150% of Median House Price</b>
1980	5.09	21.63	34.37	22.99	9.58	6.34
1981	6.95	22.14	32.70	22.58	9.62	6.01
1982	10.19	21.82	27.85	21.75	10.61	7.78
1983	5.53	20.14	29.01	23.48	12.21	9.64
1984	8.98	23.58	29.20	21.32	10.09	6.82
1985	7.59	22.95	27.59	21.43	11.88	8.56
1986	5.11	19.37	28.76	24.10	13.42	9.24
1987	5.70	21.02	30.72	23.6	11.92	7.04
1988	8.05	25.33	32.68	21.24	8.76	3.94
1989	6.45	24.67	33.22	21.61	9.21	4.84
1990	5.18	22.79	33.17	23.13	10.37	5.36
1991	5.77	25.23	34.27	22.18	8.46	4.09
1992	5.98	27.04	36.02	21.20	6.70	3.06
1993	5.94	28.12	37.09	20.46	5.82	2.56
1994	6.53	29.63	36.62	19.19	5.34	2.70
1995	8.71	32.85	35.35	16.82	4.00	2.26
1996	8.01	31.73	35.95	17.86	4.38	2.07
1997	8.73	31.08	37.87	17.62	3.72	0.98
1998	7.58	32.05	37.54	17.22	4.01	1.60
1999	6.63	29.90	37.47	18.37	5.55	2.07
2000	6.94	29.99	36.89	17.93	5.97	2.28
2001	8.29	32.08	35.78	16.23	5.44	2.17
2002	9.50	33.31	33.59	15.93	5.55	2.12
2003	8.87	32.79	33.32	16.64	5.88	2.50
2004	8.70	32.25	33.20	16.93	6.01	2.90
2005	7.25	29.59	34.03	18.38	6.92	3.83
2006	6.04	26.10	34.19	19.80	8.26	5.61
2007	6.02	25.77	33.77	19.76	8.54	6.14
2008	7.49	27.51	31.28	17.69	8.31	7.72
2009 <sup>a</sup>	14.85	28.60	25.58	14.72	7.69	8.56

Source: FHA data warehouse, June 30, 2009 extract

<sup>a</sup> Based on partial year data.



### **G. Initial Loan Size Distributions**

In addition to the relative house price categories, the relative loan size categories used in previous years are still utilized in the modeling of streamline refinance loans. The streamlined refinance loans are endorsed without a purchase price or an appraisal requirement. There is no reliable indicator of the market value of the underlying house, so the relative loan size variable is still used in modeling the performance of these loans.

Exhibit IV-8 shows the percentage of new originations within each relative loan size category. Overall, the FY 2009 book of business is similar to other recent books of business, for the reasons discussed above. Over the years, the largest loan size category (> 140 percent of the median loan size) has been gradually increasing. Most of this increase corresponds to a decrease in the share of loans in the 100-140 percent relative loan size categories.



## Exhibit IV-8

Distribution of Originations by Relative Loan Size Category (Percentage of FHA-Insured Mortgages by Dollar Volume)						
Book of Business	0-60% of Average Loan Size	60-80% of Average Loan Size	80-100% of Average Loan Size	100-120% of Average Loan Size	120-140% of Average Loan Size	>140% of Average Loan Size
1980	3.50	10.70	23.45	33.64	19.85	8.87
1981	4.07	11.04	23.46	29.62	19.49	12.32
1982	4.90	11.31	21.38	27.75	20.78	13.88
1983	4.16	11.48	22.36	28.25	22.23	11.52
1984	4.30	11.71	22.27	28.22	21.29	12.21
1985	4.27	11.62	21.91	28.39	23.75	10.06
1986	3.60	11.48	23.01	30.17	23.98	7.76
1987	3.51	11.78	23.14	29.51	23.88	8.16
1988	4.22	12.18	21.71	28.58	21.36	11.94
1989	4.51	12.37	21.40	26.23	21.28	14.20
1990	4.79	12.63	21.42	25.59	18.93	16.63
1991	4.80	12.55	21.39	24.33	21.40	15.53
1992	4.43	12.35	21.97	25.62	21.60	14.03
1993	3.92	12.31	23.16	26.89	20.90	12.82
1994	4.33	12.81	22.34	24.93	20.31	15.27
1995	4.74	12.98	20.93	24.59	20.85	15.90
1996	4.56	12.87	21.01	25.27	21.55	14.74
1997	4.63	12.92	20.49	25.78	21.68	14.50
1998	4.29	12.53	21.14	27.71	21.53	12.79
1999	4.63	12.94	21.45	25.82	19.07	16.08
2000	5.27	12.82	20.80	23.98	18.93	18.19
2001	4.93	12.31	22.02	24.85	19.11	16.78
2002	5.14	12.29	21.72	24.51	18.88	17.46
2003	5.08	12.22	21.80	25.09	18.85	16.96
2004	5.89	12.46	20.10	22.97	18.77	19.80
2005	5.88	12.77	19.57	22.75	18.85	20.18
2006	5.91	13.17	19.29	22.63	18.22	20.78
2007	5.96	13.04	19.47	22.66	17.94	20.93
2008	6.37	13.34	20.31	21.03	16.09	22.86
2009 <sup>a</sup>	7.24	13.45	19.25	18.81	14.85	26.39

<sup>a</sup> Based on partial year data.



## **H. Initial Contract Interest Rate**

Exhibit IV-9 shows the average contract rate by mortgage type since FY 1992. In general, average contract rates in FY 2009 are lowest among loans originated during this time period.

Research has found that, in general, an FRM with a lower initial contract rate tends to prepay at a slower speed. Slower prepayment rates imply that mortgages are exposed to default risk for longer periods of time. This means that in an initially-low-and-falling-rate environment conditional claim rates will be somewhat higher than in an initially-high-and-falling-rate environment. Likewise, during a housing recession where default is more likely, the conditional prepayment rate also tends to be low. These prepayment effects drive the performance of FRMs in particular. As the interest rate is expected to stay low for the next two years, the prepayment rates of the earlier FY 2006 through FY 2008 originations are likely to be high, which will help to reduce claims on these books. On the other hand, as the more recent FY 2009 book was originated during the interest rate trough, it is expected to experience slower prepayment rates and correspondingly higher claim rates.



**Exhibit IV-9**

Average Contract Interest Rate by Loan Type (Percent)							
Fiscal Year	30-Year FRMs	15-Year FRMs	ARMs	30-Year SRs	15-Year SRs	ARM SRs	Average
1992	8.55	8.36	6.47	8.92	8.38	6.52	8.26
1993	7.77	7.45	5.87	8.17	7.58	6.28	7.64
1994	7.57	7.22	6.06	7.77	7.44	6.09	7.36
1995	8.41	8.34	7.18	8.71	8.76	7.34	8.10
1996	7.85	7.55	6.49	8.01	7.69	6.79	7.53
1997	7.99	7.83	6.53	8.29	8.05	6.81	7.51
1998	7.37	7.16	6.12	7.58	7.18	6.48	7.25
1999	7.24	6.95	6.00	7.17	6.89	6.05	7.16
2000	8.31	8.11	6.95	8.31	8.05	6.19	8.16
2001	7.56	7.11	6.19	7.42	6.85	6.12	7.49
2002	7.00	6.54	5.28	6.95	6.42	5.31	6.84
2003	6.07	5.50	4.38	6.01	5.48	4.44	5.91
2004	6.12	5.56	4.46	5.98	5.52	4.39	5.88
2005	5.92	5.63	4.79	5.84	5.63	4.67	5.79
2006	6.33	6.18	5.42	6.13	6.04	5.13	6.28
2007	6.51	6.41	5.62	6.38	6.25	5.59	6.49
2008	6.33	5.95	5.40	6.08	5.64	5.33	6.29
2009 <sup>a</sup>	5.72	5.30	5.42	5.27	4.87	4.68	5.62

Source: FHA data warehouse, June 30, 2009 extract.

<sup>a</sup> Based on partial year data.

**I. Source of Downpayment Assistance**

Exhibit IV-10 reports the distribution of loans endorsed annually by source of downpayment assistance starting in FY 2000. Exhibit IV-10 shows that starting in FY 2001, there was a rapid increase in the share of loans with gift letters from non-profit, religious, or community institutions. This concentration reached about 10 percent by FY 2003 and increased dramatically to almost one-fourth in the FY 2005 book of business. Only very recently, in FY 2009, we observed a noticeable reduction of the share of this type of loan due to the passage of HERA, which effectively terminated seller-financed downpayment assistance effective October 1, 2008.



**Exhibit IV-10**

<b>Concentration of Loans with Downpayment Assistance by Source</b>					
<b>(Percent)<sup>a</sup></b>					
<b>Origination Year</b>	<b>No Gift</b>	<b>Relative</b>	<b>Non-profit, Religious, or Community</b>	<b>Government</b>	<b>Employer</b>
2000	77.17	18.81	1.83	2.10	0.09
2001	83.23	11.08	4.26	1.36	0.07
2002	82.26	9.15	7.05	1.48	0.06
2003	81.35	7.41	9.76	1.42	0.06
2004	70.24	9.59	18.05	2.04	0.08
2005	63.87	9.50	23.52	3.03	0.08
2006	62.03	9.39	24.30	4.18	0.10
2007	65.58	7.80	23.14	3.40	0.08
2008	72.21	7.12	18.91	1.70	0.06
2009 <sup>b</sup>	85.61	10.13	3.60	0.60	0.06

Source: FHA data warehouse, June 30, 2009 extract.

<sup>a</sup> As a percentage of all Fund endorsed loans, including purchase and refinance loans. The concentration rate of downpayment assistance would be much higher if refinance loans were excluded from this calculation.

<sup>b</sup> Based on partial year data.

Exhibit IV-11 shows the cumulative claim rates realized on loans by downpayment gift source and origination year since FY 2001. With the exception of relative-funded loans in FY 2008, we find that loans with any form of downpayment assistance performed worse across all origination years than loans receiving no downpayment assistance. In order to reflect this differential performance of loans with different downpayment assistance sources, our econometric model incorporated a series of categorical variables to reflect this important characteristic. As shown in Appendix A, the estimated coefficients of these downpayment assistance-source variables are both economically and statistically significant.



**Exhibit IV-11**

<b>Cumulative Claim Rates of Loans with Different Downpayment Assistance Sources (Percent)</b> <b>As of June 30, 2009</b>					
<b>Origination Year</b>	<b>No Gift</b>	<b>Relative</b>	<b>Non-profit, Religious, or Community</b>	<b>Government</b>	<b>Employer</b>
2001	5.40	7.11	16.91	14.54	8.24
2002	4.37	5.20	14.46	12.03	6.72
2003	3.38	4.60	13.27	10.83	6.82
2004	3.63	4.35	12.50	8.08	6.19
2005	3.78	4.17	11.41	7.22	5.01
2006	3.32	3.38	8.62	4.98	6.58
2007	1.96	1.88	4.99	2.57	2.27
2008	0.29	0.20	0.60	0.47	0.17

Source: FHA data warehouse, June 30, 2009 extract.

Among the different downpayment assistance sources, non-profit organization sources have the highest cumulative claim rates for all origination years. GAO has reported<sup>20</sup> that the downpayment assistance program has been misused by many non-profit organizations that are funded by home sellers. The high concentration of these high-claim-rate loans that receive downpayment assistance from non-profit organizations makes the claim risk of these recent books of business particularly high. These loans have contributed significant negative economic value to the Fund. Exhibit IV-12 shows the present value of future cash flows by downpayment assistance sources. While loans funded with assistance from non-profit organizations account for about 19.5 percent of the origination volume of FY 2004 through FY 2008, they generate 39.9 percent of the negative present value of future cash flows for the existing portfolio.

These costly non-profit downpayment assistance loans have had a significant negative impact on the financial state of the Fund. If these loans had never been endorsed since FY 1998, the economic value at the end of FY 2009 would have been \$10.43 billion higher, or \$13.15 billion in the base case. The revised IIF would have been \$620.39 billion. On the positive side, following the elimination of this type of high-risk loan by HERA in 2008, the performance of FY 2009 and future books of business will be much improved over what would have been the case if these loans were still being endorsed in significant amounts.

<sup>20</sup> "Mortgage Finance Additional Action Needed to Manage Risks of FHA-Insured Loans with Downpayment Assistance," Government Accountability Office, November 2005.



Exhibit IV-12

Present Value of Future Cash Flows as of the End of FY 2009						
By Downpayment Assistance Source (\$ Millions)						
Origination Year	No Gift	Relative	Non-Profit, Religious, or Community	Government	Employer	Total
Pre-2000	-43	-12	-1	-1	0	-56
2000	-38	-13	-3	-4	0	-59
2001	-129	-22	-23	-8	0	-183
2002	-221	-36	-74	-10	-1	-341
2003	-526	-67	-290	-32	-1	-916
2004	-662	-117	-583	-37	-2	-1,401
2005	-682	-120	-875	-72	0	-1,750
2006	-1,098	-220	-1,076	-95	-3	-2,492
2007	-1,723	-288	-1,547	-144	-1	-3,704
2008	-5,094	-551	-3,295	-186	-2	-9,129
2009	-5,310	-887	-753	-374	-17	-7,342
<b>Total</b>	-15,526	-2,334	-8,522	-963	-28	-27,373



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**Section V: Sensitivity of the Fund - Performance under Alternative Scenarios**

This section reports the results of the sensitivity analyses performed as part of the FY 2009 Actuarial Review of the Fund.<sup>21</sup> This year the Fund was severely impacted by the current economic environment, and its economic value decreased significantly from that of last year under the base-case projections. To better understand the possible deviations of the economic values of the Fund with respect to the base-case economic forecasts, several sensitivity analyses were conducted. While these scenario analyses do not describe all possible outcomes, they do provide insights into the relative importance and magnitude of the impact of each selected factor on the performance of the Fund. Among these variables and economic assumptions, one of the most critical factors is the future economic conditions that will prevail during the remaining life of FHA's current portfolio. The purpose of these analyses is to test the sensitivity of the economic value of the Fund in response to possible alternative economic scenarios. The selected scenarios, both favorable and unfavorable, are those we believe to be most relevant in considering possible impacts on the Fund's economic value. These sensitivity analyses include:

- Deeper housing recession
- Up-Interest-Rate Shock
- Down-Interest-Rate Shock
- Higher loss severity rates
- Earlier onset of recovery

We used the August 2009 quarterly economic forecasts from IHS Global Insight for the base-case actuarial analysis. The forecasted series include the FHFA national average house price index, the Freddie Mac 30-year fixed-rate mortgage commitment rate, and the 10-year and 1-year Constant Maturity Treasury rates.

Exhibit V-1 repeats the projected Fund performance under the base-case scenario shown in Exhibit II-1. Under the base-case scenario, the current forecasted economic value of the Fund is \$2.73 billion, and the projected economic value for FY 2016 is \$41.07 billion.

Exhibit V-1 also shows the predicted economic values and IIFs for the Fund from FY 2009 through FY 2016 under our base-case assumptions. The economic values and IIFs of the Fund over FY 2009 through FY 2016 under the five alternative scenarios are presented in Exhibits V-2 to V-6.

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<sup>21</sup> The Fund in this Review refers to the MMI Fund excluding HECMs.



**Exhibit V-1**

<b>Projected Fund Performance for the Base-Case Scenario (\$ Millions)</b>						
<b>Fiscal Year</b>	<b>Economic Value of the Fund</b>	<b>Unamortized Insurance in Force</b>	<b>Amortized Insurance in Force</b>	<b>Economic Value of Each New Book of Business</b>	<b>Volume of New Endorsements</b>	<b>Investment Earnings on Fund Balances</b>
2009	2,732	686,263	656,012	-835	337,436	
2010	7,882	871,892	835,886	5,124	299,954	27
2011	14,171	996,792	952,354	6,084	245,997	204
2012	20,425	1,124,334	1,068,027	5,872	222,320	383
2013	25,650	1,248,181	1,178,519	4,638	223,856	587
2014	30,272	1,392,590	1,306,650	3,822	226,737	800
2015	35,488	1,531,136	1,427,563	4,267	235,490	949
2016	41,068	1,664,357	1,542,385	4,483	243,691	1,097

**A. Deeper Housing Recession**

The house price appreciation rate is the most important economic factor influencing FHA mortgage insurance claim and loss rates. Under the deeper housing recession scenario, we investigated the impact on the Fund performance by splicing together the worst segments of the house price growth rates forecasted by IHS Global Insight in their July 2009 and August 2009 forecasts. In particular, the house price growth rates are assumed to follow the IHS Global Insight July 2009 forecast up to the 3rd quarter of 2010, and then switch to the August 2009 forecast thereafter. This scenario combines the deeper short-term housing recession of the July forecast with the slower long-term recovery of the August forecast. This scenario is more stressful than the base-case forecast.

Exhibit V-2 indicates that, compared to the base-case scenario, the economic value of the FY 2009 Fund would decrease by \$6.08 billion from its base-case value, and the IIF for FY 2009 would be reduced by \$0.73 billion. The negative impact relative to the base case persists through FY 2016 and would reduce the FY 2016 economic value by \$8.30 billion.



**Exhibit V-2**

<b>Projected Fund Performance with Deeper Housing Recession Scenario (\$ Millions)</b>						
<b>Fiscal Year</b>	<b>Economic Value of the Fund</b>	<b>Unamortized Insurance in Force</b>	<b>Amortized Insurance in Force</b>	<b>Economic Value of Each New Book of Business</b>	<b>Volume of New Endorsements</b>	<b>Investment Earnings on Fund Balances</b>
2009	-3,344	686,988	656,697	-2,153	337,436	
2010	902	874,963	838,735	4,279	299,954	-33
2011	7,010	1,001,645	956,790	6,085	245,997	23
2012	13,070	1,129,383	1,072,541	5,871	222,320	189
2013	18,082	1,253,446	1,183,116	4,636	223,856	376
2014	22,469	1,397,900	1,311,170	3,823	226,737	564
2015	27,441	1,536,781	1,432,260	4,268	235,490	704
2016	32,768	1,670,694	1,547,551	4,479	243,691	848

**B. Up-Interest-Rate Shock**

In this scenario, we assumed an interest rate shock of 300 basis points higher than IHS Global Insight forecast for FY 2010 through FY 2012, with rates returning to their base-case levels in FY 2013. As interest rates go up, prepayment rates go down. As fewer loans are prepaid, more loans remain in the Fund and are therefore exposed to the risk of claim. Even where the conditional claim rate does not increase, the cumulative claim rate increases, causing the lifetime claim loss to increase.

Exhibit V-3 displays the results based on this scenario. The impact of higher interest rates is mainly on the higher IIF in future years due to slower prepayment rates. For existing books with low interest rates, their below-market rates provide borrowers an incentive to avoid default even when there is negative equity in the house, thereby yielding lower claim rates. The economic value for FY 2009 increases by \$7.80 billion over the base-case projection.

On the other hand, the next three books of business from FY 2010 through FY 2012 will be originated with higher initial interest rates. When the market rate drops suddenly in FY 2013, most good-quality loans would be refinanced, while remaining borrowers are unable to refinance, presumably due to lower credit quality or the lack of borrower equity. This adverse-selection effect is taken into account with our models, and it shows strongly in the negative economic values of the new books from FY 2010 to FY 2012.



Under the base-case scenario, due to the currently low market interest rates, the future negative net cash flows of existing books translated into high negative present values. With this high interest rate assumption, the highly negative claim losses in the future are discounted to a less negative present value. This impact in the present value improves the economic value of all existing books of business.

**Exhibit V-3**

<b>Projected Fund Performance under Up-Interest-Rate Shock Scenario</b> (\$ Millions)						
<b>Fiscal Year</b>	<b>Economic Value of the Fund</b>	<b>Unamortized Insurance in Force</b>	<b>Amortized Insurance in Force</b>	<b>Economic Value of Each New Book of Business</b>	<b>Volume of New Endorsements</b>	<b>Investment Earnings on Fund Balances</b>
2009	10,528	686,101	655,967	-1,259	337,436	
2010	9,150	926,345	888,244	-1,796	299,954	418
2011	9,196	1,101,854	1,053,697	-465	245,997	511
2012	10,569	1,259,187	1,198,534	849	222,320	524
2013	15,511	1,275,617	1,206,062	4,638	223,856	304
2014	19,817	1,343,527	1,262,683	3,822	226,737	484
2015	24,705	1,426,839	1,333,611	4,267	235,490	621
2016	29,952	1,521,054	1,414,937	4,483	243,691	764

**C. Down-Interest-Rate Shock**

In the reverse of the Up-Interest-Rate Shock scenario, we considered a sudden interest rate drop. In this scenario, we assumed a downward interest rate shock of 300 basis points below IHS Global Insight forecast for FY 2010 through FY 2012, and then rates return to their base-case levels in FY 2013. (Rates are not allowed to be negative numbers.) As interest rates go down, prepayment rates go up. As more loans are prepaid, less annual premium income will be realized and more premium refunds will occur. Meanwhile, loans that do not refinance and remain in the Fund are likely to be subject to higher claim risk, leading to higher claim loss. The latter has been referred to as the adverse selection effect and is captured in our econometric model by a variable measuring the extent to which the borrower has been in the money with respect to their option to prepay. This down-rate shock scenario is particularly stressful to the existing books of business.



On the other hand, future books of business originated during the low interest rate environment tend to perform well. These loans will have very low initial interest rates. When the market interest rate rises again, these borrowers will have incentive to keep their mortgages current, so as to continue to enjoy the below-market interest rate. Historically, lower interest rate mortgages experience lower claim rates than otherwise comparable loans.

Exhibit V-4 displays the results based on this scenario. The impact of lower interest rates is most significant in the current year, with the economic value lowered by \$19.82 billion from the base case, to *negative* \$17.09 billion, making this the most stressful scenario among the ones being studied in this Review. On the other hand, as mentioned, the FY 2010 to FY 2012 books of business are projected to perform very well, helping the economic value to recover from the significant negative position and become positive by the end of FY 2012.

#### Exhibit V-4

Projected Fund Performance with Down-Interest-Rate Shock Scenario (\$ Millions)						
Fiscal Year	Economic Value of the Fund	Unamortized Insurance in Force	Amortized Insurance in Force	Economic Value of Each New Book of Business	Volume of New Endorsements	Investment Earnings on Fund Balances
2009	-17,089	686,389	655,950	-8,468	337,436	
2010	-10,707	813,014	777,496	6,382	299,954	0
2011	-3,675	874,098	830,609	7,033	245,997	0
2012	3,061	938,488	884,766	6,736	222,320	0
2013	7,787	1,087,585	1,017,662	4,638	223,856	88
2014	11,852	1,245,988	1,157,731	3,822	226,737	243
2015	16,490	1,401,603	1,293,444	4,267	235,490	371
2016	21,483	1,546,536	1,418,328	4,483	243,691	510

#### D. Higher Loss Severity Rates

The loss severity rate is defined as the percentage of the unpaid principal of a claimed loan that is not recovered through the disposition of the foreclosed property. The loss rates of the Fund have been rising during the past three years, mainly due to a result of the deteriorating housing market and insufficient recoveries on foreclosed properties. Due to the increased number of foreclosure sales on the market, it takes longer to dispose of the properties acquired through the claim process, so the sales prices of these REO properties are further depressed as house prices are



projected to continue falling. We enhanced our estimation of the loss rate by developing an econometric model to capture the response of loss severity rates to the differences in the characteristics of the loans, the location of the collateral properties, and changes in economic conditions. This higher loss severity rate scenario will provide insights into the impact if the actual loss rate turns out to be higher than the econometric model projects under the base-case scenario. Under this higher loss severity scenario, the loss rates of claimed loans over all future years were assumed to be 5 percentage points higher than the rates projected using the loss rate model.

The higher level of loss-severity rates produces lower economic values for FY 2009 through FY 2016 as shown in Exhibit V-5. An increase in the loss severity rate by 5 percentage points would decrease the economic value for FY 2009 to negative \$2.04 billion and the FY 2016 economic value to \$28.93 billion.

**Exhibit V-5**

<b>Projected Fund Performance with Higher Loss Severity Rates Scenario</b> (\$ Millions)						
<b>Fiscal Year</b>	<b>Economic Value of the Fund</b>	<b>Unamortized Insurance in Force</b>	<b>Amortized Insurance in Force</b>	<b>Economic Value of Each New Book of Business</b>	<b>Volume of New Endorsements</b>	<b>Investment Earnings on Fund Balances</b>
2009	-2,036	686,263	656,012	-2,713	337,436	
2010	2,007	871,892	835,886	4,063	299,954	-20
2011	7,445	996,792	952,354	5,386	245,997	52
2012	12,879	1,124,334	1,068,027	5,232	222,320	201
2013	17,079	1,248,181	1,178,519	3,830	223,856	370
2014	20,559	1,392,590	1,306,650	2,947	226,737	532
2015	24,583	1,531,136	1,427,563	3,380	235,490	644
2016	28,933	1,664,357	1,542,385	3,591	243,691	760

### **E. Early Onset of Recovery**

Typically, scenario analyses only portray more adverse conditions than the base case. However, given the severe house price forecast in the base case, it is informative to also show the results of a less pessimistic economic scenario. This scenario takes the base-case housing price forecast through the end of FY 2009, then switches to last year's base-case scenario based on the July 2008 IHS Global Insight forecast. This scenario portrays the housing recession reaching



bottom in FY 2009 and the recovery starting in FY 2010. It is consistent with the recent comment by Federal Reserve Board Chairman Bernanke that the U.S. and the global economy appear to be leveling out and prospects for a return to growth in the near term appear good.<sup>22</sup> Exhibit V-6 indicates that, under this less pessimistic scenario, the economic value of the FY 2009 Fund would increase by \$8 billion from its base-case value to \$10.73 billion, and the FY 2016 economic value would increase from \$41.07 billion in the base case to \$54.53 billion.

#### Exhibit V-6

Projected Fund Performance for the Early Onset of Recovery Scenario (\$ Millions)						
Fiscal Year	Economic Value of the Fund	Unamortized Insurance in Force	Amortized Insurance in Force	Economic Value of Each New Book of Business	Volume of New Endorsements	Investment Earnings on Fund Balances
2009	10,727	686,257	656,005	2,320	337,436	
2010	18,058	868,556	832,700	7,227	299,954	104
2011	25,082	989,672	945,620	6,556	245,997	467
2012	31,672	1,114,044	1,058,394	5,913	222,320	677
2013	37,295	1,236,086	1,167,387	4,713	223,856	911
2014	42,397	1,379,613	1,294,949	3,938	226,737	1,163
2015	48,200	1,517,480	1,415,515	4,475	235,490	1,329
2016	54,533	1,650,045	1,530,035	4,844	243,691	1,490

#### F. Summary

It is clear from these scenario analyses that the Fund's soundness depends critically on the future course of the economy. Exhibit V-7 compares the Fund's projected economic value corresponding to each of the selected scenarios: (1) base case, (2) deeper housing recession, (3) up-interest-rate shock, (4) down-interest-rate shock, (5) higher loss severity, and (6) early onset of recovery. In the deeper housing recession scenario, the economic value can be lowered by another 222.4 percent from that of the base case. With five percentage point higher loss severity rates, the FY 2009 economic value would be below zero.

For the down-rate shock scenario, the economic value falls to *negative* \$17.09 billion in FY 2009 and remains negative until FY 2012. The economic value of the Fund as of the end of FY 2016

<sup>22</sup> Federal Reserve Chairman Ben S. Bernanke rendered his assessment of the economy on Aug 21, 2009 at the Federal Reserve Bank of Kansas City's Annual Symposium in Jackson Hole, Wyoming.



would be 47.69 percent below that of the base case. Under such a stressful scenario, the Fund would not remain financially self-sustaining. Thus, although under the base-case projection, no additional sources of funds would be needed to cover future claim losses (excluding consideration of HECMs), if the future experience is significantly worse than the base case assumption, this may no longer be the case.

**Exhibit V-7**

Projected Fund's Economic Value by Scenario						
Fiscal Year	Base-Case	Deeper Recession	Up-Rate Shock	Down-Rate Shock	Higher Loss Severity Rate	Early Recovery
2009	2,732	-3,344	10,528	-17,089	-2,036	10,727
2010	7,882	902	9,150	-10,707	2,007	18,058
2011	14,171	7,010	9,196	-3,675	7,445	25,082
2012	20,425	13,070	10,569	3,061	12,879	31,672
2013	25,650	18,082	15,511	7,787	17,079	37,295
2014	30,272	22,469	19,817	11,852	20,559	42,397
2015	35,488	27,441	24,705	16,490	24,583	48,200
2016	41,068	32,768	29,952	21,483	28,933	54,533



## **Section VI. Summary of Methodology**

This section provides an overview of the analytical approach used in this Review. Appendix A provides additional details of the statistical models, as well as a description of the variables used to explain prepayment and claim terminations. Appendices B, C, and D provide additional detail on the cash flow model and sensitivity analyses. Appendix E describes the loss severity rate model newly developed and applied in this year's Review.

### **A. Specification of FHA Mortgage Termination Models**

This Review applies statistical techniques consistent with the literature and applicable to the FHA experience. The purpose of the analysis is to estimate future probabilities of default and prepayment for FHA loans in the insurance portfolio as of the end of FY 2009, so as to compute future outstanding balances, cash flows, and current economic values. Using loan-level data, ordinary regression analysis breaks down, because the dependent variable indicating default or prepayment is not continuous, but rather is discrete: it is a "1" if either a prepayment or a default occurs in any given quarter or a "0" otherwise (*i.e.*, it is an active loan). One of the problems for ordinary regression analysis in this situation is that the estimated probability of default is not constrained to be between 0 and 1. Binomial logit analysis is an appropriate technique to deal with this issue, and we have used it here.

Further complicating the statistical analysis is the fact that mortgage borrowers possess two mutually exclusive options, one to prepay the loan and the other to default on it. From a lender's or insurer's point of view, these are "competing risks" in the sense that they are mutually exclusive, and realization of one of these events precludes the other. Prepayment means cessation of cash flows from mortgage insurance premiums, but thereafter eliminates any chance of default. Conversely, defaulting means default costs are incurred and uncertainty about the possibility and timing of prepayment is eliminated. These competing risks present unique challenges for statistical estimation.

Multinomial logit regression is a general approach to deal with these competing risks, but it is computationally demanding. An equivalent technique, based on separate binomial logit estimates for default and prepayment can be used when appropriate adjustments are made for competing risks. The adjustments for competing risks are of two types: (1) adjustments to the data used for estimation, and (2) adjustments to the resulting estimated coefficients from the separate binomial logit regressions.

Once the separate default and prepayment logit equations are estimated, multinomial logit probabilities of default and prepayment can be computed mathematically from the separate



estimates. Another motivation to estimate separate binomial logit models is that FHA mortgage insurance risk exposure is ultimately determined by the timing and frequency of claim events, rather than the mortgage borrower default events that precede insurance claims on the Fund. Thus, the default events (ultimately leading to a claim termination) that result in censoring of prepayment occur with different timing than the claim events. Separating the estimation of logit models of prepayment and claim events facilitates accounting for this timing difference.

The general approach used in this Review is similar to the multinomial logit models reported by Calhoun and Deng (2002) that were originally developed for application to the OFHEO (now FHFA) risk-based capital adequacy test for Fannie Mae and Freddie Mac. The multinomial model recognizes the competing-risks nature of prepayment and claim terminations, while the use of quarterly data aligns closely with key economic predictors of mortgage prepayment and claims such as changes in interest rates and housing values.

The multinomial logit models have several benefits over a traditional linear regression. First, it ensures the event probabilities sum to 100 percent. This means that at any point in time, a loan can experience only one of the three possible outcomes over the next period: prepay, claim, or survive. Second, the possible values of each probability are constrained to be between zero and one under this approach. There is no possibility of estimating a negative probability or a probability exceeding 100 percent. Third, as the probability of one risk increases, the probability of the other risk would automatically be reduced, reflecting the competing-risk nature between prepayment and default. Finally, it allows us to estimate the conditional termination rates using loan-level data. With loan-level observations, the possible outcomes at each point in time are either 0, the event did not happen, or 1, the event happened. Standard multivariate linear regression analysis is unsuitable for estimating discrete dependent variable models, whereas logit models are specifically designed to handle these types of observations.

Following an approach suggested by Begg and Gray (1984), we estimated separate binomial logit models for prepayment and claim terminations, and then mathematically recombined the parameter estimates to compute the corresponding multinomial logit probabilities for a competing risk model of claims and prepayments. This approach allowed us to account for differences between the timing of FHA claim terminations and the appropriate censoring of potential prepayment outcomes at the onset of default episodes that ultimately lead to claims.

The loan performance analysis was undertaken at the loan level. Through the use of categorical explanatory variables and discrete indexing of mortgage age—in effect classifying loan data into “strata” -- it was possible to achieve considerable efficiency in data storage and estimation. In effect, the data were transformed into synthetic loan pools, but without loss of detail on individual loan characteristics beyond that implied by the categorization of the explanatory variables. Sampling weights were used to account for differences in the number of loans in each stratum.



Conditional claim and prepayment rates increase quickly during the first few years following mortgage origination before peaking, and then decline slowly over the remaining life of the loan. We applied a series of piece-wise linear spline functions to model the impact of mortgage age on conditional claim and prepayment probabilities. This approach is sufficiently flexible to provide a close fit during the first few years following mortgage origination, including the peak years of claim or prepayment risk, while limiting the number of model parameters that have to be estimated.

## **B. Loan Event Data**

We used loan-level data to reconstruct quarterly loan-event histories by relating mortgage origination information to contemporaneous values of time-dependent factors. In the process of creating quarterly event histories, each loan contributed an additional observed “transition” for every quarter from origination up to and including the period of mortgage termination, or until the last time period of the historical data sample (if the loan remained active). The term “transition” is used here to refer to any period in which a loan remains active or in which claim or prepayment terminations are observed. Claim or prepayment are terminal transitions, in the sense that no additional quarterly observations for the loan follow either of these events.

The FHA single-family data warehouse records each loan for which insurance has been endorsed and includes additional data fields updating the timing of changes in the status of the loan. A dynamic event-history sample was constructed from the database of loan originations by creating additional observations for each quarter that the loan was active from the beginning amortization date up to and including the termination date for the loan, or the second quarter of FY 2009 if the loan had not terminated prior to that date.

Additional “future” observations were created for projecting the future performance of loans currently outstanding, and additional future cohorts were created to enable simulation of the performance of future books of business. These aspects of data creation and simulation of future loan performance are discussed in greater detail in Appendix C.

## **C. Statistical Sampling**

The entire population of loan-level data from the FHA single-family data warehouse was extracted for the FY 2009 analysis. This produced a starting population of approximately 21.8 million single-family loans originated between FY 1975 through the second quarter of FY 2009. These data were used to generate loan-level event histories for up to 120 quarters (30 years) of loan life per loan (or until the scheduled age of maturity of the loan).



Estimation and forecasting were undertaken separately for each of the following six FHA mortgage product types: (1) FRM30 – fixed-rate 30-year fully-underwritten home purchase and refinance mortgages; (2) FRM15 – fixed-rate 15-year fully-underwritten home purchase and refinance mortgages; (3) ARM – adjustable-rate fully-underwritten home purchase and refinance mortgages; (4) FRM30\_SR – fixed-rate 30-year streamlined refinance mortgages; (5) FRM15\_SR – fixed-rate 15-year streamlined refinance mortgages; and (6) ARM\_SR – adjustable-rate streamlined refinance mortgages.

We used a 20-percent random sample of FRM30 mortgages and 100-percent samples for all other product types for estimation. For forecasting we used a 2-percent sample for FRM30, a 10-percent sample for FRM30\_SR mortgages, and 100-percent sample for all other product types.

#### **D. Borrower Credit Scores**

FHA has relatively complete data on borrower FICO scores for loans originated since FY 2004. In addition, FHA has retroactively obtained borrower credit history information for selected samples of FHA loan applications submitted as far back as FY 1992 and continuing up to FY 2005. These data provide an additional source of loan-level information on borrower FICO scores that were used in the estimation. The application of loan-level data on borrower FICO scores is described in greater detail in Appendix A.

#### **E. Cash Flow Model**

After the future claim and prepayment rates were projected using the econometric models, the corresponding cash flows were computed. The cash flow computation model includes the calculation of four types of cash flows: 1) upfront mortgage insurance premiums, 2) annual mortgage insurance premiums, 3) claim losses, and 4) premium refunds. Two other cash flows were modeled in previous reviews, but are not included in our analyses. The administrative expense was discontinued according to Federal credit reform requirements, and distributive shares were suspended in 1990. There is no indication that either of these will be resumed in the foreseeable future. The Federal credit subsidy present value conversion factors published by the Office of Management and Budget are used in discounting future cash flows to determine their present value as of the end of FY 2009.



**F. Loss Severity Rate Model**

In previous Reviews, the loss severity rates of claimed loans were assumed to be constant over time and over different economic environments. During the recent housing recession, realized loss severity rates have risen sharply from their levels prior to FY 2006. This change suggested the need to use a dynamic loss severity rate model so that the projected loss severity rates can more accurately reflect their dependence on projected future economic environments. A multiple regression model was estimated for this purpose. The loss severity model captured characteristics of the loan, the collateral house, the borrower, and the market environment when a claim occurs. The model was estimated using the ordinary least squares method with loan-level cash flow data from FY 1999 through FY 2008. Details of the new loss severity rate models are provided in Appendix E.



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## **Section VII: Qualifications and Limitations**

The actuarial models used for this analysis are based on a theoretical framework and certain assumptions. This framework relates the rates of claims and prepayments to a number of individual loan characteristics and certain key macroeconomic variables. The model is calibrated using econometric regression techniques based on data from FHA's actual historical experience regarding the performance of mortgage loans. The calibration identifies the parameters of the model through a statistical optimization technique known as maximum likelihood estimation. The parameters of the model are estimated over a wide variety of economic conditions and mortgage market experience during the past 34 years. The calibrated model is used together with assumptions about future loan portfolios and certain key economic assumptions to produce the future projections.

The financial estimates presented in this Review require projections of events more than 30 years into the future. These projections are dependent upon the validity and robustness of the underlying model and the assumptions about future economic environment and loan characteristics. These assumptions include economic forecasts by IHS Global Insight and assumptions concerning FHA's future endorsement portfolio volume and composition. To the extent that the realized experience deviates from these or other assumptions, the actual results may differ, perhaps significantly, from our current projections.

As of this writing, the U.S. housing and mortgage markets are two years into the most stressful economic conditions in recent history. As noted elsewhere in this Review, the entire country is in the midst of a widespread and very severe house price decline and it is projected that this will continue for the next two years. Such extreme conditions have occurred before in the last thirty years, but were restricted to certain regions of the country, such as Texas in the mid 1980s, New England in the late 1980s, or California in the early 1990s. It is necessary to go back to the Great Depression to find a house price recession of the magnitude and scale currently being experienced and projected to continue over the near term. The model used in this Review takes the future projected house price declines into account when computing claim and prepayment rates.

Given that the current economic conditions and those expected to prevail over the near term are extremely stressful, it is worth discussing the ability of the model to perform properly in such an extreme environment. The model assumes that certain general relationships which have been observed over a long historical period and under a wide variety of economic conditions will continue to hold in the future. However, it is possible that under the current extremely stressful environment, some new phenomena may emerge that change these relationships in a significant way and that could affect the projected claim and prepayment rates. At this time we have not been able to obtain any convincing evidence that a change of this nature has occurred, but it is



important to continue to monitor the model to verify its performance and reliability. If such a change does take place, the projected future claims could be either higher or lower.

#### **A. Model Sensitivity to Economic Projections**

The main purpose of this Review is to assess the long-term financial performance of the Fund. One of the critical economic variables used in making these projections is future house price appreciation rates. As illustrated in Section II, the changes in forecasted house price appreciation rates in the current Review, relative to the corresponding assumptions used in the FY 2008 Review, have had a dramatic impact on the Fund's projected economic condition. As noted in Exhibit II-4 item (d), the change in the house price forecast this year compared to last year reduced the Fund's economic value by approximately \$10 billion. If the future house price changes on FHA's portfolio are more pessimistic than the IHS Global Insight forecast, then actual claim rates will be higher than those projected in this Review. Conversely, if the future house price changes in FHA's portfolio are more optimistic than IHS Global Insight forecast, the actual claim rates would be lower than those projected in this Review. These two possibilities as well as others were explored quantitatively in Section V.

#### **B. Basic Data Inputs**

The analysis in this Review uses a data extract from FHA's data warehouse as of March 31, 2009. Future economic conditions are based on August 2009 forecasts by IHS Global Insight. Future endorsement volume and composition data are based on HUD projections as of July 2009. The volume and composition of the existing portfolio are further updated by an extract of FHA data as of June 30, 2009. While we have reviewed the integrity and consistency of these data and believe the data to be reasonable, we have not audited them for accuracy. The information contained in this Review may not correspond exactly with other published analyses that rely on FHA data compiled at a different time or obtained from other data sources.



**Section VIII: Conclusions**

This Review does not render an opinion regarding the compliance of the total Fund performance with the 2 percent capital ratio required by the 1990 National Affordable Housing Act, because this Review did not analyze the Home Equity Conversion Mortgage Program, which was included in the MMI Fund for FY 2009. Throughout this Review, we have computed the economic value and the unamortized and amortized IIF for the Fund that contains all loans in the MMI Fund except HECMs. Readers should be alerted to the limitation of these results in that they do not include the HECM Program.

According to our estimates for the base-case economic scenario, the Fund has an economic value of \$2.73 billion and unamortized IIF of \$686.26 billion as of the end of FY2009. Furthermore, we project that the economic value will steadily increase after FY 2009 at an average of 47.28 percent per year to \$41.07 billion by the end of FY 2016. Meanwhile, the unamortized IIF will also increase steadily at an average of 13.5 percent per year to the end of FY 2016. The faster rate of increase in economic value than in the IIF reflects the projected stronger financial performance of new books of business to be added to the Fund during the next 7 years. If the future economic experience is worse than what is projected in this Review, such as simulated in our scenario analyses, it is possible that the economic value becomes negative in FY 2009 and remains negative until the end of FY 2012.

As a result of the extremely stressful conditions during the last three years, the economic value of the Fund has declined to a very low level. Furthermore, in some of the projected scenarios the economic value of the Fund is projected to be negative and to remain low for several years. Given these circumstances, and in view of the inherent volatility of the variables used in our projections, it is entirely possible that the economic value of the Fund could become negative. This could occur if there is an adverse fluctuation in one of more of the variables that affect the performance of the Fund or if some event occurs that negatively impacts the Fund.

Observed house price growth rates deteriorated significantly in FY 2007 and FY 2008. There were some improvements during FY 2009 – the annualized rates were positive 0.59 and 1.69 percent during the first and second quarters of FY 2009, respectively, which was less severe than the rates forecasted by IHS Global Insight in July 2008 that were used in last year's Review. IHS Global Insight's revised economic forecast for August 2009 projects the house price growth rate to turn deeply negative in the second half of FY 2009, and even more negative in FY 2010. Specifically, IHS Global Insight forecasts that the FHFA national house price index will decrease by 4.41 percent during the second half of FY 2009 and decrease by another 6.51 percent during FY 2010. The realized and forecasted decline in the national housing market was the largest contributor to the \$13.09 billion reduction in the FY 2009 economic value of the Fund. This reduction represents a very severe decline of 82.74 percent from the \$15.82 billion estimated for year-end FY 2009 in the FY 2008 Review.



The credit quality of the recent endorsements under the Fund has shown significant improvement from historical books. Due to capital constraints, all private mortgage insurance companies in the U.S. have tightened their underwriting standards considerably. Lacking private mortgage insurance support, Fannie Mae and Freddie Mac are prohibited from underwriting mortgages with LTVs above 80 percent. This leaves the FHA as the primary source of housing finance for borrowers with less than a 20 percent downpayment.

In addition to the improved credit quality composition, this market environment also led to the dramatic increase in FHA's market share from 4.12 percent in FY 2007 to 17.96 percent in the first seven months of FY 2009. However, despite the improved credit condition of the FY 2009 book of business, it is still estimated to have a negative economic value due to the severely adverse house price growth rate forecast.

One of this year's actuarial model enhancements was the implementation of a dynamic loss severity rate model. The loss rate regression model takes into account the variation of loss rates by the characteristics of the loan, the property, the borrower, and the economic environment. The model captures the higher loss rates during the current economic recession while keeping the long-term stable loss rate unaffected.

The passage of HERA prohibits FHA's endorsement of seller-financed downpayment assistance loans endorsed for FHA insurance on or after October 1, 2008. These loans experienced claim rates that are considerably higher than otherwise comparable non-assisted loans. The share of loans with downpayment assistance from non-profit organizations has declined significantly after the passage of HERA. This will help improve the credit quality of the FHA portfolio, particularly the new books of business to be endorsed in the coming years. The significance of eliminating this program is highlighted by our estimate that if non-profit assisted loans had been excluded, the economic value of the Fund would have been \$13.15 billion in FY 2009.



## **Appendix A: Econometric Analysis of Mortgage Terminations**

This appendix describes the technical details of the econometric models used to estimate the historical and future performance of FHA single-family loans for the FY 2009 Review. The overall modeling approach remains consistent with that applied in previous years. Section I of this appendix summarizes the model specification and estimation issues arising from the analysis of FHA claim and prepayment rates. We discuss issues related to differences in the timing of borrower default episodes and prepayment and claim terminations, followed by a review of the mathematical derivation of multinomial logit probabilities from the separate binomial logit estimates. We then turn to a description of the historical loan event history data needed for estimation and the future loan records required for forecasting future loan performance.

Appendix E describes the new loss severity model developed for this Review. In our projections, it is used along with the claim and prepayment models discussed here.

### **I. Model Specification and Estimation Issues**

#### **A. Specification of FHA Mortgage Termination Models**

Competing risk models for mortgage prepayment and claim terminations were specified and estimated for the FY 2009 Review. Prepayment- and claim-rate estimates were based on a multinomial logit model for quarterly conditional probabilities of prepayment and claim terminations. The general approach is based on the multinomial logit models reported by Calhoun and Deng (2002) that were originally developed for application to FHFA's risk-based capital adequacy test for Fannie Mae and Freddie Mac. The multinomial model recognizes the competing-risks nature of prepayment and claim terminations. The use of quarterly data aligns closely with key economic predictors of mortgage prepayment and claims such as changes in interest rates and housing values.

The loan performance analysis was undertaken at the loan level. Through the use of categorical explanatory variables and discrete indexing of mortgage age, it was possible to achieve considerable efficiency in data storage and reduced estimation times by collapsing the data into a much smaller number of loan strata (i.e., observations). In effect, the data were transformed into synthetic loan pools, but without loss of detail on individual loan characteristics beyond that implied by the original categorization of the explanatory variables, which were entirely under our control. Sampling weights were created to account for differences in the number of loans in each loan strata.

The present analysis extended the Calhoun-Deng (2002) study in two important ways. First, following the approach suggested by Begg and Gray (1984), we estimated separate binomial



logit models for prepayment and claim terminations, and then mathematically recombined the parameter estimates to compute the corresponding multinomial logit probabilities. This approach allowed us to account for differences between the timing of claim terminations and the censoring of potential prepayment outcomes at the onset of default episodes that ultimately lead to claims. This issue is discussed in greater detail below.

A second extension of the Calhoun-Deng (2002) study was the treatment of the age of the mortgage in the models. The traditional models applied quadratic age functions for both mortgage default and prepayment terminations. While the quadratic age function fits reasonably well for estimating conventional mortgage defaults rates, it performed less well for prepayments, as it failed to capture the more rapid increase in conditional prepayment rates early in the life of the loans. FHA conditional claim and prepayment rates also show a more rapid increase than conventional mortgages during their early loan life. We found a quadratic specification not to be sufficiently flexible to capture the age patterns of conditional claim and prepayment rates observed in the FHA data. The approach we adopted was to apply piece-wise linear spline functions. This approach is sufficiently flexible to fit the relatively rapid increase in conditional claim and prepayment rates observed during the first three years following mortgage origination, while still providing a good fit over the later ages and still limiting the overall number of model parameters that have to be estimated.

The starting point for specification of the loan performance models was a multinomial logit model of quarterly conditional probabilities of prepayment and claim terminations. The corresponding mathematical expressions for the conditional probabilities of claim ( $\pi_c(t)$ ), prepayment ( $\pi_p(t)$ ), or remaining active ( $\pi_A(t)$ ) over the time interval from  $t$  to  $t+1$  are given by:

$$\pi_c(t) = \frac{e^{\alpha_c + X_c(t)\beta_c}}{1 + e^{\alpha_c + X_c(t)\beta_c} + e^{\alpha_p + X_p(t)\beta_p}} \quad (1)$$

$$\pi_p(t) = \frac{e^{\alpha_p + X_p(t)\beta_p}}{1 + e^{\alpha_c + X_c(t)\beta_c} + e^{\alpha_p + X_p(t)\beta_p}} \quad (2)$$

$$\pi_A(t) = \frac{1}{1 + e^{\alpha_c + X_c(t)\beta_c} + e^{\alpha_p + X_p(t)\beta_p}} \quad (3)$$

where the constant terms  $\alpha_c$  and  $\alpha_p$  and the coefficient vectors  $\beta_c$  and  $\beta_p$  are the unknown parameters to be estimated for the multinomial logit model. The subscripts “P” and “C” denote prepayments and claims. We denote by  $X_c(t)$  the vector of explanatory variables for the conditional probability of a claim termination, and  $X_p(t)$  is the vector of explanatory variables



for the conditional probability of prepayment. Some components of  $X_C(t)$  and  $X_P(t)$  are constant over the life of the loan and therefore do not vary with  $t$ .

## **B. Differences in the Timing of Borrower Default Episodes and Claim Terminations**

The primary events of interest in the present context are mortgage prepayments that result in termination of positive cash flows from mortgage premiums paid by borrowers, and claim terminations that result in direct payouts to lenders. For consistency with the available data on loss rates, the incidence and timing of mortgage default-related terminations is defined specifically according to FHA claim incidences, although these typically arise from earlier decisions by borrowers to cease payment on their mortgages. In recognition of the potential censoring of prepayment prior to the actual claim termination date, we used information on the timing of the initiation of default episodes leading to claim terminations to create a prepayment-censoring indicator that was applied when estimating the prepayment-rate model, in effect removing that observation from the sample at risk of prepayment whenever it was clear from the details of the delinquency/default/claim sequence that the probability of prepayment was zero. Implementation of this strategy required estimating the prepayment function separately from that for claims. The Begg-Gray method of estimating separate binomial logit models is particularly advantageous in dealing with this requirement while preserving consistency with the competing risks multinomial logit model outlined above.

To complete the model, a separate binomial logit claim-rate model was estimated accounting for censoring of potential claim terminations by observed prepayments, and the two sets of parameter estimates were recombined mathematically to produce the final multinomial model for conditional prepayment and claim probabilities. This approach facilitated unbiased estimation of the prepayment function, which would not be possible in a joint multinomial model of claim and prepayment terminations, since one could not simultaneously censor loans at the onset of default episodes and still retain the observations for estimating subsequent claim termination rates.

To summarize, estimation of the multinomial logit model for prepayment and claim terminations involved the following steps:

- Data on the start of a default episode that ultimately leads to an FHA claim was used to define a default-censoring indicator for prepayment.
- A binomial logit model for conditional prepayment probabilities was estimated using the default-censoring indicator to truncate individual loan event samples at the onset of any default episodes (and all subsequent quarters).



- A binomial logit model for conditional claim probabilities was estimated using observed prepayments to truncate individual loan event samples during the quarter of the prepayment event (and all subsequent quarters).
- The separate sets of binomial logit parameter estimates were recombined mathematically to derive the corresponding multinomial logit model for the joint probabilities of prepayment and claim terminations accounting for the competing risks.

### C. Computation of Multinomial Logit Parameters from Binomial Logit Parameters

Begg and Gray applied Bayes Law for conditional probabilities to demonstrate that the values of parameters  $\alpha_C, \beta_C, \alpha_P$ , and  $\beta_P$  estimated from separate binomial logit (BNL) models of claims and prepayments are identical to those for the corresponding multinomial logit (MNL) model once the appropriate calculations are performed. Assume that conditional probabilities for claim and prepayment terminations for separate BNL models are given, respectively, by:

$$\pi_{BNL}^C = \frac{e^{\alpha_C + X_C \beta_C}}{1 + e^{\alpha_C + X_C \beta_C}}, \quad \pi_{BNL}^P = \frac{e^{\alpha_P + X_P \beta_P}}{1 + e^{\alpha_P + X_P \beta_P}}. \quad (4)$$

We have suppressed the time index  $t$  to simplify the notation. We can rearrange terms to solve for components  $e^{\alpha_C + X_C \beta_C}$  and  $e^{\alpha_P + X_P \beta_P}$  of the multinomial model in terms of binomial probabilities  $\pi_{BNL}^C$  and  $\pi_{BNL}^P$ , respectively,

$$e^{\alpha_C + X_C \beta_C} = \frac{\pi_{BNL}^C}{(1 - \pi_{BNL}^C)}, \quad e^{\alpha_P + X_P \beta_P} = \frac{\pi_{BNL}^P}{(1 - \pi_{BNL}^P)}. \quad (5)$$

Then we can substitute directly into the MNL probabilities shown in equations (1) and (2) for  $e^{\alpha_C + X_C \beta_C}$  and  $e^{\alpha_P + X_P \beta_P}$ :

$$\pi_{MNL}^C = \frac{\frac{\pi_{BNL}^C}{(1 - \pi_{BNL}^C)}}{1 + \frac{\pi_{BNL}^C}{(1 - \pi_{BNL}^C)} + \frac{\pi_{BNL}^P}{(1 - \pi_{BNL}^P)}}, \quad \pi_{MNL}^P = \frac{\frac{\pi_{BNL}^P}{(1 - \pi_{BNL}^P)}}{1 + \frac{\pi_{BNL}^C}{(1 - \pi_{BNL}^C)} + \frac{\pi_{BNL}^P}{(1 - \pi_{BNL}^P)}}. \quad (6)$$



These expressions for the MNL probabilities can be simplified algebraically to:

$$\pi_{MNL}^C = \frac{\pi_{BNL}^C \cdot (1 - \pi_{BNL}^P)}{(1 - \pi_{BNL}^C \cdot \pi_{BNL}^P)}, \quad \pi_{MNL}^P = \frac{\pi_{BNL}^P \cdot (1 - \pi_{BNL}^C)}{(1 - \pi_{BNL}^C \cdot \pi_{BNL}^P)}. \quad (7)$$

Equations (7) were used to derive the corresponding MNL probabilities directly from separately estimated BNL probabilities.

#### **D. Loan Event Data**

We used loan-level data to reconstruct quarterly loan event histories by combining mortgage origination information with contemporaneous values of time-dependent factors. In the process of creating quarterly event histories, each loan contributed an additional observed “transition” for every quarter from origination up to and including the period of mortgage termination, or until the last time period of the historical data sample. The term “transition” is used here to refer to any period in which a loan remains active, or in which claim or prepayment terminations are observed.

The FHA single-family data warehouse records each loan for which insurance was endorsed and includes additional data fields updating the timing of changes in the status of the loan. The historical data used in model estimation for this Actuarial Review is based on an extract from FHA’s database as of June 30, 2009. The data set was first filtered for loans with missing or invalid values of key variables in our econometric model. In addition, there is a subset of historical loans where the payoff status of the loans was never updated, to which FHA has assigned a special servicer identification code. Most of those loans were believed to have already been prepaid but the records were not yet updated. Since FY 2004, HUD has been investigating and updating the performance records of these loans. As in previous Actuarial Reviews, any surviving loans from these servicers were deleted from the sample used for model estimation based on statistical analysis that confirmed there would be no material impact on the final econometric estimates.

A dynamic event history sample was constructed from the database of loan originations by creating additional observations for each quarter that the loan was active from the beginning amortization date up to and including the termination date for the loan, or the end of the second quarter of FY 2009 if the loan was not terminated prior to that date. Additional “future” observations were created for projecting the future performance of loans currently outstanding, and additional future cohorts and transition periods were created to enable simulation of the performance of future books of business. These aspects of data creation and simulation of future loan performance are discussed in greater detail in Appendix C.



## **E. Sampling Issues**

A full 100-percent sample of loan-level data from the FHA single-family data warehouse was extracted for the FY 2009 analysis. This produced a very large sample of approximately 21.8 million single-family loans originated between the first quarter of FY 1975 and the first quarter of FY 2009. These data were used to generate loan-level event histories for up to 120 quarters (30 years) of loan life per loan or until the age at which the loan would mature based on the original term of the loan when the term is less than 30 years.

Estimation and forecasting was undertaken separately for each of the following six FHA mortgage product types:

- |             |  |
|-------------|--|
| 1. FRM30    | Fixed-rate 30-year fully-underwritten purchase and refinance mortgages |
| 2. FRM15    | Fixed-rate 15-year fully-underwritten purchase and refinance mortgages |
| 3. ARM      | Adjustable-rate fully-underwritten purchase and refinance mortgages    |
| 4. FRM30_SR | Fixed-rate 30-year streamlined refinance mortgages                     |
| 5. FRM15_SR | Fixed-rate 15-year streamlined refinance mortgages                     |
| 6. ARM_SR   | Adjustable-rate streamlined refinance mortgages                        |

We used a 20-percent random sample of FRM30 mortgages and 100-percent samples for all other product types for estimation. For forecasting future loan performance we used a 2-percent sample for FRM30 mortgages and a 10-percent sample for FRM30\_SR mortgages.

## **II. Explanatory Variables**

Four main categories of explanatory variables were developed:

1. Fixed initial loan characteristics; including mortgage product type, purpose of loan (home purchase or refinance), amortization term, origination year and quarter, original loan-to-value (LTV) ratio, relative house price level, original loan amount, original mortgage interest rate, and geographic location (MSA, state, Census division);
2. Fixed initial borrower characteristics; including borrower credit scores and indicators of the source of downpayment assistance (additional discussion of borrower credit scores and downpayment assistance is provided below);
3. Dynamic variables based entirely on loan information; including mortgage age, season of the year, and scheduled amortization of the loan balance; and



4. Dynamic variables derived by combining loan information with external economic data; including interest rates and house price indexes.

In some cases the two types of dynamic variables are combined, as in the case of adjustable-rate mortgage (ARM) loans where external data on changes in Treasury yields are used to update the original coupon rates and payment amounts on ARM loans in accordance with standard FHA loan contract features. This in turn affects the amortization schedule of the loan.

For the FY 2009 Actuarial Review a new variable was added to account for the impact of the rapid rise and fall of the subprime market from 2004 to 2006.

Exhibit A-1 summarizes the explanatory variables that are used in the statistical modeling of loan performance. All of the variables except for mortgage age listed in Exhibit A-1 were entered as 0-1 dummy variables in the statistical models. For each set of categorical variables, one of the dummy variables is omitted during estimation and serves as the baseline category. The mortgage age variable was entered as a piecewise linear spline function. The specification of each variable is described in more detail below.

#### *Mortgage Product Types*

As described above, separate statistical models were estimated for the following six FHA mortgage product types:

1. FRM30      Fixed-rate 30-year fully-underwritten purchase and refinance mortgages
2. FRM15      Fixed-rate 15-year fully-underwritten purchase and refinance mortgages
3. ARM      Adjustable-rate fully-underwritten purchase and refinance mortgages
4. FRM30\_SR      Fixed-rate 30-year streamlined refinance mortgages
5. FRM15\_SR      Fixed-rate 15-year streamlined refinance mortgages
6. ARM\_SR      Adjustable-rate streamlined refinance mortgages

#### *Specification of Piece-Wise Linear Age Functions*

Exhibit A-1 lists the series of piece-wise linear age functions that were used for the six different mortgage product types. For example, we created a piece-wise linear age function for FRM15 loans with knots (the k's) at 2, 4, 8, and 12 quarters by generating 5 new age variables age1 to age5 defined as follows:



$$\begin{aligned}
 \text{age1} &= \begin{cases} \text{AGE} & \text{if AGE} \leq k_1 \\ k_1 & \text{if AGE} > k_1 \end{cases} \\
 \text{age2} &= \begin{cases} 0 & \text{if AGE} \leq k_1 \\ \text{AGE} - k_1 & \text{if } k_1 < \text{AGE} \leq k_2 \\ k_2 - k_1 & \text{if AGE} > k_2 \end{cases} \\
 \text{age3} &= \begin{cases} 0 & \text{if AGE} \leq k_2 \\ \text{AGE} - k_2 & \text{if } k_2 < \text{AGE} \leq k_3 \\ k_3 - k_2 & \text{if AGE} > k_3 \end{cases} \\
 \text{age4} &= \begin{cases} 0 & \text{if AGE} \leq k_3 \\ \text{AGE} - k_3 & \text{if } k_3 < \text{AGE} \leq k_4 \\ k_4 - k_3 & \text{if AGE} > k_4 \end{cases} \\
 \text{age5} &= \begin{cases} 0 & \text{if AGE} \leq k_4 \\ \text{AGE} - k_4 & \text{if AGE} > k_4 \end{cases} \tag{8}
 \end{aligned}$$

Coefficient estimates corresponding to the slopes of the line segments between each knot point and for the last line segment are estimated and reported in Exhibit A-2. The overall AGE function (for this 5-age segment example) is given by:

$$\text{Age Function} = \beta_1 \cdot \text{age1} + \beta_2 \cdot \text{age2} + \beta_3 \cdot \text{age3} + \beta_4 \cdot \text{age4} + \beta_5 \cdot \text{age5} \tag{9}$$

Age functions with greater or fewer numbers of segments were developed in a similar manner. The number of segments and the selection of the knot points are determined by experimentation based on the in-sample fit for conditional claim and prepayment rates.

### *Relative House Price*

As in last year's Review we used a variable measuring the relative house price level within the local market. The relative house price variable was computed by comparing the original purchase price of the house underlying a particular mortgage with the median house value in the same time period and location. HUD provided us with Census median house price data at the



county and metropolitan Core Based Statistical Area (CBSA) levels for the years 1980, 1990, 2000, 2006, and 2007. Quarterly median price estimates for all time periods from 1980 to 2009 were derived through linear interpolation, except that values back to 1975 were imputed by discounting 1980 values based on an assumption of 3-percent annualized growth in house prices from 1975 to 1980. The CBSA median prices estimates were applied to FHA loans with properties located in those metropolitan areas. We derived separate state-wide non-metro median house price estimates using the Census county-level median data for all non-metro counties within a state. The non-metro state values were computed by taking the median of the non-metro county median values.

#### *Loan Size*

Loan size is defined relative to the average-sized FHA loan originated in the same state during the same fiscal year. The resulting values were stratified into 5 categories based on direct examination of the data, with the middle category, *category 3*, centered on the average-sized loans plus or minus 10 percent, *i.e.*, 90 to 110 percent of the average loan size.

#### *Loan-to-Value Ratio*

Initial loan-to-value is recorded in FHA's data warehouse. Based on discussions with FHA, any LTV values recorded for streamline refinance products may refer to values recorded at the time of the original FHA loan and were considered unreliable for use in the analysis. We imputed original LTV values for these loans for the purpose of establishing the starting point for tracking the evolution of the probability of negative equity (see description of this variable below). The imputed values were based on the mean LTV values for non-streamlined products FRM30, FRM15, and ARM loans stratified by product, beginning amortization year and quarter, and geographic location (state and county). The imputed LTV values do not provide good fits for these streamline mortgages. However, the "probability of negative equity" variable discussed below, built upon these imputed initial LTV values, appeared to have good explanatory power.

#### *Season*

The season of an event observation quarter is defined as the season of the year corresponding to the calendar quarter, where 1 = Winter (January, February, March), 2 = Spring (April, May, June), 3 = Summer (July, August, September), and 4 = Fall (October, November, December).

#### *Probability of Negative Equity*

Following the approach of Deng, Quigley, and Van Order (2000), Calhoun and Deng (2002), and others, we computed the equity positions of individual borrowers using *ex ante* probabilities of negative equity. The probability of negative equity is a function of the current loan balance and



the probability of individual house price outcomes that fall below this value during the quarter of observation. The distributions of individual housing values relative to the value at mortgage origination were computed using estimates of house price drift and volatility based on FHFA (formerly OFHEO) House Price Indexes (HPIs).

The probability of negative equity is computed as follows:

$$PNEQ = \Phi \left\{ \frac{\ln(UPB(t)) - \ln(P(0) \cdot HPI(t))}{\sigma(t)} \right\} \quad (10)$$

where  $\Phi(x)$  is the standard normal cumulative distribution function evaluated at  $x$ ,  $UPB(t)$  is the current unpaid mortgage balance based on scheduled amortization,  $P(0)$  is the value of the borrower's property at mortgage origination,  $HPI(t)$  is an index factor for the percentage change in housing prices in the local market since origination of the loan, and  $\sigma(t)$  is a measure of the diffusion volatility for individual house price appreciation rates over the same period of time. The values of  $HPI(t)$  are computed directly from the house price indexes published by FHFA, while the diffusion volatility is computed from the following equation:

$$\sigma(t) = \sqrt{a \cdot t + b \cdot t^2} . \quad (11)$$

The parameters “ $a$ ” and “ $b$ ” in this expression were estimated by FHFA when applying the three-stage weighted-repeat-sales methodology advanced by Case-Shiller (1987, 1989). Further details on the original FHFA HPI methodology can be found in Calhoun (1996).

The resulting values of PNEQ were stratified into seven levels ranging from less than 5-percent to more than 30-percent probability of negative equity as listed in Exhibit A-1. Further mathematical details are presented in Appendix C of this Review.

#### *Mortgage Premium (Refinance Incentive)*

The financial incentive of a borrower to refinance is measured using a variable for the relative spread between the current mortgage contract interest rate and the current market mortgage rate:

$$MP(t) = \left\{ \frac{C(t) - R(t)}{C(t)} \right\} . \quad (12)$$

Where  $C(t)$  is the current note rate on the mortgage and  $R(t)$  is the current market average fixed-rate mortgage rate. This variable is as an approximation to the call option value of the mortgage given by the difference between the present value of the “anticipated” future stream of mortgage



payments discounted at the current market rate of interest,  $R(t)$ , and the present value of the mortgage evaluated at the current note rate,  $C(t)$ . Additional details are given in Deng, Quigley, and Van Order (2000) and Calhoun and Deng (2002).

The relative mortgage premium values for ARMs and FRMs are derived in exactly the same manner, except that the current coupon is always equal to the coupon at origination for FRMs, whereas ARM coupon rates are updated over the life of the mortgage as described below.

#### *ARM Coupon Rate Dynamics*

To estimate the current financial value of the prepayment option for ARM loans, and to compute amortization rates that vary over time, we needed to track the path of the coupon rate over the active life of individual ARM loans. The coupon rate resets periodically to a new level that depends on the underlying index, plus a fixed margin, subject to periodic and lifetime caps and floors that specify the maximum and minimum amounts by which the coupon can change on each adjustment date and over the life of the loan. Accordingly, the ARM coupon rate at time  $t$ ,  $C(t)$ , was computed as follows:

$$C(t) = \max\{ \min[ \text{Index}(t - S) + \text{Margin}, \\ C(t - 1) + A(t) \cdot \text{Period\_UpCap}, C(0) + \text{Life\_UpCap} ], \\ C(t - 1) - A(t) \cdot \text{Period\_DownCap}(t), \max( C(0) - \text{Life\_DownCap}, \text{Life\_Min} ) \} \quad (13)$$

where  $\text{Index}(t)$  is the underlying rate index value at time  $t$ ,  $S$  is the “lookback” period, and  $\text{Margin}$  is the amount added to  $\text{Index}(t - S)$  to obtain the “fully-indexed” coupon rate. The periodic adjustment caps are given by  $\text{Period\_UpCap}$  and  $\text{Period\_DownCap}$ , and are multiplied by dummy variable  $A(t)$  which equals zero except during scheduled adjustment periods. Maximum lifetime adjustments are determined by  $\text{Life\_UpCap}$  and  $\text{Life\_DownCap}$ , and  $\text{Life\_Min}$  is the overall minimum lifetime rate level. Any initial discounts in ARM coupon rates are reflected in the original interest rate represented by  $C(0)$  in equation (13).

#### *Yield Curve Slope*

Expectations about future interest rates and differences in short-term and long-term borrowing rates associated with the slope of the Treasury yield curve influence the choice between ARM and FRM loans and the timing of refinancing. We use the ratio of the ten-year Constant Maturity Treasury (CMT) yield to the one-year CMT yield to measure the slope of the Treasury yield curve.



### *Burnout Factor*

A burnout factor is included to identify borrowers who have foregone recent opportunities to refinance. The burnout factor is included to account for individual differences in propensity to prepay, often characterized as unobserved heterogeneity. In addition, unmeasured differences in borrower equity at the loan level may give rise to unobserved heterogeneity that can impact both prepayment and claim rates. Borrowers with negative equity are less likely to prepay due to the difficulty of qualifying and are more likely to exercise the default option.

Changes were introduced to the burnout factor for the FY 2006 Review and continue to be applied in the FY 2009 Review. The previous burnout factor, which was identical to that used in the FHFA risk-based capital stress test model, took the value one if the mortgage note rate exceeds the market mortgage rate by 200 basis points or more in any two of the preceding eight quarters. Empirical evidence now suggests that borrowers who refinance tend to do so at much lower thresholds. The burnout factor is quantified as the moving average number of basis points the borrower was in the money, for all quarters during which the borrower was in the money, during the preceding 8 quarters. The resulting measure was categorized into 50 basis point categories corresponding to 0 (always out of the money) up to a category corresponding to a moving average value exceeding 200 basis points, for a total of 6 categories.

### *Exposure Year/Quarter FRM Rate*

A variable measuring the market average FRM mortgage rate is included to distinguish high-rate and low-rate market environments. This variable was categorized into 100 basis point categories indicating market average FRM mortgage rates of 6 percent or less up to a category for market average FRM rates exceeding 10 percent.

### *Source of Downpayment Assistance*

As documented in the FY 2006 and FY 2007 Reviews, the FHA single-family program recently experienced a significant increase in the use of downpayment assistance from relatives, non-profit organizations, and government programs. Loans to borrowers utilizing downpayment assistance from non-profit organizations have been observed to generate significantly higher claim rates. As noted earlier in this year's Review, these risky loans will be eliminated going forward. Following the approach first applied for the FY 2006 Review, we have included in this year's Review a series of indicators to control for the use of different types of downpayment assistance by FHA borrowers.



### *Borrower Credit Scores*

Borrower credit scores at the loan level were first included in the models estimated for the FY 2007 Review and continue to be an important predictor of claim and prepayment behavior. FHA has relatively complete data on borrower FICO scores for loans originated since May 2004. In addition, FHA retroactively obtained borrower credit history information for selected samples of FHA loan applications submitted as far back as FY 1992. These data provide an additional source of loan-level information on borrower FICO scores that are used for estimation. Historical FICO score data was collected for HUD by Unicon Corporation for FHA applications dated during FYs 1992, 1994, and 1996. FICO scores of the borrower and up to two co-applicants were collected from a single credit data repository for a random sample of approximately 20 percent of loan applications. A second set of sample data was collected for loan applications over the period from FY1997 to FY 2001. FICO scores for up to three co-applicants were collected from up to two credit data repositories for about 20 percent of the loans in each year, with over-sampling of loans defaulted by April 2003. A third and final set of data, similar to the second set, was collected for FY 2002 to FY 2005 applications, with over-sampling of loans defaulted by February 2005. The over-sampling of historical borrower credit scores for default outcomes introduces issues of choice-based sampling. These issues are addressed in a separate section below.

These three sets of FICO data represent the most reliable sources of borrower credit history information available for historical FHA-endorsed loans. Following the methodology adopted by Freddie Mac and Fannie Mae, the FICO score of each individual borrower or co-borrower, respectively, is the median (of three) or minimum (of two) scores when scores are provided by multiple credit data repositories. The final FICO score assigned to a loan is the simple average of these individual FICO scores for the borrower and up to four co-borrowers. FICO scores derived in this manner were further stratified into categorical outcomes for use in the estimation models.

Additional indicator variables were specified to represent two particular forms of missing data on FICO scores. The categorical outcome 000 was defined corresponding to loans originated in FY 1992 or later that were known to have been submitted for scoring to one more credit data repository, but for which the borrower credit history was insufficient to generate a FICO score. The categorical outcome 999 was defined corresponding to loans originated in FY 1992 or later for which no attempt was made to obtain the FICO score.

Finally, an indicator was defined to distinguish loans with FICO scores obtained through the normal FHA loan approval process from loans for which FICO scores were obtained from the retrospective historical sampling procedure conducted by Unicon Corporation. There are some months in FY 2004 for which both types of FICO scores are present in the data. This variable



was included to control for the potential effect of choice-based sampling due to the oversampling of defaulted loans.

*Choice-Based Sampling of Historical FICO Scores and Random Sampling of FRM30 Loans*

As described in Section I of this Appendix, a 20-percent random sample of FRM30 loans was used for estimation of conditional claim and prepay rates. A stratified random sampling scheme was applied to assure adequate representation of loans with historical FICO score data. For each fiscal year the Unicon sample loans were flagged and the total counts of Unicon loans and other FHA loans were computed. Separate sampling rates for Unicon loans and other FHA loans were derived to give as close to equal representation of both loan samples as possible, while still achieving an overall sampling rate of 20 percent for the particular FY. Individual sampling weights were assigned to each loan based on the reciprocal of their probability of selection. In some years this resulted in selecting the entire sample of available Unicon sample loans, with the remainder of the 20 percent sample comprising FHA loans not included in the Unicon samples. In other years, this resulted in selecting a random subsample of Unicon sample loans and an equally-sized random sample of other FHA loans. Our goal was to attain a balanced mix of loans with and without FICO scores (for those years in which FICO scores were potentially available) in order to analyze the impact of credit scores on loan performance and to control for choice-based sampling of FICO scores by comparison to loan performance in a random sample of FHA loans. Under the approach outlined here the estimation data included a mix of randomly sampled FHA loan originations without FICO scores and a choice-based sample of loans with FICO scores prior to 2004, and randomly sampled FHA loans with FICO scores since late 2004.

Estimation using only observations from a choice-based sample is known to result in biased estimation of the constant terms of maximum-likelihood logit probability models, but still gives unbiased estimates of the coefficients of the explanatory variables. The standard correction for bias in the intercept terms depends on the relative population and sample proportions of the selected outcome (Costlett, 1981). It is not feasible to apply this type of correction in our case, as the original procedure was applied to a sample of FHA loan “applications,” not all of which resulted in originated loans endorsed for FHA insurance. Furthermore, we were not able to access the original sampling weights applied to the population of loan applications. However, we do benefit from the fact that we have available the full “population” of FHA at-risk insured loans, which allows us to directly estimate differences in performance among loans in the choice-based samples. We have controlled directly for the differences in loan performance across our two sources of FICO score information by including an indicator for whether the loan was included in the Unicon loan subsample, along with a series of indicator variables that account for the availability and source of FICO scores across different origination years.



### *Origination Year Indicators*

The series of origination year indicators applied in past Reviews to account for changes in FHA underwriting requirements has been modified and extended to account for the periods during which loan-level credit score data were or were not available.

#### *FY 1975-1986 Origination*

An indicator for loans originated prior to FY 1986 Q3 is included to account for the period prior to tightening of FHA underwriting requirements.

#### *FY 1986-1992 Origination*

An indicator for loans originated between FY 1986 Q3 and FY 1991 Q4 is included to capture the condition that these loans were underwritten with more strict requirements but had no borrower credit history information. This variable also corresponds to the last period prior to the availability of borrower credit score data.

#### *Post-FY 1996 Origination*

An indicator for loans originated since FY 1996 Q1 is included to account for a loosening of FHA underwriting requirements. This variable is used in models for streamlined refinance loan products for which borrower credit scores are not available.

#### *Subprime Market Activity Period*

An indicator for time periods from 2004 through 2006 is included to account for the period of rapid growth in subprime market activity, which is not expected to be repeated going forward. This indicator was included to control for any positive or adverse effects on FHA loan quality not already measured by the variables already included, such as FICO scores.



**Exhibit A-1**

Logit Model Explanatory Variables								
Variable Name				Values				Description
Mortgage Age Function								
	FRM30	FRM15		ARM	FRM30_SR	FRM15_SR	ARM_SR	<p>Piece-wise linear age functions for ages up to specified knot points (shown in this table as the number of quarters since origination).</p> <p>Estimated parameters give the slope of the age function for each segment.</p> <p>Functions differ by mortgage product type and termination event as indicated (C-Claim, P-Prepay).</p>
	C, P	C	P	C, P	C, P	C, P	C, P	
age1	2	4	4	2	2	4	2	
age2	6	6	6	4	4	6	4	
age3	8	8	8	8	8	8	8	
age4	10	12	12	12	12	12	12	
age5	12	16	>12	16	> 12	16	16	
age6	14	20		20		20	20	
age7	16	>20		24		24	24	
age8	18			28		> 24	> 24	
age9	36			32				
age10	> 36			40				
age11				> 40				
Relative House Price								
rel_hp_cat_1				0 < X ≤ 50			Relative house price measured as relative percentage of Census median house value during quarter of loan origination. Census median prices for CBSAs and non-metro counties were assigned to FHA loans based on locations and origination dates.	
rel_hp_cat_2				50 < X ≤ 75				
rel_hp_cat_3				75 < X ≤ 100				
rel_hp_cat_4				100< X ≤ 125				
rel_hp_cat_5				125< X ≤ 150				
rel_hp_cat_6				X > 150				
Loan Size								
loancat_cat_1				0 < X ≤ 60			Relative loan size measured as the percentage of average size loan originated in the same state in the same year.	
loancat_cat_2				60 < X ≤ 90				
loancat_cat_3				90 < X ≤ 110				
loancat_cat_4				110 < X ≤ 140				
loancat_cat_5				X > 140				
(continued on following page)								



**Exhibit A-1**

Logit Model Explanatory Variables		
Variable Name	Values	Description
Loan Purpose		
refinance_cat_1	Not a refinance loan	Indicates whether the loan purpose was for refinancing
refinance_cat_2	Refinance loan	
Loan-to-Value		
ltvcat_cat_1	$0 < X \leq 80$	Loan-to-value at origination. Missing LTV values for SR product types are replaced by mean LTV by state, origination FY, and corresponding non-SR product types.
ltvcat_cat_2	$80 < X \leq 90$	
ltvcat_cat_3	$90 < X \leq 95$	
ltvcat_cat_4	$95 < X < 97$	
ltvcat_cat_5	$97 \leq X$	
Season		
season_cat_1	$X = 1$	Calendar quarter of mortgage origination.
season_cat_2	$X = 2$	
season_cat_3	$X = 3$	
season_cat_4	$X = 4$	
Probability of Negative Equity		
pneqcat_cat_1	$0.00 \leq X \leq 0.05$	Probability of negative equity. Based on FHFA house price drift and volatility estimates. MSA-level estimates used for selected MSAs; otherwise, Census Division level estimates were used.
pneqcat_cat_2	$0.05 < X \leq 0.10$	
pneqcat_cat_3	$0.10 < X \leq 0.15$	
pneqcat_cat_4	$0.15 < X \leq 0.20$	
pneqcat_cat_5	$0.20 < X \leq 0.25$	
pneqcat_cat_6	$0.25 < X \leq 0.30$	
pneqcat_cat_7	$X > 0.30$	
Mortgage Premium (Spread)		
spreadcat_cat_1	$X \leq -30$	Mortgage premium value measured as difference between current coupon rate and average FRM market rate, divided by current coupon rate.
spreadcat_cat_2	$-30 < X \leq -20$	
spreadcat_cat_3	$-20 < X \leq -10$	
spreadcat_cat_4	$-10 < X \leq 0$	
spreadcat_cat_5	$0 < X \leq 10$	
spreadcat_cat_6	$10 < X \leq 20$	
spreadcat_cat_7	$20 < X \leq 30$	
spreadcat_cat_8	$X > 30$	
(continued on following page)		



**Exhibit A-1**

Logit Model Explanatory Variables		
Variable Name	Values	Description
Yield Curve Slope		
yslopecat_cat_1	$0.0 \leq X \leq 1.0$	Yield curve slope measured as ratio of 10-year CMT to 1-year CMT rates.
yslopecat_cat_2	$1.0 < X \leq 1.2$	
yslopecat_cat_3	$1.2 < X \leq 1.5$	
yslopecat_cat_4	$X > 1.5$	
Burnout Factor		
in_moneycat_cat_1	$X \leq 0$	Burnout factor equal to the moving average number of basis points the prepayment option was in the money during those quarters the option was in the money over the preceding 8 quarters.
in_moneycat_cat_2	$0 < X \leq 50$	
in_moneycat_cat_3	$50 < X \leq 100$	
in_moneycat_cat_4	$100 < X \leq 150$	
in_moneycat_cat_5	$150 < X \leq 200$	
in_moneycat_cat_6	$X > 200$	
1975-1986 Origination		
fy_1975_1986_cat_1	$X \geq 1986$	Pre-FY1986 Q3 origination prior to changes in FHA underwriting requirements. Prior to availability of credit score data.
fy_1975_1986_cat_2	$X < 1986$	
1986-1992 Origination		
fy_1986_1992_cat_1	$1986 > X \text{ or } 1992 \leq X$	Post-FY 1986 Q3 and pre-FY 1992 origination. After changes in FHA underwriting requirements. Prior to availability of sample credit score data.
fy_1986_1992_cat_2	$1986 \leq X < 1992$	
Post-1996 Origination		
fy_1996_XXXX_1	$X \leq 1996$	Post-1996 origination. After changes in FHA underwriting requirements. For SR loan products with no credit score data.
fy_1996_XXXX_2	$X > 1996$	
(continued on following page)		



**Exhibit A-1**

Logit Model Explanatory Variables		
Variable Name	Values	Description
Exposure Year/Quarter FRM Rate		
ey_ratecat_cat_1	$X \leq 6$	FRM average mortgage rate during exposure year and quarter. Included to distinguish high-rate and low-rate environments.
ey_ratecat_cat_2	$6 < X \leq 7$	
ey_ratecat_cat_3	$7 < X \leq 8$	
ey_ratecat_cat_4	$8 < X \leq 9$	
ey_ratecat_cat_5	$9 < X \leq 10$	
ey_ratecat_cat_6	$X > 10$	
Subprime Activity Period		
sp_2004_2006_1	FY < 2004 or FY > 2006	Activity (exposure) periods between FY 2004 and FY 2006. Included to account for impacts of rapid growth in subprime market activity.
sp_2004_2006_2	$2004 \leq \text{FY} \leq 2006$	
Source of Downpayment Assistance		
gift_ltr_src_cat_1	None Recorded	Source of downpayment assistance.
gift_ltr_src_cat_2	Relatives	
gift_ltr_src_cat_3	Non-Profit	
gift_ltr_src_cat_4	Government	
gift_ltr_src_cat_5	Other	
(continued on following page)		



**Exhibit A-1**

<b>Logit Model Explanatory Variables</b>		
<b>Variable Name</b>	<b>Values</b>	<b>Description</b>
<b>Borrower FICO Score</b>		
fico_300_499	$300 < X \leq 499$	Borrower FICO scores obtained from sample data for FY 1992-2004 originations. Complete data on FHA FICO scores is available from FY 2004.
fico_500_559	$500 < X \leq 559$	
fico_560_599	$560 < X \leq 599$	
fico_600_639	$600 < X \leq 639$	
fico_640_659	$640 < X \leq 659$	
fico_660_679	$660 < X \leq 679$	
fico_680_719	$680 < X \leq 719$	
fico_720_850	$720 < X \leq 850$	
fico_000	No FICO Score Generated after 1992	FICO category 000 represents loans submitted to credit data repository for scoring but not resulting in a credit score.
fico_999	Missing FICO Score after 1992	FICO category 999 represents loans for which FICO score not available from any source.
unicon_loan	Loan is member of Unicon sample	Source of FICO score is FHA, not the historical sampling of applications.

**III. Model Estimation Results**

Exhibits A-2 and A-3 present the coefficient estimates for the binomial logit models for conditional claim and prepayment probabilities.



<b>Exhibit A-2</b>						
<b>Results for Conditional Claim Rate Model Estimation</b>						
Variable	FRM 30	FRM 15	ARM	SR FRM 30	SR FRM 15	SR ARM
rel_hp_cat_2	-0.0653	-0.1818	-0.1460			
rel_hp_cat_3	-0.1408	-0.3631	-0.3579			
rel_hp_cat_4	-0.1702	-0.4025	-0.4154			
rel_hp_cat_5	-0.1806	-0.4338	-0.4304			
rel_hp_cat_6	-0.1423	-0.5728	-0.3773			
ltvcat_cat_2	0.5335	1.0002	0.4580			
ltvcat_cat_3	0.4827	1.1389	0.5481			
ltvcat_cat_4	0.5740	1.2484	0.5628			
ltvcat_cat_5	0.4916	1.1346	0.4886			
loancat_cat_2				0.1677	-0.1656	0.2307
loancat_cat_3				0.2722	-0.3578	0.3899
loancat_cat_4				0.3560	-0.2906	0.3909
loancat_cat_5				0.3640	-0.0447	0.3608
refinance_cat_2	-0.1258	-0.4601	-0.0906			
season_cat_2	0.0291	0.0317	0.0461	0.0253	-0.0291 *	0.0889
season_cat_3	0.0229	0.0352	-0.0368	0.0021 *	-0.0029 *	0.0203
season_cat_4	-0.0143	-0.0225	-0.0266	-0.0220	-0.0389	-0.0026 *
pneqcat_cat_2	0.5439	0.7694	0.4279	0.8655	0.8938	0.7681
pneqcat_cat_3	0.6830	0.9374	0.5695	1.2440	0.9564	1.1757
pneqcat_cat_4	0.8160	1.2214	0.7418	1.4746	1.0061	1.3685
pneqcat_cat_5	0.9422	1.2917	0.9002	1.5014	1.2477	1.3737
pneqcat_cat_6	1.0625	1.5061	0.9942	1.6873	1.7068	1.7332
pneqcat_cat_7	1.4636	1.7757	1.3936	2.2101	1.4914	2.2497
yslopecat_cat_2	-0.0966	-0.1396	-0.0754	-0.2466	-0.1530	-0.1204
yslopecat_cat_3	-0.0670	-0.0895	-0.1774	-0.1394	0.0836	-0.2835
yslopecat_cat_4	-0.1587	-0.1745	-0.0973	-0.1556	-0.0051 *	-0.2453
spreadcat_cat_2	0.5110	-0.0698	0.0952	-0.5382		0.0677
spreadcat_cat_3	0.6699	0.0182 *	0.1538	-0.4134		0.1386
spreadcat_cat_4	0.8772	0.2231	0.1086	-0.1194		0.1153
spreadcat_cat_5	0.9949	0.2723	0.1003	0.0565		0.0818
spreadcat_cat_6	1.1203	0.3451	0.1342	0.2310		0.1441
spreadcat_cat_7	1.2573	0.4067	0.1342	0.3004		0.1441
spreadcat_cat_8	1.4168	0.5988	0.1342	0.3343		0.1441
in_moneycat_cat_2	0.0374	0.0813	0.4554	-0.1367	0.3040	0.3195
in_moneycat_cat_3	0.1939	0.2625	0.8484	0.1504	0.7077	0.2547
in_moneycat_cat_4	0.4382	0.3870	0.9854	0.4461	1.0306	0.2547
in_moneycat_cat_5	0.6553	0.5408	0.9854	0.6034	1.1809	0.2547
in_moneycat_cat_6	0.8604	0.6800	0.9854	0.7897	1.5625	0.2547
gift_ltr_src_cat_2	0.2461	0.2090	0.2578			
gift_ltr_src_cat_3	0.7911	1.4084	0.5954			
gift_ltr_src_cat_4	0.4502	1.2527	0.5464			
gift_ltr_src_cat_5	0.5025		0.2846			
ey_ratecat_cat_2			-0.0958			-0.1407
ey_ratecat_cat_3			-0.2721			-0.4121
ey_ratecat_cat_4			-0.3802			-0.5174
ey_ratecat_cat_5			-0.1374			-0.5576



<b>Exhibit A-2</b>						
<b>Results for Conditional Claim Rate Model Estimation</b>						
Variable	FRM 30	FRM 15	ARM	SR FRM 30	SR FRM 15	SR ARM
ey_ratecat_cat_6			-0.1374			-0.5576
fy_1975_1985_cat_2	0.5704	0.3069				
fy_1986_1991_cat_2	-0.0932	-0.3722	0.0645			
fy_1996_XXXX_cat_2	0.3130	0.1703	0.5154	0.5611	-0.2582	0.9086
sp_2004_2006_2	0.1510	0.1572	-0.0134	0.1791	-0.1061	0.2395
age1	2.6844	1.2068	1.9900	2.1132	1.1732	1.5465
age2	0.5904	0.4671	1.4919	1.0425	0.3627	1.0689
age3	0.1440	0.2708	0.3824	0.2511	0.3373	0.3048
age4	0.1002	0.0739	0.1294	0.0887	0.0694	0.0767
age5	0.0394	0.0039 *	0.0297	-0.0235	0.0483	0.0503
age6	0.0202	-0.0340	0.0002 *		-0.0440	0.0072 *
age7	0.0052	-0.0614	-0.0140		-0.0395	-0.0149
age8	-0.0058		-0.0321		-0.0856	-0.0684
age9	-0.0258		-0.0321			
age10	-0.0446		-0.0435			
age11			-0.0475			
fico_000	0.1867	-0.0378 *	0.0527			
fico_999	-0.3950	-0.8486	-0.0713			
fico_300_499	0.7439	1.2312	0.8409			
fico_500_559	0.3944	0.9055	0.4672			
fico_560_599	0.1377	0.5012	0.1842			
fico_640_659	-0.3689	-0.1854	-0.2554			
fico_660_679	-0.5953	-0.5219	-0.5028			
fico_680_719	-0.9485	-0.8807	-0.9006			
fico_720_850	-1.5563	-1.5680	-1.5111			
unicon_loan	0.7444	0.0599	1.0424			
_cons	-15.6023	-13.5403	-15.1094	-14.3448	-13.8303	-13.2722
Statistics	FRM 30	FRM 15	ARM	SR FRM 30	SR FRM 15	SR ARM
Log likelihood	-658177.3	-61065.22	-208189	-172717.9	-14855.07	-35952.26
Number of obs	30975228	7270638	8506708	11360909	4586653	1496103
LR $\chi^2$	6518898	.	.	2336104.4	221045.07	.
Prob > $\chi^2$	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

\*Not significant for 0.05-level asymptotic normal test



<b>Exhibit A-3</b>						
<b>Results for Conditional Prepayment Rate Model Estimation</b>						
Variable	FRM 30	FRM 15	ARM	SR FRM 30	SR FRM 15	SR ARM
rel_hp_cat_2	0.1655	0.2159	0.1473			
rel_hp_cat_3	0.3084	0.3388	0.2439			
rel_hp_cat_4	0.4017	0.4055	0.2670			
rel_hp_cat_5	0.4225	0.4040	0.2687			
rel_hp_cat_6	0.3562	0.3539	0.2424			
ltvcat_cat_2	-0.0109	0.0327	-0.0088			
ltvcat_cat_3	0.0733	0.0787	0.0759			
ltvcat_cat_4	0.1269	0.1151	0.1732			
ltvcat_cat_5	0.1150	0.1325	0.1242			
loancat_cat_2				0.3522	0.1009	0.3254
loancat_cat_3				0.5893	0.1882	0.4984
loancat_cat_4				0.7292	0.2776	0.6000
loancat_cat_5				0.8234	0.4387	0.6846
refinance_cat_2	0.1340	0.1099	0.1083			
season_cat_2	0.2350	0.2328	0.1963	0.2538	0.1855	0.2105
season_cat_3	0.1405	0.1300	0.0479	0.1860	0.1269	0.1431
season_cat_4	0.1067	0.0868	0.0287	0.1237	0.0619	0.0372
pneqcat_cat_2	-0.3216	-0.4116	-0.3451	-0.3972	-0.2383	-0.4419
pneqcat_cat_3	-0.4099	-0.5596	-0.5183	-0.4412	-0.5839	-0.5595
pneqcat_cat_4	-0.5116	-0.7372	-0.6289	-0.5619	-0.7345	-0.6908
pneqcat_cat_5	-0.6447	-0.9221	-0.7241	-0.8167	-0.8468	-0.9264
pneqcat_cat_6	-0.7716	-0.9872	-0.9262	-1.0239	-0.8739	-1.1067
pneqcat_cat_7	-0.9214	-1.1876	-1.2746	-1.3669	-1.0905	-1.5837
yslopecat_cat_2	0.0654	-0.0707	-0.0262	-0.0220	0.0670	0.1854
yslopecat_cat_3	0.2269	0.0744	0.2177	0.0184	0.1103	0.1620
yslopecat_cat_4	0.5051	0.3220	-0.0583	0.4320	0.4842	0.0464
spreadcat_cat_2	0.6496	-0.0143	*	-0.8612		0.0759
spreadcat_cat_3	0.5020	0.2442	0.2343	-0.6562		0.1464
spreadcat_cat_4	0.5362	0.4148	0.3764	-0.4872		0.2479
spreadcat_cat_5	0.7498	0.6415	0.5784	-0.2013		0.3986
spreadcat_cat_6	1.3425	0.9820	0.8166	0.3866		0.4240
spreadcat_cat_7	1.7211	1.2262	0.8166	0.7069		0.4240
spreadcat_cat_8	1.6432	1.2123	0.8166	0.7427		0.4240
in_moneycat_cat_2	0.3139	0.2199	0.3295	0.3750	0.4739	0.0409
in_moneycat_cat_3	0.6067	0.3787	0.4491	0.6150	0.7136	0.1040
in_moneycat_cat_4	0.6209	0.3216	0.5955	0.5977	0.7617	0.1040
in_moneycat_cat_5	0.5456	0.2478	0.5955	0.5278	0.7105	0.1040
in_moneycat_cat_6	0.4529	0.1485	0.5955	0.4978	0.6238	0.0437
gift_ltr_src_cat_2	0.0456	0.0041	*	0.0001	*	
gift_ltr_src_cat_3	-0.0410	0.4016	-0.2205			
gift_ltr_src_cat_4	-0.2399	-0.0805	-0.2178			
gift_ltr_src_cat_5	0.0918		0.1045			
ey_ratecat_cat_2			0.1180			0.0437
ey_ratecat_cat_3			-0.2879			-0.2680
ey_ratecat_cat_4			-0.6855			-0.6032



<b>Exhibit A-3</b>						
<b>Results for Conditional Prepayment Rate Model Estimation</b>						
Variable	FRM 30	FRM 15	ARM	SR FRM 30	SR FRM 15	SR ARM
ey_ratecat_cat_5			-1.3146			-1.0393
ey_ratecat_cat_6			-1.7629			-1.0393
fy_1975_1985_cat_2	-0.0345	-0.0344				
fy_1986_1991_cat_2	-0.2804	-0.1641	0.3065			
fy_1996_XXXX_cat_2	0.0965	0.0941	0.2831	0.3802	0.0753	0.4948
sp_2004_2006_2	0.0640	0.0743	0.3340	0.1288	0.1142	-0.0139 *
age1	1.1781	0.5007	1.2862	1.0014	0.4639	1.2233
age2	0.1881	0.1294	0.5004	0.0643	0.0252	0.2153
age3	0.0215	0.0568	0.0729	-0.0084	0.0489	-0.0283
age4	-0.0086	-0.0065	-0.0223	-0.0384	0.0042	-0.0274
age5	0.0072	0.0036	-0.0544	-0.0163	0.0161	-0.0388
age6	-0.0066		-0.0445		0.0223	-0.0442
age7	-0.0021 *		-0.0026 *		-0.0430	0.0471
age8	-0.0516		-0.0126		0.0173	-0.0106
age9	-0.0145		0.0000 *			
age10	-0.0048		-0.0142			
age11			-0.0222			
fico_000	-0.1778	-0.1153	0.0509			
fico_999	0.0680	0.0622	0.4549			
fico_300_499	-0.3914	0.1738	-0.3831			
fico_500_559	-0.2448	0.0517	-0.1994			
fico_560_599	-0.1437	0.1175	-0.0909			
fico_640_659	0.0189	0.0081 *	0.1079			
fico_660_679	0.0516	-0.0324	0.1443			
fico_680_719	0.1116	-0.0574	0.2307			
fico_720_850	0.1513	-0.0924	0.2939			
unicon_loan	0.0178	0.0475	0.2975			
_cons	-8.3573	-7.2862	-7.5891	-6.2886	-6.4163	-6.1542
Statistics	FRM 30	FRM 15	ARM	SR FRM 30	SR FRM 15	SR ARM
Log likelihood	-3878928	-939487	1472519	-1977410	-620069	-324862
Number of obs	31051540	7554692	8617527	11905345	4835175	1567007
LR $\chi^2$	12660000	.	.	2482702	2054307	.
Prob > $\chi^2$	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

\* Not significant for 0.05-level asymptotic normal test



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## **Appendix B: Cash Flow Analysis**

### **I. Introduction**

The calculation of the economic value of the Fund involves the estimation of the present value of future cash flows generated by the existing portfolio and future books of business. This requires the projection of future prepayment and claim incidences and cash flow items associated with each type of outcome. This appendix describes the components of these cash flows.

The evaluation of the Fund's economic value at a point in time (end-of-year FY 2009) requires accounting for the value of net assets plus the expected present value of future net income. The latter comprises future revenue and expenses. Similarly, the evaluation of the Fund's economic value in future years (FY 2010 through FY 2016) requires estimating both the Fund's initial net asset position and insurance portfolio composition at the end of each year, and the present value of future net income from the corresponding year-end forward.

In order to analyze future changes in the Fund's economic value, our model incorporates projections of loan performance and information about the existing portfolio composition to project the Fund's various cash flow sources. The actuarial model used the projections from the econometric models discussed in Appendices A and E. We estimated econometric models for conditional claim and prepayment probabilities for individual loans depending on the loan type, origination year, age, interest rate, loan purpose, initial LTV ratio, credit score, refinancing incentive, relative house price, probability of negative equity, loan term, burnout, and other characteristics. Using detailed loan-level characteristics, we were able to estimate more accurately the prepayment and claim probabilities and then generate respective cash flows for individual loan stratifications. We also estimated loss severity rates based on an econometric model that captures important determinants, including loan characteristics, property location, borrower credit history and house price appreciation rates.

Based on the mortgage termination rates projected by the econometric model, the major components of cash flows are projected into the future. Future interest income is included in the present value discounting process. The relevant cash flow components are itemized in Exhibit B-1.



**Exhibit B-1**

<b>Cash Flow Components</b>		
<b>Cash Flow Components</b>	<b>Cash Inflow</b>	<b>Cash Outflow</b>
Upfront Premiums	√	
Annual Premiums	√	
Net Claim Payments		√
Refunded Upfront Premiums		√
Administrative Expenses <sup>a</sup>		√
Distributive Shares <sup>b</sup>		√

<sup>a</sup> The administrative expense was discontinued since the FY 2002 Actuarial Review according to the Federal credit reform requirement.

<sup>b</sup> The distributive share has been suspended since 1990. There is no indication that it would be resumed in the foreseeable future.

These components were projected for individual loan stratifications on a probabilistic basis and then aggregated according to the product type, origination year, and policy year for reporting purposes. Below, we discuss the derivation of each of these cash flows.

## II. Background Information

The following definitions and background information clarify our discussion of the cash flow components:

- **Insurance-in-Force (IIF):** the nominal value of the unamortized original mortgage loan balances of the surviving mortgages insured by FHA. This is distinct from the conventional notion of amortized insurance-in-force, which includes only the current outstanding balances on surviving loans.
- **Conditional Claim Rate (ccr):** the number of loans that become claims during a time period divided by the number of surviving loans-in-force at the beginning of that period for a specific pool of loans.
- **Conditional Prepayment Rate (cpr):** the number of loans being completely prepaid during a time period divided by the number of surviving loans-in-force at the beginning of that period for a specific pool of loans.
- **Policy Year:** References the number of fiscal years since origination. The year in which the mortgage is originated is assigned as fiscal policy year one, even though it may not be a complete year.



- **Termination Year:** the fiscal year in which a mortgage terminates through a claim, prepayment or other reasons.
- **Unpaid Principle Balance (UPB) Factor:** the principal balance outstanding at a given time divided by the original mortgage amount. The UPB factor is calculated based only on amortization, given the original maturity, the type of mortgage, and the mortgage contract rate. For FRMs, the UPB factor for each quarter in the future can be directly computed using the initial contract rate and the amortization term. For ARMs, the UPB factor decreases at different rates depending on the interest rate of the particular loan, updated according to the contractual rate-adjustment rule. In our model, the contract interest rates of ARM loans are updated by using changes in the one-year Treasury rate as an approximation for changes in the underlying index, subject to limits implied by standard annual and lifetime rate-adjustment caps.

### III. Cash Flow Components

We now describe the different cash flow components.

#### A. Premiums

##### 1. Premium Structure

The primary source of revenue to the Fund is insurance premiums. If the Fund's mortgage insurance is priced to meet the expected liabilities, the insurance premiums collected and interest earned on them will, on average, cover all costs associated with mortgage loans insured by the Fund. According to current and past FHA mortgage insurance policies, the insurance premium has been structured in different ways during different time periods:

- For loans originated prior to September 1, 1983, the mortgage premium was collected on a monthly basis at an annualized rate of 0.50 percent of the outstanding principal balance for the period. To align this change with fiscal quarters, we assumed for this analysis that this annual premium policy was in effect through September 30, 1983.
- Between September 1, 1983 and June 30, 1991, the mortgage premium was based on a percentage of the original mortgage amount at the time of origination. This amount was 3.80 percent for 30-year mortgages and 2.40 percent for 15-year mortgages.
- Effective July 1, 1991, the NAHA specified a new premium structure. This structure specified an upfront premium of 3.80 percent for all product types except for 15-year non-streamline refinance loans (for which the upfront premium was set at 2.00 percent)



and an annual renewal premium of 0.50 percent per year on the outstanding balance. The annual premium would cease at different policy years depending on the initial LTV of the loan.

- On October 1, 1992, the upfront premium was reduced from 3.80 percent to 3.00 percent. The annual premium of 15-year mortgages was lowered to 0.25 percent or completely waived if the initial LTV ratio was less than 90 percent.
- As of April 17, 1994, FHA lowered the upfront premium rate on 30-year mortgages from 3.00 percent to 2.25 percent. To align this change with fiscal quarters, we started applying this policy change on April 1, 1994.
- Starting from October 1, 1996, FHA lowered the upfront premium rate on 30-year mortgages for first-time homebuyers who receive homeowner counseling from 2.25 percent to 2.00 percent. This rate was further reduced to 1.75 percent for mortgages executed on or after September 22, 1997. This favorable treatment for borrowers with homeownership counseling was terminated shortly thereafter.
- Effective January 1, 2001, FHA lowered the upfront premium rate of all mortgages to 1.50 percent. The annual premium was reduced to 0.50 percent on the UPB and the annual premium would stop as soon as the current LTV ratio of the loan was below 78 percent according to the home price as of the loan origination date. The annual premium must be paid for a minimum of five years for 30-year mortgages.
- Effective October 1, 2008, FHA charges an upfront premium rate of 1.75 percent for purchase money mortgages and full-credit qualifying refinances; and 1.50 percent for all types of streamline refinance loans. The annual premium, remitted on a monthly basis, is charged based on the initial loan-to-value ratio and length of the mortgage.

The upfront and annual premium rates are summarized in Exhibits B-2 and B-3.



**Exhibit B-2**

<b>Upfront Premium Rates for New FHA Originations</b>		
<b>Fiscal Year</b>	<b>30yr Loans, Fixed or Adjustable Rate (%)</b>	<b>15yr Loans, Fixed or Adjustable Rate (%)</b>
9/1/83 to 6/30/91	3.80	2.40
7/1/91 to 9/30/92	3.80	2.00/3.80 <sup>b</sup>
10/1/92 to 4/16/94	3.00	2.00
4/17/94 to 9/30/96	2.25	2.00
10/1/96 to 9/21/97	2.25/2.00 <sup>a</sup>	2.00
9/22/97 to 12/31/00	2.25/2.00/1.75 <sup>a</sup>	2.00
1/1/01 to 9/30/08	1.50	1.50
10/1/08 to present	1.75	1.75/1.50 <sup>c</sup>

<sup>a</sup> For first-time homebuyers who received homeowner counseling.<sup>b</sup> For 15-year streamline refinance loans.<sup>c</sup> For all types of streamline refinance loans.**Exhibit B-3**

<b>NAHA Annual Premium Rate for 15- and 30-Year Mortgages</b>				
<b>Fiscal Year</b>	<b>30yr Loans, Fixed or Adjustable</b>		<b>15yr Loans, Fixed or Adjustable</b>	
Prior to 9/1/1983	0.5% for life of loan		0.5% for life of loan	
9/1/83 to 6/30/91	None		None	
7/1/91 to 9/30/92	varies by LTV category <sup>a</sup>		varies by LTV category <sup>a</sup>	
10/1/92 to 12/31/00	varies by LTV category <sup>b</sup>		varies by LTV category <sup>c</sup>	
1/1/01 to 9/30/08	0.5% until loan balance reaches 78% of original property value, minimum of 5 years		varies by LTV category <sup>d</sup>	
10/1/08 to present	For loans > 15 years 0.50% if LTV ≤ 95% 0.55% if LTV > 95% until loan balance reaches 78% of original property value		For loans ≤ 15 years 0% if LTV ≤ 90% 0.25% if LTV > 90% until loan balance reaches 78% of original property value	
<b>LTV Range:</b>	<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>
below 90%	0.5% for 5 yrs	0.5% for 7 yrs	0%	0%
Between 90%~95%	0.5% for 8 yrs	0.5% for 12 yrs	0.25% for 4 yrs	0.25% until LTV reaches 78%
above 95%	0.5% for 10 yrs	0.5% for 30 yrs	0.25% for 8 yrs	0.25% until LTV reaches 78%



Insurance premium rules for streamline refinance (SR) loans are summarized in Exhibit B-4.

**Exhibit B-4**

Premium Rates for Streamline Refinance Loans				
Period of Origination	30-Year Mortgages		15-Year Mortgages	
	Upfront Premium	Annual Premium	Up-front Premium	Annual Premium
Prior to 9/1/1983	None	None	None	None
9/1/83 to 6/30/91	3.80%	None	2.40%	None
7/1/91 to 9/30/92	3.80%	0.5% for first 7 years	3.80%	0.5% for first 7 years
10/1/92 to 4/16/94	3.00%	0.5% for first 7 years	2.00%	None
4/17/94 to 12/31/00	2.25%	0.5% for first 7 years	2.00%	None
1/1/01 to 9/30/08	1.50%	0.5% until loan balance reaches 78% of original property value, minimum of 5 years	1.50%	varies by LTV category <sup>a</sup>
10/1/08 & subsequent	1.50%	0.50% if LTV ≤ 95%, 0.55% if LTV > 95% until loan balance reaches 78% of original property value	1.50%	0.25% if LTV > 90% <sup>b</sup> until loan balance reaches 78% of original property value

<sup>a</sup> 0% if original LTV is below 90 percent; 0.25% until LTV reaches 78% if original LTV is 90 percent and above.

<sup>b</sup> 0% if original LTV is equal or below 90 percent.

## 2. Upfront Premium

The upfront premium is assumed to be fully paid at the mortgage origination date and the amount is calculated as follows:

$$\text{Upfront Premium Payment} = \text{Origination Loan Amount} * \text{Upfront Insurance Premium Rate}$$



In practice, FHA offers a premium finance program to those qualified for mortgage insurance. Borrowers do not have to pay the upfront premium at the beginning of the contract. Instead, the borrower can add it to the original loan balance, in essence paying the upfront premium at the same schedule as their principal balance. Almost all borrowers finance their upfront premiums.

### 3. Quarterly Premium

The quarterly premium is calculated as follows:

$$\text{Quarterly Premium} = \text{Amortized UPB (excluding any upfront premiums)} * \text{Annual Insurance Premium Rate} / 4$$

The premium is actually collected on a monthly basis. The above formula models the premium as being collected at the beginning of each quarter for purposes of our analysis. In addition, the termination rate will have impacts on future premium flows. That is, all potential future premium income would no longer be paid when the particular mortgage loan is prepaid or claimed.

Although FHA is effectively insuring the financed upfront premiums, the quarterly premium is not assessed on the amount of the financed upfront premium.

### B. Losses Associated with Claims

The Fund's largest expense component comes in the form of losses due to claims. FHA pays the claim to the lender when a lender files a claim. In most cases, FHA takes possession of the foreclosed property and sells the property to partially recover the loss. This particular type of claim is called a conveyance.

Based on this practice, claim cash flows can be decomposed into two components:

- cash outflow of the claim payment at the claim date and
- cash inflow of any net proceeds received in selling the conveyed property at the property disposition date.

For tractability, we simplify this two-step cash flow into one lump-sum amount. We also include losses from pre-foreclosure sales, wherein the property is sold prior to the completion of a foreclosure process and the property is not conveyed to HUD (see Appendix E). The single claim loss payment estimated in our model at time  $t$  in the future is

$$\text{Claim Payment}_t = \text{Amortized Surviving UPB}_t * \text{Conditional Claim Rate}_t * \text{Loss Rate}_t$$



The *Amortized Surviving UPB<sub>t</sub>* is the amount of the unpaid balance of the loan after amortization multiplied by the probability that the loan will survive until the beginning of time *t*. The probability of survival is derived by dynamically simulating the loan subject to the projected conditional claim and conditional prepayment rates over individual time periods up to *t*. The conditional claim rate is estimated from the multinomial mortgage termination model presented in Appendix A. Note that the claim rate and the prepayment rate are in terms of the number of loans instead of the UPB. Claim and prepayment rates do vary by loan size. The potential impact of the loan size difference is controlled in this analysis by categorizing loans into different local housing markets and into different relative house price categories. Loans within a specific stratification tend to have similar original mortgage loan amounts. As a result, using the rates in terms of the number of loans would yield a close approximation to the results by using the rates in terms of UPBs.

The loss rate is usually referred to as the loss given default (LGD) or “severity” in the banking industry. It measures the amount of principal not recovered divided by the unpaid principal balance at the time of default. The claim loss rate is predicted by our new loss severity model, which was calibrated using loan-level data based on endorsements which originated during FY 1975 through FY 2008, and terminated as claims during the period FY 1999 through FY 2008. For additional technical details, refer to Appendix E.

To provide insights into the impact on the economic value of the Fund, this Review also includes an alternative scenario under which the loss rate for each product was assumed to be five percentage points higher than the above rates. This is discussed in Appendix D.

### C. Refunded Premiums

FHA first introduced the upfront premium refund program in 1983. It specified that FHA would refund a portion of the upfront premium when a household prepaid its mortgage. The upfront premium was considered to be “earned” over the life of the loan. Upon prepayment, an approximation of the unearned upfront premium is returned to the borrower. Therefore, the amount of the refund depends on the time since origination that the mortgage is prepaid. The refund payments are calculated as follows:

$$\text{Refund Payments} = \text{Original UPB} * \text{Upfront Premium Rate} * \text{Conditional Prepayment Rate} * \text{Refund Rate}$$

In the past, borrowers could receive the upfront premium refund when they prepaid their mortgages before the maturity of the mortgage contract. In 2000, FHA changed its policy so that borrowers would obtain refunds only if they prepay within the first five years of their mortgage contracts. The most recent policy change at the end of 2004 eliminated refunds for early



prepayments of any mortgages endorsed afterward, except for those borrowers refinanced into a new FHA loan within 3 years following the original endorsement date.

The upfront premium refund schedules for different endorsement dates are presented in Exhibit B-5.



## Exhibit B-5

Years since Origination	Percentage of Upfront Premium Refunded				
	9/1/83~12/31/93		1/1/94~ 12/31/00 <sup>a</sup>	1/1/01 and later <sup>b</sup>	12/8/2004 and later <sup>c</sup>
	30-Year Mortgages	15-Year Mortgages	All Mortgages	All Mortgages	If Refinanced into Another FHA Loan
1	0.99	0.99	0.95	0.85	0.58
2	0.94	0.93	0.85	0.65	0.34
3	0.82	0.81	0.70	0.45	0.10
4	0.67	0.66	0.49	0.25	0.00
5	0.54	0.51	0.30	0.10	
6	0.43	0.39	0.15	0.00	
7	0.35	0.29	0.04		
8	0.29	0.21	0.00		
9	0.24	0.15			
10	0.21	0.11			
11	0.18	0.08			
12	0.16	0.06			
13	0.15	0.04			
14	0.13	0.03			
15	0.12	0.02			
16	0.11	0.00			
17	0.10				
18	0.09				
19	0.09				
20	0.08				
21	0.07				
22	0.07				
23	0.06				
24	0.05				
25	0.05				
26	0.04				
27	0.04				
28	0.04				
29	0.04				
30	0.00				

<sup>a</sup> Based on Mortgagee Letter 94-1, which provided a monthly schedule of refund rates<sup>b</sup> Based on Mortgagee Letter 00-38<sup>c</sup> Based on Mortgagee Letter 05-03, which provided a monthly schedule of refund rates. Applicable only if refinanced into a new FHA loan.



#### IV. Economic Value

Once all the above future cash flow components are determined, their present value can be computed through discounting them at an appropriate rate. Then the economic value is the sum of the present value of future cash flows plus the current capital resources.

##### A. Discount Factors

The discount factors applied in computing the present value of cash flows are the official quarterly Federal credit subsidy present value conversion factors. The discount factor varies depending on how far into the future a cash flow will occur. The discount factors are shown in Exhibit B-8. As an example, a cash flow occurring at the end of FY 2010 is multiplied by 0.9904 to convert it into a present value in FY 2009. The discount rates used in this Review are higher than the corresponding discount rates in last year's Review since the level of interest rates has fallen since then.

**Exhibit B-8**

Year that Cash Flow Occurs	Discount Factor	Year that Cash Flow Occurs	Discount Factor	Year that Cash Flow Occurs	Discount Factor
2010	0.9904	2022	0.6729	2034	0.4795
2011	0.9654	2023	0.6508	2035	0.4684
2012	0.9400	2024	0.6301	2036	0.4579
2013	0.9137	2025	0.6107	2037	0.4480
2014	0.8861	2026	0.5925	2038	0.4384
2015	0.8592	2027	0.5754	2039	0.4294
2016	0.8334	2028	0.5593	2040	0.4205
2017	0.8066	2029	0.5441		
2018	0.7785	2030	0.5298		
2019	0.7496	2031	0.5162		
2020	0.7221	2032	0.5033		
2021	0.6966	2033	0.4911		



## B. Calculating the Economic Value

The economic value of the Fund as of the end of FY 2009 was calculated first by determining the present value of the future cash flows for all existing books of business as of September 30, 2009. This figure was then added to the capital resources of the Fund as estimated as of the same date.

For each fiscal year beyond 2009, the economic value of the fund as of the end of the fiscal year is calculated by the following equation:

$$\begin{aligned} \text{Year End Economic Value} = & \\ & \text{Economic Value at the beginning of the year} + \text{Total Investment Return on the Beginning} \\ & \text{Economic Value} + \text{Economic Value of the New Book of Business} \end{aligned}$$

The return on investment of the beginning economic value for each of the future fiscal years is assumed to equal the one-year Treasury forward rates implied by the Federal credit subsidy discount factors. Specifically, these rates are shown in Exhibit B-9.

**Exhibit B-9**

Interest Rate Earned by the Fund	
Fiscal Year	Interest Rate (%)
2009	1.42
2010	0.97
2011	2.59
2012	2.70
2013	2.88
2014	3.12
2015	3.13
2016	3.09



## **Appendix C: Data for Loan Performance Simulations**

This appendix describes the methodology we used to produce forecasts of future loan performance. We first describe how loan event data for future time periods were generated to project future loan performance and mortgage-related cash flows. This required creating future event data both for existing books of business and for future loan cohorts not yet originated. Then we summarize how the economic forecasts were applied. The forecasts of the economic factors are discussed in Appendix D. The derivation and application of the dispersion volatility parameters for the national average house price forecast are also explained in detail.

### **I. Future Loan Event Data**

The development of future loan event data was closely integrated with the development of the data used in the statistical estimation of loan performance. As described in Appendix A, the process of building the historical loan event data entailed expanding FHA loan origination records into dynamic quarter-to-quarter event data from loan origination up to, and including, the period of loan termination. The loan event data were augmented with external economic data (house price indices and interest rates) to derive a number of time-varying predictors of conditional prepayment and claim rates.

For loans that did not terminate and are still active as of FY 2009 (Q2), the process of building the period-by-period event data followed the same procedure as for terminated loans, but used forecasted values of the external economic factors to project future loan termination rates and cash flows.

In addition, we forecasted the loan performance of future FHA books originated through FY 2016. The total endorsement volumes for FY 2009 through FY 2016 are provided by HUD from their internal demand model. These forecasted volumes are allocated among the six loan product types following their distribution in the most recent FY 2009 book. HUD estimates that streamline refinance loans will account for about 15 percent of the future endorsements. Besides the total endorsement volume, HUD also projected detailed compositions by LTV and credit score for 30-year fixed-rate mortgages in future books of business. Exhibits C-1 and C-2 present the composition of future books.



## Exhibit C-1

Projected Originations By Mortgage Type (Percentage of Mortgages by Loan Counts)			
Fiscal Year	Purchase Mortgages		Streamline Refinancing
	Purchase	Fully Underwritten Refinance	
2010	57%	24%	19%
2011 to 2012	68%	19%	13%
2013 to 2016	75%	10%	15%

## Exhibit C-2

Projected Composition FY 2010 Purchase Loans							
Loan-to-Value Ratio	FICO Score Range						
	850-680	679-640	639-600	599-560	559-500	499-300	Missing
X <= 90	2.73%	1.81%	1.67%	0.80%	0.21%	0.01%	0.13%
90<X<=95	3.68%	1.57%	1.19%	0.47%	0.09%	0.00%	0.05%
95<X<=96.5	40.84%	20.32%	17.63%	5.65%	0.73%	0.01%	0.41%
Projected Composition FY 2011 to FY 2012 Purchase Loans							
Loan-to-Value Ratio	FICO Score Range						
	850-680	679-640	639-600	599-560	559-500	499-300	Missing
X <= 90	2.57%	1.85%	2.10%	1.39%	0.64%	0.06%	0.34%
90<X<=95	3.46%	1.79%	1.64%	0.81%	0.29%	0.0%	0.14%
90<X<=96.5	35.43%	19.13%	17.10%	7.76%	2.30%	0.0%	1.20%
Projected Composition FY 2013 to FY 2016 Purchase Loans							
Loan-to-Value Ratio	FICO Score Range						
	850-680	679-640	639-600	599-560	559-500	499-300	Missing
X <= 90	2.06%	1.47%	2.22%	2.24%	1.57%	0.18%	0.81%
90<X<=95	1.89%	1.33%	1.77%	1.43%	0.84%	0.0%	0.41%
95<X<=96.5	23.06%	16.41%	18.56%	13.32%	6.50%	0.0%	3.92%



## Exhibit C-3

Projected Composition FY 2010 Fully Underwritten Refinance Loans							
Loan-to-Value Ratio	FICO Score Range						
	850-680	679-640	639-600	599-560	559-500	499-300	Missing
X ≤ 90	14.07%	11.81%	10.48%	4.40%	1.46%	0.08%	0.05%
90 < X ≤ 95	17.13%	9.99%	7.17%	2.01%	0.39%	0.00%	0.02%
95 < X ≤ 96.5	9.57%	5.70%	4.24%	1.15%	0.24%	0.00%	0.02%
Projected Composition FY 2011 to FY 2012 Fully Underwritten Refinance Loans							
Loan-to-Value Ratio	FICO Score Range						
	850-680	679-640	639-600	599-560	559-500	499-300	Missing
X ≤ 90	7.23%	9.11%	12.46%	8.92%	5.17%	0.72%	0.41%
90 < X ≤ 95	10.02%	9.90%	10.15%	4.53%	1.77%	0.0%	0.22%
90 < X ≤ 96.5	4.45%	5.26%	5.72%	2.75%	1.06%	0.0%	0.16%
Projected Composition FY 2013 to FY 2016 Fully Underwritten Refinance Loans							
Loan-to-Value Ratio	FICO Score Range						
	850-680	679-640	639-600	599-560	559-500	499-300	Missing
X ≤ 90	5.23%	7.61%	12.67%	12.05%	10.23%	1.93%	1.06%
90 < X ≤ 95	5.37%	7.98%	10.12%	6.43%	3.54%	0.0%	0.57%
95 < X ≤ 96.5	1.83%	3.62%	4.87%	2.99%	1.57%	0.0%	0.33%

We then updated the initial mortgage contract rates of future loan originations according to the corresponding forecasted interest rate environments to reflect conditions at the time of origination. The future mortgage cash flows for individual loan stratifications are then aggregated to derive the total cash flows for the entire Fund. The total cash flows are calculated as weighted average cash flows among individual stratifications, with the weights calibrated to the future demand and compositions forecasted by HUD.

As described in Appendix A, the data used for statistical estimation comprise detailed loan stratifications grouped by age of loan, all possible combinations of the categorical outcomes for the explanatory variables, and additional categories such as mortgage product types. The data for future cohorts are organized in an identical manner.



## **II. Future Economic Forecasts**

We used quarterly economic forecast data from IHS Global Insight for the source of projected future interest rates and house price appreciation rates in our analysis.

For the projection of future changes in housing values, we used the IHS Global Insight forecast of the FHFA national-level housing price index. Because the national-level housing price series is an average of regional housing price performance, it tends to smooth out deviations in house price trends among individual underlying regional indexes. There is also an additional layer of uncertainty with regard to the dispersion of individual house price appreciation rates around the market average, represented by the national-level house price index (HPI). When using the national-level house price forecast to compute the probability of negative equity, it is important to take into account both sources of uncertainty.

To address this issue, we developed a methodology to estimate the historical dispersion of the FHFA regional (Census division) and metropolitan HPIs relative to the national HPI series. This analysis is described in greater detail in the remaining parts of this appendix. To summarize, estimates of additional dispersion among local housing markets were combined with the dispersion among individual house appreciation rates within the same local housing market to derive the total dispersion among individual house appreciation rates from the national average appreciation rate. The additional dispersion among local housing markets is added only after the beginning of the forecast period, i.e., as the computation of the probability of negative equity switches from using the actual MSA-level indexes to using the forecasted national-level HPI. The additional dispersion increases with time in a similar manner to the dispersion of individual property appreciation rates based on the MSA-level index.

Recall that the source of house price appreciation rates for historical loans was the HPIs obtained from FHFA. The rule for assigning metropolitan area indexes was to use the Metropolitan Statistical Area Division (MSAD) index if one exists for the loan's Federal Information Processing Standards (FIPS) state-county code, otherwise we used the Core Based Statistical Area (CBSA) index if one is available. If no MSAD or CBSA index is available, we applied one of the nine Census-division HPIs.

As described in Appendix A, the indexes are used in conjunction with estimates of house price diffusion parameters to compute probabilities of negative equity at each loan age for individual borrowers. The dispersion estimate reflects the deviations among individual house price appreciation rates around the national average appreciation rate.



### III. Dispersion of Local House Price Indices

As also described in Appendix A, the distributions of individual house values relative to the value at loan origination were computed using estimates of house price drift and diffusion volatility estimated by FHFA.

To forecast the future changes in housing values, we utilized IHS Global Insight's national-level HPI forecast. The IHS Global Insight's national average house price data and forecast do not provide estimates of the diffusion volatility between a single property and the national index. Although FHFA publishes a national-level HPI, it is based on a weighted average of indexes for the nine Census divisions, and no separate diffusion parameters are produced by IHS Global Insight at the national level. Thus, direct estimates of house price dispersion around a national index do not exist. Since we used Census-division-level and metropolitan-level indexes for calculating historical probability of negative equity, we adopted an approach that built upon the FHFA local house price volatility estimates and modified them to be consistent with the forecasting period when a national-level index is used.

We estimated the variance of the growth rates of housing values implied by the division indexes around the growth rates of the national-level index. The following discussion uses the case of MSA indexes as an example, but the same approach is also applied in the case of the Census-division indexes.

The growth rate for property  $i$  between time periods  $t$  and  $s$  relative to its MSA index is given by:

$$\ln(G_{i,t,s}) = \ln(H_{i,t}) - \ln(H_{i,s}) = \ln(H_{MSA,t}) - \ln(H_{MSA,s}) + \varepsilon_{i,t,s} \quad (1)$$

where  $H_{i,t}$  is the value of the house  $i$  at time  $t$ ,  $H_{MSA,t}$  is the HPI of the surrounding MSA at time  $t$ , and  $\varepsilon_{i,t,s}$  is the deviation of the growth rates of the house  $i$  and its surrounding MSA index from time  $s$  to  $t$ . Similarly, the growth rate implied by the MSA index relative to the national average forecast can be decomposed as follows:

$$\ln(G_{MSA,t,s}) = \ln(H_{MSA,t}) - \ln(H_{MSA,s}) = \ln(H_{N,t}) - \ln(H_{N,s}) + \varepsilon_{MSA,t,s} \quad (2)$$

where  $H_{N,t}$  is the national HPI at time  $t$ , and  $\varepsilon_{MSA,t,s}$  is the deviation of the growth rates of the MSA index and the national index from time  $s$  to  $t$ . Intuitively, one can think of the growth rate of a particular MSA as the national average growth rate plus a deviation term ( $\varepsilon_{MSA,t,s}$ ). Similarly, the growth rate of a particular house is equal to the MSA-level average growth rate plus another deviation term ( $\varepsilon_{i,t,s}$ ).



Plugging equation (2) into equation (1), we find that the individual house price growth rate equals the national average HPI growth rate and the sum of the dispersions of individual property around MSA levels, and the specific MSA levels around the national average growth rate:

$$\ln(G_{i,t,s}) = \ln(H_{N,t}) - \ln(H_{N,s}) + \varepsilon_{i,t,s} + \varepsilon_{MSA,t,s} \quad (3)$$

Notice that the variance of the first component of dispersion error given by  $\varepsilon_{i,t,s}$  can be computed directly from the “a” and “b” parameters estimated by FHFA using the three-stage weighted-repeat-sales methodology:

$$E(\sigma^2(\ln G_{i,t,s} - \ln G_{MSA,t,s})) = E(\sigma^2(\varepsilon_{i,t,s})) = a \cdot (t - s) + b \cdot (t - s)^2 \quad (4)$$

where  $E(\bullet)$  is the expectation operator and  $(t - s)$  is the number of quarters since the loan origination time  $s$ . We estimated the variance of the second component error  $\varepsilon_{MSA,t,s}$  for the dispersion of the MSA index growth rate around the national index growth rate forecast by a linear regression in the following form:

$$\sigma^2(\ln G_{MSA,t,s} - \ln G_{N,t,s}) = \sigma^2(\varepsilon_{MSA,t,s}) = c \cdot (t - s) + e \quad (5)$$

where  $e$  is the residual of the regression. Because equation (4) was estimated by FHFA as a residual term when estimating the MSA HPI using all houses within that location, the individual property diffusion term must be orthogonal to the diffusion term between the MSA and the national HPIs. That is, the noise term  $\varepsilon_{i,t,s}$  is independent of  $\varepsilon_{MSA,t,s}$ , or:

$$\rho(\varepsilon_{i,t,s}, \varepsilon_{MSA,t,s}) = 0 \quad (6)$$

This implies the following model for the variance of individual house price cumulative appreciation rates around the national average forecast:

$$E(\sigma^2(\ln G_{i,t,s})) = a \cdot (t - s) + b \cdot (t - s)^2 + c \cdot (t - s) \quad (7)$$



The parameter “ $c$ ” required for projecting the additional dispersion of the MSA index around the national average forecast was estimated as follows. For each quarter  $t$  we computed the cross-sectional (across MSAs) dispersion variance (MSA versus national) for each possible value of  $(t - s) > 0$ , which corresponds to time since loan origination, *i.e.*, mortgage age. We then computed the average dispersion variance according to each age of loan:

$$\sigma^2(\bar{\varepsilon}_{t-s}) = \frac{1}{N} \sum_{\{MSA\}} [\ln(G_{MSA,t,s} / G_{N,t,s})]^2 \quad t = s+1, s+2, \dots, T \quad (8)$$

where  $N$  is the number of MSAs used in the estimation sample, and  $T$  is the most recent quarter that HPIs are available (first quarter of 2008 in this Review). This gives us a cross-section/time-series sample of average MSA index dispersion variance around the national average forecast that we assume is a linear function of  $(t - s)$ :

$$\sigma^2(\bar{\varepsilon}_{t-s}) = c \cdot (t - s) + u_{t-s} \quad t = s+1, s+2, \dots, T; \quad s = 0, 1, \dots; \quad s < t \quad (9)$$

where  $u_{t-s}$  is the regression residual. We estimated the unknown parameter “ $c$ ” using a weighted least square regression with the number of average variance observations at each value of  $t - s$  as weights. The estimated quarterly standard deviations ( $\sqrt{c}$ ) at age one, *i.e.*,  $(t - s) = 1$ , were 2.77 percent for MSA indexes and 2.72 percent for Census division indexes.

One of the following two formulas was applied depending on whether the time period was historical or future:

$$\begin{cases} E(\ln G_{i,t,s}) = \ln G_{MSA,t,s} \\ \sigma^2(\ln G_{i,t,s}) = a \cdot (t - s) + b \cdot (t - s)^2 \end{cases} \quad \text{if } s < t \leq T \quad (10a)$$

$$\begin{cases} E(\ln G_{i,t,s}) = \ln G_{MSA,T,t} + \ln G_{N,t,T} \\ \sigma^2(\ln G_{i,T,s}) = a \cdot (t - s) + b \cdot (t - s)^2 + c \cdot (t - T) \end{cases} \quad \text{if } s < T \leq t \quad (10b)$$

Equations (10a) were applied to historical sample time periods when either an MSAD or CBSA index was used to update expected housing values, and equations (10b) were applied during future simulated time periods when the national average forecast was used to update expected housing values.



For future loan originations only a single formula set is required:

$$\begin{cases} E(\ln G_{i,t,s}) = \ln G_{N,t,s} \\ \sigma^2(\ln G_{i,t,s}) = a \cdot (t-s) + b \cdot (t-s)^2 + c \cdot (t-s) \end{cases} \quad \text{if } T \leq s < t \quad (11)$$

Equations (11) were applied to future loan originations when only the national average forecast was used to update the expected housing values.

The additional term associated with the dispersion of the growth rate of an MSA HPI around the growth rate of the national HPI increases the overall dispersion volatility and results in higher probabilities of negative equity. This is counterbalanced by the reduced relative frequency of low expected HPI values when using a national average house price forecast instead of the more volatile metropolitan area HPIs.

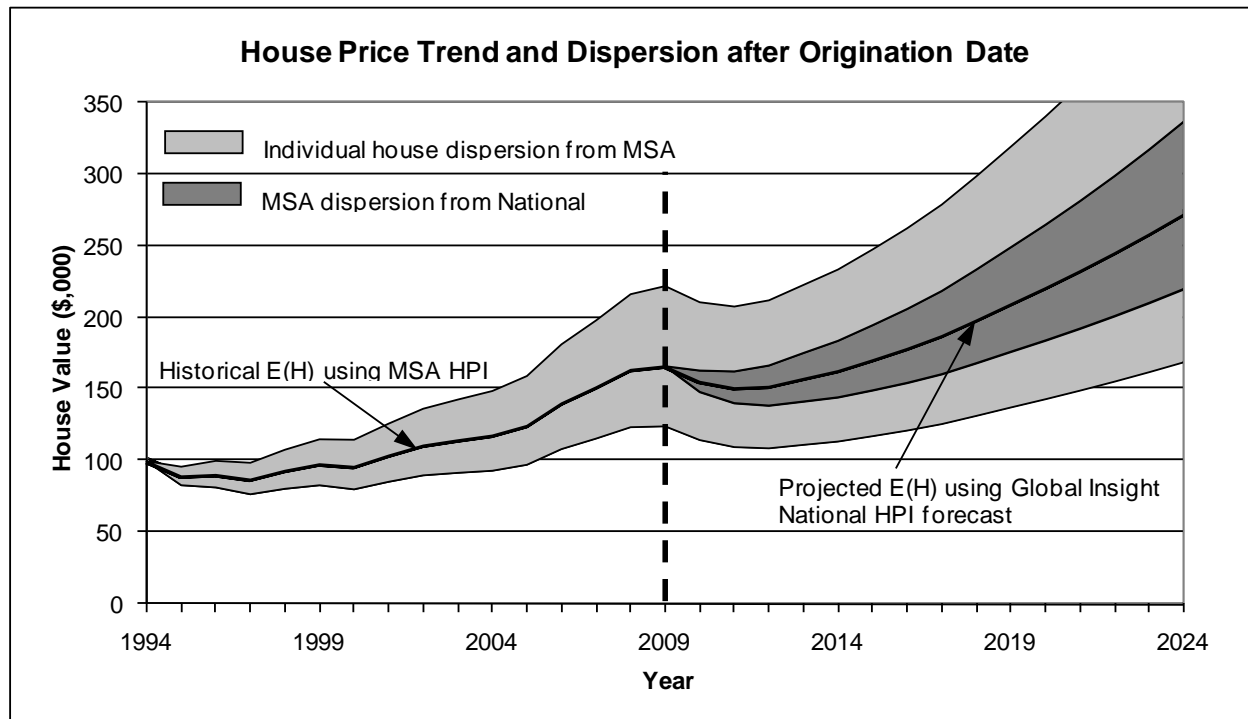
#### IV. A Numerical Example

Exhibit C-3 presents an example to depict the expected value and the dispersion of the growth of the value of a house  $[E(H)]$  over time. Let's assume that the sales price of an underlying house of a mortgage loan originated in a particular MSA at the first quarter of FY 1994 ( $s$ ) was \$100,000. We further assume that the last historical HPIs available are as of the first quarter of FY 2009 ( $T$ ).

The expected value and the dispersion standard deviation of this house at each exposure year ( $t$ ) can be computed following equations (10b). The center line in Exhibit C-3 demonstrates the expected value of the house at each exposure year. This expected value was updated by using the FHFA HPI for the particular MSA up to  $T$ . After  $T$ , the future expected value of the house is then updated according to the national house price growth rate forecasted by IHS Global Insight, since a forecast of the HPI growth rate for the particular MSA was not provided.



Exhibit C-3



The house price growth rate of an MSA could be higher or lower than the national average for the next 15 years. The dark shaded area represents the possible future MSA house price index if the realized MSA growth rate is within one standard deviation above or below the national average growth rates. Note that, prior to  $T$ , such MSA-level dispersion did not exist in historical distributions since the expected house price was updated by using the MSA-specific index.

The light shaded area represents the additional dispersion of one standard deviation due to the individual house-level volatility around the MSA average. The size of this source of dispersion starts immediately after the house was sold in the first quarter of 1994 and continues to grow over the age of the mortgage loan. The FHFA dispersion volatility parameters were used in computing this source of dispersion.

As a result, the outer boundary of the shaded area in Exhibit C-3 provides a visual demonstration of the dynamics of the house price distribution over the life of the mortgage. The probability of negative equity variable is directly computed as the probability that the house price may fall below the UPB of the mortgage at any point in time.



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## Appendix D: Economic Forecasts

In order to measure the Fund's soundness against potential future losses on the current and future portfolios, the economic value of the Fund was estimated under alternative economic scenarios. We began this analysis with a base-case scenario. The base-case economic scenario is extracted from the August 2009 forecast of the U.S. economy published by IHS Global Insight. The economic factors of the IHS Global Insight forecast used in our analysis are:

- FHFA national housing price index
- Ten-year Treasury rate
- One-year Treasury rate
- Commitment rate on 30-year fixed-rate mortgages

Data used in the base-case scenario are summarized in Exhibit D-1. The economic factors forecasted by IHS Global Insight are available from FY 2009 through FY 2019.

**Exhibit D-1**

<b>Economic Forecast (Base-Case Scenario)</b>				
<b>Fiscal Year</b>	<b>FHFA National Housing Price Index</b>	<b>10-Year Treasury Rate (%)</b>	<b>1-Year Treasury Rate (%)</b>	<b>Commitment Rate on 30-Year Fixed- Rate (%)</b>
2009	358.8	3.34	0.55	5.16
2010	336.0	3.79	0.95	5.33
2011	336.3	3.92	2.48	5.51
2012	342.9	4.50	3.62	6.12
2013	354.5	4.81	3.94	6.43
2014	367.0	5.49	4.84	7.11
2015	385.8	5.49	4.85	7.11
2016	401.7	5.49	4.85	7.11
2017	423.8	5.49	4.85	7.11
2018	447.6	5.49	4.85	7.11
2019	472.3	5.49	4.85	7.11



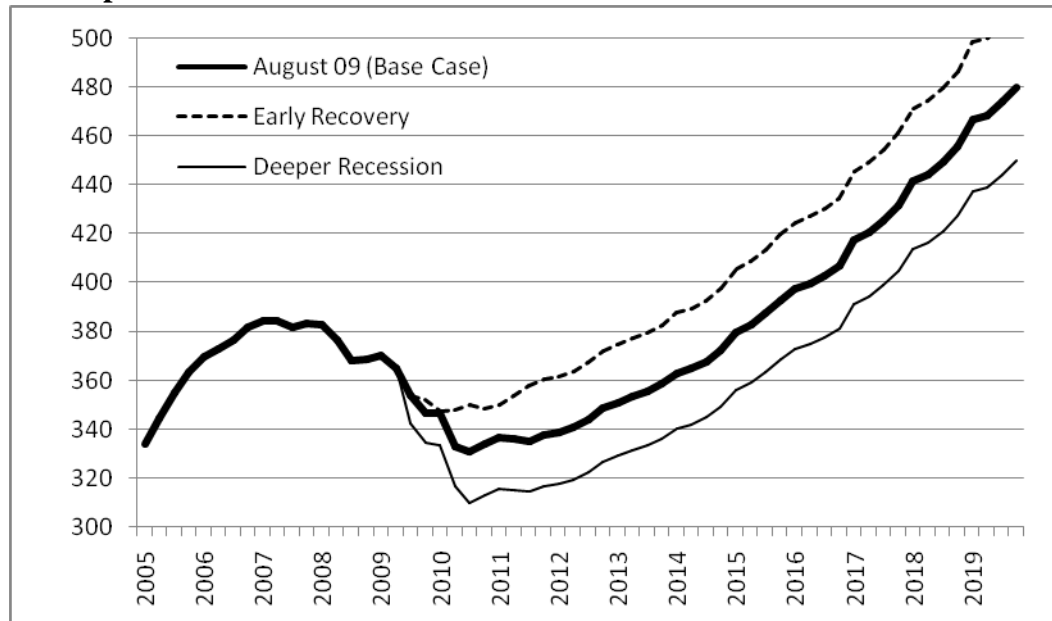
### Alternative Economic Scenarios

To conduct sensitivity analysis of the Fund's economic value, five alternative scenarios were used to assess the financial viability of the Fund. The selected scenarios are summarized as follows:

1. **Deeper Housing Recession Scenario** – We assumed that the national house price growth rates during the remainder of FY 2009 and FY 2010 follow the July 2009 IHS Global Insight more pessimistic short-term forecast, and then return to the more pessimistic long-term base-case levels starting FY 2011.
2. **Up-Interest-Rate Shock Scenario** – We assumed that all three interest rates are 300 basis points higher than in the IHS Global Insight forecast for FY 2010 through FY 2012, and then they return to the base-case levels in FY 2013. The OMB discount rates used to compute the present values are similarly changed.
3. **Down-Interest-Rate Shock Scenario** – This is the opposite of the up-interest-rate shock. We assumed a 300 basis point downward shock to the three projected interest rates. None of the rates were allowed to go below zero. This is the most severe scenario analyzed in this Review.
4. **Higher Loss Severity Rates Scenario** – We assumed that loss severity rates on claimed mortgages were 5 percentage points higher than the base-case level. Note that this alternative scenario is based on the same forecasted variables as the base-case scenario. In other words, this sensitivity analysis examines the marginal impact of a change in loss severity rates.
5. **Earlier Onset of Recovery Scenario** – We assumed that the national house price growth rates follow the base-case scenario through the end of FY 2009, and then switch to last year's base-case scenario. This scenario portrays the housing recession reaching its bottom at the end of FY 2009 and the recovery starting in FY 2010.

Exhibit D-2 shows the future movements of the national house price index assumed under different house price scenarios. The figure shows clearly the difference among the three scenarios depends on the severity and duration of the housing recession. Under the optimistic scenario, house prices will return to their pre-recession level by FY 2013. Under the pessimistic scenario, house prices will not return to their pre-recession level until the end of FY 2016. The projected performance of the Fund in response to the selected scenarios listed above is provided in Section V of this Review.



**Exhibit D-2****Assumptions of the Future National House Price Index in Different Scenarios**



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## Appendix E: Loss Severity Model

One of the primary sources of variation in the MMI Fund performance has been the loss severity experienced on loans that result in claims. This loss, when expressed as a percentage of the remaining unpaid principal balance at the claim date, is referred to as the “loss rate” or the “loss severity rate.”<sup>1</sup> This appendix describes the technical details of the loss severity model used for the FY 2009 Review. Prior Reviews used fixed loss severity rates, while the rates used in this Review vary by loan and economic circumstances, as well as by a number of other factors. Section I of this appendix summarizes the model specification and estimation approach, Section II describes explanatory variables used in this model and Section III presents the multiple regression estimation results.

### I. Model Specification and Estimation Approach

To help understand our approach, it is illustrative to consider the process that occurs prior to a claim payment by FHA. When mortgagees miss a monthly payment, they are considered delinquent. If the delinquency persists for 60 days, the mortgage is in default and the lender may initiate foreclosure proceedings. We first describe the process used when foreclosure is pursued and completed. FHA currently offers and encourages alternatives to foreclosure, and we discuss these next.

Once foreclosure is completed, FHA makes a payment to the lender to settle the claim and acquires the underlying property. The claim payment FHA makes to the lender, known as the “acquisition cost,” consists of three components: the remaining principal balance of the loan; the foregone interest lost by the lender as a result of the loan default; and legal and administrative costs associated with foreclosure, including any expenses associated with the cost of repairing or maintaining the property prior to conveyance. The acquisition cost can be expressed as:

$$\text{Acquisition Cost} = \text{Unpaid Principal Balance} + \text{Foregone Interest} + \text{Foreclosure Expense}$$

Following acquisition, FHA attempts to sell the property, sometimes at a reduced price in order to assist low-income prospective homebuyers in obtaining a home. During the time in which the property is held by FHA, but not yet sold, FHA incurs various costs and incurs several cash outflows in preparation for selling the property. Outflows include any taxes, repairs and maintenance on the property, and inflows include rental income and other types of income. The net effect of these cash flows is called the “holding cost.” Upon sale, FHA receives the sales

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<sup>1</sup> This definition is different from HUD’s definition, which uses the acquisition cost as the denominator of the loss rate.



price less any sales expense. In sum, the loss amount is the total amount that FHA loses on the mortgage:

$$\text{Loss Amount} = \text{Acquisition Cost} + \text{Holding Cost} - \text{Sales Price} + \text{Sales Expense}$$

In pre-foreclosure sales, the property is sold without the foreclosure process being completed or even started. Instead of acquiring the foreclosed house, FHA directly pays the loss amount claimed by the lender. The loss amount is reported as the acquisition cost to HUD.

The loss amount expressed as a percentage of the unpaid principal balance is referred to as the “loss rate” or “loss severity rate”:

$$\text{Loss Rate} = \frac{\text{Loss Amount}}{\text{Unpaid Principal Balance}}$$

Exhibit E-1 presents the overall loss severity rates over the sample period. The loss rate has been steadily increasing since FY 2003, due in large part to the overall deceleration in house price growth rates.

#### Exhibit E-1

Termination Year	Loss Rate	Termination Year	Loss Rate	Termination Year	Loss Rate
1981	55.24%	1991	46.65%	2001	33.98%
1982	46.08%	1992	46.18%	2002	31.68%
1983	44.27%	1993	45.26%	2003	32.66%
1984	48.91%	1994	45.49%	2004	35.60%
1985	47.62%	1995	45.81%	2005	38.71%
1986	48.61%	1996	45.65%	2006	42.46%
1987	51.21%	1997	45.31%	2007	50.15%
1988	51.11%	1998	44.37%	2008	56.87%
1989	48.87%	1999	42.48%		
1990	47.29%	2000	38.79%		

Exhibit E-2 shows the distribution of claimed loans among different claim types. Conveyance refers to the type of procedure discussed above, wherein the property is conveyed to HUD after foreclosure is completed. It is the most common type of claim. There was a significant volume of asset (non-performing loan) sales during the FY 2003 through FY 2006 time period. In these cases, the remaining foreclosure procedures or house sales were avoided by HUD. Asset Sales



have been ad hoc events, and as of today, there are no plans to conduct further asset sales in the foreseeable future, so we have not included them in our model estimation sample. Coinsurance and Without Conveyance have been miniscule and are also not included in our analysis. The stable pattern of pre-foreclosure sales suggests that they are likely to continue to be used as a form of claim settlement going forward. Consequently, the loss severity rate for our modeling is based only on the losses observed under the Conveyance and Pre-Foreclosure Sales categories. Implicitly, the model assumes the distribution between future conveyance and pre-foreclosure sales will remain stable and consistent with those observed over the last ten years.

### Exhibit E-2

Termination Year	Distribution of Terminations by Claim Type (Percent)				
	Conveyance	Assignment/ Asset Sales	Coinsurance	Without Conveyance	Pre-Foreclosure
1999	94.77	0.11	0.02	0.00	5.10
2000	94.94	0.08	0.01	0.00	4.96
2001	94.95	0.01	0.00	0.00	5.04
2002	94.27	0.00	0.00	0.00	5.73
2003	86.64	8.40	0.00	0.00	4.96
2004	85.50	8.45	0.00	0.00	6.05
2005	83.22	9.84	0.00	0.00	6.94
2006	89.34	2.84	0.00	0.00	7.82
2007	92.79	0.00	0.00	0.00	7.21
2008	93.13	0.00	0.00	0.06	6.81

### A. Specification of the Loss Severity Model

As described above, there are many components of the loss amount, and each component can be influenced by several factors. For example, forgone interest depends on the interest rate of the mortgage and the length of the default-to-claim lag. Foreclosure expenses can vary by whether a judicial foreclosure process is used, which varies by state. Repair expenses may be a function of the character of the mortgagees, which we proxy by the credit score. Sales prices are influenced by the housing market conditions during the default period as well as the house price appreciation rate leading up to the default. Several components of the loss amount involve expenses that are fixed per foreclosed property, so loans with smaller unpaid principal balances are more likely to realize higher loss rates.

We estimated the loss rate as a function of all these potentially explanatory factors. In contrast to the claim and prepayment rate modeling, the loss rate here is not bounded between zero and one. It can be more than one hundred percent if the loss amount is more than the unpaid principal



balance; it can also be less than zero if the sales price of the house is more than enough to cover the unpaid principal balance and all associated costs to HUD. The loss rate appears to be a smooth and continuous function. As a result, the ordinary least squares (OLS) linear regression model is an appropriate method of estimating the loss rate model. The regression model takes the following form:

$$\text{Loss Rate}_i = f(X_i) + \varepsilon_i$$

where  $\text{Loss Rate}_i$  is the realized loss rate of claim  $i$ ,  $X_i$  includes all explanatory factors for claim  $i$ , and  $\varepsilon_i$  is the usual error term.

## B. Sampling Approach

The sample used to estimate the loss severity model for the FY 2009 Review consists of claimed loans under the categories conveyance and pre-foreclosure sales with loan-level data from the FHA single-family data warehouse. This produced the sample originated between the first quarter of FY 1975 to the fourth quarter of FY 2008. However, there have been substantial changes made to the FHA loss recovery policies over time. To focus on the policy environment most relevant going forward, our analysis used the sample with termination years over the FY 1999 through FY 2008 period. The claim data during this period is more stable, with completed data for which all the elements of cost have been recorded. Many of the loans terminated in FY 2009 have not yet been resolved, so the full loss rate has not yet been reported. Thus, loans with claims in FY 2009 are excluded from the estimation sample. We also excluded the data missing the date on which HUD-owned property was sold or disposed of, except for pre-foreclosure sales. The final sample used for estimation includes 596,493 loans claimed over these past 10 years, which includes 93.7 percent of the total of the claims over this period.

## II. Explanatory Variables

For the claim and prepayment models described in Appendix A, there are four main categories of explanatory variables:

1. Fixed initial loan characteristics, including mortgage product type, origination year, original loan-to value (LTV) ratio, original loan amount;
2. Fixed initial borrower characteristics, including borrower credit scores and indicators of the source of downpayment assistance;



3. Dynamic variables based entirely on loan information, including mortgage age, scheduled amortization of the loan balance, current loan-to-value; and
4. Dynamic variables derived by combining loan information with external economic data, including house price appreciation rates.

Exhibit E-3 summarizes the explanatory variables that were used in the loss severity model. All variables are 0-1 dummy variables, with one of a given set of dummy variables omitted during estimation, called the baseline category. Most of the variables are the same as those used in the claim and prepayment models, including refinance, source of downpayment assistance, judicial foreclosure process, loan age, mortgage type, borrower credit scores, original LTV, origination year, termination year, yield curve slope, and loan size. Only the current loan-to-value ratio and the foreclosure-period house price appreciation rate are newly created variables for the loss severity model. The specifications of these two variables are now described.

#### *Current Loan-to-Value Ratio (CLTV)*

CLTV is calculated from the initial LTV by updating the underlying property value with state-level house price indices. CLTV has significant explanatory power for estimating the loss rate.

#### *House Price Appreciation Rate*

The house price appreciation rate is the appreciation rate by state over the foreclosure period, between default and disposition. This indicator is highly related to the sale price when FHA disposes the property. In a declining (buoyant) house market, the FHA loss rate is relatively high (low). By industrial experience, we assume the foreclosure process (from default to claim) takes 4 quarters, and the period the real estate is owned by FHA (from claim to disposition) is 4 quarters as well. Thus, the appreciation is measured over 8 quarters, centered on the claim date.

### **Exhibit E-3**

Variable Name	Value	Description
Refinance		
refinance_cat_1	Not Refinance Loan	Indicates whether the loan purpose was for refinancing
refinance_cat_2	Refinance Loan	
Judicial		
judicial_cat_1	Not Judicial	Indicates whether the default process was judicial or not.
judicial_cat_2	Judicial	



Variable Name	Value	Description
Downpayment Source		
Nonprofit	Non-profit gift	Indicates whether borrower received a non-profit gift.
Unicon		
Unicon	Loan is member of Unicon sample	Source of the FICO score taken from archives, not the historical sampling at the time of the application.
Age		
age1	X <= 3	Quarterly age of the loans.
age2	3 < X <= 7	
age3	7 < X <= 11	
age4	11 < X <= 15	
age5	15 < X <= 19	
age6	19 < X <= 23	
age7	23 < X <= 27	
age8	27 < X <= 31	
age9	31 < X <= 35	
age10	35 < X <= 39	
age11	39 < X	
Loan Type		
loan_type_1	30-year FRM	
loan_type_2	15-year FRM	
loan_type_3	ARM	
loan_type_4	30-year SR FRM	
loan_type_5	15-year SR FRM	
loan_type_6	SR ARM	
Credit Score		
fico_000	Missing	Borrower FICO scores obtained from sample data for FY 1992-2004 originations. Complete data on FHA FICO scores is available from FY 2004.
fico_300_499	300 <= X < 499	
fico_500_559	500 <= X < 559	
fico_560_599	560 <= X < 599	



Variable Name	Value	Description
fico_600_639	600 <= X < 639	
fico_640_659	640 <= X < 659	
fico_660_679	660 <= X < 679	
fico_680_719	680 <= X < 719	
fico_720_850	720 <= X <= 850	
fico_999	Not Collected	
LTV		
ltvcat_cat_1	X < 80	Loan-to-value at origination. Missing LTV values for SR product types are replaced by mean LTV by state, origination FY, and corresponding non-SR product types.
ltvcat_cat_2	80 <= X < 90	
ltvcat_cat_3	90 <= X < 95	
ltvcat_cat_4	95 <= X < 97	
ltvcat_cat_5	97 <= X	
CLTV		
cltv_1	X < 60	Current loan-to-value at the claim date. House price is updated by state house price indices.
cltv_2	60 <= X < 70	
cltv_3	70 <= X < 80	
cltv_4	80 <= X < 90	
cltv_5	90 <= X < 100	
cltv_6	X >= 100	
HPA		
hpa4_1	X < -0.12	State-level house price appreciation rate during the 8 quarters surrounding the termination date.
hpa4_2	-0.12<= X < -0.08	
hpa4_3	-0.08 <= X < -0.04	
hpa4_4	-0.04 <= X < 0	
hpa4_5	0 <= X < 0.04	
hpa4_6	0.04 <= X < 0.08	
hpa4_7	0.08 <= X < 0.12	
hpa4_8	0.12 <= X < 0.16	
hpa4_9	0.16 <= X	
Begin Amortization Year		
fy_1975_1986_cat_1	X >= 1986	Pre-FY 1986 Q3 origination prior to changes



Variable Name	Value	Description
fy_1975_1986_cat_2	X < 1986	in FHA underwriting requirements. Prior to availability of credit score data.
fy_1986_1992_cat_1	1986 > X or 1992 <= X	Post-FY 1986 Q3 and pre-FY 1992 origination. After changes in FHA underwriting requirements. Prior to availability of sample credit score data.
fy_1986_1992_cat_2	1986 <= X < 1992	
fY_1996_XXXX_cat_1	X <= 1996	Post-FY1996 origination. After changes in FHA underwriting requirements. For SR loan products with no credit score data.
fY_1996_XXXX_cat_2	X > 1996	
Termination Year		
term_fy_2001_XXXX_cat_1	X <= 2001	Dummy variables based on termination year, with regime change after 2001.
term_fy_2001_XXXX_cat_2	X > 2001	
Yield Curve Slope		
yslopecat_cat_1	0 <= X <= 1	Yield curve slope measured as ratio of 10-year CMT to 1-year CMT rates.
yslopecat_cat_2	1 < X <= 1.2	
yslopecat_cat_3	1.2 < X <= 1.5	
yslopecat_cat_4	X > 1.5	
Loan Size		
loancat_cat_1	0 < X <= 60	Relative loan size measured as relative percentage of average size loan originated in the same state in the same year.
loancat_cat_2	60 < X <= 90	
loancat_cat_3	90 < X <= 110	
loancat_cat_4	110 < X <= 140	
loancat_cat_5	X > 140	



**III. Estimation Results**

Exhibit E-4 presents the statistics from estimating the linear loss severity rate model with OLS.

**Exhibit E-4**

Variable	Coefficient	Standard Error	t - statistic
refinance_cat_2	0.0678	0.0023	30.14
unicon	0.0462	0.0023	20.34
judicial_cat_2	0.1136	0.0008	135.12
nonprofit	0.0370	0.0015	25.12
yslopecat_cat_2	-0.0011	0.0012	-0.88
yslopecat_cat_3	-0.0283	0.0016	-17.71
yslopecat_cat_4	-0.0635	0.0012	-51.8
fy_1975_1985_cat_2	0.3755	0.0059	63.6
fy_1986_1991_cat_2	0.0787	0.0037	21.01
fy_1996_XXXX_cat_2	0.0073	0.0015	4.86
term_fy_2001_XXXX_cat_2	0.0329	0.0014	24.16
age2	0.0594	0.0055	10.85
age3	0.0936	0.0056	16.78
age4	0.1319	0.0057	23.33
age5	0.1687	0.0058	29.3
age6	0.2090	0.0059	35.71
age7	0.2528	0.0060	42.27
age8	0.2894	0.0061	47.13
age9	0.3298	0.0064	51.85
age10	0.3601	0.0066	54.25
age11	0.4611	0.0067	68.63
loan_type_2	0.1820	0.0053	34.31
loan_type_3	0.0156	0.0014	11.49
loan_type_4	-0.0893	0.0026	-34.18
loan_type_5	0.0597	0.0074	8.09
loan_type_6	-0.0675	0.0040	-16.88
fico_000	0.0526	0.0020	26.45
fico_300_499	0.0602	0.0037	16.45
fico_500_559	0.0370	0.0020	18.52
fico_560_599	0.0186	0.0019	9.92
fico_640_659	-0.0097	0.0025	-3.93
fico_660_679	-0.0121	0.0029	-4.17



Variable	Coefficient	Standard Error	t - statistic
fico_680_719	-0.0215	0.0029	-7.46
fico_720_850	-0.0214	0.0041	-5.29
fico_999	0.0607	0.0025	23.84
ltvcat_cat_2	-0.0103	0.0038	-2.73
ltvcat_cat_3	-0.0239	0.0037	-6.53
ltvcat_cat_4	-0.0329	0.0036	-9.03
ltvcat_cat_5	-0.0226	0.0036	-6.18
cltv_2	0.0936	0.0017	53.72
cltv_3	0.1979	0.0019	101.85
cltv_4	0.2741	0.0023	121.17
cltv_5	0.3107	0.0032	97.92
cltv_6	0.2151	0.0065	33.27
loancat_cat_2	-0.1926	0.0012	-157.07
loancat_cat_3	-0.2951	0.0013	-219.1
loancat_cat_4	-0.3483	0.0014	-251.31
loancat_cat_5	-0.3749	0.0018	-205.98
hpa4_2	-0.1027	0.0048	-21.3
hpa4_3	-0.1606	0.0045	-35.61
hpa4_4	-0.1883	0.0048	-39.09
hpa4_5	-0.2779	0.0044	-63.51
hpa4_6	-0.3601	0.0041	-87.38
hpa4_7	-0.3979	0.0041	-96.41
hpa4_8	-0.4006	0.0042	-95.18
hpa4_9	-0.4276	0.0042	-102.83
_cons	0.6013	0.0084	71.87
Summary Statistics			
Number of observations	596493		
Adjusted R-Square	0.2644		
F	3828.85		
Prob > F	0.0000		



Conditional Claim Rates    All Mortgages    by Credit Subsidy Endorsement Cohort																														
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1980	0.00	1.03	1.38	1.92	1.90	2.09	1.56	2.04	2.50	1.77	1.05	1.90	1.06	1.50	1.89	1.60	1.14	1.35	0.30	0.71	0.41	0.97	0.00	0.63	0.00	0.92	0.00	0.00	0.00	0.04
1981	0.07	1.79	3.67	4.08	4.13	3.90	3.16	3.78	4.40	2.99	2.10	0.89	3.44	1.66	2.10	1.21	2.77	0.82	0.92	1.24	0.00	0.00	0.00	0.00	0.00	0.00	3.98	0.00	0.06	0.10
1982	0.18	2.34	4.38	6.57	6.01	6.90	9.35	8.17	5.53	3.33	3.88	3.54	5.55	7.71	2.14	2.51	3.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.12	0.11
1983	0.00	0.61	1.64	2.52	3.58	5.19	4.54	2.63	2.74	2.80	2.14	2.78	2.67	1.05	2.43	2.91	1.62	0.70	0.86	0.00	1.09	0.00	1.58	0.00	0.00	0.00	0.08	0.14	0.12	0.11
1984	0.00	1.28	2.68	5.31	7.97	5.49	4.34	3.50	2.75	2.48	2.46	0.93	0.72	1.13	0.88	1.73	1.31	2.96	0.78	0.00	0.96	1.01	0.00	0.00	0.00	0.09	0.16	0.13	0.12	0.10
1985	0.00	0.71	2.82	5.09	5.33	3.79	2.77	4.19	3.02	2.61	3.20	1.26	2.51	1.29	1.16	0.88	0.00	1.21	0.00	0.00	0.82	1.73	0.00	0.00	0.11	0.19	0.17	0.15	0.13	0.11
1986	0.00	0.45	1.70	2.04	1.84	1.77	1.54	1.46	1.47	1.77	2.16	1.11	1.08	1.11	1.53	0.61	0.22	0.29	0.49	0.00	0.00	0.26	0.29	0.09	0.14	0.12	0.11	0.09	0.07	0.06
1987	0.00	0.32	1.08	1.17	1.28	1.20	1.20	1.32	1.15	1.06	1.10	1.05	1.10	0.88	0.54	0.31	0.70	0.38	0.24	0.25	0.06	0.00	0.25	0.14	0.13	0.11	0.09	0.07	0.05	0.04
1988	0.02	0.56	1.08	1.59	2.02	1.42	1.77	2.39	1.99	1.62	1.28	0.88	0.76	0.62	0.57	1.12	0.84	0.24	0.31	1.27	0.36	0.11	0.17	0.14	0.13	0.11	0.08	0.07	0.05	0.05
1989	0.04	0.44	1.32	1.51	2.04	2.41	2.81	1.93	1.85	1.83	0.91	1.23	0.72	0.67	0.66	0.25	0.82	1.17	0.01	0.39	0.12	0.20	0.17	0.16	0.13	0.10	0.08	0.06	0.05	0.04
1990	0.00	0.35	1.30	1.78	1.84	2.19	2.29	1.89	1.85	1.35	2.06	1.06	1.28	1.22	0.92	0.36	0.66	0.79	0.44	0.14	0.25	0.21	0.19	0.15	0.11	0.09	0.07	0.06	0.05	0.04
1991	0.02	0.26	1.06	1.58	2.65	2.06	1.68	2.05	1.41	0.97	0.89	0.46	0.76	1.94	0.03	0.80	0.50	0.55	1.31	0.28	0.24	0.21	0.17	0.12	0.09	0.07	0.06	0.05	0.04	0.04
1992	0.00	0.27	0.93	0.79	1.36	1.87	1.19	1.21	1.17	0.74	0.63	0.43	0.52	1.81	0.23	0.88	0.18	0.35	0.29	0.25	0.21	0.17	0.12	0.09	0.07	0.06	0.05	0.04	0.04	0.03
1993	0.00	0.16	0.65	0.86	1.12	1.34	1.16	0.90	0.69	0.47	0.20	0.67	0.55	0.18	0.49	0.50	0.24	0.31	0.28	0.24	0.18	0.12	0.09	0.06	0.06	0.05	0.04	0.04	0.03	0.03
1994	0.00	0.24	0.74	1.32	1.49	1.70	1.52	0.75	0.66	0.66	0.58	1.22	0.11	0.10	0.66	0.22	0.32	0.30	0.25	0.19	0.12	0.09	0.07	0.06	0.05	0.05	0.04	0.03	0.03	0.03
1995	0.04	0.24	1.39	2.09	2.49	2.02	1.64	1.80	1.74	1.51	1.69	0.95	1.47	0.79	0.30	0.40	0.36	0.30	0.23	0.16	0.12	0.09	0.08	0.06	0.05	0.04	0.04	0.03	0.03	0.02
1996	0.00	0.40	1.26	2.03	2.66	1.60	1.27	1.74	1.26	1.37	1.30	0.83	1.23	0.93	0.70	0.65	0.56	0.42	0.28	0.21	0.15	0.13	0.11	0.09	0.08	0.07	0.06	0.05	0.04	0.03
1997	0.00	0.47	1.63	2.39	1.83	2.17	2.13	2.36	1.08	1.40	1.32	1.56	0.97	0.88	0.76	0.63	0.49	0.34	0.25	0.18	0.15	0.13	0.11	0.09	0.07	0.06	0.05	0.04	0.04	0.03
1998	0.01	0.31	1.25	1.21	1.37	1.93	2.17	1.83	1.86	0.67	1.27	0.63	0.92	0.87	0.71	0.51	0.33	0.24	0.18	0.15	0.13	0.11	0.09	0.08	0.06	0.05	0.05	0.04	0.03	0.03
1999	0.00	0.34	0.91	1.27	2.07	2.29	2.12	1.25	1.39	1.05	0.94	1.01	0.98	0.79	0.54	0.34	0.25	0.20	0.16	0.14	0.12	0.10	0.09	0.07	0.06	0.05	0.04	0.04	0.03	0.03
2000	0.02	0.58	2.00	3.90	5.07	4.01	4.06	4.12	2.97	1.62	2.13	1.91	1.58	1.12	0.74	0.53	0.38	0.32	0.26	0.22	0.18	0.15	0.13	0.11	0.09	0.08	0.06	0.05	0.04	0.04
2001	0.00	0.40	1.97	4.04	3.64	2.76	2.69	2.16	2.44	2.47	2.44	1.98	1.30	0.75	0.48	0.34	0.29	0.24	0.20	0.17	0.14	0.12	0.10	0.09	0.07	0.06	0.05	0.04	0.04	0.03
2002	0.01	0.51	2.27	2.83	2.10	2.79	1.69	2.37	2.35	2.52	2.00	1.25	0.69	0.46	0.34	0.28	0.24	0.20	0.17	0.14	0.12	0.10	0.09	0.07	0.06	0.05	0.05	0.04	0.03	0.03
2003	0.01	0.68	1.39	1.37	1.73	1.55	1.65	2.04	2.14	1.71	1.07	0.61	0.45	0.33	0.26	0.23	0.20	0.17	0.15	0.13	0.11	0.09	0.08	0.07	0.06	0.05	0.05	0.04	0.03	0.03
2004	0.13	0.90	1.33	1.54	1.99	2.41	2.66	2.66	2.07	1.39	0.82	0.59	0.43	0.32	0.26	0.23	0.20	0.17	0.14	0.12	0.10	0.09	0.08	0.07	0.06	0.05	0.04	0.04	0.03	0.03
2005	0.15	0.79	2.13	3.09	3.84	5.81	5.79	4.39	2.90	1.74	1.25	0.90	0.65	0.46	0.35	0.29	0.25	0.21	0.17	0.15	0.12	0.10	0.09	0.07	0.06	0.05	0.05	0.04	0.03	0.03
2006	0.00	0.67	2.28	3.73	6.93	7.73	6.23	4.06	2.33	1.70	1.24	0.91	0.62	0.44	0.34	0.27	0.22	0.18	0.15	0.13	0.11	0.09	0.08	0.06	0.05	0.05	0.04	0.03	0.03	0.02
2007	0.04	0.91	3.92	8.38	10.22	9.13	6.35	3.67	2.57	1.91	1.44	1.04	0.71	0.50	0.38	0.31	0.25	0.21	0.17	0.14	0.12	0.10	0.09	0.07	0.06	0.05	0.04	0.04	0.03	0.03
2008	0.02	1.14	4.74	7.27	7.16	5.53	3.43	2.30	1.70	1.32	0.97	0.69	0.47	0.34	0.27	0.22	0.19	0.16	0.13	0.11	0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02
2009	0.07	1.22	3.25	3.82	3.30	2.04	1.34	1.03	0.79	0.59	0.39	0.27	0.21	0.18	0.15	0.13	0.12	0.10	0.09	0.07	0.06	0.06	0.05	0.04	0.04	0.03	0.03	0.02	0.02	0.02
2010	0.06	0.92	2.21	2.07	1.48	1.15	0.88	0.67	0.46	0.35	0.29	0.25	0.21	0.18	0.16	0.14	0.12	0.10	0.09	0.08	0.07	0.06	0.05	0.04	0.04	0.03	0.03	0.03	0.02	0.02
2011	0.05	0.67	1.56	1.49	1.28	1.06	0.82	0.57	0.45	0.40	0.34	0.29	0.24	0.21	0.18	0.15	0.13	0.11	0.09	0.08	0.07	0.06	0.05	0.04	0.04	0.03	0.03	0.02	0.02	0.02
2012	0.05	0.64	1.35	1.47	1.34	1.14	0.81	0.62	0.53	0.47	0.40	0.34	0.28	0.24	0.20	0.17	0.15	0.12	0.11	0.09	0.08	0.06	0.06	0.05	0.04	0.03	0.03	0.03	0.02	0.02
2013	0.05	0.65	1.60	1.88	1.78	1.43	1.05	0.85	0.72	0.63	0.54	0.45	0.38	0.32	0.27	0.23	0.20	0.17	0.14	0.12	0.10	0.09	0.07	0.06	0.05	0.05	0.04	0.03	0.03	0.03
2014	0.06	0.76	1.93	2.29	2.12	1.64	1.24	1.02	0.86	0.76	0.64	0.54	0.45	0.38	0.32	0.27	0.23	0.19	0.16	0.14	0.12	0.10	0.09	0.07	0.06	0.05	0.05	0.04	0.03	0.03
2015	0.05	0.75	1.89	2.20	2.01	1.56	1.22	1.02	0.88	0.76	0.64	0.54	0.45	0.38	0.32	0.27	0.23	0.19	0.16	0.14	0.12	0.10	0.09	0.07	0.06	0.05	0.05	0.04	0.03	0.03
2016	0.06	0.76	1.83	2.16	1.99	1.58	1.26	1.07	0.92</																					



Conditional Prepayment Rates			All Mortgages			by Credit Subsidy Endorsement Cohort																									
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
1980	0.63	0.86	0.51	2.11	2.35	2.71	9.04	14.11	8.92	6.61	6.59	8.75	14.17	18.84	19.43	10.08	14.55	8.36	15.53	11.70	13.03	13.81	12.28	13.60	18.45	13.95	19.81	13.79	7.85	14.95	
1981	0.26	0.53	8.39	6.17	5.85	20.69	23.26	10.34	8.63	9.24	8.14	14.30	13.80	19.14	10.06	12.07	11.81	10.56	24.76	12.34	16.49	12.13	17.49	18.35	6.08	22.89	4.41	4.82	13.75	16.99	
1982	0.45	19.59	13.14	14.52	32.59	28.31	14.32	7.69	11.18	10.86	13.77	11.92	22.40	2.16	8.89	17.18	25.20	17.55	15.64	18.58	22.98	31.03	14.26	0.00	33.36	24.97	0.00	9.84	17.33	15.97	
1983	0.27	1.21	2.43	18.01	28.51	11.37	9.12	11.37	12.49	23.34	25.31	24.89	11.00	14.26	15.16	18.69	21.73	16.27	10.27	13.50	15.88	14.90	9.52	5.33	13.18	0.00	18.49	18.76	17.44	14.14	
1984	0.14	1.56	18.12	23.80	10.51	8.79	9.36	9.54	16.44	18.21	22.91	12.63	9.18	11.97	13.95	11.42	9.18	3.65	8.67	8.74	5.92	4.24	8.89	7.21	0.00	10.69	18.90	17.57	14.25	14.00	
1985	0.37	11.01	22.95	10.15	8.80	10.97	13.91	21.95	25.72	26.13	9.63	12.97	9.40	15.03	13.43	10.19	5.82	8.66	11.05	4.70	5.82	7.17	1.00	0.04	11.38	18.54	17.20	13.95	13.71	11.58	
1986	0.62	3.70	3.01	3.04	4.81	5.97	14.12	26.45	25.62	8.29	11.40	10.36	17.31	18.31	11.12	12.57	16.19	19.60	16.90	12.20	11.87	6.07	4.06	9.83	15.98	14.80	11.95	11.76	10.14	10.01	
1987	0.29	1.03	1.90	3.08	3.42	8.73	19.79	20.94	7.51	10.73	9.48	16.02	17.66	11.67	13.53	19.63	24.54	16.19	12.34	14.81	8.18	6.24	11.30	16.15	14.89	12.07	11.89	9.46	9.42	9.49	
1988	0.46	1.49	3.28	4.57	13.27	26.18	25.67	8.89	12.35	10.29	15.14	18.55	11.98	15.01	14.50	20.84	15.73	10.54	13.46	6.98	5.20	10.66	15.51	14.32	11.69	11.55	9.48	9.35	9.24	9.05	
1989	0.45	1.81	4.04	14.47	27.74	27.53	8.35	12.53	10.55	16.85	20.47	10.00	11.79	16.84	20.17	18.48	13.69	16.16	6.49	3.69	10.45	16.43	15.21	12.45	12.37	9.55	9.45	9.45	9.28	9.10	
1990	0.41	2.16	9.67	29.03	28.58	8.97	12.85	11.65	17.11	21.11	12.04	13.51	20.64	21.00	18.39	11.51	16.12	9.17	4.92	11.68	16.84	15.62	12.81	12.59	10.00	10.02	9.96	9.78	9.58	9.40	
1991	0.34	5.19	25.08	29.07	7.81	13.68	11.69	20.19	20.72	10.21	13.75	21.02	25.40	21.63	15.32	19.95	7.35	6.75	10.81	16.86	15.56	12.83	12.67	9.62	9.54	9.47	9.24	9.05	8.85	8.67	
1992	0.52	8.27	17.21	7.36	11.98	11.64	19.51	21.35	11.64	17.71	24.21	32.68	21.88	20.75	19.05	12.20	9.38	14.02	19.73	18.01	14.97	14.78	10.05	9.97	9.99	9.74	9.50	9.26	9.04	8.82	
1993	1.26	6.19	5.05	8.79	8.60	14.39	18.81	10.26	15.75	24.42	37.96	26.94	20.19	17.19	14.70	12.20	16.15	21.78	19.38	14.49	13.48	8.23	8.04	7.30	7.04	6.82	6.62	6.41	6.22	6.03	
1994	1.00	2.89	6.71	7.73	12.95	15.72	9.63	14.93	23.34	33.71	27.01	21.25	18.24	14.72	12.99	17.46	21.28	18.79	13.17	12.14	7.16	6.79	5.97	5.70	5.48	5.29	5.11	4.93	4.75	4.59	
1995	1.46	8.52	8.95	19.70	20.00	10.47	16.24	21.88	30.69	25.30	19.40	20.49	14.84	8.19	16.20	23.27	21.07	16.68	16.04	10.61	10.32	9.95	9.70	9.48	9.26	9.07	8.89	8.69	8.50	8.32	
1996	0.63	4.17	16.78	18.43	9.78	16.69	22.80	33.80	26.38	20.64	16.35	14.96	9.49	18.76	27.24	24.50	18.46	17.39	10.56	10.19	9.51	9.24	9.00	8.76	8.54	8.36	8.16	7.96	7.77	7.58	
1997	0.89	13.25	21.74	10.55	20.29	22.16	33.35	25.81	20.74	17.77	12.19	9.83	19.14	27.04	24.53	19.38	18.57	11.42	11.10	10.62	10.33	10.08	9.83	9.59	9.36	9.13	8.92	8.71	8.52	8.32	
1998	1.78	9.06	7.01	15.89	21.55	37.31	29.45	22.43	18.58	15.01	10.01	21.36	29.27	26.30	18.63	17.02	9.31	8.47	7.33	7.08	6.90	6.72	6.55	6.39	6.24	6.10	5.96	5.82	5.69	5.56	
1999	0.89	3.60	11.76	20.34	36.03	29.91	23.73	19.36	13.89	9.19	20.74	29.48	26.42	17.62	15.90	8.68	7.59	6.40	6.13	5.96	5.80	5.64	5.48	5.33	5.18	5.06	4.93	4.80	4.68	4.56	
2000	0.99	24.95	32.72	35.49	28.05	23.99	18.62	13.23	9.00	18.85	26.74	24.43	19.58	19.44	12.88	12.65	12.42	12.14	11.88	11.63	11.40	11.15	10.90	10.67	10.43	10.21	9.99	9.78	9.58	9.37	
2001	4.95	19.36	41.80	31.32	26.04	20.68	14.07	8.43	20.64	28.15	24.84	17.48	16.48	9.64	9.14	8.10	7.75	7.57	7.38	7.19	7.01	6.82	6.64	6.47	6.30	6.15	6.00	5.85	5.71	5.57	
2002	3.91	34.06	28.43	24.23	18.33	14.16	9.23	21.12	27.86	23.81	15.25	13.91	8.01	7.39	6.16	5.77	5.51	5.37	5.23	5.10	4.97	4.84	4.72	4.60	4.48	4.37	4.27	4.17	4.07	3.97	
2003	9.59	19.52	22.76	16.80	12.04	8.81	16.24	21.38	18.08	9.94	8.32	5.63	5.34	5.01	5.01	4.51	4.20	4.07	3.96	3.84	3.74	3.63	3.53	3.42	3.33	3.24	3.16	3.07	2.99	2.92	
2004	6.40	18.15	15.11	11.94	7.92	13.91	16.75	14.33	8.27	7.25	5.16	5.11	5.04	5.12	5.03	4.51	4.31	4.18	4.06	3.93	3.83	3.72	3.60	3.50	3.40	3.32	3.23	3.14	3.05	2.68	
2005	8.20	13.34	12.23	9.20	16.24	17.93	15.03	8.59	7.53	5.18	5.19	5.13	5.40	5.63	5.64	5.35	5.15	5.01	4.88	4.75	4.63	4.51	4.39	4.28	4.16	4.08	3.98	3.88	3.78	3.54	
2006	1.09	6.95	8.15	15.64	16.09	13.06	7.20	6.08	3.90	3.84	3.53	3.79	4.13	4.36	4.43	4.33	4.23	4.15	4.07	3.99	3.91	3.83	3.75	3.67	3.59	3.52	3.45	3.38	3.31	3.24	
2007	1.25	9.86	17.22	17.12	14.74	7.69	6.19	3.76	3.75	3.27	3.44	3.74	4.13	4.36	4.42	4.35	4.26	4.20	4.12	4.04	3.96	3.88	3.80	3.73	3.65	3.58	3.51	3.44	3.37	3.30	
2008	1.91	16.63	15.95	14.24	7.80	5.81	3.60	3.67	3.41	3.56	3.79	4.15	4.53	4.66	4.67	4.56	4.43	4.34	4.25	4.16	4.07	3.99	3.90	3.82	3.74	3.67	3.59	3.52	3.45	3.38	
2009	2.40	8.31	9.10	5.46	4.68	3.21	3.48	3.61	3.70	3.83	4.30	4.51	4.48	4.37	4.25	4.07	3.92	3.80	3.69	3.58	3.48	3.38	3.29	3.20	3.11	3.03	2.95	2.87	2.79	2.72	
2010	2.24	7.28	6.34	6.40	4.83	4.68	4.51	4.72	5.12	5.15	5.01	4.86	4.71	4.57	4.43	4.25	4.07	3.95	3.82	3.70	3.59	3.48	3.37	3.27	3.18	3.08	2.99	2.91	2.83	2.75	
2011	2.30	5.65	7.53	5.33	5.15	4.59	4.82	5.19	5.11	4.88	4.72	4.59	4.46	4.34	4.22	4.05	3.91	3.79	3.69	3.58	3.48	3.38	3.29	3.20	3.12	3.03	2.95	2.88	2.80	2.73	
2012	1.80	6.80	6.31	6.35	5.76	5.61	6.08	6.10	5.88	5.60	5.44	5.30	5.16	5.04	4.91	4.74	4.59	4.47	4.36	4.25	4.14	4.04	3.94	3.84	3.75	3.66	3.57	3.48	3.40	3.32	
2013	1.88	4.90																													



Cumulative Claim Rates			All Mortgages																												
			by Credit Subsidy Endorsement Cohort																												
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
1980	0.00	1.03	2.38	4.21	5.96	7.79	9.10	10.62	12.19	13.17	13.71	14.60	15.04	15.58	16.12	16.47	16.70	16.92	16.97	17.06	17.10	17.20	17.20	17.24	17.24	17.29	17.29	17.29	17.29	17.29	
1981	0.07	1.85	5.41	8.91	12.08	14.78	16.43	17.88	19.33	20.19	20.71	20.92	21.57	21.84	22.10	22.23	22.50	22.56	22.63	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.76	22.76	22.76	22.76	22.77
1982	0.18	2.50	5.90	10.10	13.14	15.28	17.15	18.41	19.12	19.48	19.83	20.10	20.46	20.82	20.91	21.00	21.09	21.09	21.09	21.09	21.09	21.09	21.09	21.09	21.09	21.09	21.09	21.09	21.09	21.09	21.09
1983	0.00	0.61	2.21	4.58	7.25	9.88	11.80	12.76	13.62	14.37	14.79	15.19	15.46	15.56	15.74	15.92	16.00	16.02	16.05	16.05	16.08	16.08	16.10	16.10	16.10	16.10	16.10	16.10	16.11	16.11	16.11
1984	0.00	1.28	3.89	7.96	12.30	14.74	16.40	17.55	18.33	18.91	19.36	19.48	19.57	19.69	19.77	19.91	20.00	20.18	20.22	20.22	20.27	20.31	20.31	20.31	20.31	20.31	20.31	20.32	20.32	20.33	20.33
1985	0.00	0.70	3.18	6.51	9.46	11.26	12.38	13.79	14.55	15.01	15.41	15.55	15.79	15.90	15.98	16.03	16.03	16.09	16.09	16.09	16.12	16.18	16.18	16.18	16.18	16.19	16.19	16.20	16.20	16.20	16.20
1986	0.00	0.44	2.07	3.92	5.50	6.93	8.07	8.98	9.64	10.23	10.86	11.15	11.39	11.60	11.82	11.90	11.93	11.96	11.99	11.99	11.99	12.00	12.02	12.02	12.03	12.03	12.03	12.03	12.04	12.04	12.04
1987	0.00	0.32	1.38	2.50	3.67	4.72	5.66	6.48	7.03	7.50	7.92	8.28	8.60	8.81	8.92	8.97	9.07	9.11	9.13	9.15	9.15	9.15	9.17	9.18	9.18	9.18	9.19	9.19	9.19	9.19	9.19
1988	0.02	0.58	1.63	3.11	4.88	5.93	6.88	7.82	8.50	8.98	9.31	9.51	9.64	9.73	9.81	9.93	10.00	10.02	10.04	10.11	10.13	10.13	10.14	10.14	10.15	10.15	10.15	10.16	10.16	10.16	10.16
1989	0.04	0.48	1.76	3.15	4.73	6.04	7.11	7.76	8.30	8.76	8.95	9.15	9.25	9.34	9.41	9.43	9.48	9.55	9.55	9.56	9.57	9.58	9.58	9.59	9.59	9.59	9.59	9.59	9.59	9.60	9.60
1990	0.00	0.35	1.62	3.15	4.25	5.17	6.01	6.61	7.11	7.40	7.76	7.91	8.07	8.19	8.26	8.28	8.32	8.35	8.37	8.38	8.38	8.39	8.39	8.40	8.40	8.40	8.40	8.40	8.40	8.40	8.40
1991	0.02	0.28	1.28	2.37	3.65	4.54	5.15	5.80	6.15	6.33	6.48	6.55	6.63	6.80	6.80	6.84	6.86	6.89	6.93	6.94	6.95	6.95	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96
1992	0.00	0.27	1.12	1.70	2.63	3.74	4.35	4.85	5.21	5.42	5.56	5.63	5.69	5.85	5.86	5.91	5.92	5.94	5.95	5.95	5.96	5.96	5.96	5.97	5.97	5.97	5.97	5.97	5.97	5.97	5.97
1993	0.00	0.16	0.76	1.50	2.39	3.34	4.04	4.47	4.77	4.93	4.99	5.10	5.16	5.18	5.22	5.25	5.27	5.28	5.29	5.30	5.31	5.31	5.31	5.31	5.31	5.31	5.31	5.31	5.31	5.31	5.31
1994	0.00	0.24	0.95	2.12	3.32	4.49	5.36	5.74	6.02	6.23	6.36	6.54	6.56	6.57	6.62	6.64	6.66	6.67	6.68	6.69	6.69	6.69	6.69	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70
1995	0.04	0.27	1.52	3.21	4.78	5.76	6.46	7.09	7.56	7.83	8.05	8.15	8.27	8.33	8.35	8.37	8.38	8.39	8.40	8.40	8.40	8.40	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41
1996	0.00	0.40	1.60	3.17	4.81	5.68	6.24	6.83	7.10	7.32	7.47	7.56	7.66	7.73	7.77	7.80	7.82	7.83	7.84	7.84	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85
1997	0.00	0.47	1.86	3.43	4.47	5.44	6.15	6.66	6.83	7.00	7.13	7.27	7.34	7.39	7.43	7.45	7.46	7.47	7.47	7.47	7.48	7.48	7.48	7.48	7.48	7.48	7.48	7.48	7.48	7.48	7.48
1998	0.01	0.31	1.42	2.41	3.34	4.34	5.03	5.43	5.73	5.82	5.96	6.02	6.09	6.14	6.16	6.18	6.19	6.19	6.20	6.20	6.20	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21
1999	0.00	0.34	1.20	2.26	3.61	4.53	5.11	5.36	5.59	5.73	5.84	5.94	6.01	6.04	6.06	6.08	6.08	6.09	6.09	6.10	6.10	6.10	6.10	6.10	6.11	6.11	6.11	6.11	6.11	6.11	6.11
2000	0.02	0.60	2.08	3.95	5.43	6.21	6.78	7.23	7.50	7.63	7.76	7.85	7.90	7.93	7.94	7.95	7.96	7.96	7.96	7.97	7.97	7.97	7.97	7.97	7.97	7.97	7.97	7.97	7.97	7.97	7.97
2001	0.00	0.38	1.88	3.62	4.62	5.16	5.56	5.83	6.10	6.31	6.46	6.54	6.59	6.61	6.62	6.63	6.64	6.64	6.64	6.65	6.65	6.65	6.65	6.65	6.65	6.65	6.65	6.66	6.66	6.66	6.66
2002	0.01	0.50	1.93	3.16	3.83	4.53	4.89	5.33	5.67	5.92	6.07	6.14	6.18	6.20	6.22	6.23	6.24	6.24	6.25	6.25	6.26	6.26	6.26	6.26	6.27	6.27	6.27	6.27	6.27	6.27	6.27
2003	0.01	0.62	1.63	2.38	3.15	3.75	4.32	4.90	5.37	5.66	5.83	5.91	5.97	6.01	6.04	6.06	6.09	6.10	6.12	6.13	6.14	6.15	6.15	6.16	6.16	6.17	6.17	6.17	6.17	6.18	6.18
2004	0.13	0.96	1.97	2.94	4.03	5.22	6.32	7.20	7.77	8.11	8.30	8.42	8.51	8.57	8.62	8.66	8.69	8.71	8.73	8.75	8.77	8.78	8.79	8.80	8.80	8.81	8.81	8.82	8.82	8.82	8.82
2005	0.15	0.87	2.54	4.62	6.89	9.64	11.72	12.97	13.69	14.08	14.34	14.51	14.63	14.71	14.77	14.81	14.85	14.87	14.90	14.91	14.93	14.94	14.95	14.96	14.96	14.97	14.97	14.97	14.98	14.98	14.98
2006	0.00	0.67	2.75	5.80	10.38	14.31	16.81	18.22	18.95	19.45	19.80	20.04	20.19	20.30	20.38	20.44	20.48	20.52	20.55	20.57	20.59	20.60	20.62	20.63	20.63	20.64	20.65	20.65	20.65	20.65	20.66
2007	0.04	0.94	4.39	10.21	15.50	19.04	21.10	22.13	22.80	23.27	23.61	23.84	23.99	24.09	24.16	24.22	24.26	24.29	24.32	24.34	24.36	24.37	24.39	24.39	24.40	24.41	24.41	24.42	24.42	24.42	24.42
2008	0.02	1.14	4.96	9.61	13.21	15.57	16.87	17.67	18.24	18.65	18.94	19.14	19.26	19.35	19.42	19.47	19.51	19.54	19.57	19.59	19.61	19.62	19.63	19.64	19.65	19.66	19.66	19.67	19.67	19.67	19.67
2009	0.07	1.25	4.12	7.08	9.39	10.70	11.52	12.12	12.56	12.87	13.07	13.20	13.30	13.38	13.44	13.50	13.54	13.58	13.61	13.63	13.65	13.67	13.69	13.70	13.71	13.72	13.72	13.73	13.74	13.74	13.74
2010	0.06	0.96	2.94	4.64	5.75	6.56	7.15	7.57	7.84	8.03	8.19	8.31	8.41	8.49	8.56	8.61	8.66	8.70	8.73	8.76	8.78	8.80	8.81	8.83	8.84	8.85	8.86	8.86	8.87	8.87	8.87
2011	0.05	0.71	2.14	3.38	4.37	5.13	5.69	6.06	6.33	6.56	6.75	6.90	7.02	7.11	7.19	7.26	7.31	7.35	7.39	7.42	7.44	7.46	7.48	7.49	7.50						



Cumulative Prepayment Rates			All Mortgages			by Credit Subsidy Endorsement Cohort																													
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					
1980	0.63	1.48	1.97	3.99	6.14	8.52	16.09	26.65	32.24	35.92	39.27	43.39	49.34	56.05	61.56	63.81	66.68	68.07	70.40	71.88	73.32	74.64	75.65	76.62	77.75	78.45	79.29	79.77	80.00	80.40					
1981	0.26	0.79	8.96	14.25	18.74	33.06	45.19	49.16	52.01	54.65	56.70	59.93	62.58	65.61	66.87	68.20	69.33	70.20	71.99	72.65	73.42	73.89	74.49	75.00	75.14	75.64	75.71	75.78	75.98	76.20					
1982	0.45	19.92	30.11	39.40	55.86	64.64	67.51	68.69	70.14	71.30	72.57	73.48	74.92	75.01	75.39	76.02	76.77	77.15	77.42	77.70	77.98	78.27	78.36	78.36	78.54	78.63	78.63	78.66	78.70	78.74					
1983	0.27	1.47	3.85	20.77	42.06	47.82	51.68	55.83	59.75	65.97	70.94	74.49	75.63	76.90	78.04	79.21	80.27	80.87	81.19	81.56	81.94	82.24	82.40	82.48	82.67	82.67	82.89	83.08	83.22	83.32					
1984	0.14	1.70	19.28	37.57	43.29	47.19	50.75	53.89	58.58	62.79	66.98	68.71	69.79	71.06	72.36	73.25	73.88	74.11	74.60	75.05	75.33	75.52	75.89	76.16	76.16	76.54	77.14	77.58	77.88	78.13					
1985	0.37	11.34	31.52	38.15	43.02	48.24	53.87	61.28	67.69	72.33	73.55	74.98	75.87	77.12	78.06	78.67	78.98	79.41	79.91	80.09	80.32	80.57	80.60	80.61	80.97	81.50	81.89	82.16	82.39	82.55					
1986	0.62	4.30	7.17	9.93	14.08	18.87	29.35	45.90	57.46	60.19	63.56	66.21	70.13	73.51	75.17	76.81	78.63	80.48	81.76	82.52	83.17	83.47	83.65	84.08	84.70	85.18	85.52	85.81	86.02	86.22					
1987	0.29	1.32	3.18	6.12	9.25	16.86	32.38	45.35	48.97	53.69	57.37	62.93	68.01	70.74	73.51	76.96	80.41	82.12	83.20	84.33	84.87	85.24	85.87	86.67	87.29	87.72	88.09	88.34	88.58	88.79					
1988	0.46	1.94	5.14	9.40	21.01	40.41	54.18	57.65	61.91	64.95	68.90	72.94	75.04	77.34	79.22	81.50	82.85	83.60	84.46	84.85	85.11	85.62	86.28	86.79	87.15	87.46	87.69	87.89	88.07	88.23					
1989	0.45	2.24	6.18	19.50	40.96	55.91	59.09	63.32	66.37	70.64	74.86	76.48	78.17	80.29	82.38	83.90	84.81	85.74	86.04	86.20	86.65	87.27	87.75	88.08	88.37	88.56	88.74	88.90	89.04	89.16					
1990	0.41	2.56	11.95	37.04	54.13	57.86	62.61	66.27	70.91	75.55	77.60	79.58	82.16	84.21	85.61	86.32	87.19	87.60	87.80	88.25	88.81	89.25	89.55	89.81	89.99	90.15	90.30	90.42	90.54	90.64					
1991	0.34	5.52	29.15	49.37	53.14	59.05	63.30	69.67	74.75	76.70	79.04	82.08	84.97	86.78	87.77	88.85	89.17	89.44	89.83	90.38	90.80	91.08	91.33	91.50	91.64	91.78	91.89	92.00	92.09	92.17					
1992	0.52	8.75	24.41	29.89	38.08	44.99	54.99	63.67	67.33	72.19	77.61	83.11	85.58	87.39	88.68	89.34	89.79	90.39	91.11	91.64	92.00	92.30	92.48	92.63	92.77	92.90	93.00	93.10	93.18	93.26					
1993	1.26	7.36	12.03	19.69	26.47	36.71	47.98	52.90	59.62	68.32	78.47	82.93	85.34	86.98	88.13	88.94	89.88	90.94	91.67	92.11	92.46	92.64	92.81	92.94	93.07	93.18	93.28	93.37	93.45	93.52					
1994	1.00	3.86	10.30	17.15	27.61	38.47	43.96	51.53	61.50	72.45	78.21	81.49	83.67	85.11	86.19	87.45	88.71	89.58	90.07	90.47	90.67	90.85	91.00	91.13	91.25	91.36	91.45	91.55	91.63	91.71					
1995	1.46	9.86	17.90	33.78	46.38	51.49	58.44	66.12	74.34	78.92	81.49	83.63	84.85	85.42	86.43	87.64	88.49	89.01	89.43	89.66	89.86	90.03	90.18	90.32	90.43	90.54	90.63	90.72	90.79	90.86					
1996	0.63	4.77	20.68	35.00	41.05	50.09	60.17	71.52	77.23	80.47	82.47	83.97	84.77	86.19	87.85	88.92	89.53	89.99	90.22	90.42	90.58	90.73	90.85	90.97	91.07	91.16	91.24	91.31	91.38	91.44					
1997	0.89	14.02	32.61	39.52	51.10	60.94	72.15	77.75	80.99	83.15	84.35	85.19	86.63	88.26	89.33	89.96	90.44	90.68	90.89	91.06	91.21	91.34	91.46	91.56	91.65	91.73	91.80	91.86	91.92	91.97					
1998	1.78	10.68	16.92	29.90	44.48	63.95	73.29	78.15	81.20	83.16	84.26	86.35	88.59	89.99	90.71	91.24	91.48	91.68	91.83	91.97	92.10	92.21	92.32	92.41	92.50	92.58	92.65	92.72	92.78	92.83					
1999	0.89	4.46	15.66	32.57	56.05	68.12	74.61	78.54	80.77	82.03	84.57	87.39	89.15	90.01	90.64	90.92	91.15	91.33	91.49	91.63	91.76	91.88	91.99	92.09	92.19	92.27	92.35	92.43	92.50	92.56					
2000	0.99	25.68	49.80	66.88	75.06	79.74	82.36	83.79	84.60	86.09	87.77	88.86	89.51	90.01	90.28	90.50	90.69	90.86	91.00	91.12	91.22	91.31	91.39	91.46	91.52	91.57	91.62	91.66	91.69	91.72					
2001	4.95	23.35	55.23	68.67	75.88	79.91	82.01	83.06	85.35	87.76	89.23	89.98	90.56	90.83	91.07	91.25	91.42	91.56	91.70	91.82	91.92	92.02	92.11	92.19	92.26	92.33	92.39	92.45	92.50	92.54					
2002	3.91	36.64	54.51	65.07	70.89	74.47	76.41	80.36	84.34	86.72	87.85	88.69	89.11	89.45	89.72	89.96	90.17	90.36	90.54	90.70	90.85	90.99	91.12	91.24	91.35	91.46	91.56	91.65	91.73	91.81					
2003	9.59	27.24	43.65	52.85	58.24	61.64	67.26	73.34	77.27	79.00	80.27	81.06	81.75	82.37	82.95	83.45	83.89	84.30	84.68	85.03	85.36	85.67	85.96	86.23	86.48	86.72	86.94	87.16	87.36	87.54					
2004	6.40	23.37	34.81	42.36	46.69	53.54	60.45	65.21	67.49	69.29	70.45	71.54	72.55	73.52	74.42	75.18	75.88	76.52	77.12	77.68	78.20	78.68	79.14	79.56	79.95	80.33	80.68	81.01	81.32	81.58					
2005	8.20	20.43	30.05	36.25	45.85	54.32	59.74	62.19	64.06	65.21	66.29	67.28	68.27	69.23	70.13	70.94	71.67	72.35	72.97	73.55	74.08	74.58	75.04	75.47	75.87	76.24	76.59	76.92	77.22	77.50					
2006	1.09	7.96	15.40	28.20	38.83	45.46	48.36	50.47	51.70	52.82	53.80	54.80	55.84	56.89	57.90	58.84	59.71	60.54	61.31	62.03	62.71	63.35	63.95	64.52	65.05	65.56	66.03	66.48	66.91	67.31					
2007	1.25	10.98	26.15	38.04	45.67	48.65	50.65	51.71	52.69	53.49	54.29	55.12	55.99	56.87	57.71	58.50	59.23	59.93	60.58	61.19	61.76	62.30	62.81	63.29	63.74	64.16	64.56	64.94	65.30	65.64					
2008	1.91	18.22	31.08	40.19	44.10	46.58	47.94	49.23	50.36	51.48	52.61	53.79	55.02	56.22	57.36	58.42	59.40	60.31	61.17	61.97	62.72	63.42	64.08	64.71	65.29	65.84	66.36	66.86	67.32	67.76					
2009	2.40	10.50	18.53	22.76	26.04	28.12	30.25	32.35	34.40	36.43	38.61	40.79	42.85	44.77	46.55	48.18	49.68</																		



**Conditional Claim Rates    Fixed Rate 30 Year Mortgages    by Credit Subsidy Endorsement Cohort**

Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1980	0.00	1.04	1.38	1.92	1.90	2.09	1.55	2.03	2.50	1.77	1.06	1.90	1.07	1.51	1.90	1.61	1.14	1.35	0.30	0.71	0.41	0.97	0.00	0.63	0.00	0.92	0.00	0.00	0.00	0.04
1981	0.07	1.79	3.66	4.09	4.13	3.92	3.17	3.79	4.42	3.00	2.11	0.88	3.46	1.67	2.12	1.20	2.78	0.81	0.92	1.23	0.00	0.00	0.00	0.00	0.00	0.00	3.99	0.00	0.06	0.10
1982	0.18	2.34	4.39	6.59	6.05	6.98	9.46	8.28	5.63	3.39	3.96	3.61	5.71	8.00	2.22	2.50	3.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.12	0.11
1983	0.00	0.65	1.73	2.65	3.84	5.63	4.98	2.90	3.06	3.14	2.41	3.17	3.13	1.21	2.86	3.02	1.63	0.71	0.85	0.00	1.11	0.00	1.57	0.00	0.00	0.00	0.08	0.14	0.12	0.11
1984	0.00	1.34	2.81	5.63	8.48	5.89	4.69	3.82	2.99	2.72	2.70	1.00	0.77	1.28	0.99	1.72	1.32	2.94	0.79	0.00	0.95	1.02	0.00	0.00	0.00	0.09	0.16	0.13	0.12	0.10
1985	0.00	0.75	2.97	5.40	5.72	4.06	2.98	4.65	3.35	2.89	3.64	1.40	2.96	1.49	1.35	1.05	0.00	1.23	0.00	0.00	0.81	1.77	0.00	0.00	0.12	0.19	0.17	0.15	0.13	0.11
1986	0.00	0.48	1.84	2.19	1.97	1.91	1.66	1.59	1.60	1.98	2.46	1.25	1.19	1.25	1.74	0.69	0.22	0.27	0.50	0.00	0.00	0.27	0.29	0.09	0.14	0.12	0.11	0.09	0.07	0.06
1987	0.00	0.32	1.13	1.20	1.32	1.27	1.30	1.44	1.26	1.15	1.19	1.20	1.30	0.94	0.64	0.31	0.76	0.41	0.24	0.28	0.00	0.00	0.27	0.14	0.12	0.11	0.08	0.06	0.05	0.04
1988	0.02	0.56	1.02	1.57	2.03	1.40	1.85	2.63	2.19	1.72	1.35	0.90	0.79	0.65	0.61	1.25	0.92	0.28	0.31	1.44	0.39	0.10	0.17	0.15	0.13	0.11	0.09	0.07	0.06	0.05
1989	0.03	0.43	1.29	1.53	2.08	2.50	2.96	2.00	1.92	1.92	0.93	1.30	0.73	0.69	0.67	0.21	0.78	1.22	0.00	0.40	0.12	0.21	0.18	0.16	0.13	0.10	0.08	0.06	0.05	0.04
1990	0.00	0.35	1.33	1.82	1.88	2.27	2.36	1.97	1.88	1.41	2.14	1.12	1.31	1.31	0.97	0.30	0.67	0.81	0.45	0.14	0.25	0.21	0.19	0.15	0.11	0.09	0.07	0.06	0.05	0.04
1991	0.02	0.28	1.08	1.67	2.89	2.21	1.73	2.14	1.43	0.99	0.97	0.48	0.82	2.23	0.00	0.86	0.54	0.58	1.43	0.29	0.25	0.22	0.18	0.12	0.10	0.08	0.06	0.05	0.04	0.04
1992	0.00	0.31	1.11	0.72	1.45	1.95	1.01	1.22	1.15	0.83	0.72	0.39	0.61	2.62	0.29	1.31	0.20	0.41	0.32	0.27	0.24	0.18	0.13	0.09	0.07	0.06	0.05	0.04	0.03	0.03
1993	0.00	0.15	0.76	0.82	0.92	1.39	1.28	0.95	0.73	0.54	0.08	0.75	0.80	0.24	0.83	0.63	0.17	0.30	0.28	0.23	0.17	0.11	0.07	0.05	0.04	0.04	0.03	0.03	0.02	0.02
1994	0.00	0.23	0.67	1.33	1.53	2.10	2.22	0.83	0.84	0.92	0.87	2.45	0.07	0.09	1.30	0.17	0.30	0.29	0.24	0.17	0.11	0.08	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02
1995	0.05	0.18	1.32	1.87	2.21	1.79	1.64	1.87	1.76	1.55	1.93	1.05	1.78	0.84	0.24	0.43	0.38	0.32	0.25	0.16	0.12	0.09	0.08	0.06	0.05	0.04	0.04	0.03	0.03	0.02
1996	0.00	0.41	1.14	1.84	2.73	1.60	1.19	1.76	1.32	1.59	1.49	0.92	1.38	1.00	0.74	0.67	0.57	0.42	0.28	0.20	0.15	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03	0.03
1997	0.00	0.50	1.58	2.14	1.54	1.96	1.85	2.41	0.92	1.48	1.44	1.55	0.91	0.92	0.82	0.69	0.52	0.34	0.24	0.17	0.15	0.12	0.10	0.09	0.07	0.06	0.05	0.04	0.04	0.03
1998	0.01	0.28	1.29	1.24	1.39	2.04	2.33	2.00	2.09	0.69	1.46	0.58	0.99	0.95	0.77	0.53	0.32	0.23	0.17	0.14	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02
1999	0.00	0.39	1.04	1.45	2.41	2.64	2.50	1.44	1.60	1.20	1.04	1.11	1.07	0.87	0.59	0.35	0.25	0.19	0.16	0.13	0.11	0.09	0.08	0.06	0.05	0.05	0.04	0.03	0.03	0.02
2000	0.02	0.61	2.06	4.05	5.43	4.31	4.50	4.52	3.02	1.55	2.22	2.03	1.71	1.21	0.79	0.55	0.39	0.32	0.27	0.22	0.18	0.15	0.13	0.11	0.09	0.08	0.06	0.05	0.04	0.04
2001	0.00	0.47	2.16	4.43	4.00	2.96	2.91	2.31	2.53	2.62	2.57	2.09	1.37	0.80	0.51	0.36	0.29	0.24	0.20	0.17	0.14	0.11	0.10	0.08	0.07	0.06	0.05	0.04	0.03	0.03
2002	0.01	0.56	2.53	3.22	2.25	3.10	1.72	2.56	2.48	2.73	2.20	1.36	0.75	0.51	0.36	0.29	0.24	0.20	0.17	0.14	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02
2003	0.00	0.84	1.61	1.47	2.15	1.75	1.95	2.32	2.46	2.03	1.29	0.74	0.54	0.40	0.31	0.25	0.21	0.17	0.14	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02
2004	0.13	1.02	1.45	1.67	2.23	2.77	2.99	3.08	2.51	1.70	0.98	0.70	0.51	0.38	0.30	0.24	0.20	0.17	0.14	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02
2005	0.15	0.76	2.09	3.05	3.75	5.63	5.87	4.66	3.09	1.83	1.31	0.94	0.68	0.48	0.37	0.30	0.25	0.21	0.17	0.14	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02
2006	0.00	0.63	2.20	3.61	6.88	7.77	6.32	4.15	2.39	1.74	1.26	0.93	0.64	0.45	0.34	0.27	0.22	0.18	0.15	0.13	0.10	0.09	0.07	0.06	0.05	0.04	0.04	0.03	0.03	0.02
2007	0.03	0.90	3.89	8.31	10.20	9.21	6.45	3.75	2.63	1.95	1.47	1.06	0.73	0.51	0.39	0.31	0.25	0.21	0.17	0.14	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02
2008	0.02	1.14	4.66	7.14	7.16	5.58	3.48	2.34	1.73	1.34	0.99	0.71	0.48	0.35	0.28	0.23	0.19	0.16	0.13	0.11	0.09	0.08	0.06	0.05	0.05	0.04	0.03	0.03	0.02	0.02
2009	0.07	1.04	2.86	3.41	2.95	1.72	1.13	0.85	0.68	0.53	0.36	0.25	0.20	0.16	0.13	0.11	0.09	0.08	0.07	0.05	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01
2010	0.06	0.77	1.83	1.71	1.13	0.91	0.73	0.57	0.42	0.32	0.26	0.22	0.18	0.15	0.13	0.10	0.09	0.07	0.06	0.05	0.04	0.04	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01
2011	0.05	0.64	1.47	1.30	1.15	0.97	0.78	0.55	0.44	0.38	0.32	0.27	0.22	0.19	0.16	0.13	0.11	0.09	0.08	0.06	0.05	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01
2012	0.05	0.63	1.31	1.43	1.32	1.15	0.83	0.64	0.54	0.48	0.41	0.34	0.28	0.24	0.20	0.16	0.14	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01
2013	0.05	0.65	1.60	1.90	1.85	1.53	1.12	0.90	0.76	0.68	0.57	0.48	0.40	0.33	0.28	0.23	0.19	0.16	0.13	0.11	0.09	0.08	0.07	0.05	0.05	0.04	0.03	0.03	0.02	0.02
2014	0.07	0.78	2.01	2.41	2.28	1.80	1.37	1.13	0.95	0.84	0.71	0.59	0.49	0.41	0.34	0.28	0.23	0.20	0.16	0.14	0.11	0.09	0.08	0.07	0.05	0.05	0.04	0.03	0.03	0.02
2015	0.06	0.77	1.96	2.29	2.15	1.68	1.32	1.10	0.95	0.83	0.70	0.58	0.48	0.40	0.33	0.28	0.23	0.19	0.16	0.13	0.11	0.09	0.08	0.06	0.05	0.05	0.04	0.03	0.03	0.02
2016	0.06	0.78	1.92	2.28	2.15	1.72	1.38	1.17	1.01	0.86	0.72	0.60	0.50	0.41	0.34	0.29	0.24	0.20	0.16	0.14	0.11	0.10	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02



Conditional Prepayment Rates			Fixed Rate 30 Year Mortgages						by Credit Subsidy Endorsement Cohort																										
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					
1980	0.63	0.86	0.51	2.11	2.34	2.70	9.04	14.12	8.92	6.61	6.60	8.76	14.18	18.87	19.43	10.04	14.55	8.36	15.52	11.70	13.02	13.81	12.28	13.59	18.45	13.94	19.81	13.78	7.85	14.96					
1981	0.26	0.53	8.41	6.17	5.85	20.73	23.32	10.34	8.63	9.24	8.16	14.37	13.84	19.25	10.05	12.05	11.81	10.57	24.77	12.35	16.48	12.14	17.52	18.33	6.07	22.87	4.39	4.79	13.76	16.99					
1982	0.45	19.66	13.18	14.59	32.74	28.49	14.41	7.69	11.27	11.02	13.86	12.05	22.86	2.00	8.89	17.50	25.00	17.39	15.79	18.75	23.08	30.00	14.29	0.00	33.33	25.00	0.00	9.84	17.32	15.95					
1983	0.27	1.22	2.44	18.67	29.25	11.57	9.17	11.54	12.57	23.53	25.80	25.51	10.70	13.94	14.29	17.67	21.74	16.31	10.26	13.49	15.67	14.83	9.51	5.29	13.16	0.00	18.56	18.77	17.44	14.14					
1984	0.13	1.56	18.58	24.03	10.66	8.89	9.38	9.41	16.04	18.06	23.53	12.96	8.88	11.97	13.30	10.92	9.21	3.68	8.66	8.75	5.89	4.22	8.87	7.14	0.00	10.69	18.90	17.57	14.25	14.00					
1985	0.37	11.12	23.14	10.35	8.98	11.20	14.23	22.02	26.20	27.16	9.71	13.45	8.88	15.30	13.00	8.90	5.81	8.64	10.96	4.62	5.69	7.05	0.95	0.00	11.43	18.61	17.27	14.01	13.77	11.64					
1986	0.64	3.64	2.88	2.86	4.66	5.81	13.85	26.86	26.17	8.19	11.20	10.12	17.57	18.64	10.16	11.33	16.35	19.73	17.11	12.42	11.58	5.91	4.00	9.99	16.30	15.12	12.22	12.02	10.39	10.27					
1987	0.22	0.88	1.77	2.93	3.16	8.68	19.89	20.89	7.33	10.61	9.28	15.81	17.33	11.24	12.26	19.03	24.43	16.02	12.14	14.82	8.09	6.15	11.74	16.75	15.53	12.68	12.52	9.99	9.99	10.10					
1988	0.36	1.13	3.01	4.28	13.20	26.84	26.44	9.13	12.71	10.24	15.54	19.15	11.98	14.90	13.65	20.93	16.09	10.53	13.35	6.47	5.12	11.25	16.56	15.37	12.47	12.31	10.23	10.12	10.04	9.87					
1989	0.26	1.41	3.78	14.37	28.01	27.90	8.23	12.50	10.55	17.04	20.95	9.95	11.57	16.81	20.20	18.30	13.84	16.21	6.30	3.56	10.62	16.78	15.56	12.72	12.63	9.78	9.69	9.71	9.54	9.36					
1990	0.22	1.63	9.20	29.16	28.74	8.88	12.80	11.55	16.98	21.42	12.00	13.36	20.88	21.01	18.12	11.04	16.16	9.31	4.96	11.81	17.02	15.81	12.98	12.74	10.13	10.16	10.12	9.94	9.74	9.56					
1991	0.23	4.23	25.63	30.21	7.62	13.74	11.47	20.61	20.94	9.85	13.26	20.93	25.82	21.79	14.71	19.40	7.03	6.43	11.04	17.66	16.38	13.44	13.22	10.13	10.07	10.02	9.81	9.63	9.44	9.26					
1992	0.25	6.85	18.15	7.08	11.42	11.61	19.40	21.33	11.07	17.19	24.47	35.30	22.18	22.26	19.66	10.61	9.88	16.31	23.82	22.13	18.18	17.74	12.14	12.20	12.37	12.15	11.93	11.71	11.50	11.30					
1993	0.66	3.23	3.98	7.72	7.48	12.69	18.85	9.09	14.11	24.31	39.16	28.13	19.65	15.18	12.62	7.94	18.25	25.63	23.09	17.34	15.97	9.48	9.34	8.40	8.20	8.02	7.86	7.70	7.53	7.37					
1994	0.40	1.65	4.92	6.52	11.61	15.44	8.44	13.64	24.43	33.45	28.11	21.68	18.45	13.47	7.47	17.62	25.32	22.77	15.96	14.60	8.34	7.98	6.97	6.75	6.58	6.44	6.31	6.16	6.01	5.88					
1995	1.36	7.88	6.78	16.44	19.37	9.70	14.54	21.15	31.55	25.88	19.07	20.67	14.60	7.11	16.83	25.78	23.64	18.35	17.39	11.65	11.40	11.04	10.81	10.61	10.42	10.25	10.08	9.89	9.71	9.53					
1996	0.40	3.01	11.73	15.28	8.25	14.42	22.33	34.63	26.32	20.52	15.70	15.02	8.62	18.75	28.50	25.94	19.38	18.03	10.93	10.60	9.91	9.68	9.48	9.30	9.11	8.97	8.81	8.64	8.46	8.30					
1997	0.68	9.89	16.32	7.65	15.56	21.10	35.01	26.35	20.74	17.10	10.54	9.39	20.17	29.48	26.95	20.72	19.46	12.06	11.84	11.38	11.16	10.97	10.77	10.57	10.38	10.20	10.01	9.83	9.65	9.47					
1998	0.88	5.00	5.33	13.32	19.59	36.42	28.81	21.99	18.10	14.49	9.38	21.78	30.19	27.16	18.83	17.10	9.33	8.50	7.33	7.12	6.98	6.84	6.71	6.58	6.46	6.34	6.22	6.10	5.99	5.88					
1999	0.45	2.84	10.69	19.42	34.84	29.70	23.21	19.45	13.67	8.49	20.72	29.55	26.54	17.56	15.62	8.52	7.69	6.56	6.33	6.19	6.05	5.91	5.78	5.65	5.52	5.40	5.28	5.16	5.05	4.94					
2000	0.92	24.42	33.28	36.43	28.67	23.87	17.93	11.53	8.23	19.02	27.74	25.42	19.88	19.46	12.83	12.83	12.70	12.46	12.25	12.05	11.85	11.63	11.41	11.20	10.99	10.78	10.57	10.38	10.18	9.99					
2001	4.63	16.85	40.37	30.68	25.20	20.43	13.32	7.85	20.43	27.99	24.77	17.49	16.46	9.41	8.91	8.09	7.88	7.72	7.56	7.40	7.24	7.07	6.91	6.76	6.61	6.47	6.33	6.19	6.06	5.93					
2002	2.34	31.69	28.25	23.19	16.90	12.71	8.45	21.56	28.53	24.23	15.18	13.63	7.37	6.68	5.53	5.41	5.33	5.24	5.15	5.06	4.96	4.87	4.78	4.69	4.60	4.52	4.43	4.35	4.27	4.19					
2003	4.89	16.83	21.63	15.37	10.75	8.43	15.46	20.52	17.37	9.37	7.67	5.11	4.87	4.49	4.50	4.45	4.38	4.31	4.24	4.16	4.09	4.01	3.93	3.86	3.79	3.72	3.65	3.58	3.51	3.45					
2004	4.53	16.26	12.97	10.45	7.24	13.58	16.38	14.08	7.80	6.52	4.49	4.45	4.33	4.43	4.42	4.36	4.29	4.22	4.15	4.08	4.00	3.92	3.85	3.78	3.71	3.64	3.57	3.50	3.44	3.07					
2005	6.70	10.74	9.27	7.66	15.60	17.60	14.99	8.16	6.76	4.60	4.62	4.54	4.82	5.06	5.13	5.09	5.02	4.93	4.85	4.76	4.68	4.59	4.51	4.42	4.34	4.26	4.18	4.10	4.02	3.78					
2006	0.84	6.50	7.88	15.77	16.31	13.17	7.14	5.89	3.72	3.65	3.35	3.62	3.97	4.21	4.29	4.29	4.25	4.19	4.13	4.06	3.98	3.91	3.84	3.77	3.70	3.63	3.56	3.49	3.43	3.36					
2007	1.12	9.45	17.32	17.44	15.03	7.75	6.13	3.66	3.63	3.15	3.32	3.63	4.02	4.26	4.33	4.33	4.28	4.23	4.16	4.09	4.02	3.94	3.87	3.80	3.73	3.66	3.59	3.52	3.46	3.39					
2008	1.81	16.58	16.38	14.70	8.01	5.85	3.56	3.58	3.28	3.43	3.66	4.03	4.41	4.56	4.58	4.52	4.45	4.38	4.30	4.22	4.14	4.06	3.99	3.91	3.84	3.77	3.70	3.63	3.56	3.49					
2009	2.26	8.64	9.86	5.97	5.02	3.06	3.11	3.13	3.22	3.34	3.71	3.93	3.95	3.89	3.81	3.74	3.66	3.59	3.52	3.45	3.38	3.31	3.25	3.18	3.12	3.06	3.00	2.94	2.88	2.82					
2010	2.21	7.66	6.61	6.23	4.19	3.89	3.71	3.83	4.05	4.08	4.01	3.94	3.86	3.78	3.70	3.62	3.55	3.47	3.40	3.33	3.26	3.19	3.13	3.06	3.00	2.94	2.88	2.82	2.76	2.71					
2011	2.16	5.44	7.30	4.77	4.58	3.97	4.05	4.35	4.30	4.11	4.00	3.91	3.83	3.75	3.67	3.60	3.52	3.45	3.38	3.31	3.24	3.17	3.11	3.05	2.98	2.92	2.86	2.80	2.75	2.69					
2012	1.66	6.65	6.09	6.18	5.59	5.34	5.78	5.81	5.59	5.32	5.18	5.07	4.97	4.87	4.77	4.67	4.58	4.48	4.39	4.30	4.22	4.13	4.05	3.97	3.89	3.81	3.73	3.66	3.5						



Cumulative Claim Rates			Fixed Rate 30 Year Mortgages																														by Credit Subsidy Endorsement Cohort																													
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30																																
1980	0.00	1.03	2.37	4.21	5.96	7.79	9.09	10.61	12.18	13.17	13.70	14.60	15.05	15.58	16.12	16.48	16.70	16.93	16.97	17.06	17.11	17.20	17.20	17.25	17.25	17.29	17.29	17.29	17.29	17.29																																
1981	0.07	1.85	5.42	8.92	12.09	14.80	16.45	17.90	19.35	20.21	20.74	20.94	21.60	21.86	22.13	22.26	22.52	22.59	22.66	22.72	22.72	22.72	22.72	22.72	22.72	22.72	22.79	22.79	22.79	22.79																																
1982	0.18	2.51	5.91	10.13	13.17	15.32	17.20	18.46	19.18	19.53	19.89	20.16	20.52	20.88	20.97	21.06	21.15	21.15	21.15	21.15	21.15	21.15	21.15	21.15	21.15	21.15	21.15	21.15	21.15	21.15																																
1983	0.00	0.65	2.33	4.82	7.65	10.43	12.47	13.49	14.41	15.20	15.65	16.07	16.37	16.47	16.67	16.84	16.92	16.94	16.96	16.96	16.99	16.99	17.01	17.01	17.01	17.01	17.02	17.02	17.02	17.02																																
1984	0.00	1.34	4.07	8.36	12.91	15.46	17.19	18.41	19.23	19.84	20.31	20.44	20.53	20.66	20.74	20.87	20.96	21.13	21.18	21.18	21.22	21.26	21.26	21.26	21.26	21.27	21.27	21.28	21.28	21.28																																
1985	0.00	0.75	3.36	6.86	9.99	11.88	13.06	14.58	15.38	15.87	16.30	16.44	16.70	16.81	16.90	16.96	16.96	17.02	17.02	17.02	17.04	17.10	17.10	17.10	17.10	17.11	17.11	17.12	17.12	17.12																																
1986	0.00	0.48	2.23	4.22	5.92	7.45	8.69	9.68	10.40	11.04	11.76	12.08	12.34	12.57	12.82	12.91	12.93	12.96	13.00	13.00	13.00	13.01	13.02	13.03	13.03	13.04	13.04	13.04	13.04	13.04																																
1987	0.00	0.32	1.43	2.58	3.79	4.91	5.93	6.83	7.44	7.94	8.41	8.83	9.20	9.42	9.55	9.61	9.72	9.76	9.78	9.81	9.81	9.81	9.82	9.83	9.83	9.84	9.84	9.84	9.84	9.85																																
1988	0.02	0.57	1.57	3.05	4.85	5.90	6.90	7.91	8.66	9.16	9.50	9.69	9.83	9.92	10.00	10.13	10.21	10.23	10.25	10.32	10.34	10.35	10.35	10.36	10.36	10.37	10.37	10.37	10.37	10.37																																
1989	0.03	0.47	1.73	3.15	4.77	6.14	7.27	7.94	8.49	8.98	9.17	9.38	9.48	9.57	9.64	9.65	9.70	9.77	9.77	9.79	9.80	9.80	9.81	9.81	9.82	9.82	9.82	9.82	9.82	9.82																																
1990	0.00	0.35	1.65	3.24	4.38	5.33	6.21	6.84	7.35	7.66	8.03	8.19	8.36	8.49	8.56	8.58	8.61	8.65	8.67	8.67	8.68	8.69	8.69	8.70	8.70	8.70	8.70	8.70	8.70	8.70																																
1991	0.02	0.30	1.33	2.50	3.87	4.81	5.43	6.10	6.44	6.63	6.79	6.85	6.95	7.13	7.13	7.18	7.20	7.22	7.27	7.28	7.29	7.29	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30																																
1992	0.00	0.31	1.34	1.88	2.88	4.05	4.58	5.08	5.45	5.68	5.85	5.91	5.98	6.20	6.22	6.29	6.30	6.32	6.33	6.33	6.34	6.34	6.34	6.34	6.35	6.35	6.35	6.35	6.35	6.35																																
1993	0.00	0.15	0.88	1.63	2.40	3.46	4.30	4.80	5.15	5.37	5.39	5.53	5.63	5.66	5.73	5.78	5.79	5.81	5.82	5.83	5.83	5.83	5.84	5.84	5.84	5.84	5.84	5.84	5.84	5.84																																
1994	0.00	0.23	0.89	2.11	3.42	4.97	6.32	6.77	7.16	7.48	7.68	8.07	8.08	8.09	8.20	8.22	8.24	8.25	8.26	8.26	8.27	8.27	8.27	8.27	8.27	8.27	8.27	8.27	8.27	8.27																																
1995	0.05	0.23	1.43	2.98	4.49	5.44	6.22	6.96	7.49	7.81	8.09	8.22	8.38	8.44	8.46	8.48	8.50	8.51	8.52	8.52	8.52	8.53	8.53	8.53	8.53	8.53	8.53	8.53	8.53	8.53																																
1996	0.00	0.41	1.51	3.06	4.96	5.95	6.57	7.26	7.60	7.89	8.10	8.21	8.35	8.43	8.49	8.52	8.54	8.55	8.56	8.57	8.57	8.57	8.57	8.57	8.57	8.57	8.57	8.58	8.58	8.58																																
1997	0.00	0.49	1.90	3.47	4.48	5.55	6.33	6.97	7.14	7.36	7.54	7.70	7.79	7.86	7.90	7.93	7.94	7.95	7.95	7.96	7.96	7.96	7.96	7.96	7.96	7.96	7.97	7.97	7.97	7.97																																
1998	0.01	0.29	1.50	2.59	3.63	4.83	5.68	6.18	6.58	6.69	6.88	6.94	7.03	7.09	7.12	7.14	7.15	7.16	7.16	7.16	7.17	7.17	7.17	7.17	7.17	7.17	7.17	7.17	7.17	7.17																																
1999	0.00	0.39	1.39	2.62	4.24	5.35	6.07	6.37	6.64	6.81	6.95	7.06	7.13	7.18	7.20	7.21	7.22	7.23	7.23	7.23	7.24	7.24	7.24	7.24	7.24	7.24	7.24	7.24	7.24	7.24																																
2000	0.02	0.63	2.16	4.10	5.65	6.47	7.07	7.55	7.81	7.94	8.07	8.16	8.22	8.25	8.26	8.27	8.28	8.28	8.28	8.29	8.29	8.29	8.29	8.29	8.29	8.29	8.29	8.29	8.29	8.29																																
2001	0.00	0.45	2.15	4.16	5.34	5.95	6.42	6.73	7.03	7.27	7.44	7.54	7.59	7.61	7.63	7.63	7.64	7.65	7.65	7.65	7.66	7.66	7.66	7.66	7.66	7.66	7.66	7.66	7.66	7.66																																
2002	0.01	0.56	2.23	3.70	4.46	5.31	5.70	6.23	6.62	6.91	7.08	7.17	7.21	7.24	7.26	7.27	7.28	7.29	7.29	7.30	7.30	7.31	7.31	7.31	7.31	7.31	7.31	7.32	7.32	7.32																																
2003	0.00	0.80	2.06	2.95	4.02	4.78	5.54	6.29	6.90	7.31	7.54	7.66	7.74	7.79	7.84	7.87	7.90	7.92	7.93	7.95	7.96	7.96	7.97	7.98	7.98	7.98	7.99	7.99	7.99	7.99																																
2004	0.13	1.10	2.24	3.37	4.69	6.18	7.52	8.64	9.39	9.85	10.09	10.25	10.36	10.44	10.50	10.55	10.59	10.62	10.64	10.66	10.67	10.69	10.70	10.70	10.71	10.71	10.72	10.72	10.72	10.73																																
2005	0.15	0.87	2.59	4.82	7.27	10.23	12.60	14.09	14.95	15.41	15.72	15.93	16.07	16.16	16.23	16.29	16.33	16.36	16.38	16.40	16.42	16.43	16.44	16.45	16.46	16.46	16.47	16.47	16.47	16.48																																
2006	0.00	0.63	2.66	5.65	10.24	14.22	16.78	18.24	18.99	19.51	19.86	20.11	20.27	20.38	20.46	20.52	20.57	20.60	20.63	20.66	20.68	20.69	20.70	20.71	20.72	20.73	20.73	20.74	20.74	20.74																																
2007	0.03	0.92	4.36	10.16	15.45	19.02	21.09	22.15	22.83	23.31	23.65	23.88	24.03	24.14	24.21	24.27	24.31	24.35	24.37	24.40	24.41	24.43	24.44	24.45	24.46	24.46	24.47	24.47	24.47	24.48																																
2008	0.02	1.14	4.90	9.46	13.02	15.38	16.69	17.50	18.07	18.49	18.78	18.98	19.11	19.20	19.27	19.32	19.36	19.40	19.42	19.45	19.46	19.48	19.49	19.50	19.50	19.51	19.51	19.52	19.52	19.52																																
2009	0.07	1.08	3.61	6.23	8.29	9.40	10.09	10.59	10.97	11.25	11.44	11.57	11.66	11.73	11.79	11.84	11.88	11.91	11.93	11.95	11.97	11.98	11.99	12.00	12.01	12.01	12.02	12.02	12.02	12.03																																
2010	0.06	0.81	2.45	3.85	4.70	5.35	5.84	6.22	6.47	6.66	6.81	6.93	7.02	7.10	7.16	7.21	7.24	7.28	7.30	7.32	7.34	7.35	7.36	7.37	7.38	7.38	7.39	7.39	7.39	7.40																																
2011	0.05	0.68	2.03	3.12	4.02	4.75	5.30	5.67	5.95	6.18	6.37	6.52	6.63	6.73	6.81	6.87	6.92	6.96	6.99	7.02	7.04	7.05	7.07	7.08	7.09	7.10	7.10	7.11	7.11	7.11																																
2012	0.05	0.67	1.87	3.08	4.11	4.94	5.50	5.90	6.22	6.49	6.70	6.87	7.00	7.11	7.19	7.26	7.31	7.35	7.38	7.41	7.43	7.45	7.46	7.47	7.48	7.49	7.49	7.50	7.50	7.51																																
2013	0.05	0.69	2.18	3.81	5.25	6.35	7.08	7.63	8.05	8.40	8.68	8.90	9.07	9.20	9.30	9.39																																														



Cumulative Prepayment Rates			Fixed Rate 30 Year Mortgages										by Credit Subsidy Endorsement Cohort																										
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30									
1980	0.63	1.48	1.97	3.99	6.14	8.51	16.08	26.65	32.24	35.92	39.27	43.39	49.35	56.07	61.58	63.82	66.68	68.07	70.40	71.88	73.32	74.64	75.64	76.61	77.75	78.45	79.29	79.76	79.99	80.40									
1981	0.26	0.79	8.98	14.27	18.76	33.09	45.24	49.21	52.05	54.69	56.74	59.97	62.62	65.65	66.91	68.23	69.35	70.21	71.99	72.66	73.42	73.89	74.48	74.99	75.13	75.62	75.70	75.77	75.97	76.18									
1982	0.45	19.98	30.20	39.52	56.00	64.78	67.65	68.82	70.25	71.42	72.67	73.57	75.00	75.09	75.45	76.08	76.79	77.15	77.42	77.69	77.96	78.23	78.32	78.32	78.49	78.58	78.58	78.61	78.65	78.68									
1983	0.27	1.49	3.87	21.39	42.97	48.68	52.43	56.48	60.26	66.22	71.01	74.42	75.43	76.58	77.57	78.59	79.58	80.15	80.45	80.80	81.15	81.43	81.58	81.65	81.83	81.83	82.04	82.22	82.35	82.44									
1984	0.13	1.69	19.71	38.03	43.74	47.60	51.06	54.05	58.47	62.49	66.65	68.34	69.34	70.55	71.72	72.54	73.15	73.37	73.84	74.28	74.55	74.72	75.08	75.34	75.34	75.70	76.28	76.71	76.99	77.24									
1985	0.37	11.45	31.76	38.48	43.39	48.61	54.23	61.43	67.72	72.31	73.46	74.84	75.61	76.79	77.62	78.11	78.39	78.79	79.25	79.43	79.63	79.86	79.89	79.89	80.24	80.73	81.10	81.35	81.56	81.72									
1986	0.64	4.26	7.00	9.60	13.61	18.28	28.57	45.42	57.17	59.83	63.09	65.63	69.55	72.93	74.40	75.85	77.69	79.54	80.82	81.59	82.22	82.50	82.68	83.11	83.74	84.23	84.56	84.85	85.07	85.26									
1987	0.22	1.10	2.85	5.65	8.55	16.16	31.86	44.85	48.39	53.08	56.70	62.22	67.24	69.88	72.42	75.85	79.40	81.15	82.25	83.43	83.98	84.36	85.04	85.90	86.57	87.02	87.42	87.69	87.94	88.16									
1988	0.36	1.49	4.44	8.47	20.15	40.28	54.51	58.03	62.36	65.33	69.30	73.36	75.39	77.59	79.30	81.54	82.88	83.60	84.43	84.77	85.02	85.55	86.23	86.75	87.11	87.42	87.65	87.85	88.03	88.19									
1989	0.26	1.66	5.36	18.72	40.60	55.84	58.97	63.19	66.23	70.54	74.83	76.42	78.07	80.16	82.23	83.72	84.64	85.56	85.85	86.01	86.45	87.08	87.57	87.90	88.19	88.38	88.56	88.72	88.86	88.98									
1990	0.22	1.85	10.85	36.36	53.72	57.44	62.21	65.85	70.49	75.24	77.29	79.25	81.87	83.93	85.30	85.98	86.86	87.28	87.48	87.94	88.51	88.96	89.26	89.52	89.70	89.87	90.01	90.14	90.25	90.35									
1991	0.23	4.45	28.86	49.95	53.58	59.42	63.53	69.92	74.94	76.78	78.98	81.96	84.85	86.63	87.55	88.58	88.88	89.13	89.54	90.10	90.53	90.82	91.07	91.24	91.38	91.52	91.63	91.73	91.82	91.91									
1992	0.25	7.09	23.90	29.19	37.06	44.03	54.10	62.92	66.46	71.29	76.93	83.01	85.46	87.37	88.63	89.18	89.63	90.29	91.10	91.67	92.03	92.32	92.48	92.63	92.75	92.86	92.96	93.04	93.11	93.17									
1993	0.66	3.88	7.70	14.75	21.01	30.73	43.13	47.91	54.58	64.37	76.22	81.40	83.96	85.54	86.65	87.26	88.53	89.99	90.96	91.52	91.94	92.15	92.34	92.49	92.63	92.75	92.86	92.96	93.05	93.14									
1994	0.40	2.04	6.85	12.86	22.73	34.13	39.27	46.69	58.06	69.69	76.11	79.63	81.89	83.25	83.89	85.29	86.93	88.03	88.63	89.08	89.30	89.50	89.65	89.79	89.92	90.04	90.14	90.24	90.33	90.41									
1995	1.36	9.13	15.28	28.97	42.15	47.33	54.20	62.57	72.19	77.44	80.26	82.66	84.00	84.54	85.72	87.22	88.24	88.83	89.30	89.55	89.77	89.96	90.12	90.27	90.39	90.50	90.60	90.69	90.76	90.83									
1996	0.40	3.40	14.68	27.49	33.21	42.13	53.72	67.48	74.12	77.88	80.11	81.88	82.74	84.41	86.45	87.76	88.48	89.02	89.28	89.51	89.70	89.87	90.02	90.15	90.27	90.37	90.46	90.55	90.62	90.69									
1997	0.68	10.50	25.03	30.61	40.87	52.40	67.12	74.12	78.04	80.57	81.85	82.84	84.75	86.95	88.35	89.13	89.70	89.98	90.23	90.44	90.62	90.77	90.91	91.03	91.13	91.22	91.31	91.38	91.44	91.50									
1998	0.88	5.83	10.83	22.51	37.19	58.74	69.24	74.75	78.20	80.41	81.62	84.13	86.82	88.49	89.32	89.93	90.21	90.43	90.61	90.77	90.91	91.04	91.16	91.27	91.37	91.47	91.55	91.63	91.70	91.77									
1999	0.45	3.28	13.57	30.08	53.53	66.07	72.70	76.83	79.13	80.34	83.00	85.97	87.82	88.71	89.35	89.64	89.89	90.08	90.25	90.40	90.55	90.68	90.80	90.91	91.01	91.10	91.19	91.27	91.35	91.42									
2000	0.92	25.12	49.83	67.32	75.51	80.01	82.43	83.64	84.37	85.86	87.58	88.68	89.31	89.79	90.04	90.26	90.45	90.61	90.74	90.86	90.96	91.05	91.12	91.19	91.25	91.30	91.34	91.38	91.41	91.44									
2001	4.63	20.70	52.53	66.43	73.84	78.10	80.22	81.27	83.72	86.31	87.90	88.72	89.33	89.62	89.87	90.07	90.25	90.41	90.56	90.69	90.81	90.92	91.02	91.11	91.19	91.26	91.33	91.39	91.45	91.50									
2002	2.34	33.28	51.98	62.59	68.29	71.75	73.69	78.13	82.59	85.21	86.41	87.29	87.70	88.04	88.30	88.54	88.77	88.97	89.17	89.34	89.51	89.67	89.81	89.95	90.07	90.19	90.30	90.40	90.50	90.59									
2003	4.89	20.89	37.83	47.06	52.44	56.11	62.16	68.79	73.12	74.99	76.35	77.17	77.91	78.55	79.17	79.75	80.29	80.80	81.28	81.73	82.15	82.55	82.92	83.27	83.60	83.92	84.21	84.49	84.76	85.01									
2004	4.53	20.03	30.26	37.32	41.61	48.91	56.26	61.36	63.70	65.46	66.57	67.60	68.56	69.50	70.38	71.22	72.00	72.73	73.42	74.07	74.68	75.26	75.80	76.31	76.79	77.25	77.68	78.08	78.47	78.80									
2005	6.70	16.70	24.34	29.93	40.11	49.37	55.43	58.04	59.92	61.08	62.16	63.17	64.18	65.18	66.13	67.03	67.87	68.65	69.38	70.05	70.69	71.28	71.83	72.35	72.84	73.29	73.72	74.12	74.50	74.84									
2006	0.84	7.28	14.54	27.60	38.49	45.24	48.13	50.20	51.37	52.45	53.39	54.36	55.38	56.40	57.40	58.35	59.25	60.09	60.89	61.64	62.34	63.01	63.63	64.22	64.78	65.31	65.80	66.27	66.72	67.14									
2007	1.12	10.46	25.82	37.99	45.79	48.79	50.76	51.80	52.74	53.51	54.28	55.08	55.93	56.78	57.61	58.39	59.13	59.83	60.49	61.11	61.69	62.24	62.76	63.24	63.70	64.14	64.54	64.93	65.30	65.64									
2008	1.81	18.08	31.31	40.69	44.68	47.15	48.49	49.73	50.81	51.87	52.96	54.10	55.29	56.45	57.57	58.62	59.60	60.52	61.38	62.19	62.95	63.67	64.34	64.97	65.57	66.13	66.66	67.16	67.64	68.09									
2009	2.26	10.69	19.39	23.99	27.49	29.45	31.35	33.19	35.00	36.80	38.73	40.69	42.57	44.35	46.03	47.60	49.09	50.49	51.81	53.06																			



Conditional Claim Rates			Fixed Rate 30 Year Streamline Refinance Mortgages										by Credit Subsidy Endorsement Cohort																										
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30									
1990	0.11	0.81	1.40	1.98	2.31	2.13	3.13	0.00	4.46	1.30	3.28	0.00	4.76	0.00	0.00	4.17	0.00	0.00	0.00	0.17	0.30	0.27	0.26	0.24	0.19	0.17	0.16	0.14	0.13	0.12									
1991	0.00	0.22	2.00	0.66	1.70	0.68	0.00	2.02	1.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.33	0.31	0.29	0.27	0.22	0.20	0.18	0.16	0.15	0.13	0.12									
1992	0.00	0.27	0.42	1.00	1.28	1.50	1.14	0.74	1.23	0.24	0.00	0.40	0.58	0.00	0.00	0.00	0.00	0.20	0.36	0.33	0.31	0.28	0.22	0.19	0.15	0.14	0.13	0.11	0.10	0.10									
1993	0.00	0.22	0.60	0.97	1.26	1.33	1.10	0.78	0.71	0.43	0.31	0.99	0.51	0.00	0.16	0.35	0.39	0.38	0.37	0.34	0.28	0.19	0.15	0.11	0.10	0.09	0.08	0.07	0.07	0.06									
1994	0.00	0.33	0.85	1.13	1.18	1.21	0.84	0.72	0.47	0.38	0.35	0.37	0.08	0.10	0.22	0.31	0.37	0.37	0.34	0.27	0.17	0.13	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.05									
1995	0.00	0.87	0.51	1.31	1.44	2.88	1.48	0.44	0.63	1.18	1.67	0.00	0.00	0.00	0.24	0.43	0.41	0.38	0.34	0.26	0.22	0.18	0.17	0.15	0.14	0.13	0.12	0.11	0.10	0.09									
1996	0.00	0.62	1.61	1.38	1.25	0.57	0.62	0.64	0.19	0.00	0.39	0.93	0.53	0.97	0.78	0.76	0.71	0.60	0.42	0.33	0.25	0.23	0.21	0.19	0.17	0.16	0.14	0.13	0.12	0.11									
1997	0.08	0.75	1.62	2.10	1.48	0.93	0.00	0.62	0.00	0.00	0.00	3.45	2.47	0.84	0.80	0.76	0.66	0.47	0.38	0.30	0.28	0.26	0.23	0.21	0.20	0.17	0.16	0.14	0.13	0.12									
1998	0.00	0.21	0.74	0.65	0.77	0.99	1.40	1.21	0.95	0.41	0.00	0.99	0.87	0.91	0.83	0.64	0.38	0.28	0.21	0.20	0.18	0.16	0.15	0.14	0.12	0.11	0.10	0.09	0.09	0.08									
1999	0.01	0.23	0.55	0.60	0.79	1.03	0.79	0.57	0.90	0.63	0.63	0.87	0.94	0.83	0.58	0.32	0.23	0.21	0.19	0.17	0.16	0.14	0.13	0.12	0.11	0.10	0.09	0.08	0.07	0.07									
2000	0.00	0.23	1.31	2.07	4.59	3.85	3.45	2.74	1.72	0.65	1.51	1.55	1.41	1.03	0.71	0.50	0.38	0.35	0.32	0.29	0.27	0.25	0.22	0.20	0.18	0.17	0.15	0.14	0.12	0.11									
2001	0.00	0.16	1.25	2.64	2.28	2.03	1.82	1.49	2.16	2.08	2.31	1.98	1.32	0.66	0.40	0.30	0.26	0.23	0.21	0.19	0.17	0.15	0.14	0.13	0.12	0.11	0.10	0.09	0.08	0.07									
2002	0.01	0.49	2.02	2.35	1.88	2.25	1.15	1.41	2.05	2.39	1.99	1.20	0.57	0.36	0.29	0.26	0.23	0.20	0.18	0.16	0.15	0.14	0.12	0.11	0.10	0.09	0.09	0.08	0.07	0.07									
2003	0.01	0.54	1.19	1.32	1.15	1.21	1.20	1.85	2.02	1.52	0.89	0.48	0.37	0.28	0.23	0.20	0.18	0.16	0.15	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.06	0.06	0.05									
2004	0.16	0.84	1.16	1.19	1.38	1.67	1.98	2.06	1.49	0.94	0.58	0.43	0.32	0.25	0.22	0.19	0.17	0.15	0.14	0.13	0.12	0.10	0.10	0.09	0.08	0.07	0.07	0.06	0.05	0.04									
2005	0.10	0.58	1.43	1.91	2.44	4.59	4.81	3.31	1.98	1.15	0.87	0.64	0.45	0.32	0.26	0.22	0.19	0.17	0.16	0.14	0.13	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.06	0.05									
2006	0.00	0.84	3.10	5.00	8.07	8.59	6.38	3.66	1.79	1.35	1.10	0.77	0.52	0.36	0.28	0.23	0.20	0.18	0.16	0.14	0.13	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.06	0.06									
2007	0.32	1.22	4.66	10.28	11.74	9.14	5.75	2.66	1.92	1.61	1.19	0.82	0.53	0.37	0.28	0.24	0.20	0.18	0.16	0.14	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.06	0.06									
2008	0.03	1.49	6.48	10.08	8.34	5.88	3.13	2.11	1.62	1.21	0.85	0.55	0.36	0.26	0.22	0.19	0.18	0.16	0.15	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.06	0.06	0.05									
2009	0.08	2.14	5.22	5.94	5.04	3.54	2.32	1.83	1.31	0.91	0.52	0.35	0.30	0.27	0.25	0.22	0.20	0.19	0.17	0.15	0.14	0.13	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.06									
2010	0.08	1.72	4.05	3.77	2.99	2.21	1.56	1.10	0.62	0.46	0.41	0.37	0.34	0.31	0.28	0.26	0.23	0.21	0.19	0.18	0.16	0.15	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.07									
2011	0.04	0.91	2.24	2.73	2.04	1.53	0.96	0.59	0.49	0.44	0.40	0.37	0.33	0.31	0.28	0.25	0.23	0.21	0.19	0.17	0.16	0.14	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.07									
2012	0.03	0.74	1.65	1.79	1.43	0.97	0.59	0.45	0.41	0.37	0.34	0.31	0.28	0.26	0.23	0.21	0.19	0.18	0.16	0.15	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.06	0.06									
2013	0.03	0.71	1.51	1.69	1.34	0.79	0.53	0.45	0.41	0.37	0.34	0.31	0.28	0.26	0.23	0.21	0.19	0.18	0.16	0.15	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.06	0.06									
2014	0.04	0.68	1.56	1.77	1.28	0.76	0.56	0.48	0.44	0.40	0.36	0.33	0.30	0.27	0.25	0.23	0.21	0.19	0.17	0.15	0.14	0.13	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.06									
2015	0.03	0.68	1.51	1.67	1.15	0.74	0.56	0.48	0.44	0.40	0.36	0.33	0.30	0.27	0.25	0.23	0.21	0.19	0.17	0.16	0.14	0.13	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.06									
2016	0.03	0.67	1.37	1.56	1.08	0.74	0.59	0.49	0.44	0.40	0.36	0.33	0.30	0.27	0.25	0.23	0.21	0.19	0.17	0.16	0.14	0.13	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.06									



Conditional Prepayment Rates			Fixed Rate 30 Year Streamline Refinance Mortgages										by Credit Subsidy Endorsement Cohort																										
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30									
1990	5.74	17.15	27.63	38.14	35.64	12.77	12.50	17.04	26.79	19.48	14.75	16.00	14.29	23.53	7.69	12.50	10.00	0.00	0.00	8.48	14.39	12.48	8.75	8.28	7.43	6.78	6.30	5.91	5.55	5.21									
1991	2.82	32.89	47.33	41.45	14.77	20.41	14.66	21.21	18.42	6.56	14.04	24.49	21.62	20.69	17.39	10.53	0.00	11.77	9.33	15.89	13.81	9.71	9.11	8.09	7.58	7.12	6.65	6.24	5.86	5.50									
1992	2.49	25.26	30.96	9.22	13.27	10.92	21.74	27.15	12.35	16.90	27.59	31.75	20.47	17.78	8.11	5.88	3.13	11.17	17.31	15.00	10.28	9.46	7.56	7.18	6.93	6.50	6.10	5.73	5.39	5.07									
1993	2.61	11.89	5.99	8.57	8.99	15.76	19.16	10.68	16.33	26.29	44.77	29.40	22.04	17.92	9.31	10.99	14.65	18.61	16.11	10.64	9.45	6.43	6.22	5.75	5.40	5.06	4.75	4.46	4.16	3.90									
1994	1.90	4.08	7.21	7.47	11.75	15.37	9.71	13.61	23.38	40.46	30.23	22.52	16.75	12.06	9.52	15.13	19.39	16.63	10.39	9.05	5.70	5.37	4.69	4.37	4.09	3.85	3.61	3.38	3.16	2.96									
1995	2.82	13.79	8.67	20.79	23.56	10.58	14.81	29.20	45.91	28.24	25.00	29.55	6.45	17.24	10.78	18.01	15.55	10.51	9.65	7.67	7.03	6.45	6.04	5.66	5.31	5.12	4.85	4.55	4.27	4.06									
1996	2.17	6.05	16.98	19.70	12.81	17.88	26.05	43.16	33.58	26.21	16.22	11.11	7.37	20.49	28.63	24.99	16.81	15.08	10.18	9.66	9.00	8.46	7.94	7.46	7.01	6.56	6.13	5.75	5.39	5.04									
1997	2.52	27.25	26.62	10.97	18.37	27.55	47.90	34.78	20.19	18.07	14.71	12.07	20.61	28.60	24.95	17.01	15.36	10.85	10.31	9.78	9.27	8.70	8.18	7.68	7.22	6.68	6.23	5.84	5.49	5.15									
1998	4.19	16.70	7.77	17.17	30.00	50.65	40.85	29.25	22.38	17.18	11.81	22.37	31.89	27.59	17.29	15.13	8.70	7.78	6.52	6.04	5.65	5.27	4.95	4.65	4.36	4.11	3.86	3.62	3.40	3.19									
1999	2.67	6.31	12.47	24.06	45.74	36.03	29.74	20.01	14.04	10.79	22.64	32.28	27.60	15.81	13.39	7.27	6.28	4.71	4.32	4.05	3.81	3.58	3.36	3.15	2.95	2.77	2.60	2.44	2.28	2.13									
2000	2.81	29.17	35.25	41.60	35.78	29.23	12.64	17.81	10.34	25.80	30.56	26.43	18.42	17.47	12.38	12.24	11.89	11.18	10.51	9.88	9.41	8.81	8.16	7.62	7.15	6.73	6.30	5.91	5.49	5.14									
2001	6.82	30.88	52.66	38.53	32.65	22.19	16.40	10.55	24.30	32.53	27.50	16.73	14.80	8.53	7.81	6.43	5.98	5.66	5.32	5.01	4.72	4.44	4.16	3.90	3.66	3.43	3.22	3.02	2.83	2.66									
2002	9.77	47.67	34.63	28.77	20.51	14.37	9.19	23.93	30.83	25.47	13.97	11.87	6.68	6.05	4.52	4.18	3.94	3.72	3.50	3.29	3.11	2.93	2.75	2.58	2.42	2.27	2.12	1.99	1.87	1.75									
2003	17.22	24.90	25.22	18.15	12.43	8.60	19.22	24.82	20.12	9.51	7.38	4.67	4.14	3.67	3.51	3.32	3.13	2.94	2.77	2.60	2.45	2.30	2.16	2.02	1.90	1.78	1.67	1.56	1.47	1.37									
2004	10.08	20.75	15.98	11.50	7.79	15.41	18.42	15.01	7.43	6.10	4.26	4.03	3.87	3.75	3.56	3.36	3.16	2.97	2.79	2.62	2.47	2.32	2.18	2.04	1.92	1.81	1.69	1.59	1.49	1.21									
2005	11.30	15.01	14.32	8.33	18.71	18.75	15.01	7.45	6.33	4.23	4.02	3.84	3.92	3.97	3.81	3.62	3.42	3.22	3.03	2.84	2.68	2.52	2.37	2.22	2.08	1.96	1.84	1.73	1.62	1.47									
2006	3.13	10.42	8.10	15.23	15.16	12.05	6.02	5.39	3.73	3.75	3.24	3.38	3.63	3.74	3.63	3.48	3.30	3.12	2.94	2.76	2.61	2.46	2.31	2.17	2.03	1.91	1.79	1.68	1.58	1.48									
2007	2.91	17.35	17.16	13.69	10.99	5.19	4.29	3.05	3.37	2.96	3.07	3.25	3.62	3.73	3.67	3.50	3.32	3.15	2.96	2.79	2.62	2.46	2.31	2.16	2.03	1.90	1.79	1.67	1.57	1.47									
2008	4.04	20.45	12.66	9.63	4.31	3.26	2.28	2.67	2.83	3.04	3.10	3.46	3.69	3.69	3.54	3.34	3.14	2.95	2.77	2.60	2.44	2.29	2.15	2.01	1.89	1.77	1.66	1.56	1.46	1.37									
2009	3.37	7.42	5.92	2.77	2.38	3.21	4.30	4.86	4.91	4.96	5.84	6.01	5.73	5.37	5.04	4.72	4.43	4.15	3.89	3.65	3.43	3.21	3.01	2.82	2.65	2.48	2.32	2.18	2.04	1.91									
2010	2.61	5.76	4.36	5.90	6.81	7.21	7.05	7.51	8.56	8.48	7.99	7.49	7.02	6.58	6.16	5.77	5.41	5.07	4.74	4.44	4.17	3.90	3.66	3.42	3.21	3.01	2.81	2.64	2.47	2.31									
2011	3.45	6.48	7.38	8.07	7.92	7.66	8.79	9.37	8.98	8.42	7.89	7.39	6.92	6.49	6.07	5.69	5.33	4.99	4.67	4.37	4.10	3.84	3.60	3.37	3.15	2.95	2.77	2.59	2.43	2.27									
2012	2.99	7.16	7.14	6.49	5.95	6.64	7.27	7.13	6.71	6.30	5.92	5.55	5.21	4.89	4.59	4.31	4.04	3.79	3.55	3.33	3.13	2.94	2.75	2.58	2.42	2.27	2.13	2.00	1.87	1.76									
2013	3.02	7.35	7.43	6.55	6.55	7.56	7.79	7.42	6.96	6.52	6.11	5.73	5.37	5.03	4.72	4.42	4.14	3.88	3.64	3.41	3.19	3.00	2.81	2.63	2.46	2.31	2.17	2.03	1.90	1.78									
2014	3.17	8.06	7.85	6.94	7.18	7.93	7.79	7.29	6.75	6.27	5.83	5.43	5.06	4.72	4.41	4.12	3.85	3.60	3.37	3.15	2.96	2.77	2.59	2.43	2.27	2.13	2.00	1.87	1.75	1.64									
2015	3.24	8.07	7.86	7.07	7.61	8.03	7.78	7.29	6.77	6.28	5.84	5.44	5.07	4.73	4.42	4.13	3.86	3.61	3.38	3.16	2.96	2.78	2.60	2.44	2.28	2.14	2.00	1.88	1.76	1.65									
2016	3.15	8.05	7.96	7.23	7.77	7.99	7.66	7.24	6.74	6.26	5.82	5.43	5.06	4.72	4.41	4.12	3.85	3.61	3.37	3.16	2.96	2.77	2.60	2.43	2.28	2.14	2.00	1.87	1.76	1.65									



Cumulative Claim Rates			Fixed Rate 30 Year Streamline Refinance Mortgages																														by Credit Subsidy Endorsement Cohort																													
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30																																
1990	0.11	0.87	1.95	3.03	3.79	4.23	4.77	4.77	5.31	5.42	5.63	5.63	5.85	5.85	5.85	5.96	5.96	5.96	5.96	5.96	5.97	5.97	5.97	5.98	5.98	5.98	5.98	5.98	5.99	5.99																																
1991	0.00	0.22	1.52	1.73	2.06	2.17	2.17	2.38	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.50	2.50	2.51	2.51	2.51	2.51	2.51	2.52	2.52	2.52																																
1992	0.00	0.27	0.57	1.07	1.65	2.22	2.60	2.80	3.03	3.06	3.06	3.10	3.14	3.14	3.14	3.14	3.14	3.15	3.16	3.17	3.17	3.18	3.18	3.19	3.19	3.19	3.19	3.19	3.20	3.20																																
1993	0.00	0.22	0.73	1.50	2.41	3.28	3.87	4.21	4.48	4.61	4.68	4.81	4.85	4.85	4.86	4.88	4.90	4.91	4.93	4.93	4.94	4.94	4.95	4.95	4.95	4.95	4.95	4.95	4.96	4.96																																
1994	0.00	0.33	1.12	2.10	3.03	3.86	4.34	4.71	4.91	5.04	5.11	5.16	5.17	5.18	5.20	5.22	5.24	5.26	5.27	5.28	5.28	5.29	5.29	5.29	5.30	5.30	5.30	5.30	5.30	5.30																																
1995	0.00	0.85	1.27	2.26	3.10	4.37	4.94	5.08	5.22	5.36	5.50	5.50	5.50	5.50	5.51	5.52	5.53	5.54	5.55	5.55	5.55	5.56	5.56	5.56	5.56	5.56	5.56	5.57	5.57	5.57																																
1996	0.00	0.61	2.08	3.10	3.84	4.12	4.38	4.57	4.60	4.60	4.64	4.70	4.73	4.79	4.82	4.84	4.86	4.87	4.88	4.88	4.89	4.89	4.89	4.89	4.89	4.89	4.90	4.90	4.90	4.90																																
1997	0.08	0.81	1.95	3.00	3.65	3.98	3.98	4.06	4.06	4.06	4.06	4.22	4.32	4.34	4.36	4.37	4.38	4.39	4.39	4.39	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.41	4.41																																
1998	0.00	0.20	0.79	1.26	1.72	2.13	2.41	2.55	2.63	2.66	2.66	2.70	2.73	2.75	2.77	2.77	2.78	2.78	2.78	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79																																
1999	0.01	0.23	0.73	1.21	1.67	2.00	2.16	2.24	2.34	2.40	2.45	2.51	2.55	2.57	2.59	2.60	2.60	2.60	2.61	2.61	2.61	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.63	2.63																																
2000	0.00	0.22	1.12	2.02	3.15	3.71	4.05	4.27	4.39	4.42	4.49	4.53	4.56	4.58	4.59	4.59	4.60	4.60	4.60	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61																																
2001	0.00	0.15	0.95	1.73	2.13	2.36	2.52	2.62	2.75	2.85	2.92	2.96	2.98	2.99	3.00	3.00	3.00	3.00	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.02	3.02	3.02																																
2002	0.01	0.46	1.40	2.10	2.48	2.84	2.99	3.16	3.34	3.48	3.56	3.61	3.63	3.64	3.64	3.65	3.66	3.66	3.66	3.67	3.67	3.67	3.68	3.68	3.68	3.68	3.68	3.69	3.69	3.69																																
2003	0.01	0.46	1.19	1.79	2.21	2.59	2.93	3.35	3.69	3.89	3.99	4.04	4.08	4.10	4.13	4.14	4.16	4.17	4.18	4.19	4.20	4.21	4.22	4.22	4.23	4.24	4.24	4.24	4.25	4.25																																
2004	0.16	0.91	1.72	2.42	3.12	3.89	4.65	5.28	5.66	5.88	6.00	6.09	6.15	6.20	6.23	6.27	6.30	6.32	6.34	6.36	6.38	6.39	6.41	6.42	6.43	6.44	6.45	6.45	6.46	6.47																																
2005	0.10	0.62	1.69	2.89	4.27	6.31	7.96	8.87	9.35	9.61	9.79	9.92	10.01	10.07	10.11	10.15	10.18	10.21	10.23	10.26	10.27	10.29	10.30	10.32	10.33	10.34	10.35	10.36	10.36	10.37																																
2006	0.00	0.81	3.48	7.29	12.21	16.22	18.59	19.78	20.31	20.69	20.98	21.17	21.30	21.38	21.45	21.50	21.54	21.57	21.60	21.63	21.65	21.68	21.69	21.71	21.72	21.74	21.75	21.76	21.77	21.78																																
2007	0.32	1.51	5.18	11.51	17.01	20.32	22.10	22.85	23.35	23.75	24.03	24.22	24.34	24.41	24.47	24.52	24.55	24.59	24.61	24.64	24.66	24.68	24.69	24.71	24.72	24.74	24.75	24.76	24.76	24.77																																
2008	0.03	1.46	6.32	12.42	16.48	18.97	20.18	20.95	21.51	21.91	22.18	22.35	22.46	22.53	22.59	22.64	22.68	22.72	22.76	22.79	22.81	22.84	22.86	22.88	22.89	22.91	22.92	22.93	22.94	22.95																																
2009	0.08	2.14	6.70	11.31	14.88	17.19	18.62	19.66	20.36	20.81	21.06	21.21	21.33	21.44	21.53	21.61	21.67	21.73	21.78	21.83	21.87	21.90	21.93	21.96	21.98	22.00	22.02	22.04	22.05	22.06																																
2010	0.08	1.75	5.39	8.50	10.73	12.21	13.16	13.77	14.09	14.30	14.47	14.61	14.73	14.83	14.92	14.99	15.06	15.11	15.16	15.20	15.23	15.26	15.29	15.31	15.33	15.35	15.37	15.38	15.39	15.40																																
2011	0.04	0.91	2.92	5.13	6.60	7.59	8.15	8.47	8.70	8.89	9.05	9.18	9.29	9.39	9.47	9.54	9.60	9.65	9.69	9.73	9.76	9.79	9.82	9.84	9.86	9.87	9.89	9.90	9.91	9.92																																
2012	0.03	0.75	2.23	3.68	4.75	5.43	5.80	6.07	6.29	6.47	6.63	6.77	6.89	6.99	7.07	7.15	7.22	7.27	7.32	7.37	7.41	7.44	7.47	7.50	7.52	7.54	7.56	7.58	7.59	7.61																																
2013	0.03	0.72	2.07	3.44	4.44	4.98	5.31	5.57	5.79	5.97	6.12	6.26	6.37	6.47	6.55	6.62	6.69	6.74	6.79	6.83	6.87	6.90	6.93	6.96	6.98	7.00	7.02	7.04	7.05	7.06																																
2014	0.04	0.70	2.08	3.50	4.43	4.94	5.28	5.55	5.77	5.96	6.12	6.26	6.38	6.48	6.57	6.64	6.71	6.77	6.82	6.86	6.90	6.94	6.97	7.00	7.02	7.04	7.06	7.08	7.09	7.11																																
2015	0.03	0.68	2.02	3.35	4.19	4.68	5.02	5.29	5.51	5.70	5.86	6.00	6.12	6.22	6.31	6.38	6.45	6.51	6.56	6.60	6.64	6.68	6.71	6.74	6.76	6.78	6.80	6.82	6.83	6.85																																
2016	0.03	0.68	1.89	3.14	3.93	4.42	4.78	5.05	5.27	5.46	5.62	5.76	5.88	5.98	6.07	6.14	6.21	6.27	6.32	6.36	6.40	6.44	6.47	6.50	6.52	6.54	6.56	6.58	6.59	6.61																																



Cumulative Prepayment Rates			Fixed Rate 30 Year Streamline Refinance Mortgages										by Credit Subsidy Endorsement Cohort																										
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30									
1990	5.74	21.89	43.23	64.14	75.84	78.44	80.61	83.10	86.35	87.97	88.95	89.82	90.47	91.33	91.55	91.87	92.09	92.09	92.09	92.26	92.51	92.70	92.82	92.92	93.00	93.07	93.13	93.18	93.23	93.27									
1991	2.82	34.78	65.55	79.20	82.02	85.27	87.11	89.38	90.90	91.33	92.20	93.50	94.37	95.02	95.45	95.67	95.67	95.88	96.03	96.27	96.44	96.54	96.63	96.70	96.76	96.81	96.85	96.89	96.93	96.96									
1992	2.49	27.12	49.60	54.19	60.13	64.30	71.58	78.59	80.89	83.61	87.28	90.35	91.69	92.61	92.95	93.18	93.30	93.70	94.24	94.63	94.86	95.04	95.18	95.30	95.40	95.49	95.57	95.64	95.71	95.76									
1993	2.61	14.19	19.32	26.17	32.68	42.91	53.22	57.80	64.01	72.30	82.64	86.36	88.31	89.53	90.06	90.62	91.27	91.99	92.49	92.76	92.98	93.11	93.23	93.34	93.43	93.51	93.59	93.65	93.71	93.76									
1994	1.90	5.91	12.67	19.10	28.36	38.91	44.46	51.43	61.68	75.20	81.17	84.26	86.03	87.09	87.83	88.88	90.03	90.82	91.22	91.54	91.72	91.88	92.02	92.13	92.24	92.33	92.42	92.50	92.57	92.63									
1995	2.82	16.22	23.41	39.07	52.89	57.55	63.19	72.50	82.79	86.18	88.29	90.13	90.41	91.11	91.48	92.02	92.40	92.62	92.80	92.93	93.03	93.12	93.20	93.27	93.34	93.39	93.44	93.49	93.53	93.57									
1996	2.17	8.09	23.59	38.24	45.75	54.76	65.47	78.48	84.18	87.12	88.46	89.23	89.67	90.82	92.08	92.85	93.24	93.53	93.69	93.83	93.94	94.04	94.13	94.20	94.26	94.32	94.37	94.41	94.45	94.48									
1997	2.52	29.06	47.73	53.25	61.28	70.94	82.95	87.50	89.20	90.42	91.23	91.80	92.62	93.50	94.04	94.31	94.51	94.63	94.73	94.82	94.89	94.95	95.01	95.05	95.09	95.12	95.15	95.18	95.20	95.22									
1998	4.19	20.19	26.38	38.88	56.84	77.83	86.01	89.40	91.20	92.26	92.86	93.86	94.96	95.60	95.88	96.09	96.19	96.27	96.33	96.38	96.43	96.47	96.51	96.54	96.57	96.59	96.62	96.64	96.66	96.68									
1999	2.67	8.81	20.15	39.19	66.45	77.94	83.90	86.69	88.25	89.26	91.15	93.21	94.39	94.88	95.22	95.38	95.51	95.60	95.67	95.74	95.81	95.86	95.91	95.96	96.00	96.04	96.07	96.11	96.13	96.16									
2000	2.81	31.16	55.34	73.45	82.23	86.50	87.74	89.20	89.88	91.36	92.65	93.40	93.78	94.07	94.24	94.38	94.50	94.60	94.69	94.76	94.82	94.87	94.91	94.95	94.98	95.01	95.03	95.05	95.07	95.09									
2001	6.82	35.59	69.44	80.85	86.53	89.05	90.46	91.20	92.70	94.18	95.00	95.35	95.60	95.72	95.82	95.90	95.96	96.02	96.07	96.12	96.16	96.20	96.23	96.26	96.29	96.31	96.33	96.35	96.37	96.39									
2002	9.77	52.78	68.97	77.50	81.68	83.96	85.17	88.00	90.73	92.24	92.84	93.27	93.47	93.65	93.77	93.88	93.98	94.07	94.15	94.22	94.28	94.34	94.40	94.45	94.49	94.53	94.57	94.61	94.64	94.67									
2003	17.22	37.83	53.39	61.63	66.18	68.90	74.38	80.01	83.36	84.59	85.44	85.93	86.35	86.70	87.02	87.32	87.58	87.83	88.05	88.25	88.43	88.60	88.76	88.90	89.03	89.15	89.26	89.36	89.46	89.54									
2004	10.08	28.70	39.95	46.66	50.62	57.75	64.82	69.40	71.28	72.69	73.60	74.42	75.18	75.88	76.52	77.09	77.62	78.10	78.53	78.93	79.29	79.63	79.93	80.21	80.47	80.70	80.92	81.12	81.31	81.45									
2005	11.30	24.59	35.30	40.55	51.13	59.49	64.63	66.67	68.22	69.17	70.02	70.80	71.55	72.28	72.96	73.57	74.13	74.63	75.09	75.51	75.89	76.24	76.56	76.85	77.12	77.36	77.59	77.80	77.99	78.16									
2006	3.13	13.23	20.19	31.81	41.04	46.68	48.91	50.66	51.77	52.81	53.67	54.53	55.41	56.28	57.09	57.84	58.52	59.14	59.71	60.23	60.70	61.13	61.53	61.90	62.23	62.53	62.82	63.08	63.32	63.54									
2007	2.91	19.70	33.22	41.65	46.80	48.67	50.01	50.86	51.74	52.48	53.21	53.95	54.74	55.52	56.26	56.93	57.55	58.11	58.62	59.09	59.52	59.91	60.26	60.59	60.89	61.16	61.41	61.65	61.86	62.06									
2008	4.04	23.66	33.14	38.97	41.07	42.45	43.33	44.30	45.29	46.30	47.28	48.34	49.42	50.46	51.41	52.28	53.07	53.79	54.44	55.03	55.57	56.07	56.52	56.94	57.32	57.67	57.99	58.29	58.56	58.82									
2009	3.37	10.53	15.70	17.85	19.53	21.64	24.27	27.05	29.66	32.14	34.89	37.54	39.90	41.98	43.82	45.46	46.92	48.22	49.39	50.45	51.40	52.25	53.03	53.74	54.38	54.97	55.51	55.99	56.44	56.86									
2010	2.61	8.21	12.14	17.00	22.08	26.92	31.22	35.39	39.74	43.66	47.02	49.90	52.39	54.55	56.44	58.09	59.55	60.83	61.98	62.99	63.90	64.72	65.45	66.11	66.70	67.24	67.73	68.18	68.58	68.96									
2011	3.45	9.70	16.30	22.82	28.53	33.49	38.67	43.65	47.95	51.60	54.72	57.39	59.71	61.72	63.47	65.01	66.37	67.57	68.63	69.58	70.43	71.19	71.87	72.49	73.05	73.55	74.01	74.43	74.81	75.16									
2012	2.99	9.93	16.30	21.59	26.04	30.64	35.29	39.49	43.14	46.33	49.12	51.58	53.75	55.68	57.39	58.92	60.29	61.52	62.63	63.63	64.54	65.36	66.11	66.79	67.42	67.99	68.51	68.98	69.42	69.83									
2013	3.02	10.15	16.77	22.08	26.96	32.15	37.04	41.32	45.02	48.23	51.03	53.49	55.65	57.56	59.26	60.77	62.12	63.33	64.42	65.40	66.28	67.09	67.82	68.48	69.09	69.64	70.15	70.61	71.03	71.43									
2014	3.17	10.97	17.91	23.46	28.70	34.01	38.76	42.84	46.33	49.33	51.94	54.21	56.21	57.98	59.55	60.95	62.19	63.31	64.32	65.23	66.06	66.81	67.49	68.11	68.67	69.19	69.67	70.10	70.50	70.87									
2015	3.24	11.05	17.99	23.64	29.20	34.55	39.28	43.34	46.81	49.81	52.41	54.68	56.67	58.44	60.00	61.39	62.64	63.75	64.76	65.66	66.49	67.23	67.91	68.53	69.09	69.61	70.08	70.52	70.91	71.28									
2016	3.15	10.94	17.97	23.77	29.45	34.77	39.43	43.47	46.94	49.93	52.53	54.80	56.80	58.56	60.12	61.52	62.76	63.88	64.89	65.80	66.62	67.37	68.05	68.67	69.24	69.75	70.23	70.66	71.06	71.43									



Conditional Claim Rates Fixed Rate 15 Year Mortgages by Credit Subsidy Endorsement Cohort															
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1980	0.00	0.29	3.26	2.17	1.63	1.39	3.35	2.53	1.93	1.08	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.93	4.09	2.38	3.69	0.41	1.89	2.21	1.26	1.38	1.60	2.70	0.00	0.00	0.00
1982	0.00	1.42	2.98	4.00	2.08	1.28	3.08	2.34	0.65	0.70	0.74	0.92	0.00	0.00	0.00
1983	0.01	0.18	0.61	1.03	1.01	1.29	1.00	0.51	0.37	0.43	0.36	0.37	0.03	0.17	0.04
1984	0.02	0.52	1.06	1.76	2.70	1.74	1.30	0.76	0.78	0.49	0.49	0.45	0.34	0.00	0.15
1985	0.00	0.24	1.22	2.10	1.79	1.44	0.99	0.64	0.67	0.78	0.66	0.45	0.14	0.21	0.14
1986	0.00	0.16	0.60	0.78	0.62	0.51	0.50	0.34	0.34	0.26	0.21	0.18	0.14	0.08	0.23
1987	0.00	0.13	0.34	0.41	0.44	0.42	0.32	0.27	0.25	0.21	0.17	0.14	0.10	0.14	0.08
1988	0.01	0.22	0.59	0.74	0.78	0.73	0.62	0.61	0.48	0.42	0.41	0.16	0.19	0.15	0.09
1989	0.02	0.15	0.41	0.68	0.81	0.65	0.60	0.64	0.36	0.47	0.37	0.39	0.25	0.17	0.21
1990	0.00	0.07	0.48	0.57	0.49	0.69	0.42	0.47	0.33	0.20	0.19	0.06	0.06	0.16	0.19
1991	0.00	0.17	0.37	0.76	0.58	0.40	0.50	0.34	0.37	0.14	0.00	0.13	0.08	0.10	0.12
1992	0.00	0.10	0.27	0.43	0.38	0.42	0.41	0.39	0.35	0.08	0.10	0.06	0.31	0.10	0.00
1993	0.01	0.05	0.24	0.25	0.23	0.31	0.17	0.26	0.19	0.10	0.12	0.08	0.05	0.06	0.00
1994	0.00	0.07	0.19	0.32	0.43	0.31	0.37	0.28	0.21	0.17	0.22	0.09	0.05	0.20	0.00
1995	0.00	0.13	0.51	0.81	0.90	0.75	0.40	0.60	0.51	0.63	0.17	0.50	0.12	0.00	<b>0.33</b>
1996	0.00	0.08	0.38	0.38	0.50	0.49	0.49	0.44	0.25	0.51	0.37	0.36	0.08	<b>0.04</b>	<b>0.07</b>
1997	0.00	0.11	0.40	0.65	0.53	0.50	0.27	0.45	0.61	0.66	0.08	0.00	<b>0.16</b>	<b>0.10</b>	<b>0.08</b>
1998	0.00	0.05	0.29	0.23	0.52	0.44	0.46	0.44	0.48	0.41	0.00	<b>0.20</b>	<b>0.12</b>	<b>0.10</b>	<b>0.08</b>
1999	0.00	0.11	0.23	0.40	0.56	0.54	0.47	0.21	0.25	0.14	<b>0.19</b>	<b>0.14</b>	<b>0.12</b>	<b>0.10</b>	<b>0.07</b>
2000	0.00	0.08	0.68	1.16	1.65	1.30	0.80	0.59	0.67	<b>0.36</b>	<b>0.35</b>	<b>0.29</b>	<b>0.22</b>	<b>0.16</b>	<b>0.10</b>
2001	0.00	0.11	0.74	1.14	1.22	1.19	0.65	0.48	<b>0.70</b>	<b>0.29</b>	<b>0.25</b>	<b>0.20</b>	<b>0.14</b>	<b>0.09</b>	<b>0.06</b>
2002	0.01	0.20	0.68	0.77	0.70	0.34	0.39	<b>0.40</b>	<b>0.27</b>	<b>0.24</b>	<b>0.20</b>	<b>0.13</b>	<b>0.08</b>	<b>0.06</b>	<b>0.05</b>
2003	0.01	0.19	0.39	0.37	0.34	0.28	<b>0.32</b>	<b>0.28</b>	<b>0.23</b>	<b>0.18</b>	<b>0.12</b>	<b>0.08</b>	<b>0.06</b>	<b>0.05</b>	<b>0.04</b>
2004	0.01	0.17	0.29	0.55	0.53	<b>0.38</b>	<b>0.34</b>	<b>0.27</b>	<b>0.21</b>	<b>0.15</b>	<b>0.10</b>	<b>0.08</b>	<b>0.06</b>	<b>0.05</b>	<b>0.03</b>
2005	0.02	0.74	2.18	1.84	<b>2.07</b>	<b>2.15</b>	<b>1.74</b>	<b>1.27</b>	<b>0.85</b>	<b>0.54</b>	<b>0.41</b>	<b>0.32</b>	<b>0.25</b>	<b>0.19</b>	<b>0.15</b>
2006	0.09	1.40	2.29	<b>3.30</b>	<b>5.72</b>	<b>5.02</b>	<b>3.21</b>	<b>1.71</b>	<b>0.98</b>	<b>0.72</b>	<b>0.54</b>	<b>0.42</b>	<b>0.33</b>	<b>0.26</b>	<b>0.20</b>
2007	0.03	0.90	<b>4.09</b>	<b>9.09</b>	<b>9.35</b>	<b>6.72</b>	<b>3.31</b>	<b>1.43</b>	<b>0.94</b>	<b>0.69</b>	<b>0.53</b>	<b>0.42</b>	<b>0.32</b>	<b>0.25</b>	<b>0.20</b>
2008	0.01	<b>0.83</b>	<b>4.92</b>	<b>6.81</b>	<b>5.36</b>	<b>3.00</b>	<b>1.36</b>	<b>0.68</b>	<b>0.48</b>	<b>0.38</b>	<b>0.29</b>	<b>0.23</b>	<b>0.18</b>	<b>0.14</b>	<b>0.11</b>
2009	<b>0.03</b>	<b>0.72</b>	<b>2.04</b>	<b>2.05</b>	<b>1.28</b>	<b>0.69</b>	<b>0.36</b>	<b>0.25</b>	<b>0.20</b>	<b>0.16</b>	<b>0.12</b>	<b>0.10</b>	<b>0.07</b>	<b>0.06</b>	<b>0.05</b>
2010	<b>0.03</b>	<b>0.59</b>	<b>1.51</b>	<b>1.38</b>	<b>0.85</b>	<b>0.59</b>	<b>0.46</b>	<b>0.36</b>	<b>0.28</b>	<b>0.22</b>	<b>0.17</b>	<b>0.14</b>	<b>0.11</b>	<b>0.08</b>	<b>0.07</b>
2011	<b>0.03</b>	<b>0.69</b>	<b>1.69</b>	<b>1.70</b>	<b>1.08</b>	<b>0.89</b>	<b>0.72</b>	<b>0.56</b>	<b>0.44</b>	<b>0.34</b>	<b>0.27</b>	<b>0.21</b>	<b>0.16</b>	<b>0.13</b>	<b>0.10</b>
2012	<b>0.04</b>	<b>0.71</b>	<b>1.65</b>	<b>1.46</b>	<b>1.16</b>	<b>1.02</b>	<b>0.81</b>	<b>0.63</b>	<b>0.49</b>	<b>0.38</b>	<b>0.30</b>	<b>0.23</b>	<b>0.18</b>	<b>0.14</b>	<b>0.11</b>
2013	<b>0.03</b>	<b>0.69</b>	<b>1.85</b>	<b>1.97</b>	<b>1.63</b>	<b>1.45</b>	<b>1.17</b>	<b>0.91</b>	<b>0.72</b>	<b>0.56</b>	<b>0.44</b>	<b>0.34</b>	<b>0.27</b>	<b>0.21</b>	<b>0.17</b>
2014	<b>0.04</b>	<b>0.75</b>	<b>2.03</b>	<b>2.00</b>	<b>1.84</b>	<b>1.63</b>	<b>1.30</b>	<b>1.01</b>	<b>0.78</b>	<b>0.61</b>	<b>0.47</b>	<b>0.37</b>	<b>0.28</b>	<b>0.22</b>	<b>0.17</b>
2015	<b>0.03</b>	<b>0.83</b>	<b>2.30</b>	<b>2.33</b>	<b>2.26</b>	<b>1.99</b>	<b>1.59</b>	<b>1.24</b>	<b>0.97</b>	<b>0.75</b>	<b>0.59</b>	<b>0.46</b>	<b>0.35</b>	<b>0.28</b>	<b>0.21</b>
2016	<b>0.05</b>	<b>0.86</b>	<b>1.92</b>	<b>1.94</b>	<b>1.91</b>	<b>1.67</b>	<b>1.32</b>	<b>1.02</b>	<b>0.79</b>	<b>0.61</b>	<b>0.47</b>	<b>0.37</b>	<b>0.28</b>	<b>0.22</b>	<b>0.17</b>



Conditional Prepayment Rates			Fixed Rate 15 Year Mortgages					by Credit Subsidy Endorsement Cohort							
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1980	0.58	0.88	0.89	2.79	4.56	5.21	8.55	10.13	8.70	8.65	4.86	4.81	9.95	11.48	18.59
1981	0.31	0.93	3.46	5.44	6.64	12.35	12.74	9.94	7.55	9.66	5.63	4.45	8.49	6.22	11.13
1982	0.24	11.35	8.94	7.08	16.96	15.38	9.23	7.60	7.14	4.23	9.84	7.33	6.79	6.33	8.94
1983	0.19	1.04	2.40	10.52	21.03	9.61	8.72	10.12	11.94	21.72	22.04	21.02	12.71	16.05	20.10
1984	0.24	1.58	12.45	21.10	8.95	7.81	9.19	10.62	19.79	19.52	17.66	10.12	11.37	11.99	18.77
1985	0.32	10.00	21.31	8.37	7.29	9.08	11.33	21.75	22.57	19.67	9.33	10.51	12.28	13.65	15.66
1986	0.58	4.63	4.11	4.72	6.20	7.89	16.45	23.44	22.22	9.54	13.31	12.97	15.78	16.90	18.51
1987	0.48	1.64	2.79	4.39	5.25	10.00	17.63	20.10	9.36	12.35	11.89	15.88	18.17	16.19	25.99
1988	0.47	1.83	3.54	5.33	11.66	20.23	21.04	8.64	11.47	11.44	12.94	15.43	14.36	16.91	22.69
1989	0.42	2.28	4.30	12.52	22.02	22.73	10.13	12.82	10.85	14.58	15.26	12.34	13.88	18.43	24.00
1990	0.63	2.55	9.27	23.93	25.45	9.71	14.21	12.22	16.63	15.90	12.19	14.41	17.69	19.78	27.16
1991	0.74	4.37	18.67	25.84	9.72	13.90	14.48	16.89	20.81	13.11	12.78	18.75	20.48	20.33	24.08
1992	0.62	6.48	13.85	8.76	12.38	12.19	17.60	19.01	13.21	16.21	18.09	23.18	23.17	23.87	32.46
1993	0.65	4.55	6.27	9.25	10.15	13.70	18.58	11.85	14.01	18.81	24.24	20.89	19.50	21.26	31.52
1994	0.92	3.29	6.34	7.56	12.12	13.12	10.25	12.64	17.33	22.59	18.84	17.44	18.41	19.13	31.92
1995	1.17	6.29	8.38	14.68	14.94	9.59	14.34	16.83	19.04	16.60	13.68	14.25	14.44	11.16	<b>24.16</b>
1996	0.78	3.78	9.31	13.10	9.75	13.26	17.56	23.05	18.88	15.24	12.47	12.20	13.23	<b>24.11</b>	<b>29.74</b>
1997	0.86	6.68	12.71	8.40	12.90	18.35	23.85	18.28	15.64	13.73	11.44	11.57	<b>21.83</b>	<b>29.54</b>	<b>27.53</b>
1998	0.98	5.84	6.74	11.12	16.91	26.33	20.11	16.31	14.35	13.11	10.12	<b>22.76</b>	<b>29.68</b>	<b>27.40</b>	<b>20.64</b>
1999	0.79	3.61	8.77	16.45	26.94	20.15	16.21	13.27	11.43	9.31	<b>20.85</b>	<b>29.09</b>	<b>26.87</b>	<b>19.73</b>	<b>19.07</b>
2000	0.94	14.70	25.43	33.71	23.12	17.72	14.26	10.99	8.29	<b>19.58</b>	<b>26.74</b>	<b>25.43</b>	<b>21.42</b>	<b>21.37</b>	<b>16.30</b>
2001	2.09	12.90	33.84	26.32	21.91	13.98	12.96	10.25	<b>19.21</b>	<b>27.94</b>	<b>25.88</b>	<b>19.36</b>	<b>18.83</b>	<b>12.68</b>	<b>12.43</b>
2002	1.87	22.85	23.42	18.76	15.30	11.99	10.03	<b>18.40</b>	<b>26.51</b>	<b>24.37</b>	<b>16.91</b>	<b>15.67</b>	<b>10.09</b>	<b>9.63</b>	<b>8.51</b>
2003	3.91	13.79	17.37	14.87	12.20	9.67	<b>13.40</b>	<b>18.90</b>	<b>17.37</b>	<b>11.47</b>	<b>10.07</b>	<b>6.52</b>	<b>6.42</b>	<b>6.40</b>	<b>6.48</b>
2004	4.08	13.18	12.54	11.01	8.49	<b>12.20</b>	<b>16.30</b>	<b>14.96</b>	<b>9.92</b>	<b>8.80</b>	<b>6.12</b>	<b>6.08</b>	<b>6.13</b>	<b>6.22</b>	<b>5.73</b>
2005	4.86	12.05	12.05	11.46	<b>16.24</b>	<b>22.66</b>	<b>21.17</b>	<b>14.23</b>	<b>12.52</b>	<b>8.14</b>	<b>7.91</b>	<b>7.90</b>	<b>8.02</b>	<b>8.15</b>	<b>7.82</b>
2006	3.66	10.02	11.24	<b>15.61</b>	<b>19.27</b>	<b>18.43</b>	<b>13.64</b>	<b>13.11</b>	<b>8.68</b>	<b>8.42</b>	<b>7.72</b>	<b>7.80</b>	<b>7.92</b>	<b>8.03</b>	<b>8.14</b>
2007	2.95	10.25	<b>16.62</b>	<b>16.38</b>	<b>15.49</b>	<b>11.92</b>	<b>12.98</b>	<b>9.28</b>	<b>9.18</b>	<b>8.16</b>	<b>8.22</b>	<b>8.34</b>	<b>8.46</b>	<b>8.58</b>	<b>8.70</b>
2008	1.46	<b>11.38</b>	<b>11.72</b>	<b>11.01</b>	<b>8.24</b>	<b>8.87</b>	<b>6.77</b>	<b>7.20</b>	<b>6.78</b>	<b>6.86</b>	<b>6.95</b>	<b>7.05</b>	<b>7.15</b>	<b>7.24</b>	<b>7.34</b>
2009	<b>1.21</b>	<b>5.73</b>	<b>7.72</b>	<b>5.96</b>	<b>6.38</b>	<b>5.19</b>	<b>5.60</b>	<b>5.57</b>	<b>5.64</b>	<b>5.72</b>	<b>5.80</b>	<b>5.89</b>	<b>5.97</b>	<b>6.05</b>	<b>6.13</b>
2010	<b>1.31</b>	<b>5.49</b>	<b>6.04</b>	<b>6.38</b>	<b>5.12</b>	<b>5.23</b>	<b>5.14</b>	<b>5.21</b>	<b>5.28</b>	<b>5.35</b>	<b>5.43</b>	<b>5.50</b>	<b>5.57</b>	<b>5.65</b>	<b>5.72</b>
2011	<b>1.63</b>	<b>5.25</b>	<b>7.80</b>	<b>5.80</b>	<b>5.94</b>	<b>5.58</b>	<b>5.66</b>	<b>5.73</b>	<b>5.81</b>	<b>5.89</b>	<b>5.97</b>	<b>6.05</b>	<b>6.13</b>	<b>6.21</b>	<b>6.28</b>
2012	<b>1.38</b>	<b>6.23</b>	<b>6.42</b>	<b>6.97</b>	<b>6.62</b>	<b>6.67</b>	<b>6.73</b>	<b>6.80</b>	<b>6.86</b>	<b>6.92</b>	<b>6.99</b>	<b>7.06</b>	<b>7.12</b>	<b>7.19</b>	<b>7.25</b>
2013	<b>0.89</b>	<b>3.31</b>	<b>6.26</b>	<b>6.67</b>	<b>7.27</b>	<b>7.34</b>	<b>7.41</b>	<b>7.49</b>	<b>7.56</b>	<b>7.63</b>	<b>7.70</b>	<b>7.77</b>	<b>7.84</b>	<b>7.91</b>	<b>7.97</b>
2014	<b>0.77</b>	<b>4.42</b>	<b>8.20</b>	<b>10.11</b>	<b>10.55</b>	<b>10.63</b>	<b>10.72</b>	<b>10.82</b>	<b>10.92</b>	<b>11.01</b>	<b>11.11</b>	<b>11.21</b>	<b>11.31</b>	<b>11.40</b>	<b>11.50</b>
2015	<b>1.06</b>	<b>5.31</b>	<b>8.82</b>	<b>10.15</b>	<b>10.31</b>	<b>10.34</b>	<b>10.40</b>	<b>10.45</b>	<b>10.50</b>	<b>10.55</b>	<b>10.61</b>	<b>10.67</b>	<b>10.72</b>	<b>10.77</b>	<b>10.82</b>
2016	<b>1.33</b>	<b>6.19</b>	<b>9.78</b>	<b>10.57</b>	<b>10.60</b>	<b>10.61</b>	<b>10.63</b>	<b>10.66</b>	<b>10.68</b>	<b>10.69</b>	<b>10.71</b>	<b>10.73</b>	<b>10.74</b>	<b>10.76</b>	<b>10.77</b>



Cumulative Claim Rates Fixed Rate 15 Year Mortgages by Credit Subsidy Endorsement Cohort															
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1980	0.00	0.29	3.50	5.54	7.00	8.16	10.79	12.54	13.70	14.29	14.29	14.29	14.29	14.29	14.29
1981	0.00	0.92	4.92	7.08	10.15	10.46	11.69	12.92	13.54	14.15	14.79	15.78	15.78	15.78	15.78
1982	0.00	1.42	4.01	7.08	8.49	9.20	10.61	11.56	11.79	12.03	12.26	12.53	12.53	12.53	12.53
1983	0.01	0.19	0.79	1.77	2.62	3.48	4.06	4.33	4.51	4.69	4.80	4.90	4.90	4.93	4.94
1984	0.02	0.54	1.57	3.06	4.82	5.82	6.50	6.86	7.18	7.34	7.47	7.57	7.63	7.63	7.65
1985	0.00	0.24	1.33	2.79	3.90	4.71	5.22	5.50	5.73	5.94	6.08	6.16	6.19	6.22	6.23
1986	0.00	0.16	0.72	1.43	1.96	2.36	2.73	2.93	3.09	3.18	3.25	3.30	3.33	3.35	3.39
1987	0.00	0.13	0.46	0.85	1.25	1.61	1.85	2.03	2.15	2.25	2.31	2.36	2.39	2.42	2.44
1988	0.01	0.23	0.80	1.50	2.18	2.74	3.11	3.40	3.61	3.77	3.91	3.95	4.00	4.03	4.05
1989	0.02	0.17	0.57	1.19	1.84	2.24	2.53	2.80	2.93	3.08	3.18	3.28	3.33	3.36	3.39
1990	0.00	0.07	0.53	1.03	1.36	1.70	1.88	2.05	2.16	2.22	2.26	2.27	2.28	2.30	2.33
1991	0.00	0.17	0.52	1.10	1.43	1.64	1.85	1.98	2.09	2.12	2.12	2.15	2.16	2.17	2.18
1992	0.00	0.10	0.35	0.70	0.97	1.24	1.47	1.64	1.77	1.80	1.82	1.83	1.88	1.90	1.90
1993	0.01	0.06	0.28	0.50	0.69	0.91	1.01	1.15	1.23	1.27	1.30	1.32	1.33	1.34	1.34
1994	0.00	0.07	0.24	0.53	0.89	1.11	1.34	1.50	1.60	1.66	1.73	1.75	1.76	1.80	1.80
1995	0.00	0.13	0.60	1.28	1.92	2.36	2.58	2.85	3.04	3.24	3.28	3.39	3.41	3.41	3.46
1996	0.00	0.08	0.44	0.77	1.14	1.47	1.76	1.97	2.06	2.21	2.30	2.37	2.39	2.40	2.40
1997	0.00	0.10	0.47	1.00	1.38	1.70	1.84	2.01	2.20	2.38	2.40	2.40	2.42	2.44	2.45
1998	0.00	0.05	0.32	0.52	0.92	1.21	1.42	1.58	1.73	1.84	1.84	1.88	1.90	1.91	1.91
1999	0.00	0.11	0.33	0.68	1.08	1.37	1.56	1.64	1.71	1.75	1.79	1.82	1.84	1.85	1.85
2000	0.00	0.07	0.65	1.37	2.04	2.44	2.63	2.76	2.88	2.94	2.99	3.02	3.04	3.04	3.05
2001	0.00	0.11	0.74	1.38	1.87	2.24	2.41	2.52	2.66	2.71	2.74	2.76	2.77	2.77	2.77
2002	0.01	0.20	0.72	1.16	1.49	1.62	1.75	1.87	1.94	1.98	2.01	2.03	2.03	2.04	2.04
2003	0.01	0.20	0.52	0.78	0.97	1.12	1.26	1.37	1.44	1.49	1.52	1.54	1.55	1.56	1.56
2004	0.01	0.18	0.42	0.82	1.16	1.38	1.55	1.67	1.74	1.79	1.82	1.84	1.86	1.87	1.88
2005	0.02	0.73	2.54	3.85	5.13	6.21	6.87	7.25	7.46	7.57	7.65	7.71	7.75	7.78	7.80
2006	0.09	1.43	3.39	5.82	9.24	11.49	12.59	13.08	13.32	13.48	13.58	13.66	13.71	13.75	13.78
2007	0.03	0.90	4.43	10.64	15.40	17.97	19.00	19.37	19.59	19.74	19.84	19.91	19.96	20.00	20.03
2008	0.01	0.83	5.08	9.99	13.17	14.70	15.32	15.60	15.79	15.92	16.02	16.08	16.14	16.17	16.20
2009	0.03	0.73	2.62	4.32	5.30	5.79	6.03	6.19	6.31	6.39	6.46	6.50	6.54	6.56	6.58
2010	0.03	0.61	2.00	3.19	3.86	4.30	4.62	4.86	5.04	5.17	5.27	5.34	5.39	5.43	5.46
2011	0.03	0.70	2.27	3.70	4.53	5.18	5.66	6.01	6.27	6.46	6.60	6.70	6.77	6.83	6.87
2012	0.04	0.74	2.25	3.48	4.38	5.10	5.64	6.02	6.30	6.50	6.65	6.75	6.83	6.88	6.92
2013	0.03	0.71	2.47	4.19	5.49	6.55	7.33	7.88	8.28	8.56	8.77	8.92	9.02	9.10	9.16
2014	0.04	0.79	2.70	4.39	5.75	6.81	7.55	8.06	8.40	8.64	8.81	8.92	8.99	9.05	9.08
2015	0.03	0.86	2.99	4.91	6.54	7.80	8.68	9.29	9.70	9.99	10.19	10.32	10.42	10.48	10.53
2016	0.05	0.89	2.65	4.22	5.57	6.61	7.32	7.81	8.15	8.38	8.53	8.64	8.72	8.77	8.80



Cumulative Prepayment Rates			Fixed Rate 15 Year Mortgages					by Credit Subsidy Endorsement Cohort							
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1980	0.58	1.46	2.33	4.96	9.04	13.41	20.12	27.11	32.36	37.03	39.39	41.62	46.01	50.57	57.10
1981	0.31	1.23	4.62	9.54	15.08	24.31	32.62	38.15	41.85	46.15	48.39	50.03	52.93	54.88	58.14
1982	0.24	11.56	19.34	24.76	36.32	44.81	49.06	52.12	54.72	56.13	59.26	61.35	63.12	64.67	66.71
1983	0.19	1.23	3.60	13.66	31.45	37.78	42.90	48.27	53.93	62.96	70.09	75.37	77.88	80.64	83.54
1984	0.24	1.81	13.97	31.79	37.62	42.11	46.90	51.85	60.02	66.42	71.06	73.23	75.41	77.45	80.25
1985	0.32	10.29	29.35	35.15	39.67	44.79	50.51	60.14	67.90	73.08	75.04	77.03	79.09	81.10	83.09
1986	0.58	5.19	9.08	13.34	18.63	24.89	36.86	51.02	61.25	64.65	68.94	72.54	76.36	79.79	82.91
1987	0.48	2.11	4.84	8.99	13.72	22.23	35.66	48.22	52.87	58.43	63.10	68.60	73.87	77.72	82.88
1988	0.47	2.29	5.74	10.73	20.96	36.51	49.29	53.41	58.36	62.71	67.05	71.53	75.05	78.59	82.54
1989	0.42	2.70	6.87	18.46	36.15	50.25	55.06	60.50	64.48	69.23	73.46	76.34	79.17	82.40	85.81
1990	0.63	3.16	12.13	33.03	49.82	54.55	60.77	65.34	70.76	75.07	77.83	80.70	83.71	86.48	89.53
1991	0.74	5.08	22.77	42.59	48.06	55.08	61.35	67.57	73.90	77.05	79.71	83.12	86.14	88.52	90.76
1992	0.62	7.06	19.92	26.90	35.87	43.57	53.28	61.88	66.70	71.81	76.59	81.59	85.43	88.46	91.59
1993	0.65	5.17	11.11	19.30	27.44	37.28	48.77	54.72	60.90	68.02	75.47	80.32	83.90	87.04	90.70
1994	0.92	4.18	10.25	17.01	27.01	36.47	42.87	49.92	58.34	67.39	73.22	77.59	81.39	84.62	88.95
1995	1.17	7.39	15.13	27.50	38.14	43.89	51.60	59.31	66.51	71.57	75.01	78.11	80.78	82.54	<b>85.94</b>
1996	0.78	4.53	13.42	24.70	31.97	40.84	50.97	61.86	68.69	73.15	76.22	78.84	81.33	<b>85.26</b>	<b>88.93</b>
1997	0.86	7.48	19.22	25.97	35.39	46.99	59.23	66.35	71.30	74.93	77.53	79.85	<b>83.73</b>	<b>87.82</b>	<b>90.50</b>
1998	0.98	6.77	13.05	22.68	35.66	52.36	61.70	67.71	72.12	75.55	77.84	<b>82.46</b>	<b>87.11</b>	<b>90.12</b>	<b>91.77</b>
1999	0.79	4.37	12.75	27.05	46.52	57.08	63.81	68.41	71.83	74.29	<b>79.29</b>	<b>84.79</b>	<b>88.39</b>	<b>90.32</b>	<b>91.81</b>
2000	0.94	15.51	36.98	58.00	67.40	72.81	76.34	78.65	80.19	<b>83.51</b>	<b>87.13</b>	<b>89.64</b>	<b>91.21</b>	<b>92.44</b>	<b>93.18</b>
2001	2.09	14.71	43.54	58.21	67.06	71.41	74.82	77.16	<b>81.06</b>	<b>85.61</b>	<b>88.63</b>	<b>90.30</b>	<b>91.61</b>	<b>92.32</b>	<b>92.93</b>
2002	1.87	24.29	41.97	52.72	59.78	64.42	67.83	<b>73.42</b>	<b>79.97</b>	<b>84.38</b>	<b>86.69</b>	<b>88.46</b>	<b>89.42</b>	<b>90.24</b>	<b>90.90</b>
2003	3.91	17.16	31.52	41.62	48.65	53.52	<b>59.60</b>	<b>67.00</b>	<b>72.49</b>	<b>75.48</b>	<b>77.80</b>	<b>79.15</b>	<b>80.39</b>	<b>81.55</b>	<b>82.64</b>
2004	4.08	16.72	27.14	35.12	40.55	<b>47.66</b>	<b>55.97</b>	<b>62.33</b>	<b>65.90</b>	<b>68.75</b>	<b>70.55</b>	<b>72.23</b>	<b>73.82</b>	<b>75.33</b>	<b>76.64</b>
2005	4.86	16.32	26.31	34.47	<b>44.48</b>	<b>55.90</b>	<b>63.92</b>	<b>68.08</b>	<b>71.17</b>	<b>72.91</b>	<b>74.45</b>	<b>75.86</b>	<b>77.18</b>	<b>78.41</b>	<b>79.49</b>
2006	3.66	13.30	22.89	<b>34.40</b>	<b>45.92</b>	<b>54.18</b>	<b>58.87</b>	<b>62.61</b>	<b>64.72</b>	<b>66.57</b>	<b>68.11</b>	<b>69.54</b>	<b>70.87</b>	<b>72.11</b>	<b>73.26</b>
2007	2.95	12.90	<b>27.23</b>	<b>38.43</b>	<b>46.32</b>	<b>50.88</b>	<b>54.92</b>	<b>57.34</b>	<b>59.48</b>	<b>61.19</b>	<b>62.76</b>	<b>64.21</b>	<b>65.55</b>	<b>66.79</b>	<b>67.94</b>
2008	1.46	<b>12.67</b>	<b>22.81</b>	<b>30.75</b>	<b>35.63</b>	<b>40.17</b>	<b>43.23</b>	<b>46.22</b>	<b>48.80</b>	<b>51.23</b>	<b>53.52</b>	<b>55.67</b>	<b>57.68</b>	<b>59.58</b>	<b>61.36</b>
2009	<b>1.21</b>	<b>6.86</b>	<b>14.00</b>	<b>18.97</b>	<b>23.86</b>	<b>27.54</b>	<b>31.28</b>	<b>34.77</b>	<b>38.10</b>	<b>41.28</b>	<b>44.32</b>	<b>47.21</b>	<b>49.97</b>	<b>52.61</b>	<b>55.11</b>
2010	<b>1.31</b>	<b>6.73</b>	<b>12.33</b>	<b>17.80</b>	<b>21.84</b>	<b>25.73</b>	<b>29.33</b>	<b>32.77</b>	<b>36.06</b>	<b>39.22</b>	<b>42.24</b>	<b>45.12</b>	<b>47.88</b>	<b>50.52</b>	<b>53.04</b>
2011	<b>1.63</b>	<b>6.80</b>	<b>14.01</b>	<b>18.87</b>	<b>23.47</b>	<b>27.49</b>	<b>31.30</b>	<b>34.91</b>	<b>38.35</b>	<b>41.61</b>	<b>44.71</b>	<b>47.65</b>	<b>50.45</b>	<b>53.10</b>	<b>55.62</b>
2012	<b>1.38</b>	<b>7.52</b>	<b>13.42</b>	<b>19.30</b>	<b>24.41</b>	<b>29.15</b>	<b>33.58</b>	<b>37.71</b>	<b>41.57</b>	<b>45.18</b>	<b>48.56</b>	<b>51.72</b>	<b>54.68</b>	<b>57.44</b>	<b>60.03</b>
2013	<b>0.89</b>	<b>4.17</b>	<b>10.13</b>	<b>15.96</b>	<b>21.76</b>	<b>27.10</b>	<b>32.02</b>	<b>36.56</b>	<b>40.76</b>	<b>44.65</b>	<b>48.25</b>	<b>51.59</b>	<b>54.69</b>	<b>57.56</b>	<b>60.22</b>
2014	<b>0.77</b>	<b>5.16</b>	<b>12.87</b>	<b>21.40</b>	<b>29.23</b>	<b>36.14</b>	<b>42.26</b>	<b>47.69</b>	<b>52.52</b>	<b>56.83</b>	<b>60.66</b>	<b>64.09</b>	<b>67.14</b>	<b>69.86</b>	<b>72.29</b>
2015	<b>1.06</b>	<b>6.31</b>	<b>14.50</b>	<b>22.87</b>	<b>30.31</b>	<b>36.84</b>	<b>42.60</b>	<b>47.69</b>	<b>52.21</b>	<b>56.23</b>	<b>59.81</b>	<b>63.01</b>	<b>65.87</b>	<b>68.42</b>	<b>70.71</b>
2016	<b>1.33</b>	<b>7.43</b>	<b>16.39</b>	<b>24.95</b>	<b>32.46</b>	<b>39.03</b>	<b>44.81</b>	<b>49.91</b>	<b>54.43</b>	<b>58.43</b>	<b>61.99</b>	<b>65.15</b>	<b>67.96</b>	<b>70.47</b>	<b>72.71</b>



**Conditional Claim Rates    Fixed Rate 15 Year Streamline Refinance Mortgages    by Credit Subsidy Endorsement Cohort**

Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1990	0.00	0.24	0.79	0.79	0.87	0.89	0.33	1.16	0.91	0.56	0.00	0.00	0.00	0.00	0.00
1991	0.00	0.00	0.12	0.48	0.12	0.00	0.30	0.17	0.20	0.00	0.00	0.00	0.00	0.53	1.30
1992	0.00	0.05	0.11	0.17	0.19	0.21	0.35	0.14	0.04	0.19	0.00	0.00	0.00	0.00	0.00
1993	0.00	0.02	0.11	0.13	0.17	0.17	0.13	0.16	0.09	0.09	0.04	0.03	0.00	0.04	0.00
1994	0.00	0.07	0.21	0.22	0.29	0.32	0.21	0.12	0.13	0.09	0.06	0.09	0.07	0.02	0.04
1995	0.03	0.14	0.41	0.48	0.52	0.49	0.33	0.25	0.30	0.09	0.00	0.27	0.00	0.00	<b>0.02</b>
1996	0.00	0.04	0.13	0.26	0.43	0.34	0.13	0.13	0.27	0.08	0.14	0.06	0.00	<b>0.01</b>	<b>0.03</b>
1997	0.00	0.10	0.17	0.45	0.39	0.20	0.15	0.13	0.25	0.10	0.00	0.00	<b>0.19</b>	<b>0.04</b>	<b>0.03</b>
1998	0.00	0.02	0.14	0.10	0.18	0.16	0.14	0.23	0.03	0.04	0.05	<b>0.02</b>	<b>0.04</b>	<b>0.04</b>	<b>0.03</b>
1999	0.00	0.03	0.08	0.15	0.13	0.20	0.12	0.13	0.11	0.05	<b>0.03</b>	<b>0.05</b>	<b>0.04</b>	<b>0.03</b>	<b>0.02</b>
2000	0.00	0.16	0.06	0.36	0.38	0.37	0.46	0.19	0.43	<b>0.30</b>	<b>0.11</b>	<b>0.09</b>	<b>0.07</b>	<b>0.04</b>	<b>0.02</b>
2001	0.00	0.02	0.12	0.22	0.73	0.12	0.21	0.16	<b>0.23</b>	<b>0.11</b>	<b>0.09</b>	<b>0.07</b>	<b>0.04</b>	<b>0.02</b>	<b>0.01</b>
2002	0.00	0.03	0.24	0.12	0.18	0.18	0.11	<b>0.12</b>	<b>0.12</b>	<b>0.10</b>	<b>0.08</b>	<b>0.04</b>	<b>0.02</b>	<b>0.01</b>	<b>0.01</b>
2003	0.00	0.03	0.11	0.15	0.13	0.15	<b>0.15</b>	<b>0.11</b>	<b>0.09</b>	<b>0.07</b>	<b>0.04</b>	<b>0.02</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>
2004	0.01	0.08	0.17	0.19	0.16	<b>0.17</b>	<b>0.13</b>	<b>0.10</b>	<b>0.08</b>	<b>0.05</b>	<b>0.02</b>	<b>0.02</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>
2005	0.05	0.07	0.22	0.11	<b>0.42</b>	<b>0.34</b>	<b>0.29</b>	<b>0.20</b>	<b>0.11</b>	<b>0.05</b>	<b>0.03</b>	<b>0.02</b>	<b>0.02</b>	<b>0.01</b>	<b>0.01</b>
2006	0.00	0.10	0.10	<b>0.54</b>	<b>0.65</b>	<b>0.64</b>	<b>0.43</b>	<b>0.19</b>	<b>0.07</b>	<b>0.04</b>	<b>0.03</b>	<b>0.02</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>
2007	0.00	0.23	<b>0.25</b>	<b>0.93</b>	<b>1.18</b>	<b>0.89</b>	<b>0.40</b>	<b>0.13</b>	<b>0.07</b>	<b>0.04</b>	<b>0.03</b>	<b>0.02</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>
2008	0.00	<b>0.09</b>	<b>0.61</b>	<b>0.97</b>	<b>0.86</b>	<b>0.52</b>	<b>0.18</b>	<b>0.09</b>	<b>0.06</b>	<b>0.04</b>	<b>0.03</b>	<b>0.02</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>
2009	<b>0.01</b>	<b>0.16</b>	<b>0.58</b>	<b>0.61</b>	<b>0.49</b>	<b>0.22</b>	<b>0.10</b>	<b>0.07</b>	<b>0.05</b>	<b>0.04</b>	<b>0.03</b>	<b>0.02</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>
2010	<b>0.01</b>	<b>0.12</b>	<b>0.33</b>	<b>0.35</b>	<b>0.18</b>	<b>0.12</b>	<b>0.10</b>	<b>0.07</b>	<b>0.05</b>	<b>0.04</b>	<b>0.03</b>	<b>0.02</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>
2011	<b>0.01</b>	<b>0.10</b>	<b>0.27</b>	<b>0.17</b>	<b>0.15</b>	<b>0.12</b>	<b>0.10</b>	<b>0.08</b>	<b>0.05</b>	<b>0.04</b>	<b>0.03</b>	<b>0.02</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>
2012	<b>0.01</b>	<b>0.09</b>	<b>0.17</b>	<b>0.14</b>	<b>0.14</b>	<b>0.12</b>	<b>0.10</b>	<b>0.08</b>	<b>0.05</b>	<b>0.04</b>	<b>0.03</b>	<b>0.02</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>
2013	<b>0.00</b>	<b>0.07</b>	<b>0.15</b>	<b>0.13</b>	<b>0.15</b>	<b>0.13</b>	<b>0.11</b>	<b>0.08</b>	<b>0.06</b>	<b>0.04</b>	<b>0.03</b>	<b>0.02</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>
2014	<b>0.00</b>	<b>0.06</b>	<b>0.14</b>	<b>0.15</b>	<b>0.16</b>	<b>0.14</b>	<b>0.12</b>	<b>0.09</b>	<b>0.06</b>	<b>0.04</b>	<b>0.03</b>	<b>0.02</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>
2015	<b>0.00</b>	<b>0.07</b>	<b>0.13</b>	<b>0.14</b>	<b>0.16</b>	<b>0.14</b>	<b>0.12</b>	<b>0.09</b>	<b>0.06</b>	<b>0.04</b>	<b>0.03</b>	<b>0.02</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>
2016	<b>0.00</b>	<b>0.06</b>	<b>0.11</b>	<b>0.14</b>	<b>0.16</b>	<b>0.14</b>	<b>0.12</b>	<b>0.09</b>	<b>0.06</b>	<b>0.04</b>	<b>0.03</b>	<b>0.02</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>



**Conditional Prepayment Rates      Fixed Rate 15 Year Streamline Refinance Mortgages      by Credit Subsidy Endorsement Cohort**

Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1990	1.20	7.88	15.70	26.86	25.33	10.06	13.62	13.13	16.70	16.56	13.36	13.10	22.14	22.75	25.43
1991	0.39	8.56	24.71	31.27	10.37	12.24	10.49	17.31	20.98	12.66	10.67	19.61	22.34	18.09	24.20
1992	0.62	8.36	16.44	7.15	11.55	10.77	14.90	18.60	11.46	14.41	23.40	24.67	23.26	21.67	26.86
1993	0.93	6.25	6.09	8.87	9.52	13.63	16.45	11.56	14.37	19.87	27.42	21.90	20.17	22.52	25.75
1994	1.44	4.15	7.57	8.06	11.74	14.02	10.15	13.11	17.73	24.11	20.63	18.86	20.01	20.31	32.85
1995	1.89	9.85	8.77	13.26	16.89	10.20	12.24	17.12	20.27	17.65	14.28	14.15	15.95	15.56	<b>25.10</b>
1996	0.96	4.41	9.73	13.59	9.37	12.42	17.20	26.20	21.51	17.54	16.59	15.43	16.79	<b>25.21</b>	<b>30.61</b>
1997	1.31	9.00	14.64	8.74	10.01	19.37	25.32	19.84	19.09	16.38	14.46	11.55	<b>20.66</b>	<b>28.35</b>	<b>27.55</b>
1998	1.06	7.05	6.50	10.00	15.73	28.66	21.57	16.59	15.41	12.65	14.12	<b>20.27</b>	<b>27.95</b>	<b>27.20</b>	<b>22.79</b>
1999	1.26	4.29	8.46	13.40	25.21	20.16	16.50	14.64	11.92	11.77	<b>18.28</b>	<b>26.70</b>	<b>26.46</b>	<b>21.95</b>	<b>22.52</b>
2000	2.35	11.30	15.37	24.68	23.19	17.60	17.96	13.43	9.50	<b>18.72</b>	<b>23.90</b>	<b>23.18</b>	<b>19.34</b>	<b>21.05</b>	<b>21.97</b>
2001	1.09	11.82	32.82	25.22	18.60	13.71	11.34	10.11	<b>16.49</b>	<b>22.84</b>	<b>22.78</b>	<b>18.79</b>	<b>19.08</b>	<b>17.42</b>	<b>17.30</b>
2002	2.21	21.11	18.54	17.21	13.03	9.77	8.63	<b>13.79</b>	<b>21.18</b>	<b>21.75</b>	<b>17.62</b>	<b>17.07</b>	<b>14.77</b>	<b>14.33</b>	<b>11.95</b>
2003	5.11	11.28	13.45	11.83	9.84	8.08	<b>11.50</b>	<b>16.86</b>	<b>17.03</b>	<b>13.70</b>	<b>13.27</b>	<b>10.69</b>	<b>10.84</b>	<b>11.19</b>	<b>11.92</b>
2004	4.46	9.93	10.57	8.89	7.20	<b>10.86</b>	<b>14.52</b>	<b>14.39</b>	<b>11.61</b>	<b>11.53</b>	<b>9.89</b>	<b>10.28</b>	<b>10.83</b>	<b>11.54</b>	<b>12.33</b>
2005	6.11	11.57	12.51	10.14	<b>15.50</b>	<b>23.34</b>	<b>21.32</b>	<b>17.10</b>	<b>16.56</b>	<b>13.31</b>	<b>13.20</b>	<b>13.73</b>	<b>14.62</b>	<b>15.60</b>	<b>16.73</b>
2006	1.84	5.44	7.12	<b>10.81</b>	<b>15.29</b>	<b>16.55</b>	<b>12.64</b>	<b>12.52</b>	<b>10.75</b>	<b>10.56</b>	<b>9.49</b>	<b>10.13</b>	<b>10.80</b>	<b>11.52</b>	<b>12.28</b>
2007	0.70	8.69	<b>9.07</b>	<b>10.00</b>	<b>11.24</b>	<b>10.80</b>	<b>11.06</b>	9.91	9.99	8.78	9.37	10.00	10.66	11.37	12.12
2008	1.15	<b>6.18</b>	<b>6.08</b>	<b>6.61</b>	<b>6.33</b>	<b>8.48</b>	<b>7.65</b>	8.05	8.11	8.67	9.27	9.90	10.56	11.26	12.00
2009	<b>0.88</b>	<b>3.44</b>	<b>4.45</b>	<b>4.30</b>	6.15	7.59	7.49	7.67	8.18	8.74	9.33	9.96	10.62	11.32	12.07
2010	<b>1.07</b>	<b>4.28</b>	<b>5.18</b>	<b>7.13</b>	7.99	8.38	7.43	7.70	8.23	8.78	9.37	10.00	10.66	11.37	12.12
2011	<b>1.22</b>	<b>4.08</b>	<b>6.87</b>	<b>7.57</b>	8.17	8.21	7.46	7.73	8.26	8.81	9.41	10.04	10.70	11.41	12.16
2012	<b>1.12</b>	<b>5.03</b>	<b>7.03</b>	<b>7.99</b>	7.95	8.29	7.54	7.82	8.34	8.90	9.49	10.12	10.79	11.50	12.26
2013	<b>1.08</b>	<b>4.75</b>	<b>7.54</b>	<b>7.85</b>	8.29	8.65	7.87	8.14	8.69	9.26	9.89	10.54	11.22	11.95	12.72
2014	<b>1.07</b>	<b>5.08</b>	<b>7.70</b>	<b>8.51</b>	9.03	9.38	8.52	8.78	9.34	9.92	10.54	11.19	11.88	12.60	13.37
2015	<b>1.15</b>	<b>5.07</b>	<b>7.71</b>	<b>8.52</b>	9.00	9.34	8.48	8.75	9.29	9.87	10.50	11.14	11.82	12.54	13.30
2016	<b>1.03</b>	<b>5.09</b>	<b>7.87</b>	<b>8.44</b>	8.91	9.26	8.40	8.67	9.22	9.80	10.42	11.06	11.75	12.46	13.22



**Cumulative Claim Rates Fixed Rate 15 Year Streamline Refinance Mortgages by Credit Subsidy Endorsement Cohort**

Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1990	0.00	0.24	0.96	1.56	2.04	2.40	2.51	2.87	3.12	3.24	3.24	3.24	3.24	3.24	3.24
1991	0.00	0.00	0.11	0.44	0.50	0.50	0.61	0.66	0.72	0.72	0.72	0.72	0.72	0.77	0.88
1992	0.00	0.05	0.15	0.28	0.41	0.54	0.74	0.80	0.82	0.88	0.88	0.88	0.88	0.88	0.88
1993	0.00	0.02	0.13	0.24	0.37	0.50	0.58	0.66	0.71	0.74	0.75	0.76	0.76	0.77	0.77
1994	0.00	0.07	0.26	0.46	0.68	0.91	1.03	1.10	1.16	1.19	1.21	1.23	1.24	1.25	1.25
1995	0.03	0.17	0.53	0.92	1.28	1.55	1.72	1.83	1.94	1.97	1.97	2.03	2.03	2.03	2.03
1996	0.00	0.04	0.17	0.39	0.71	0.93	1.01	1.07	1.17	1.19	1.22	1.23	1.23	1.23	1.23
1997	0.00	0.10	0.25	0.59	0.87	0.99	1.06	1.11	1.19	1.21	1.21	1.21	1.24	1.25	1.25
1998	0.00	0.02	0.15	0.23	0.37	0.47	0.54	0.62	0.63	0.64	0.65	0.66	0.66	0.67	0.67
1999	0.00	0.03	0.11	0.24	0.34	0.45	0.50	0.55	0.58	0.60	0.60	0.61	0.62	0.62	0.62
2000	0.00	0.16	0.21	0.47	0.68	0.84	0.99	1.05	1.15	1.22	1.24	1.25	1.25	1.26	1.26
2001	0.00	0.02	0.13	0.26	0.58	0.62	0.68	0.73	0.78	0.80	0.82	0.83	0.83	0.83	0.83
2002	0.00	0.03	0.21	0.29	0.38	0.46	0.51	0.55	0.59	0.62	0.63	0.64	0.64	0.64	0.64
2003	0.00	0.02	0.12	0.23	0.31	0.40	0.48	0.53	0.57	0.59	0.60	0.61	0.61	0.61	0.61
2004	0.01	0.08	0.23	0.37	0.48	0.59	0.67	0.72	0.75	0.77	0.78	0.78	0.79	0.79	0.79
2005	0.05	0.11	0.29	0.37	0.64	0.83	0.95	1.01	1.04	1.05	1.06	1.06	1.07	1.07	1.07
2006	0.00	0.10	0.19	0.65	1.15	1.56	1.79	1.87	1.90	1.92	1.92	1.93	1.93	1.94	1.94
2007	0.00	0.23	0.46	1.22	2.08	2.65	2.88	2.95	2.98	2.99	3.00	3.01	3.01	3.02	3.02
2008	0.00	0.09	0.65	1.49	2.18	2.56	2.69	2.74	2.77	2.79	2.81	2.81	2.82	2.82	2.83
2009	0.01	0.16	0.71	1.26	1.69	1.87	1.94	2.00	2.03	2.05	2.06	2.07	2.08	2.08	2.09
2010	0.01	0.13	0.44	0.75	0.90	0.99	1.06	1.11	1.14	1.16	1.18	1.19	1.19	1.19	1.20
2011	0.01	0.10	0.36	0.51	0.63	0.72	0.79	0.84	0.87	0.89	0.90	0.91	0.92	0.92	0.92
2012	0.01	0.10	0.25	0.38	0.49	0.58	0.65	0.70	0.73	0.75	0.76	0.77	0.77	0.78	0.78
2013	0.00	0.07	0.21	0.33	0.44	0.54	0.61	0.66	0.69	0.71	0.72	0.73	0.74	0.74	0.74
2014	0.00	0.07	0.20	0.33	0.45	0.56	0.63	0.68	0.72	0.74	0.75	0.76	0.76	0.77	0.77
2015	0.00	0.07	0.19	0.32	0.45	0.55	0.62	0.68	0.71	0.73	0.74	0.75	0.76	0.76	0.76
2016	0.00	0.06	0.17	0.29	0.42	0.52	0.59	0.64	0.68	0.70	0.71	0.72	0.72	0.73	0.73



**Cumulative Prepayment Rates      Fixed Rate 15 Year Streamline Refinance Mortgages      by Credit Subsidy Endorsement Cohort**

Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1990	1.20	8.98	23.23	43.59	57.49	61.56	66.47	70.54	74.98	78.61	81.03	83.09	86.12	88.54	90.63
1991	0.39	8.92	31.43	52.83	57.68	62.80	66.65	72.32	77.99	80.68	82.67	85.93	88.91	90.79	92.83
1992	0.62	8.93	23.90	29.33	37.46	44.14	52.39	61.11	65.47	70.33	77.07	82.51	86.37	89.13	91.81
1993	0.93	7.11	12.76	20.49	28.04	37.80	47.95	53.89	60.42	68.15	76.68	81.62	85.18	88.34	91.15
1994	1.44	5.52	12.67	19.69	29.06	38.91	45.02	52.09	60.39	69.66	75.67	80.03	83.78	86.83	90.74
1995	1.89	11.55	19.29	29.92	41.60	47.43	53.68	61.32	68.79	73.95	77.39	80.31	83.13	85.44	<b>88.58</b>
1996	0.96	5.33	14.54	26.13	33.01	41.24	51.19	63.71	71.29	76.12	79.89	82.80	85.48	<b>88.83</b>	<b>91.87</b>
1997	1.31	10.19	23.32	30.00	36.95	49.00	61.66	69.06	74.75	78.69	81.60	83.58	<b>86.73</b>	<b>90.14</b>	<b>92.51</b>
1998	1.06	8.04	14.02	22.60	34.74	53.34	63.30	69.30	73.94	77.15	80.29	<b>84.15</b>	<b>88.40</b>	<b>91.37</b>	<b>93.19</b>
1999	1.26	5.50	13.49	25.07	43.90	55.14	62.47	67.89	71.65	74.92	<b>79.40</b>	<b>84.74</b>	<b>88.61</b>	<b>90.98</b>	<b>92.87</b>
2000	2.35	13.39	26.67	44.72	57.43	64.80	70.97	74.74	77.04	<b>81.12</b>	<b>85.34</b>	<b>88.45</b>	<b>90.45</b>	<b>92.19</b>	<b>93.63</b>
2001	1.09	12.78	41.40	56.15	64.26	69.08	72.51	75.22	<b>79.19</b>	<b>83.77</b>	<b>87.28</b>	<b>89.52</b>	<b>91.36</b>	<b>92.72</b>	<b>93.84</b>
2002	2.21	22.86	37.16	47.93	54.68	59.07	62.57	<b>67.66</b>	<b>74.39</b>	<b>79.83</b>	<b>83.28</b>	<b>86.02</b>	<b>87.99</b>	<b>89.62</b>	<b>90.79</b>
2003	5.11	15.82	27.14	35.74	42.04	46.70	<b>52.78</b>	<b>60.66</b>	<b>67.27</b>	<b>71.68</b>	<b>75.36</b>	<b>77.93</b>	<b>80.26</b>	<b>82.40</b>	<b>84.42</b>
2004	4.46	13.95	23.04	29.86	34.88	<b>41.90</b>	<b>50.25</b>	<b>57.31</b>	<b>62.19</b>	<b>66.46</b>	<b>69.70</b>	<b>72.73</b>	<b>75.60</b>	<b>78.32</b>	<b>80.90</b>
2005	6.11	16.97	27.35	34.68	<b>44.75</b>	<b>57.50</b>	<b>66.38</b>	<b>71.97</b>	<b>76.45</b>	<b>79.44</b>	<b>82.02</b>	<b>84.34</b>	<b>86.47</b>	<b>88.42</b>	<b>90.18</b>
2006	1.84	7.18	13.79	<b>23.09</b>	<b>34.75</b>	<b>45.35</b>	<b>52.06</b>	<b>57.84</b>	<b>62.17</b>	<b>65.96</b>	<b>69.01</b>	<b>71.96</b>	<b>74.78</b>	<b>77.46</b>	<b>79.99</b>
2007	0.70	9.32	<b>17.53</b>	<b>25.73</b>	<b>33.94</b>	<b>40.85</b>	<b>47.09</b>	<b>52.05</b>	<b>56.55</b>	<b>60.10</b>	<b>63.56</b>	<b>66.90</b>	<b>70.11</b>	<b>73.17</b>	<b>76.05</b>
2008	1.15	<b>7.26</b>	<b>12.89</b>	<b>18.61</b>	<b>23.66</b>	<b>29.95</b>	<b>35.11</b>	<b>40.12</b>	<b>44.76</b>	<b>49.30</b>	<b>53.75</b>	<b>58.05</b>	<b>62.18</b>	<b>66.12</b>	<b>69.85</b>
2009	<b>0.88</b>	<b>4.29</b>	<b>8.54</b>	<b>12.44</b>	<b>17.75</b>	<b>23.86</b>	<b>29.42</b>	<b>34.68</b>	<b>39.87</b>	<b>44.94</b>	<b>49.89</b>	<b>54.67</b>	<b>59.27</b>	<b>63.65</b>	<b>67.78</b>
2010	<b>1.07</b>	<b>5.31</b>	<b>10.21</b>	<b>16.58</b>	<b>23.19</b>	<b>29.55</b>	<b>34.71</b>	<b>39.66</b>	<b>44.53</b>	<b>49.30</b>	<b>53.94</b>	<b>58.43</b>	<b>62.74</b>	<b>66.84</b>	<b>70.71</b>
2011	<b>1.22</b>	<b>5.25</b>	<b>11.75</b>	<b>18.41</b>	<b>25.03</b>	<b>31.13</b>	<b>36.22</b>	<b>41.09</b>	<b>45.88</b>	<b>50.57</b>	<b>55.14</b>	<b>59.55</b>	<b>63.78</b>	<b>67.81</b>	<b>71.61</b>
2012	<b>1.12</b>	<b>6.09</b>	<b>12.69</b>	<b>19.64</b>	<b>26.00</b>	<b>32.09</b>	<b>37.17</b>	<b>42.03</b>	<b>46.80</b>	<b>51.48</b>	<b>56.01</b>	<b>60.38</b>	<b>64.58</b>	<b>68.56</b>	<b>72.32</b>
2013	<b>1.08</b>	<b>5.78</b>	<b>12.87</b>	<b>19.69</b>	<b>26.32</b>	<b>32.66</b>	<b>37.92</b>	<b>42.93</b>	<b>47.83</b>	<b>52.59</b>	<b>57.21</b>	<b>61.64</b>	<b>65.87</b>	<b>69.86</b>	<b>73.60</b>
2014	<b>1.07</b>	<b>6.09</b>	<b>13.32</b>	<b>20.68</b>	<b>27.81</b>	<b>34.54</b>	<b>40.07</b>	<b>45.28</b>	<b>50.33</b>	<b>55.19</b>	<b>59.83</b>	<b>64.24</b>	<b>68.40</b>	<b>72.29</b>	<b>75.89</b>
2015	<b>1.15</b>	<b>6.16</b>	<b>13.40</b>	<b>20.76</b>	<b>27.86</b>	<b>34.56</b>	<b>40.06</b>	<b>45.25</b>	<b>50.27</b>	<b>55.11</b>	<b>59.75</b>	<b>64.15</b>	<b>68.30</b>	<b>72.18</b>	<b>75.78</b>
2016	<b>1.03</b>	<b>6.06</b>	<b>13.45</b>	<b>20.74</b>	<b>27.78</b>	<b>34.42</b>	<b>39.89</b>	<b>45.05</b>	<b>50.06</b>	<b>54.88</b>	<b>59.51</b>	<b>63.91</b>	<b>68.07</b>	<b>71.96</b>	<b>75.57</b>



Conditional Claim Rates			Adjustable Rate Mortgages										by Credit Subsidy Endorsement Cohort																										
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30									
1989	0.05	0.41	1.64	1.99	1.91	1.38	1.23	1.21	1.04	0.93	0.95	1.07	0.64	1.18	0.13	0.32	0.54	0.00	0.23	0.52	0.07	0.10	0.07	0.05	0.04	0.03	0.02	0.02	0.02	0.01									
1990	0.00	0.14	0.85	1.20	1.54	0.99	1.96	2.14	1.37	1.08	1.32	0.84	0.21	0.00	0.98	0.00	0.46	0.00	0.00	0.09	0.16	0.11	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01									
1991	0.02	0.12	0.70	0.99	1.38	1.64	2.16	2.14	1.84	1.56	0.72	0.48	0.73	0.14	0.18	0.21	0.13	0.29	0.27	0.17	0.12	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01									
1992	0.00	0.18	0.71	1.13	1.46	2.26	2.24	1.75	1.63	0.86	0.80	0.78	0.36	0.43	0.24	0.18	0.21	0.27	0.20	0.14	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.01									
1993	0.00	0.17	0.76	1.35	2.52	2.31	1.91	1.87	1.11	0.78	0.84	0.62	0.40	0.56	0.25	0.43	0.35	0.23	0.16	0.11	0.09	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02									
1994	0.00	0.19	0.94	2.21	2.77	2.61	1.94	1.20	1.10	1.22	0.78	0.36	0.42	0.30	0.38	0.34	0.32	0.22	0.14	0.11	0.09	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02									
1995	0.01	0.34	1.79	3.08	3.98	3.05	1.97	2.06	2.22	1.73	1.19	0.78	0.77	0.98	0.63	0.34	0.24	0.16	0.14	0.11	0.09	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02									
1996	0.00	0.33	1.67	3.48	3.88	2.74	2.83	3.37	2.17	1.39	1.30	0.70	1.58	1.15	0.91	0.63	0.38	0.32	0.26	0.20	0.17	0.14	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03									
1997	0.01	0.43	1.84	3.25	2.91	3.59	4.11	2.89	1.98	1.55	1.39	1.91	1.41	1.00	0.70	0.44	0.37	0.30	0.24	0.20	0.16	0.14	0.11	0.09	0.08	0.06	0.05	0.04	0.04	0.03									
1998	0.01	0.72	2.11	2.41	3.19	3.86	3.01	1.99	1.94	1.32	1.92	1.53	1.09	0.79	0.56	0.47	0.39	0.31	0.26	0.21	0.18	0.15	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03									
1999	0.00	0.22	0.80	2.25	3.49	2.97	2.03	1.75	1.29	1.75	2.52	1.82	1.25	0.70	0.57	0.47	0.36	0.30	0.25	0.21	0.17	0.14	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03									
2000	0.01	0.53	1.88	3.48	3.25	2.63	1.85	2.25	3.57	3.07	2.08	1.44	0.89	0.70	0.57	0.44	0.36	0.30	0.25	0.21	0.17	0.14	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03									
2001	0.00	0.29	1.42	2.04	1.72	2.12	2.53	2.79	3.68	3.02	2.17	1.23	0.95	0.72	0.54	0.44	0.36	0.30	0.25	0.21	0.17	0.14	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03									
2002	0.00	0.25	1.53	2.00	2.30	2.84	4.60	5.59	4.60	3.32	1.93	1.48	1.13	0.78	0.60	0.49	0.39	0.32	0.27	0.22	0.18	0.15	0.13	0.10	0.09	0.07	0.06	0.05	0.04	0.03									
2003	0.02	0.55	1.74	2.25	3.51	5.83	5.95	5.61	4.22	2.74	2.10	1.61	1.13	0.83	0.66	0.53	0.44	0.36	0.29	0.24	0.20	0.17	0.14	0.12	0.10	0.08	0.07	0.05	0.05	0.04									
2004	0.13	0.68	1.77	3.22	5.19	7.05	8.32	6.31	3.92	2.97	2.25	1.58	1.17	0.87	0.69	0.56	0.46	0.38	0.31	0.26	0.22	0.18	0.15	0.12	0.10	0.08	0.07	0.06	0.05	0.04									
2005	0.15	1.10	3.46	6.68	9.61	12.45	9.59	5.82	4.41	3.22	2.22	1.63	1.19	0.83	0.63	0.51	0.41	0.34	0.27	0.23	0.19	0.15	0.13	0.11	0.09	0.07	0.06	0.05	0.04	0.03									
2006	0.02	1.37	3.52	7.08	9.56	8.46	6.14	4.89	3.68	2.52	1.86	1.34	0.95	0.69	0.52	0.41	0.34	0.27	0.23	0.19	0.15	0.13	0.11	0.09	0.07	0.06	0.05	0.04	0.03	0.03									
2007	0.00	0.97	3.93	7.25	8.24	7.28	6.40	4.94	3.41	2.51	1.86	1.32	0.94	0.70	0.53	0.42	0.34	0.28	0.23	0.19	0.16	0.13	0.11	0.09	0.07	0.06	0.05	0.04	0.03	0.03									
2008	0.00	0.62	3.44	6.05	5.64	5.65	4.68	3.12	2.31	1.70	1.24	0.89	0.62	0.47	0.38	0.31	0.25	0.21	0.17	0.14	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02									
2009	0.02	0.66	2.46	3.49	3.67	3.02	2.17	1.66	1.29	0.97	0.67	0.49	0.39	0.32	0.27	0.22	0.19	0.15	0.13	0.11	0.09	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02									
2010	0.01	0.42	1.38	1.71	1.85	1.59	1.38	1.11	0.80	0.62	0.50	0.42	0.35	0.29	0.24	0.20	0.17	0.14	0.12	0.10	0.08	0.07	0.05	0.05	0.04	0.03	0.03	0.02	0.02	0.01									
2011	0.01	0.30	1.15	1.91	1.97	1.85	1.65	1.17	0.94	0.79	0.67	0.56	0.46	0.39	0.32	0.27	0.22	0.18	0.15	0.13	0.10	0.09	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02									
2012	0.01	0.30	1.23	1.84	2.00	1.96	1.48	1.21	1.00	0.85	0.72	0.60	0.50	0.42	0.35	0.29	0.24	0.20	0.16	0.14	0.11	0.09	0.08	0.06	0.05	0.04	0.04	0.03	0.03	0.02									
2013	0.01	0.44	1.57	2.30	2.61	2.26	1.78	1.52	1.32	1.13	0.95	0.80	0.66	0.55	0.46	0.38	0.32	0.26	0.22	0.18	0.15	0.12	0.10	0.09	0.07	0.06	0.05	0.04	0.03	0.03									
2014	0.01	0.32	1.19	1.78	1.91	1.61	1.40	1.21	1.05	0.90	0.76	0.63	0.53	0.44	0.36	0.30	0.25	0.21	0.17	0.14	0.12	0.10	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02									
2015	0.01	0.30	1.36	2.24	2.59	2.37	1.82	1.62	1.40	1.20	1.01	0.84	0.70	0.58	0.49	0.40	0.33	0.28	0.23	0.19	0.16	0.13	0.11	0.09	0.07	0.06	0.05	0.04	0.04	0.03									
2016	0.01	0.31	1.29	2.14	2.47	2.02	1.79	1.60	1.39	1.18	1.00	0.83	0.69	0.58	0.48	0.40	0.33	0.27	0.23	0.19	0.16	0.13	0.11	0.09	0.07	0.06	0.05	0.04	0.03	0.03									



Conditional Prepayment Rates			Adjustable Rate Mortgages						by Credit Subsidy Endorsement Cohort																										
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					
1989	0.31	2.72	5.94	9.41	14.71	12.77	7.71	9.68	8.93	13.98	16.09	9.37	13.49	18.38	15.67	12.78	11.98	10.37	10.42	6.99	5.28	4.93	4.04	4.77	5.28	2.80	2.52	2.31	2.12	1.94					
1990	0.05	1.80	5.23	10.68	12.34	8.12	13.08	10.69	17.17	16.51	11.26	18.56	18.88	21.54	15.36	15.23	19.35	9.20	8.23	7.18	6.33	4.86	5.16	5.83	3.05	2.84	2.60	2.38	2.18	2.00					
1991	0.29	2.19	6.52	9.04	7.35	11.65	12.15	17.22	18.67	12.81	20.10	22.96	24.43	21.18	14.74	18.26	12.85	9.21	8.11	6.22	4.94	5.40	6.16	3.33	3.06	2.80	2.57	2.35	2.16	1.98					
1992	0.23	3.14	6.89	7.19	13.28	11.96	19.99	20.14	13.09	20.89	23.47	26.15	20.87	15.86	16.69	13.53	10.01	8.18	7.36	5.86	6.68	7.62	4.20	3.81	3.50	3.20	2.94	2.69	2.47	2.26					
1993	0.47	3.46	5.49	12.87	11.22	19.43	20.00	12.86	23.93	26.46	28.70	24.60	19.96	17.12	16.28	10.15	8.00	7.71	6.28	7.14	8.18	4.53	4.12	3.78	3.46	3.17	2.91	2.66	2.44	2.24					
1994	0.29	2.46	9.70	11.27	20.43	19.46	13.01	24.97	26.27	30.18	25.87	20.98	18.77	16.07	11.01	8.74	8.55	6.86	7.78	8.87	4.91	4.47	4.10	3.76	3.44	3.16	2.89	2.65	2.43	2.22					
1995	1.55	9.55	14.84	30.31	22.76	13.59	24.23	25.35	27.37	25.10	22.57	21.37	16.88	10.25	9.48	9.07	7.35	8.35	9.53	5.31	4.83	4.43	4.06	3.73	3.42	3.13	2.87	2.63	2.41	2.21					
1996	0.47	5.74	32.16	31.06	15.68	29.77	26.38	26.02	26.40	21.18	21.84	17.70	12.17	12.34	13.12	10.58	11.79	13.40	7.51	6.87	6.31	5.80	5.32	4.88	4.48	4.11	3.77	3.45	3.17	2.90					
1997	0.88	17.19	32.55	18.02	35.46	26.11	25.97	24.40	21.61	21.02	18.29	11.00	13.25	13.88	11.27	12.71	14.46	8.16	7.45	6.84	6.28	5.77	5.29	4.86	4.46	4.09	3.75	3.44	3.15	2.89					
1998	2.64	19.60	16.95	35.72	27.82	26.46	25.65	23.65	22.77	20.74	13.30	13.90	12.59	10.98	13.27	15.26	8.87	7.96	7.31	6.72	6.17	5.67	5.20	4.77	4.38	4.01	3.68	3.37	3.09	2.83					
1999	0.44	4.07	30.10	29.53	28.40	23.98	26.48	25.86	24.69	16.89	15.93	17.56	14.20	15.28	17.40	9.72	9.10	8.40	7.75	7.12	6.54	6.00	5.51	5.06	4.64	4.26	3.90	3.58	3.28	3.01					
2000	1.00	30.92	29.21	27.60	22.95	25.67	24.70	25.33	15.54	15.72	15.98	13.42	15.77	18.22	10.53	9.62	8.90	8.21	7.57	6.96	6.39	5.87	5.39	4.94	4.54	4.16	3.82	3.50	3.21	2.94					
2001	4.70	18.36	27.89	23.65	29.02	29.43	29.43	16.98	16.35	16.29	13.79	15.50	18.45	10.98	10.37	9.63	8.91	8.25	7.60	6.99	6.42	5.90	5.41	4.97	4.56	4.18	3.83	3.51	3.22	2.95					
2002	2.12	25.51	21.76	29.34	30.18	31.71	19.67	14.01	14.53	12.37	14.86	17.88	10.66	10.53	10.01	9.34	8.70	8.07	7.46	6.87	6.31	5.80	5.32	4.88	4.48	4.11	3.77	3.45	3.17	2.90					
2003	7.46	20.19	31.37	33.62	34.02	19.61	13.97	12.37	11.02	14.11	17.65	10.85	10.54	10.36	9.71	9.03	8.40	7.76	7.17	6.59	6.05	5.55	5.10	4.68	4.29	3.93	3.61	3.31	3.03	2.78					
2004	5.83	27.31	33.19	33.40	19.37	13.52	12.44	10.30	13.01	16.60	10.40	10.38	10.32	10.08	9.51	8.82	8.18	7.54	6.95	6.38	5.86	5.38	4.94	4.53	4.16	3.81	3.49	3.20	2.94	2.54					
2005	10.78	27.21	32.33	24.70	13.19	9.29	7.46	9.42	12.82	8.03	8.39	8.44	8.44	8.48	8.07	7.47	6.90	6.34	5.82	5.33	4.87	4.46	4.08	3.73	3.41	3.12	2.85	2.61	2.39	2.11					
2006	2.07	11.71	17.71	12.82	5.62	4.32	5.62	7.85	5.33	5.81	6.15	6.40	6.64	6.65	6.47	6.08	5.65	5.24	4.83	4.44	4.07	3.74	3.43	3.14	2.88	2.64	2.42	2.21	2.03	1.86					
2007	1.64	10.78	11.01	4.93	4.15	4.95	6.81	4.71	5.49	5.95	6.30	6.70	6.94	6.85	6.59	6.14	5.71	5.28	4.86	4.48	4.11	3.77	3.45	3.17	2.90	2.66	2.44	2.23	2.04	1.87					
2008	0.63	13.56	7.67	6.83	6.90	7.57	4.79	5.97	6.74	7.23	7.73	8.22	8.45	8.19	7.66	7.07	6.50	5.98	5.49	5.04	4.62	4.24	3.89	3.56	3.27	2.99	2.74	2.51	2.30	2.11					
2009	0.98	5.05	7.86	10.01	11.60	6.79	7.74	8.26	9.06	9.76	10.75	10.62	10.02	9.24	8.49	7.81	7.17	6.59	6.05	5.55	5.09	4.67	4.28	3.93	3.60	3.30	3.02	2.77	2.54	2.32					
2010	1.23	8.44	17.01	20.91	10.49	9.92	10.16	10.99	12.24	12.49	11.98	11.13	10.25	9.43	8.68	7.98	7.33	6.73	6.18	5.68	5.21	4.78	4.38	4.02	3.69	3.38	3.10	2.84	2.60	2.38					
2011	1.58	11.35	21.91	12.01	11.02	10.24	10.47	11.89	12.27	11.93	11.30	10.50	9.67	8.89	8.18	7.52	6.91	6.35	5.83	5.35	4.91	4.50	4.13	3.79	3.47	3.18	2.92	2.67	2.45	2.24					
2012	2.08	12.99	12.09	12.53	11.33	10.23	11.52	11.84	12.10	11.67	11.06	10.28	9.46	8.71	8.01	7.36	6.76	6.21	5.70	5.23	4.80	4.41	4.04	3.70	3.40	3.11	2.85	2.61	2.40	2.19					
2013	2.08	6.84	11.96	11.49	10.37	10.03	10.95	10.97	10.91	10.50	9.94	9.22	8.48	7.80	7.17	6.59	6.05	5.56	5.10	4.68	4.29	3.93	3.61	3.31	3.03	2.78	2.54	2.33	2.14	1.96					
2014	1.27	8.06	13.45	13.39	11.85	11.63	11.71	11.68	11.56	11.12	10.52	9.76	8.99	8.27	7.60	6.98	6.41	5.89	5.41	4.96	4.55	4.17	3.83	3.51	3.22	2.95	2.70	2.48	2.27	2.08					
2015	0.97	6.68	12.00	12.82	11.28	10.86	11.42	11.18	11.22	10.83	10.26	9.53	8.78	8.08	7.43	6.83	6.27	5.76	5.29	4.85	4.45	4.08	3.74	3.43	3.15	2.88	2.64	2.42	2.22	2.03					
2016	0.98	6.97	12.57	12.85	11.43	11.34	11.16	10.93	10.88	10.56	10.00	9.29	8.55	7.87	7.23	6.65	6.11	5.61	5.15	4.72	4.33	3.97	3.64	3.34	3.06	2.81	2.57	2.36	2.16	1.98					



Cumulative Claim Rates			Adjustable Rate Mortgages										by Credit Subsidy Endorsement Cohort																										
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30									
1989	0.05	0.46	2.04	3.81	5.32	6.23	6.93	7.55	8.03	8.42	8.75	9.06	9.23	9.49	9.52	9.57	9.64	9.64	9.66	9.71	9.72	9.72	9.73	9.73	9.74	9.74	9.74	9.74	9.74	9.74									
1990	0.00	0.14	0.97	2.08	3.32	4.01	5.26	6.41	7.06	7.48	7.89	8.12	8.17	8.17	8.31	8.31	8.35	8.35	8.35	8.36	8.37	8.37	8.38	8.38	8.38	8.38	8.39	8.39	8.39	8.39									
1991	0.02	0.14	0.83	1.72	2.85	4.07	5.46	6.64	7.46	8.01	8.23	8.35	8.48	8.50	8.52	8.54	8.55	8.57	8.58	8.59	8.60	8.60	8.61	8.61	8.61	8.61	8.61	8.61	8.61	8.61									
1992	0.00	0.18	0.87	1.88	3.07	4.65	5.99	6.80	7.39	7.66	7.85	8.00	8.04	8.09	8.11	8.12	8.14	8.15	8.16	8.17	8.17	8.18	8.18	8.18	8.18	8.18	8.18	8.18	8.19	8.19									
1993	0.00	0.18	0.90	2.12	4.06	5.60	6.59	7.35	7.74	7.94	8.10	8.18	8.22	8.27	8.29	8.31	8.33	8.34	8.34	8.35	8.35	8.35	8.35	8.36	8.36	8.36	8.36	8.36	8.36	8.36									
1994	0.00	0.19	1.10	3.02	5.10	6.60	7.47	7.93	8.24	8.49	8.60	8.64	8.67	8.69	8.71	8.73	8.74	8.75	8.75	8.76	8.76	8.76	8.76	8.77	8.77	8.77	8.77	8.77	8.77	8.77									
1995	0.01	0.34	1.93	4.20	6.16	7.26	7.85	8.31	8.67	8.87	8.96	9.01	9.05	9.09	9.11	9.13	9.13	9.14	9.14	9.14	9.14	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15									
1996	0.00	0.33	1.90	4.05	5.62	6.51	7.14	7.66	7.90	8.01	8.09	8.12	8.18	8.22	8.24	8.26	8.27	8.27	8.28	8.28	8.28	8.29	8.29	8.29	8.29	8.29	8.29	8.29	8.29	8.29									
1997	0.01	0.43	1.93	3.67	4.90	5.83	6.58	6.95	7.14	7.25	7.32	7.41	7.46	7.49	7.51	7.52	7.53	7.54	7.54	7.54	7.55	7.55	7.55	7.55	7.55	7.55	7.55	7.55	7.55	7.55									
1998	0.01	0.70	2.34	3.85	5.09	6.12	6.69	6.95	7.14	7.24	7.35	7.43	7.47	7.50	7.52	7.53	7.54	7.55	7.55	7.56	7.56	7.56	7.56	7.57	7.57	7.57	7.57	7.57	7.57	7.57									
1999	0.00	0.22	0.98	2.46	4.03	4.94	5.39	5.67	5.82	5.97	6.14	6.25	6.31	6.33	6.35	6.36	6.37	6.38	6.38	6.39	6.39	6.39	6.39	6.40	6.40	6.40	6.40	6.40	6.40	6.40									
2000	0.01	0.53	1.80	3.43	4.48	5.10	5.42	5.70	6.02	6.25	6.37	6.44	6.48	6.50	6.52	6.53	6.54	6.54	6.55	6.55	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56									
2001	0.00	0.28	1.38	2.50	3.20	3.79	4.28	4.65	5.04	5.29	5.44	5.51	5.55	5.58	5.60	5.61	5.62	5.63	5.64	5.64	5.64	5.65	5.65	5.65	5.65	5.65	5.65	5.65	5.65	5.65									
2002	0.00	0.25	1.36	2.47	3.36	4.09	4.87	5.58	6.06	6.33	6.47	6.56	6.61	6.64	6.66	6.68	6.69	6.70	6.71	6.71	6.71	6.72	6.72	6.72	6.72	6.72	6.73	6.73	6.73	6.73									
2003	0.02	0.52	1.80	2.91	4.01	5.16	6.03	6.69	7.09	7.32	7.46	7.55	7.60	7.64	7.66	7.68	7.69	7.70	7.71	7.71	7.72	7.72	7.72	7.73	7.73	7.73	7.73	7.73	7.73	7.73									
2004	0.13	0.77	1.97	3.38	4.83	6.32	7.71	8.54	8.98	9.25	9.42	9.52	9.58	9.63	9.66	9.68	9.70	9.71	9.72	9.73	9.73	9.74	9.74	9.74	9.75	9.75	9.75	9.75	9.75	9.75									
2005	0.15	1.12	3.33	6.07	8.77	11.48	13.11	13.93	14.46	14.78	14.97	15.10	15.18	15.24	15.27	15.30	15.32	15.34	15.35	15.36	15.36	15.37	15.37	15.38	15.38	15.38	15.38	15.38	15.38	15.39									
2006	0.02	1.37	4.36	9.11	14.25	18.10	20.54	22.25	23.38	24.08	24.55	24.87	25.07	25.21	25.31	25.38	25.43	25.47	25.51	25.53	25.55	25.57	25.58	25.59	25.60	25.61	25.61	25.62	25.62	25.62									
2007	0.00	0.96	4.36	9.71	15.06	19.19	22.38	24.52	25.86	26.75	27.36	27.75	28.01	28.19	28.31	28.40	28.47	28.53	28.57	28.60	28.63	28.65	28.66	28.68	28.69	28.70	28.70	28.71	28.71	28.72									
2008	0.00	0.61	3.55	8.13	11.86	15.12	17.47	18.89	19.84	20.48	20.90	21.18	21.35	21.47	21.56	21.63	21.68	21.72	21.75	21.77	21.79	21.81	21.82	21.83	21.84	21.84	21.85	21.85	21.85	21.86									
2009	0.02	0.68	2.97	5.90	8.56	10.41	11.61	12.44	13.02	13.41	13.65	13.81	13.92	14.00	14.06	14.11	14.14	14.17	14.19	14.21	14.22	14.23	14.24	14.24	14.25	14.25	14.26	14.26	14.26	14.26									
2010	0.01	0.42	1.67	2.93	3.98	4.77	5.38	5.81	6.09	6.27	6.40	6.50	6.57	6.62	6.66	6.69	6.71	6.73	6.74	6.75	6.76	6.77	6.77	6.78	6.78	6.78	6.78	6.79	6.79	6.79									
2011	0.01	0.31	1.31	2.58	3.71	4.64	5.37	5.82	6.14	6.37	6.54	6.67	6.76	6.83	6.88	6.92	6.95	6.97	6.99	7.01	7.02	7.03	7.03	7.04	7.04	7.05	7.05	7.05	7.05	7.05									
2012	0.01	0.31	1.35	2.71	3.97	5.04	5.75	6.25	6.62	6.89	7.09	7.23	7.34	7.42	7.48	7.53	7.57	7.59	7.61	7.63	7.64	7.65	7.66	7.67	7.67	7.68	7.68	7.68	7.69	7.69									
2013	0.01	0.45	1.87	3.67	5.44	6.77	7.69	8.37	8.90	9.29	9.58	9.80	9.96	10.08	10.18	10.25	10.30	10.35	10.38	10.41	10.43	10.44	10.46	10.47	10.48	10.48	10.49	10.49	10.50	10.50									
2014	0.01	0.32	1.40	2.77	4.02	4.92	5.61	6.12	6.52	6.81	7.02	7.18	7.30	7.39	7.46	7.51	7.55	7.58	7.61	7.63	7.64	7.65	7.66	7.67	7.68	7.68	7.69	7.69	7.69	7.69									
2015	0.01	0.30	1.55	3.34	5.09	6.48	7.40	8.12	8.65	9.05	9.35	9.57	9.74	9.86	9.95	10.03	10.08	10.12	10.16	10.18	10.20	10.22	10.23	10.24	10.25	10.26	10.26	10.27	10.27	10.27									
2016	0.01	0.31	1.50	3.19	4.85	6.01	6.91	7.61	8.14	8.53	8.83	9.05	9.21	9.33	9.43	9.50	9.56	9.60	9.63	9.66	9.68	9.70	9.71	9.72	9.73	9.73	9.74	9.74	9.75	9.75									



Cumulative Prepayment Rates			Adjustable Rate Mortgages						by Credit Subsidy Endorsement Cohort																										
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					
1989	0.31	3.02	8.75	17.14	28.77	37.19	41.55	46.54	50.64	56.41	62.07	64.80	68.33	72.45	75.28	77.22	78.81	80.00	81.08	81.73	82.18	82.58	82.89	83.25	83.62	83.80	83.97	84.11	84.24	84.36					
1990	0.05	1.85	6.97	16.80	26.81	32.49	40.79	46.56	54.64	60.96	64.51	69.64	73.83	77.71	79.88	81.68	83.62	84.36	84.96	85.44	85.83	86.11	86.40	86.70	86.85	86.99	87.11	87.21	87.31	87.40					
1991	0.29	2.47	8.82	16.98	22.96	31.60	39.42	48.91	57.21	61.74	67.82	73.32	77.79	80.70	82.29	83.97	84.93	85.53	86.01	86.35	86.60	86.86	87.14	87.28	87.40	87.52	87.62	87.70	87.78	87.86					
1992	0.23	3.36	10.00	16.41	27.26	35.59	47.53	56.90	61.65	68.12	73.80	78.60	81.40	83.07	84.55	85.54	86.17	86.64	87.02	87.30	87.61	87.93	88.09	88.23	88.36	88.47	88.57	88.66	88.73	88.80					
1993	0.47	3.92	9.18	20.76	29.41	42.34	52.75	57.98	66.28	73.15	78.58	81.85	83.84	85.20	86.26	86.82	87.21	87.55	87.81	88.08	88.38	88.52	88.65	88.77	88.87	88.95	89.03	89.10	89.16	89.22					
1994	0.29	2.74	12.16	21.93	37.27	48.48	54.33	63.86	71.27	77.46	81.09	83.26	84.78	85.83	86.43	86.86	87.24	87.51	87.80	88.11	88.26	88.40	88.51	88.61	88.70	88.78	88.86	88.92	88.97	89.02					
1995	1.55	10.95	24.12	46.54	57.75	62.65	69.94	75.57	79.98	82.83	84.70	86.06	86.89	87.31	87.65	87.94	88.16	88.38	88.62	88.74	88.84	88.93	89.01	89.08	89.14	89.19	89.24	89.28	89.32	89.35					
1996	0.47	6.18	36.25	55.46	61.81	71.50	77.30	81.35	84.25	85.92	87.24	88.07	88.53	88.94	89.31	89.57	89.83	90.08	90.20	90.31	90.40	90.47	90.54	90.60	90.65	90.69	90.73	90.76	90.79	90.82					
1997	0.88	17.92	44.49	54.15	69.11	75.89	80.64	83.76	85.77	87.26	88.26	88.75	89.26	89.71	90.03	90.34	90.65	90.80	90.92	91.03	91.12	91.19	91.26	91.32	91.37	91.41	91.45	91.49	91.52	91.54					
1998	2.64	21.72	34.87	57.30	68.11	75.20	79.99	83.14	85.40	86.94	87.72	88.40	88.93	89.32	89.74	90.16	90.37	90.53	90.67	90.79	90.89	90.98	91.06	91.12	91.18	91.23	91.27	91.31	91.35	91.38					
1999	0.44	4.49	33.17	52.62	65.38	72.72	78.63	82.76	85.62	87.06	88.17	89.17	89.82	90.41	90.98	91.24	91.46	91.64	91.79	91.92	92.03	92.13	92.21	92.28	92.34	92.40	92.44	92.48	92.52	92.55					
2000	1.00	31.61	51.43	64.34	71.74	77.84	82.06	85.23	86.64	87.79	88.74	89.40	90.05	90.69	90.98	91.22	91.42	91.59	91.73	91.85	91.95	92.04	92.12	92.18	92.24	92.29	92.33	92.37	92.40	92.44					
2001	4.70	22.20	43.83	56.78	68.60	76.90	82.58	84.81	86.53	87.91	88.85	89.73	90.61	91.03	91.38	91.67	91.91	92.12	92.29	92.43	92.56	92.66	92.76	92.83	92.90	92.96	93.02	93.06	93.10	93.14					
2002	2.12	27.09	42.90	59.26	70.81	79.00	82.33	84.12	85.62	86.65	87.69	88.73	89.24	89.67	90.04	90.35	90.61	90.83	91.01	91.17	91.30	91.42	91.52	91.60	91.68	91.74	91.80	91.85	91.90	91.94					
2003	7.46	26.14	49.15	65.64	76.34	80.19	82.24	83.69	84.75	85.90	87.10	87.69	88.19	88.63	88.99	89.29	89.55	89.76	89.94	90.10	90.23	90.34	90.44	90.53	90.60	90.67	90.73	90.78	90.82	90.86					
2004	5.83	31.51	53.98	68.70	74.10	76.95	79.03	80.40	81.84	83.36	84.13	84.80	85.39	85.89	86.32	86.67	86.97	87.22	87.44	87.62	87.77	87.91	88.02	88.12	88.21	88.29	88.36	88.42	88.47	88.52					
2005	10.78	35.02	55.66	65.79	69.50	71.52	72.79	74.12	75.65	76.44	77.18	77.84	78.44	78.98	79.45	79.84	80.18	80.46	80.71	80.92	81.10	81.26	81.39	81.51	81.62	81.71	81.80	81.87	81.94	81.99					
2006	2.07	13.53	28.60	37.20	40.22	42.18	44.41	47.16	48.79	50.41	51.98	53.48	54.92	56.25	57.45	58.50	59.41	60.20	60.89	61.50	62.02	62.49	62.90	63.26	63.58	63.87	64.12	64.35	64.55	64.73					
2007	1.64	12.24	21.80	25.45	28.14	30.95	34.34	36.38	38.53	40.65	42.70	44.71	46.62	48.36	49.90	51.24	52.40	53.41	54.29	55.06	55.73	56.32	56.84	57.29	57.70	58.06	58.39	58.67	58.93	59.16					
2008	0.63	14.11	20.65	25.83	30.38	34.75	37.15	39.86	42.64	45.35	47.99	50.55	52.94	55.04	56.84	58.37	59.67	60.78	61.74	62.57	63.30	63.93	64.48	64.97	65.40	65.79	66.13	66.43	66.70	66.94					
2009	0.98	5.98	13.32	21.70	30.10	34.26	38.55	42.66	46.73	50.66	54.52	57.90	60.74	63.08	65.03	66.66	68.04	69.21	70.22	71.08	71.83	72.48	73.05	73.55	73.99	74.38	74.72	75.03	75.30	75.54					
2010	1.23	9.56	24.87	40.23	46.19	51.13	55.61	59.90	64.10	67.82	70.93	73.45	75.51	77.20	78.60	79.78	80.77	81.61	82.33	82.95	83.49	83.96	84.36	84.72	85.03	85.31	85.55	85.77	85.96	86.14					
2011	1.58	12.75	31.79	39.83	46.18	51.31	55.92	60.52	64.65	68.14	71.02	73.38	75.30	76.90	78.23	79.35	80.30	81.11	81.80	82.40	82.92	83.37	83.77	84.12	84.43	84.70	84.94	85.15	85.34	85.51					
2012	2.08	14.80	25.06	34.28	41.42	47.01	52.53	57.47	61.86	65.54	68.59	71.09	73.14	74.84	76.26	77.46	78.47	79.34	80.08	80.73	81.29	81.77	82.20	82.58	82.91	83.20	83.46	83.69	83.90	84.08					
2013	2.08	8.78	19.64	28.66	35.67	41.58	47.24	52.18	56.49	60.12	63.16	65.68	67.76	69.50	70.96	72.20	73.27	74.18	74.97	75.65	76.25	76.77	77.24	77.64	78.00	78.32	78.61	78.86	79.09	79.29					
2014	1.27	9.22	21.39	31.73	39.49	46.06	51.80	56.77	61.06	64.66	67.67	70.14	72.18	73.87	75.30	76.50	77.52	78.40	79.16	79.82	80.39	80.89	81.33	81.71	82.06	82.36	82.63	82.87	83.08	83.27					
2015	0.97	7.58	18.64	28.87	36.52	42.86	48.64	53.56	57.86	61.48	64.51	67.00	69.06	70.77	72.21	73.43	74.46	75.35	76.12	76.79	77.37	77.87	78.32	78.71	79.06	79.37	79.64	79.89	80.11	80.30					
2016	0.98	7.88	19.42	29.58	37.27	43.83	49.43	54.20	58.36	61.90	64.85	67.30	69.32	71.01	72.43	73.64	74.67	75.55	76.32	76.98	77.56	78.07	78.51	78.91	79.25	79.56	79.84	80.08	80.30	80.50					



Conditional Claim Rates			Adjustable Rate Streamline Refinance Mortgages										by Credit Subsidy Endorsement Cohort																	
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1992	0.00	0.12	0.33	0.41	0.83	1.05	1.17	0.98	0.57	0.34	0.28	0.18	0.25	0.00	0.00	0.42	0.00	0.03	0.04	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
1993	0.00	0.17	0.88	1.63	2.23	2.17	1.71	1.27	0.84	0.51	0.34	0.20	0.13	0.15	0.53	0.00	0.03	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
1994	0.02	0.49	2.01	3.51	3.13	2.85	1.77	1.15	0.76	0.36	0.39	0.00	0.09	0.00	0.00	0.04	0.05	0.04	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
1995	0.00	0.36	2.51	2.02	3.76	3.92	0.71	1.23	1.79	0.60	0.00	1.89	0.00	1.33	0.06	0.08	0.05	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
1996	0.00	0.48	1.86	3.30	3.07	1.46	1.33	0.78	1.12	1.52	0.81	0.53	1.23	0.18	0.26	0.17	0.10	0.08	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00
1997	0.00	0.53	1.86	3.56	2.29	2.26	2.13	1.16	0.81	0.00	1.04	2.13	0.22	0.31	0.21	0.13	0.10	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00
1998	0.00	0.30	1.08	1.41	1.89	1.69	1.59	1.08	0.51	0.00	0.45	0.81	0.38	0.25	0.17	0.12	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00
1999	0.00	0.11	0.53	1.15	2.25	1.82	1.82	0.79	0.67	0.29	0.43	0.68	0.45	0.25	0.19	0.13	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00
2000	0.00	0.27	1.57	3.83	2.80	2.41	2.02	3.04	3.24	0.90	0.74	0.51	0.31	0.22	0.17	0.12	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00
2001	0.00	0.24	2.20	2.95	2.19	1.98	2.34	3.18	3.87	1.99	1.33	0.69	0.43	0.27	0.18	0.13	0.10	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00
2002	0.01	0.44	1.66	2.04	2.71	3.09	4.13	3.92	3.62	2.46	1.39	0.87	0.52	0.29	0.20	0.14	0.10	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00
2003	0.01	0.76	2.14	2.92	2.85	5.10	4.86	4.56	3.18	1.88	1.20	0.75	0.42	0.25	0.18	0.13	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00
2004	0.14	1.13	2.51	3.57	5.68	6.16	6.82	4.83	2.75	1.74	1.12	0.63	0.38	0.23	0.16	0.12	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00
2005	0.28	2.22	5.04	6.24	9.50	15.72	12.38	6.99	4.36	2.80	1.67	0.97	0.56	0.33	0.22	0.16	0.12	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.02	0.00	0.03	0.00	0.00	0.00
2006	0.00	0.59	5.88	8.86	17.20	16.49	11.61	6.97	4.65	2.89	1.84	1.00	0.52	0.32	0.21	0.14	0.10	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.00	0.01	0.01	0.00
2007	0.00	0.81	6.36	13.15	15.59	14.50	10.87	7.03	3.85	2.43	1.43	0.80	0.44	0.28	0.17	0.13	0.09	0.07	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00
2008	0.00	1.69	10.07	14.50	14.62	14.74	10.45	5.12	3.30	2.09	1.23	0.68	0.38	0.22	0.17	0.13	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.01
2009	0.12	3.08	9.58	12.46	12.27	8.17	5.54	3.83	2.38	1.35	0.75	0.39	0.28	0.21	0.16	0.13	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00
2010	0.14	2.35	5.81	5.15	5.34	4.48	3.34	2.13	1.12	0.65	0.47	0.36	0.28	0.21	0.16	0.12	0.09	0.07	0.06	0.04	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.01
2011	0.05	1.06	3.22	4.16	3.99	3.37	2.62	1.36	0.83	0.62	0.47	0.36	0.28	0.21	0.16	0.12	0.10	0.07	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00
2012	0.04	0.88	2.77	3.26	3.12	2.85	1.73	1.08	0.81	0.62	0.48	0.37	0.28	0.22	0.16	0.13	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00
2013	0.04	0.84	2.54	3.02	3.08	2.44	1.54	1.08	0.82	0.63	0.48	0.37	0.28	0.22	0.16	0.13	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00
2014	0.03	0.69	2.22	2.71	2.58	1.85	1.40	1.06	0.81	0.62	0.48	0.37	0.28	0.22	0.16	0.13	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00
2015	0.03	0.71	2.18	2.54	2.46	1.87	1.41	1.07	0.82	0.63	0.48	0.37	0.28	0.22	0.17	0.13	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00
2016	0.04	0.70	1.91	2.37	2.21	1.82	1.48	1.08	0.81	0.62	0.48	0.37	0.28	0.21	0.16	0.13	0.10	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00



Conditional Prepayment Rates			Adjustable Rate Streamline Refinance Mortgages										by Credit Subsidy Endorsement Cohort																	
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1992	0.72	7.96	11.77	10.38	16.09	13.10	21.16	19.86	14.83	20.22	22.21	27.92	19.04	12.89	14.08	14.71	13.86	8.97	11.91	10.79	11.86	12.83	10.15	9.72	9.34	8.97	8.62	8.28	7.95	7.64
1993	1.56	8.51	8.60	13.16	10.09	16.52	18.53	13.85	23.62	25.40	31.28	20.28	15.58	16.10	14.41	10.48	13.06	12.30	11.37	12.34	13.44	10.73	10.29	9.89	9.51	9.13	8.77	8.43	8.10	7.78
1994	2.76	6.87	10.85	10.59	15.82	16.25	12.10	20.68	22.64	27.84	21.67	21.45	16.15	17.44	12.60	10.71	12.06	11.36	12.39	13.53	10.96	10.40	10.00	9.61	9.23	8.87	8.52	8.19	7.86	7.55
1995	2.56	17.56	20.26	26.46	16.30	13.53	21.85	30.37	23.77	22.29	17.19	17.92	11.76	9.33	9.77	12.32	11.47	12.39	13.51	10.81	10.38	9.99	9.60	9.22	8.86	8.51	8.17	7.85	7.54	7.24
1996	2.70	20.41	40.51	34.00	15.65	28.89	27.32	29.92	25.50	23.48	22.36	13.23	15.34	18.49	20.80	19.07	20.83	22.45	18.06	17.32	16.67	16.05	15.45	14.87	14.31	13.77	13.25	12.74	12.25	11.79
1997	4.72	38.71	41.26	19.54	33.44	28.50	32.75	27.17	27.69	27.82	25.52	9.22	16.68	20.33	18.89	20.56	22.25	18.01	17.22	16.58	15.95	15.35	14.77	14.21	13.66	13.15	12.64	12.15	11.66	11.19
1998	10.33	40.84	22.68	41.81	33.48	35.18	30.73	28.47	25.58	23.18	13.06	17.66	21.19	19.99	21.83	23.74	19.50	18.49	17.81	17.15	16.51	15.89	15.29	14.71	14.15	13.61	13.09	12.58	12.11	11.64
1999	3.21	10.18	32.60	30.09	31.83	28.63	26.23	27.89	23.33	15.79	19.78	23.48	21.69	23.49	25.36	20.46	19.89	19.17	18.47	17.79	17.13	16.50	15.88	15.29	14.71	14.15	13.61	13.09	12.59	12.11
2000	2.50	20.90	19.61	17.44	23.55	22.34	25.80	24.77	13.27	18.11	22.07	21.10	22.99	25.12	20.74	19.90	19.20	18.51	17.85	17.19	16.56	15.94	15.34	14.77	14.21	13.69	13.17	12.67	12.18	11.71
2001	3.14	30.84	29.36	23.76	31.55	30.16	30.21	15.32	16.24	21.07	19.70	21.84	25.01	20.98	20.44	19.79	19.33	18.70	18.09	17.42	16.77	16.14	15.54	14.95	14.38	13.84	13.32	12.81	12.31	11.84
2002	5.60	33.16	26.81	29.70	30.72	32.29	19.43	17.41	19.11	17.79	20.14	23.06	19.91	20.55	20.27	19.80	19.40	18.85	18.30	17.64	16.99	16.36	15.75	15.16	14.59	14.04	13.51	12.99	12.50	12.02
2003	14.38	27.93	33.08	33.36	32.93	21.73	16.69	18.36	17.22	19.84	22.88	19.69	20.57	21.03	20.56	20.08	19.52	18.94	18.35	17.67	17.02	16.40	15.78	15.19	14.62	14.07	13.54	13.02	12.52	12.05
2004	10.88	29.08	31.07	29.85	17.99	15.24	16.99	15.57	18.06	21.65	18.75	19.68	20.76	21.15	20.69	20.10	19.47	18.84	18.24	17.58	16.93	16.30	15.69	15.11	14.54	13.99	13.46	12.95	12.45	11.24
2005	23.42	35.02	32.83	25.99	17.11	15.38	15.91	19.42	24.29	21.78	23.28	25.05	26.81	27.92	27.48	26.83	26.13	25.33	24.60	23.73	22.91	22.10	21.31	20.56	19.79	19.10	18.40	17.76	17.07	15.40
2006	6.11	18.93	18.38	15.55	7.01	6.04	8.92	13.14	12.51	13.87	14.86	16.41	19.80	20.58	20.27	20.39	19.96	19.59	18.91	18.22	17.55	16.90	16.28	15.67	15.08	14.52	13.96	13.44	12.92	12.43
2007	7.46	16.13	13.45	7.04	6.02	6.53	10.68	11.11	13.55	14.91	16.54	18.74	20.68	21.36	21.62	20.88	20.52	19.78	19.06	18.36	17.69	17.04	16.41	15.79	15.20	14.63	14.08	13.54	13.03	12.53
2008	2.97	21.24	8.29	6.98	6.90	7.27	8.63	12.76	14.90	16.11	17.08	19.51	21.66	22.55	21.89	21.11	20.37	19.64	18.93	18.24	17.57	16.92	16.30	15.69	15.10	14.54	13.99	13.46	12.96	12.46
2009	2.65	8.39	8.13	8.23	10.28	10.15	14.42	16.71	17.57	18.99	21.90	24.12	23.74	22.91	22.11	21.33	20.57	19.83	19.11	18.41	17.74	17.08	16.45	15.84	15.24	14.67	14.12	13.59	13.07	12.57
2010	3.04	14.83	17.21	21.00	16.12	16.01	18.63	21.13	24.41	25.81	25.27	24.41	23.57	22.75	21.95	21.18	20.42	19.69	18.97	18.28	17.61	16.96	16.34	15.72	15.14	14.57	14.02	13.48	12.97	12.47
2011	4.75	20.02	25.17	19.16	18.17	17.24	20.95	25.96	26.75	26.01	25.13	24.28	23.44	22.62	21.83	21.05	20.30	19.56	18.86	18.17	17.50	16.85	16.23	15.62	15.04	14.47	13.92	13.40	12.88	12.39
2012	5.54	24.38	21.71	20.94	19.58	19.32	25.86	27.85	27.05	26.16	25.29	24.43	23.59	22.77	21.97	21.19	20.43	19.69	18.98	18.29	17.62	16.97	16.34	15.73	15.16	14.58	14.03	13.51	13.00	12.51
2013	5.30	18.99	22.23	21.34	19.79	21.11	26.68	27.81	27.00	26.11	25.24	24.38	23.54	22.72	21.92	21.14	20.39	19.65	18.94	18.25	17.58	16.93	16.30	15.70	15.12	14.55	14.00	13.46	12.95	12.46
2014	4.35	20.78	23.47	22.16	22.05	23.98	27.50	28.03	27.13	26.23	25.35	24.49	23.65	22.83	22.02	21.24	20.48	19.74	19.03	18.33	17.66	17.01	16.38	15.77	15.18	14.61	14.05	13.52	13.00	12.51
2015	4.51	20.39	23.28	22.63	22.80	23.96	27.51	28.08	27.17	26.27	25.39	24.53	23.68	22.86	22.05	21.27	20.51	19.77	19.05	18.35	17.68	17.03	16.39	15.78	15.19	14.62	14.06	13.53	13.02	12.52
2016	4.48	20.72	24.15	23.20	23.80	23.94	26.78	27.67	26.93	26.04	25.17	24.31	23.48	22.66	21.86	21.08	20.33	19.60	18.89	18.20	17.53	16.88	16.25	15.66	15.07	14.51	13.96	13.43	12.91	12.42



Cumulative Claim Rates			Adjustable Rate Streamline Refinance Mortgages										by Credit Subsidy Endorsement Cohort																	
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1992	0.00	0.12	0.42	0.75	1.34	1.97	2.57	2.95	3.13	3.22	3.28	3.31	3.34	3.34	3.34	3.37	3.37	3.37	3.37	3.38	3.38	3.38	3.38	3.38	3.38	3.38	3.38	3.38	3.38	3.38
1993	0.00	0.17	0.96	2.29	3.84	5.16	6.00	6.50	6.78	6.91	6.97	7.00	7.01	7.02	7.06	7.06	7.06	7.07	7.07	7.07	7.07	7.07	7.07	7.07	7.07	7.07	7.07	7.07	7.07	7.07
1994	0.02	0.49	2.30	5.06	7.17	8.72	9.50	9.94	10.17	10.25	10.31	10.31	10.32	10.32	10.32	10.33	10.33	10.33	10.33	10.33	10.33	10.33	10.33	10.33	10.33	10.33	10.33	10.33	10.33	10.33
1995	0.00	0.35	2.35	3.60	5.26	6.65	6.86	7.13	7.41	7.48	7.48	7.62	7.62	7.69	7.69	7.69	7.69	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70
1996	0.00	0.47	1.90	3.36	4.22	4.55	4.76	4.84	4.93	5.02	5.05	5.07	5.10	5.11	5.11	5.12	5.12	5.12	5.12	5.12	5.12	5.12	5.12	5.12	5.12	5.12	5.12	5.12	5.12	5.12
1997	0.00	0.51	1.58	2.76	3.34	3.70	3.95	4.03	4.07	4.07	4.10	4.14	4.15	4.15	4.15	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16	4.16
1998	0.00	0.27	0.84	1.41	1.84	2.09	2.24	2.31	2.33	2.33	2.34	2.36	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37
1999	0.00	0.10	0.56	1.23	2.13	2.61	2.94	3.05	3.11	3.13	3.16	3.19	3.21	3.21	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22
2000	0.00	0.27	1.47	3.79	5.13	5.97	6.51	7.09	7.53	7.64	7.71	7.74	7.76	7.77	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.78
2001	0.00	0.23	1.70	3.05	3.79	4.23	4.58	4.90	5.22	5.35	5.42	5.45	5.46	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.48	5.48	5.48	5.48	5.48	5.48	5.48	5.48	5.48	5.48
2002	0.01	0.42	1.46	2.37	3.20	3.83	4.37	4.77	5.05	5.20	5.27	5.31	5.32	5.33	5.33	5.33	5.33	5.34	5.34	5.34	5.34	5.34	5.34	5.34	5.34	5.34	5.34	5.34	5.34	5.34
2003	0.01	0.66	1.96	3.12	3.84	4.66	5.24	5.66	5.89	6.00	6.05	6.08	6.09	6.09	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10
2004	0.14	1.14	2.70	4.17	5.73	7.02	8.15	8.75	9.03	9.16	9.23	9.26	9.28	9.28	9.29	9.29	9.29	9.29	9.29	9.29	9.29	9.29	9.29	9.29	9.29	9.29	9.29	9.29	9.29	9.29
2005	0.28	1.98	4.39	6.25	8.16	10.49	11.75	12.26	12.50	12.61	12.65	12.67	12.68	12.69	12.69	12.69	12.69	12.69	12.69	12.69	12.69	12.69	12.69	12.69	12.69	12.69	12.69	12.69	12.69	12.69
2006	0.00	0.56	5.00	10.07	17.51	22.91	25.86	27.27	28.02	28.40	28.61	28.70	28.74	28.76	28.77	28.78	28.78	28.78	28.78	28.78	28.78	28.78	28.78	28.78	28.78	28.78	28.78	28.78	28.78	28.78
2007	0.00	0.75	5.63	13.74	21.41	27.00	30.31	31.99	32.74	33.13	33.33	33.41	33.45	33.47	33.48	33.49	33.49	33.49	33.49	33.49	33.49	33.49	33.49	33.49	33.49	33.49	33.49	33.49	33.49	33.49
2008	0.00	1.64	9.17	18.02	25.03	30.57	33.64	34.85	35.50	35.83	35.99	36.06	36.10	36.11	36.12	36.12	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13	36.13
2009	0.12	3.12	11.36	20.19	27.08	30.64	32.60	33.69	34.23	34.48	34.59	34.63	34.65	34.67	34.67	34.68	34.68	34.68	34.69	34.69	34.69	34.69	34.69	34.69	34.69	34.69	34.69	34.69	34.69	34.69
2010	0.14	2.42	7.08	10.26	12.69	14.29	15.24	15.71	15.91	15.99	16.03	16.06	16.07	16.08	16.08	16.09	16.09	16.09	16.09	16.09	16.09	16.09	16.09	16.09	16.09	16.09	16.09	16.09	16.09	16.09
2011	0.05	1.06	3.48	5.71	7.36	8.44	9.11	9.38	9.49	9.56	9.59	9.61	9.63	9.63	9.64	9.64	9.64	9.64	9.64	9.64	9.64	9.64	9.64	9.64	9.64	9.64	9.64	9.64	9.64	9.64
2012	0.04	0.88	2.83	4.57	5.83	6.72	7.14	7.33	7.43	7.48	7.52	7.53	7.54	7.55	7.55	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56
2013	0.04	0.83	2.76	4.48	5.81	6.63	7.02	7.21	7.32	7.38	7.41	7.43	7.44	7.45	7.45	7.45	7.45	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46
2014	0.03	0.70	2.36	3.87	4.96	5.54	5.87	6.05	6.14	6.19	6.22	6.24	6.25	6.26	6.26	6.26	6.26	6.26	6.26	6.26	6.26	6.26	6.26	6.26	6.27	6.27	6.27	6.27	6.27	6.27
2015	0.03	0.71	2.35	3.78	4.81	5.40	5.73	5.90	6.00	6.05	6.08	6.10	6.11	6.11	6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12
2016	0.04	0.71	2.14	3.46	4.37	4.93	5.26	5.44	5.53	5.59	5.62	5.63	5.64	5.65	5.65	5.65	5.65	5.65	5.66	5.66	5.66	5.66	5.66	5.66	5.66	5.66	5.66	5.66	5.66	5.66



Cumulative Prepayment Rates			Adjustable Rate Streamline Refinance Mortgages										by Credit Subsidy Endorsement Cohort																										
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30									
1992	0.72	8.62	19.36	27.68	39.20	46.99	57.79	65.66	70.32	75.69	80.37	84.93	87.17	88.39	89.56	90.60	91.44	91.90	92.47	92.91	93.35	93.77	94.06	94.31	94.53	94.72	94.88	95.02	95.15	95.26									
1993	1.56	9.94	17.67	28.37	35.37	45.41	54.57	60.04	67.94	74.36	80.22	82.82	84.41	85.79	86.82	87.46	88.18	88.76	89.24	89.69	90.13	90.43	90.69	90.91	91.10	91.27	91.41	91.54	91.65	91.75									
1994	2.76	9.43	19.21	27.52	38.19	47.07	52.41	60.29	67.03	73.38	76.93	79.66	81.28	82.75	83.62	84.27	84.92	85.46	85.98	86.48	86.83	87.13	87.38	87.60	87.79	87.96	88.10	88.23	88.34	88.44									
1995	2.56	19.67	35.87	52.22	59.42	64.20	70.57	77.42	81.09	83.66	85.18	86.50	87.19	87.67	88.13	88.64	89.06	89.46	89.85	90.11	90.34	90.54	90.71	90.85	90.98	91.09	91.19	91.28	91.36	91.43									
1996	2.70	22.56	53.74	68.82	73.18	79.71	84.01	87.37	89.36	90.70	91.66	92.09	92.53	92.97	93.37	93.66	93.91	94.13	94.27	94.37	94.46	94.53	94.58	94.63	94.66	94.69	94.72	94.74	94.76	94.77									
1997	4.72	41.60	65.48	71.92	80.39	85.03	88.72	90.71	92.17	93.21	93.91	94.09	94.38	94.68	94.90	95.10	95.26	95.37	95.45	95.52	95.57	95.61	95.64	95.67	95.70	95.72	95.73	95.74	95.76	95.77									
1998	10.33	46.95	58.92	75.74	83.39	88.59	91.45	93.25	94.39	95.15	95.48	95.86	96.24	96.52	96.76	96.97	97.10	97.19	97.27	97.33	97.38	97.42	97.45	97.48	97.50	97.52	97.53	97.54	97.55	97.56									
1999	3.21	13.07	41.37	58.84	71.55	79.09	83.89	87.56	89.75	90.88	92.06	93.19	93.97	94.64	95.18	95.51	95.76	95.96	96.11	96.23	96.32	96.40	96.46	96.51	96.55	96.58	96.61	96.63	96.65	96.66									
2000	2.50	22.87	37.94	48.51	59.74	67.59	74.41	79.14	80.96	83.05	85.10	86.62	87.92	89.00	89.67	90.18	90.57	90.88	91.12	91.31	91.46	91.58	91.68	91.76	91.82	91.87	91.92	91.96	91.99	92.02									
2001	3.14	33.01	52.61	63.47	74.03	80.72	85.27	86.83	88.17	89.56	90.56	91.44	92.22	92.71	93.08	93.37	93.59	93.77	93.90	94.01	94.10	94.17	94.22	94.27	94.30	94.34	94.36	94.38	94.40	94.41									
2002	5.60	36.90	53.71	67.02	76.43	83.01	85.56	87.32	88.83	89.92	90.90	91.78	92.36	92.84	93.21	93.50	93.73	93.90	94.04	94.15	94.24	94.31	94.36	94.41	94.45	94.48	94.50	94.52	94.54	94.56									
2003	14.38	38.29	58.49	71.68	79.98	83.50	85.47	87.18	88.41	89.54	90.56	91.23	91.78	92.23	92.57	92.84	93.05	93.21	93.34	93.44	93.52	93.58	93.63	93.67	93.70	93.73	93.75	93.77	93.79	93.80									
2004	10.88	36.76	56.05	68.37	73.31	76.50	79.30	81.26	83.06	84.77	85.91	86.87	87.67	88.32	88.81	89.19	89.49	89.72	89.90	90.04	90.15	90.24	90.32	90.37	90.42	90.46	90.50	90.52	90.55	90.56									
2005	23.42	50.14	65.86	73.59	77.04	79.31	80.94	82.36	83.66	84.50	85.17	85.72	86.15	86.47	86.70	86.87	86.98	87.07	87.13	87.17	87.20	87.22	87.24	87.26	87.27	87.27	87.28	87.29	87.29	87.29									
2006	6.11	23.89	37.78	46.68	49.71	51.69	53.96	56.61	58.63	60.48	62.13	63.65	65.16	66.42	67.40	68.18	68.79	69.26	69.63	69.92	70.15	70.33	70.47	70.59	70.68	70.76	70.83	70.88	70.92	70.96									
2007	7.46	22.39	32.73	37.06	40.03	42.54	45.80	48.45	51.10	53.51	55.72	57.77	59.60	61.08	62.26	63.15	63.84	64.37	64.78	65.09	65.34	65.54	65.70	65.83	65.93	66.02	66.08	66.14	66.19	66.23									
2008	2.97	23.58	29.78	34.05	37.35	40.09	42.62	45.65	48.56	51.13	53.36	55.43	57.28	58.77	59.89	60.73	61.37	61.86	62.24	62.54	62.77	62.96	63.11	63.23	63.32	63.40	63.47	63.52	63.57	63.60									
2009	2.65	10.80	17.80	23.63	29.41	33.82	38.95	43.70	47.67	51.11	54.27	56.95	58.95	60.42	61.50	62.32	62.94	63.41	63.77	64.06	64.28	64.46	64.60	64.71	64.80	64.88	64.94	64.99	65.03	65.07									
2010	3.04	17.40	31.20	44.16	51.51	57.24	62.54	67.24	71.40	74.68	77.04	78.73	79.96	80.86	81.53	82.04	82.42	82.71	82.94	83.12	83.26	83.37	83.46	83.53	83.58	83.63	83.67	83.70	83.73	83.75									
2011	4.75	23.81	42.72	53.03	60.52	66.06	71.40	76.46	80.25	82.92	84.81	86.17	87.16	87.88	88.43	88.83	89.14	89.38	89.57	89.71	89.82	89.91	89.98	90.04	90.09	90.13	90.16	90.19	90.21	90.23									
2012	5.54	28.56	43.88	55.04	62.95	68.98	75.27	80.17	83.55	85.91	87.58	88.78	89.65	90.29	90.76	91.12	91.39	91.60	91.76	91.88	91.98	92.06	92.12	92.17	92.21	92.25	92.27	92.30	92.31	92.33									
2013	5.30	23.27	40.15	52.33	60.88	67.91	74.71	79.79	83.30	85.75	87.48	88.73	89.63	90.30	90.79	91.16	91.44	91.66	91.83	91.96	92.06	92.14	92.21	92.26	92.30	92.34	92.37	92.39	92.41	92.43									
2014	4.35	24.22	41.85	54.21	63.45	71.03	77.47	82.14	85.35	87.58	89.16	90.29	91.11	91.71	92.16	92.50	92.75	92.94	93.10	93.21	93.31	93.38	93.44	93.48	93.52	93.55	93.58	93.60	93.62	93.63									
2015	4.51	23.97	41.51	54.21	63.79	71.31	77.72	82.37	85.56	87.77	89.34	90.46	91.28	91.88	92.32	92.65	92.90	93.10	93.25	93.36	93.45	93.53	93.58	93.63	93.67	93.70	93.72	93.74	93.76	93.78									
2016	4.48	24.26	42.38	55.25	65.07	72.39	78.46	82.97	86.09	88.27	89.82	90.93	91.74	92.33	92.77	93.10	93.36	93.55	93.70	93.82	93.91	93.98	94.04	94.09	94.13	94.16	94.19	94.21	94.22	94.24									



Loss Rates		All Mortgages by Credit Subsidy Endorsement Cohort																												
Book/Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1980	140.60	23.84	43.29	40.87	44.33	33.70	39.68	46.71	47.86	44.50	42.13	44.13	43.17	37.54	35.51	37.79	44.37	42.28	52.91	60.13	62.87	43.31	50.75	76.34	79.95	95.73	170.61	252.50	82.36	112.81
1981	44.90	42.53	41.59	44.61	35.56	42.16	47.45	51.10	48.56	49.15	47.55	47.30	44.92	46.24	41.93	49.01	59.36	59.26	66.10	78.11	64.44	62.23	95.72	85.53	64.42	100.76	220.55	79.58	116.99	113.29
1982	41.69	41.60	47.44	37.82	44.99	52.57	57.05	57.52	55.11	59.15	60.97	52.36	63.43	73.47	73.38	74.24	71.52	74.90	88.37	98.52	119.10	69.32	108.72	70.39	110.10	68.69	255.08	112.02	108.66	99.92
1983	36.31	44.71	36.36	43.29	48.24	49.27	47.50	45.60	45.45	43.22	39.92	39.98	42.60	46.33	53.05	56.69	58.87	62.83	62.06	62.59	60.98	58.93	99.13	101.90	154.20	92.99	112.05	107.91	96.94	90.46
1984	38.12	35.56	44.75	48.49	50.98	50.37	48.38	47.90	47.59	46.94	46.02	46.49	53.27	71.70	68.00	66.27	68.13	60.56	78.91	65.33	69.15	67.17	128.51	161.82	103.96	110.36	105.76	94.66	88.34	88.33
1985	33.54	46.62	49.74	50.48	48.68	47.50	47.68	45.76	44.35	45.10	43.53	47.35	55.44	61.04	71.32	57.94	64.40	77.06	52.38	73.22	69.32	113.37	90.68	119.47	111.70	106.96	95.69	89.42	89.40	88.19
1986	43.97	48.34	48.57	45.81	43.41	41.48	38.97	36.40	34.76	35.67	33.81	38.46	43.85	45.45	42.13	47.47	48.57	49.25	51.25	63.83	59.10	79.85	100.60	82.04	77.39	66.14	60.03	60.09	59.08	59.07
1987	48.56	45.93	43.61	40.89	39.78	37.01	34.15	31.82	31.08	31.54	34.73	40.44	42.99	41.88	40.38	46.17	48.21	46.27	56.33	69.54	80.86	86.13	81.20	76.40	65.09	58.98	59.01	57.96	57.95	57.96
1988	49.67	40.06	38.99	39.19	37.84	36.48	34.96	35.99	36.51	39.13	46.17	47.47	47.45	48.63	49.80	47.21	53.37	62.05	66.94	91.99	81.64	82.35	77.74	66.57	60.52	60.69	59.80	59.80	59.81	59.89
1989	44.76	39.88	37.45	37.43	37.43	37.17	38.49	38.62	42.10	47.72	50.72	48.58	46.65	47.70	48.80	53.45	57.74	73.71	100.56	110.70	83.79	79.02	67.78	61.78	61.86	61.14	61.29	61.43	61.40	61.41
1990	43.31	35.50	35.19	38.17	39.64	41.32	42.71	47.16	51.94	53.26	51.34	50.23	53.47	53.27	53.13	62.26	75.59	97.58	99.38	85.61	80.86	69.66	63.61	63.68	62.70	62.84	63.01	63.05	63.28	63.52
1991	32.94	32.00	35.16	39.12	41.42	43.23	49.44	54.13	54.19	49.26	49.73	46.76	46.69	52.15	63.25	80.79	84.98	95.81	83.90	79.10	67.80	61.78	61.87	60.84	60.80	60.90	60.85	60.89	60.85	60.65
1992	29.94	32.37	34.04	36.40	38.43	45.26	50.18	49.71	45.83	42.67	39.88	34.52	42.23	52.53	64.09	85.13	87.26	77.75	73.07	61.88	55.83	55.71	54.48	54.43	54.23	54.03	53.93	53.77	53.62	53.55
1993	25.02	27.02	31.49	34.07	41.39	45.70	44.33	41.02	35.81	33.34	30.98	37.88	48.32	63.70	71.91	77.06	75.11	70.23	58.84	52.51	52.17	50.94	50.76	50.64	50.39	50.27	50.08	49.89	49.67	53.14
1994	24.40	27.18	31.70	37.81	43.29	41.22	37.51	32.71	30.79	28.17	32.33	45.77	53.62	72.53	73.92	74.98	70.11	58.88	52.63	52.48	51.37	51.29	51.19	51.00	50.93	50.89	50.84	50.81	54.57	54.71
1995	24.79	25.73	35.53	41.45	41.23	39.81	35.30	34.53	31.94	35.19	42.67	50.56	75.38	68.46	77.48	72.99	61.89	55.93	56.09	55.00	55.04	55.13	55.07	55.12	55.12	55.11	55.08	58.83	58.73	58.50
1996	21.16	37.43	37.87	37.83	35.95	33.70	31.73	29.43	31.98	39.18	50.31	62.09	64.95	77.01	72.78	61.67	55.64	55.85	54.88	54.93	54.64	54.50	54.48	54.40	54.32	54.24	57.93	57.85	57.81	57.86
1997	33.12	37.64	36.22	35.62	33.61	32.90	28.68	33.84	38.28	49.69	61.97	67.59	77.81	73.93	62.79	56.56	56.51	55.40	55.35	55.17	55.13	55.20	55.20	55.19	55.18	58.95	58.93	58.90	58.85	58.72
1998	35.89	34.36	31.58	30.25	30.12	27.27	30.62	36.06	46.40	60.60	61.43	78.01	74.49	63.42	56.71	55.71	54.32	54.16	53.92	53.80	53.82	53.76	53.71	53.65	57.38	57.30	57.24	57.17	57.07	56.91
1999	36.16	30.92	29.69	29.33	26.78	30.24	35.07	42.78	56.24	59.92	73.98	75.94	64.73	57.52	55.84	54.00	53.21	52.82	52.62	52.69	52.64	52.59	52.55	56.30	56.25	56.20	56.12	56.06	55.99	55.98
2000	28.50	30.25	29.82	30.31	33.18	37.43	45.82	56.69	61.60	72.59	77.78	71.17	63.92	61.70	58.52	56.70	55.65	55.22	55.06	54.99	55.07	55.09	58.90	58.93	58.95	58.97	58.98	59.00	59.04	59.11
2001	26.40	29.86	30.49	34.57	37.56	45.28	55.26	58.91	72.89	74.09	69.02	66.84	64.45	60.47	58.01	55.17	54.21	53.74	53.32	53.30	53.25	56.91	56.80	56.69	56.56	56.41	56.24	56.07	55.87	55.60
2002	25.17	28.57	32.08	35.70	41.81	50.78	54.09	70.87	73.34	65.55	63.93	65.31	60.95	57.39	54.36	52.61	52.11	51.92	51.86	51.85	55.56	55.47	55.40	55.33	55.25	55.14	55.03	54.94	54.82	54.71
2003	25.69	26.46	28.46	37.39	46.75	50.00	68.54	70.47	63.08	58.32	62.16	61.62	57.10	54.15	51.29	50.33	49.91	49.73	49.68	53.36	53.16	53.01	52.87	52.73	52.58	52.39	52.19	52.02	51.85	51.65
2004	10.77	20.96	36.65	45.98	49.49	67.55	69.48	61.73	57.66	57.83	61.61	59.30	55.67	52.21	50.39	49.74	49.37	49.27	53.01	52.93	52.77	52.67	52.58	52.49	52.37	52.15	52.03	51.95	51.90	52.00
2005	13.36	35.78	45.48	49.53	65.30	66.13	58.98	55.39	56.69	56.19	59.23	58.97	54.59	50.40	48.11	47.20	46.88	50.53	50.55	50.55	50.46	50.44	50.44	50.44	50.42	50.36	50.32	50.29	50.20	49.94
2006	37.75	42.83	47.79	63.67	62.07	55.06	53.01	56.16	56.76	57.14	60.32	60.31	55.95	51.64	48.97	47.96	51.01	50.74	50.55	50.50	50.50	50.51	50.53	50.56	50.57	50.57	50.59	50.61	50.63	50.67
2007	33.75	43.58	61.03	56.92	49.68	48.63	53.89	55.92	57.36	57.56	60.54	60.22	56.33	51.83	49.67	52.51	51.85	51.53	51.32	51.24	51.22	51.20	51.20	51.19	51.18	51.17	51.15	51.13	51.11	51.08
2008	32.20	57.93	51.11	42.98	42.95	49.76	52.28	54.49	55.09	55.10	55.51	56.76	51.53	48.52	51.48	51.10	50.98	50.91	50.90	50.89	50.87	50.85	50.84	50.82	50.80	50.75	50.71	50.66	50.60	50.48
2009	51.99	44.61	37.56	39.73	45.49	46.23	48.37	46.46	47.97	43.27	48.27	45.76	44.69	48.41	48.38	48.36	48.34	48.33	48.32	48.30	48.27	48.24	48.22	48.20	48.17	48.14	48.10	48.05	47.99	47.89
2010	41.09	39.61	38.63	39.53	40.44	39.44	40.69	38.56	38.39	36.47	40.64	44.86	48.62	48.61	48.60	48.59	48.59	48.60	48.61	48.61	48.58	48.56	48.56	48.55	48.55	48.57	48.55	48.53	48.51	47.45
2011	33.67	37.01	37.24	38.00	37.79	37.69	37.97	35.96	36.37	35.02	41.97	50.12	50.12	50.11	50.11	50.10	50.11	50.12	50.13	50.13	50.13	50.13	50.12	50.11	50.09	50.07	50.03	50.01	48.97	48.92
2012	32.98	36.45	34.93	36.44	34.38	36.09	33.46	34.05	33.04	33.59	44.22	48.75	48.73	48.70	48.68	48.66	48.65	48.64	48.63	48.62	48.61	48.59	48.57	48.55	48.52	48.49	48.46	47.42	47.35	48.27
2013	30.93	34.42	34.48	36.28	34.17	35.51	32.04	34.05	33.01	37.64	44.51	48.94	48.89	48.85	48.80	48.77	48.77	48.78	48.79	48.80	48.81	48.81	48.81	48.80	48.80	48.78	47.78	47.76	48.74	48.74
2014	31.82	34.57	35.27	36.04	34.29	35.24	32.45	34.95	37.86	38.20	45.00	49.43	49.35	49.27	49.20	49.13	49.08	49.04	49.00	48.95	48.91	48.86	48.81	48.75	48.70	47.63	47.55	48.48	48.42	48.35
2015	32.03	34.34	34.93	34.45	33.72	34.12	31.97	38.38	38.85	38.08	44.49	49.05	48.98	48.92	48.85	48.79	48.75	48.72	48.68	48.64	48.59	48.54	48.49	48.44	47.40	47.33	48.25	48.18	48.12	48.05
2016	32.36	34.33	35.05	33.89	33.85	34.72	35.81	38.89	40.56	38.67	44.66	49.16	49.08	49.01	48.94	48.88	48.83	48.79	48.74	48.70	48.65	48.61	48.56	47.53	47.48	48.41	48.36	48.30	48.25	48.18



Loss Rates		Fixed Rate 30 Year Mortgages by Credit Subsidy Endorsement Cohort																													
Book\Policy		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1980		140.60	23.84	43.19	40.83	44.34	33.66	39.66	46.69	47.79	44.48	42.09	44.17	43.11	37.55	35.51	37.79	44.37	42.28	52.91	60.13	62.87	43.31	50.75	76.34	79.95	95.73	170.61	252.50	82.36	112.81
1981		44.90	42.42	41.50	44.60	35.54	42.18	47.43	51.06	48.57	49.11	47.48	47.08	44.93	46.23	41.93	49.01	59.36	59.26	66.10	78.11	64.44	62.23	95.72	85.53	64.42	100.76	220.55	79.58	116.99	113.29
1982		41.69	41.49	47.36	37.79	44.95	52.54	57.07	57.20	55.10	58.97	60.93	52.36	63.43	73.47	73.38	74.24	71.52	74.90	88.37	98.52	119.10	69.32	108.72	70.39	110.10	68.69	255.08	112.02	108.66	99.92
1983		35.97	44.75	36.40	43.15	48.19	49.21	47.49	45.65	45.45	43.34	40.03	39.89	42.70	46.25	52.65	56.69	58.87	62.83	62.06	62.59	60.98	58.93	99.13	101.90	154.20	92.99	112.05	107.91	96.94	90.46
1984		38.64	35.53	44.87	48.43	50.79	50.39	48.24	47.82	47.74	46.95	45.98	46.47	52.69	71.59	67.64	65.81	68.13	60.55	78.91	65.33	69.15	67.17	128.51	161.82	103.96	110.36	105.76	94.66	88.34	88.33
1985		33.18	46.64	49.74	50.47	48.67	47.43	47.70	45.76	44.32	44.95	43.55	47.38	55.10	60.22	71.09	57.17	64.40	77.71	52.38	73.22	66.91	113.37	90.68	119.47	111.71	106.96	95.69	89.42	89.40	88.19
1986		44.35	48.42	48.63	45.85	43.40	41.45	39.13	36.43	34.87	35.47	33.85	38.32	43.74	45.35	42.07	47.60	48.48	49.23	51.41	65.03	59.10	79.85	100.60	82.20	77.56	66.33	60.23	60.33	59.35	59.43
1987		48.56	46.02	43.44	40.78	39.98	37.06	34.21	32.26	31.24	31.96	34.85	40.69	43.64	42.52	40.65	46.37	49.01	47.42	55.51	72.20	78.41	88.65	81.71	76.95	65.64	59.58	59.70	58.72	58.77	58.83
1988		48.98	40.00	38.81	39.32	37.79	36.50	35.23	36.11	36.89	38.75	46.65	47.90	47.79	48.84	50.32	47.77	53.61	62.11	65.71	92.80	80.28	82.81	78.19	66.99	60.93	61.13	60.34	60.41	60.47	60.59
1989		46.03	39.43	37.38	37.46	37.56	37.14	38.61	38.97	42.20	47.65	50.78	48.50	47.45	47.98	48.38	53.70	57.57	73.71	103.17	113.36	84.03	79.25	67.99	62.00	62.10	61.41	61.59	61.75	61.75	61.78
1990		44.24	35.59	35.23	38.30	39.86	41.47	42.87	47.10	51.81	53.58	51.35	50.15	53.11	53.10	53.35	62.35	76.20	97.53	99.81	85.80	81.06	69.85	63.78	63.87	62.91	63.08	63.28	63.36	63.64	63.99
1991		32.16	31.76	35.40	39.18	41.50	43.64	49.90	54.15	54.63	49.93	50.79	46.31	47.52	53.59	61.79	79.39	85.43	97.60	84.30	79.47	68.13	62.09	62.23	61.29	61.29	61.47	61.47	61.57	61.58	61.44
1992		31.76	32.12	34.50	36.78	39.35	46.01	51.40	51.30	46.88	43.80	42.73	34.46	43.85	55.85	66.99	88.04	87.76	80.09	75.35	64.14	58.24	58.53	57.73	58.07	58.30	58.27	58.34	58.36	58.37	58.38
1993		25.59	25.46	29.33	32.29	39.95	44.88	44.17	41.12	37.69	33.89	31.60	39.32	48.36	63.03	72.94	81.23	78.01	73.54	62.33	56.36	56.66	55.83	55.91	55.74	55.67	55.78	55.77	55.71	55.62	59.18
1994		24.10	21.19	26.85	33.78	41.74	41.65	38.54	34.43	32.62	29.01	34.17	46.55	57.60	71.35	77.76	78.23	73.68	62.67	56.70	56.92	56.04	56.15	56.12	56.11	56.20	56.23	56.28	56.32	60.18	60.33
1995		22.62	22.87	33.62	40.88	42.49	41.64	36.90	36.85	33.42	36.23	43.45	51.42	75.19	69.55	78.15	73.61	62.47	56.52	56.84	55.97	56.12	56.40	56.39	56.48	56.51	56.53	56.53	60.30	60.22	60.01
1996		18.81	35.84	37.63	39.13	37.09	34.95	32.86	31.29	32.61	39.90	50.93	61.80	64.65	78.11	73.93	62.74	56.76	57.23	56.53	56.75	56.60	56.50	56.52	56.49	56.45	56.42	60.17	60.14	60.12	60.15
1997		30.12	36.37	37.11	37.11	35.11	34.59	30.77	34.67	39.28	51.24	63.54	68.48	78.77	74.94	63.73	57.51	57.66	56.86	56.97	57.01	57.01	57.13	57.18	57.23	57.27	61.09	61.11	61.12	61.10	60.97
1998		33.43	35.47	33.35	31.60	31.37	28.20	31.11	36.83	46.44	61.75	62.87	78.74	75.23	64.20	57.57	56.59	55.18	55.00	54.75	54.65	54.72	54.70	54.68	54.66	58.43	58.42	58.40	58.38	58.35	58.30
1999		40.44	32.20	30.40	30.06	27.33	30.51	35.58	42.99	56.06	60.94	74.65	76.74	65.53	58.28	56.70	54.84	54.06	53.76	53.59	53.73	53.79	53.83	53.87	57.69	57.73	57.77	57.80	57.83	57.86	57.86
2000		29.40	30.48	30.10	30.59	33.69	38.05	46.96	57.87	62.98	73.50	78.55	71.88	64.74	62.71	59.74	57.92	56.99	56.56	56.40	56.37	56.54	56.62	60.51	60.60	60.70	60.79	60.88	60.97	61.07	61.21
2001		26.83	30.23	30.95	35.31	38.29	45.92	55.80	59.49	73.45	74.62	69.56	67.34	65.04	61.03	58.72	55.96	55.13	54.74	54.37	54.41	54.48	58.26	58.26	58.26	58.27	58.27	58.27	58.26	58.23	58.13
2002		26.91	29.40	33.13	36.97	43.03	52.01	55.10	71.47	74.30	66.33	64.56	66.00	61.62	58.12	55.31	53.67	53.29	53.20	53.14	53.18	56.98	56.99	57.00	57.01	57.02	57.03	57.04	57.05	57.05	57.03
2003		28.89	28.11	30.23	39.33	48.31	51.03	69.70	71.94	64.47	59.60	63.01	62.50	58.13	55.32	52.78	51.95	51.71	51.63	51.67	55.48	55.47	55.48	55.50	55.52	55.53	55.55	55.57	55.58	55.57	55.49
2004		11.09	21.51	37.53	46.55	50.08	68.50	70.75	62.86	58.68	58.67	62.45	60.42	56.70	53.34	51.58	51.10	50.77	50.71	54.54	54.57	54.57	54.59	54.61	54.62	54.64	54.66	54.68	54.70	54.72	54.75
2005		13.12	37.20	45.91	49.91	65.88	66.65	59.39	55.83	57.06	56.64	59.32	59.12	54.67	50.55	48.31	47.51	47.26	50.92	50.95	50.97	50.94	50.96	50.98	51.00	51.01	50.99	50.98	50.96	50.88	50.57
2006		40.15	42.89	47.78	63.66	61.96	55.00	53.01	56.29	56.87	57.19	60.23	60.26	55.88	51.56	48.89	47.96	51.03	50.78	50.59	50.54	50.55	50.57	50.60	50.63	50.65	50.68	50.71	50.73	50.75	50.76
2007		35.01	43.64	61.00	56.92	49.73	48.75	54.11	56.18	57.60	57.79	60.71	60.43	56.53	52.02	49.88	52.75	52.11	51.81	51.61	51.55	51.54	51.54	51.57	51.59	51.61	51.63	51.64	51.66	51.68	51.67
2008		32.35	58.08	51.11	43.09	43.00	49.91	52.55	54.79	55.52	55.43	55.88	57.07	51.91	48.85	51.81	51.44	51.34	51.29	51.30	51.32	51.33	51.34	51.36	51.38	51.40	51.42	51.42	51.42	51.39	51.26
2009		51.83	45.74	38.36	39.20	45.58	46.91	48.58	47.34	48.04	43.92	48.34	46.45	45.09	48.83	48.82	48.83														



Loss Rates		Fixed Rate 30 Year Streamline Refinance Mortgages										by Credit Subsidy Endorsement Cohort																			
Book\Policy		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1990		28.55	34.51	33.74	31.92	29.84	37.03	30.96	35.21	46.11	41.69	56.20	45.76	73.57	38.30	-7.27	26.55	n/a	102.73	77.52	80.98	76.30	65.21	59.26	59.51	58.71	59.05	59.19	59.20	59.22	58.83
1991		18.05	38.28	31.41	30.26	34.75	32.56	36.39	67.47	50.57	37.04	48.20	78.26	32.58	34.67	95.75	98.02	38.08	58.52	79.02	74.40	63.24	57.26	57.37	56.44	56.50	56.66	56.68	56.82	56.89	56.88
1992		14.37	36.28	30.35	35.66	36.10	41.10	44.57	44.19	51.31	31.97	47.90	54.30	55.60	61.53	70.99	43.05	97.11	72.39	67.83	56.82	51.00	51.24	50.50	50.76	51.11	51.17	51.31	51.38	51.43	51.61
1993		26.94	29.67	35.90	38.94	44.93	47.70	45.45	40.32	32.60	33.30	34.24	40.26	50.37	68.03	68.29	66.87	70.66	65.66	54.43	48.39	48.33	47.32	47.39	47.45	47.42	47.47	47.52	47.54	47.53	51.24
1994		25.76	31.84	37.42	43.59	47.02	43.07	38.53	31.89	29.09	28.29	28.86	42.50	42.34	80.51	58.15	71.73	66.92	55.70	49.71	49.87	48.90	48.93	48.94	48.87	48.92	49.08	49.19	49.30	53.15	53.37
1995		25.83	33.62	42.53	47.99	43.92	39.77	30.22	30.90	27.22	43.59	54.84	30.62	71.57	60.17	80.80	76.11	64.87	59.09	59.55	59.02	59.40	60.40	60.39	60.47	60.46	60.42	60.33	63.92	63.46	62.39
1996		24.70	38.72	39.48	37.53	33.63	27.92	29.45	25.74	27.62	33.34	52.49	66.80	51.07	73.02	68.51	57.62	51.66	51.95	51.37	51.57	51.49	51.43	51.56	51.61	51.66	51.75	55.51	55.58	55.73	56.11
1997		36.87	37.45	37.00	31.83	28.04	26.71	21.35	23.99	38.42	41.74	106.82	36.65	75.38	71.96	61.35	55.49	56.04	55.38	55.84	56.05	56.81	57.31	57.46	57.60	57.72	61.62	61.72	61.75	61.67	61.24
1998		37.23	31.47	25.60	23.34	22.98	22.60	27.35	30.46	45.59	53.18	44.80	72.84	68.90	58.08	51.54	51.08	50.13	50.19	49.86	49.73	49.71	49.75	49.75	49.74	53.50	53.45	53.58	53.60	53.57	53.38
1999		26.00	23.58	24.39	23.64	22.78	27.70	30.50	41.27	59.49	49.31	71.16	71.33	60.36	53.58	51.80	50.27	49.56	49.17	49.04	49.09	48.97	48.94	48.95	52.75	52.76	52.93	52.90	52.93	52.98	53.09
2000		15.64	24.81	24.56	26.96	28.63	29.34	36.63	40.32	68.09	74.55	80.44	73.36	65.93	61.65	59.34	58.07	56.79	56.71	56.68	56.53	56.35	56.34	60.11	60.11	60.09	60.05	60.09	60.20	60.41	60.83
2001		11.15	25.70	26.44	28.83	32.11	40.37	49.64	54.81	68.62	70.42	65.75	63.92	61.27	57.52	53.84	50.29	48.45	47.55	47.11	47.16	47.12	50.83	50.80	50.77	50.73	50.66	50.63	50.61	50.57	50.45
2002		20.84	25.11	28.58	31.23	36.30	47.81	51.03	67.97	70.12	62.76	61.94	62.91	58.79	54.72	51.03	48.88	47.97	47.49	47.54	47.58	51.30	51.25	51.27	51.29	51.32	51.29	51.31	51.33	51.32	51.29
2003		20.01	23.04	24.34	33.04	43.37	48.22	65.00	66.95	59.85	55.06	59.56	58.96	54.04	50.89	47.48	46.50	45.87	45.82	45.89	49.67	49.58	49.56	49.56	49.52	49.51	49.46	49.39	49.37	49.37	49.37
2004		9.66	18.87	35.15	44.36	48.00	64.17	65.76	58.32	54.26	54.90	58.85	55.60	52.31	48.79	47.19	46.34	46.12	46.14	49.96	49.92	49.84	49.82	49.83	49.84	49.80	49.65	49.64	49.68	49.75	49.93
2005		6.23	31.55	43.73	47.93	63.28	64.81	57.96	54.24	55.83	54.80	58.87	59.24	54.90	50.53	48.04	46.58	45.98	49.59	49.62	49.61	49.29	49.25	49.27	49.28	49.25	49.23	49.22	49.30	49.27	49.16
2006		31.42	39.99	47.34	62.92	62.68	55.64	53.41	55.83	57.03	57.80	62.32	62.07	58.18	53.95	51.09	49.20	51.80	51.26	50.95	50.80	50.65	50.59	50.58	50.56	50.52	50.31	50.34	50.35	50.42	50.61
2007		24.38	41.60	57.18	53.13	46.68	45.84	51.10	53.27	55.42	55.75	59.54	58.10	54.03	49.45	46.86	49.42	48.68	48.26	48.10	48.08	48.12	48.16	48.17	48.18	48.15	48.15	48.14	48.15	48.15	48.16
2008		29.97	53.71	46.86	39.05	40.54	48.10	50.56	52.65	52.03	52.68	52.90	53.72	47.47	44.93	48.02	48.01	47.91	47.85	47.86	47.87	47.87	47.89	47.89	47.89	47.89	47.79	47.84	47.86	47.89	47.98
2009		51.89	41.69	34.75	40.35	45.15	45.05	48.18	45.00	47.98	41.79	48.26	43.61	43.51	47.30	47.31	47.32	47.32	47.33	47.34	47.34	47.33	47.32	47.33	47.33	47.34	47.35	47.35	47.37	47.39	47.44
2010		44.00	38.52	37.75	38.54	40.18	38.50	40.93	37.25	38.42	34.29	40.42	43.57	47.39	47.42	47.46	47.49	47.52	47.54	47.57	47.59	47.50	47.48	47.51	47.53	47.55	47.64	47.68	47.71	47.75	46.80
2011		29.88	34.10	33.65	36.12	34.49	36.07	33.55	34.00	30.94	32.01	39.93	46.93	46.96	47.00	47.03	47.07	47.10	47.13	47.16	47.18	47.21	47.24	47.27	47.29	47.32	47.35	47.36	47.40	46.44	46.51
2012		29.07	32.01	32.41	33.50	32.02	34.23	30.11	32.18	28.50	31.64	43.36	46.51	46.53	46.55	46.57	46.59	46.60	46.62	46.63	46.64	46.66	46.67	46.68	46.70	46.71	46.74	46.78	45.81	45.84	46.97
2013		28.93	31.07	32.78	33.45	32.43	31.15	30.30	30.99	28.89	35.88	43.80	46.95	46.96	46.97	46.98	46.99	47.00	47.01	47.02	47.02	47.04	47.04	47.05	47.06	47.07	47.09	46.12	46.13	47.16	47.24
2014		28.42	30.39	32.99	31.53	32.38	30.00	30.30	32.44	32.73	35.91	43.77	46.97	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.97	46.97	46.98	46.98	46.98	45.93	45.91	46.91	46.93	47.00
2015		27.92	29.99	32.51	30.47	32.10	29.46	29.75	36.10	32.64	35.32	43.14	46.36	46.35	46.35	46.34	46.34	46.34	46.33	46.33	46.32	46.32	46.32	46.33	46.33	45.35	45.34	46.33	46.35	46.37	46.44
2016		28.44	30.36	33.30	30.81	32.93	29.98	34.26	38.23	34.14	36.08	43.92	47.11	47.11	47.11	47.10	47.10	47.10	47.10	47.10	47.10	47.10	47.12	47.12	46.15	46.15	47.14	47.15	47.17	47.19	47.27



Loss Rates		Fixed Rate 15 Year Mortgages by Credit Subsidy Endorsement Cohort													
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1980	n/a	n/a	74.59	64.43	36.09	68.63	50.49	81.50	141.97	115.65	113.79	59.94	317.09	0.00	23.41
1981	n/a	89.79	67.24	47.10	43.44	12.97	77.34	99.10	124.79	83.35	87.28	227.64	23.79	52.10	n/a
1982	41.53	80.99	69.80	48.54	66.39	71.03	51.24	129.25	64.10	146.86	71.31	52.33	n/a	n/a	n/a
1983	53.45	42.99	34.52	47.82	50.34	52.14	47.76	42.37	45.46	33.32	30.20	57.51	21.90	93.45	268.14
1984	21.05	36.77	39.82	50.87	57.65	49.28	53.49	52.22	39.00	46.02	50.71	48.82	172.31	285.59	464.21
1985	54.04	43.14	49.97	50.83	49.51	49.78	47.09	48.36	45.83	56.21	43.11	54.19	107.76	283.00	267.49
1986	37.24	46.63	47.18	44.73	47.54	43.33	38.70	40.16	36.04	56.59	53.21	89.15	105.17	184.05	255.32
1987	56.95	45.64	43.17	41.82	41.40	39.91	40.42	26.78	34.01	43.37	45.31	72.87	171.04	277.48	311.90
1988	44.02	37.68	41.49	44.35	45.10	40.55	43.55	57.90	42.99	74.82	116.54	215.95	147.05	261.06	12.55
1989	71.59	44.06	44.26	38.60	35.50	33.96	30.20	30.76	31.85	91.53	84.27	69.09	133.26	46.36	30.03
1990	100.16	41.32	36.06	35.47	35.80	44.44	52.83	70.05	93.18	57.32	124.77	185.77	222.76	216.22	577.84
1991	n/a	45.77	36.73	37.94	46.67	37.32	58.16	65.14	79.11	53.17	94.60	-4.51	-0.09	357.74	163.83
1992	76.43	19.09	34.01	38.52	47.06	47.99	62.52	69.43	60.57	80.47	32.32	n/a	70.15	184.89	1018.62
1993	0.00	38.70	34.24	39.65	30.10	40.66	66.12	48.16	71.41	56.45	29.62	141.56	130.38	406.54	219.72
1994	69.26	28.71	26.70	39.14	48.18	43.56	53.58	56.22	48.64	73.02	70.70	68.12	267.74	164.08	101.34
1995	171.71	27.74	38.94	46.90	48.29	52.98	49.91	46.56	36.21	57.12	91.23	152.11	173.44	535.72	102.04
1996	n/a	30.90	38.77	46.18	47.23	48.88	51.81	42.72	22.74	78.63	98.26	160.08	167.82	104.39	100.91
1997	n/a	31.02	36.79	47.47	41.07	33.44	47.07	58.39	51.95	75.65	105.49	346.34	104.62	100.46	90.02
1998	n/a	33.06	40.26	38.13	43.58	55.81	47.64	48.51	47.94	52.79	16.34	104.58	100.23	89.43	82.55
1999	n/a	34.50	41.84	36.78	41.40	47.88	54.73	71.28	84.70	94.49	100.41	100.67	89.77	83.22	83.34
2000	n/a	29.76	41.92	35.62	48.88	64.88	66.82	75.57	77.03	96.54	99.10	92.72	86.34	86.54	85.43
2001	n/a	37.55	41.01	44.73	45.98	62.56	87.68	49.65	89.86	88.76	83.95	82.87	83.02	81.96	81.63
2002	3.75	37.64	34.06	43.77	43.52	59.59	77.04	84.54	83.85	76.21	76.41	81.21	80.13	79.95	79.80
2003	73.57	31.61	37.07	48.30	51.03	52.10	80.14	79.13	71.69	68.55	76.10	78.34	78.31	78.32	78.33
2004	13.23	26.83	44.28	54.32	55.09	78.79	78.29	69.51	66.34	69.78	76.36	78.62	78.65	78.67	78.85
2005	n/a	39.61	44.21	50.95	76.81	76.88	66.13	58.18	58.69	60.96	67.50	72.39	72.38	72.43	72.19
2006	46.95	49.52	52.83	85.22	83.78	74.04	66.15	61.90	59.37	61.86	69.04	73.34	73.47	73.54	73.55
2007	48.29	47.41	88.78	86.95	77.92	71.00	68.55	63.86	61.02	63.59	70.18	75.06	75.12	75.18	75.23
2008	44.71	87.86	83.65	75.66	69.74	67.47	63.74	59.24	58.74	62.20	68.21	74.03	74.02	74.01	77.76
2009	81.59	77.39	70.71	65.85	64.13	60.04	55.59	53.95	57.28	60.87	67.33	72.51	72.52	76.31	76.26
2010	79.03	72.31	67.25	64.73	60.39	56.45	54.53	57.80	61.71	65.22	71.85	76.76	80.52	80.43	80.09
2011	57.53	63.45	66.76	64.44	59.28	56.73	56.27	59.50	63.28	66.72	73.48	82.05	82.11	82.21	82.42
2012	52.32	56.48	57.72	56.36	51.79	50.39	50.37	54.33	58.19	61.68	72.26	77.06	77.14	77.26	77.51
2013	52.41	58.05	60.23	58.76	55.35	53.07	53.56	57.85	61.91	69.48	75.96	81.65	81.87	82.11	82.43
2014	58.34	61.37	62.02	60.00	55.64	53.93	54.05	58.16	65.84	69.54	75.59	81.64	81.77	81.89	82.04
2015	61.28	62.71	61.14	58.79	54.68	52.45	54.11	61.93	65.84	69.48	75.98	81.43	81.61	81.80	82.01
2016	53.40	57.61	57.72	55.28	52.89	51.08	56.13	60.12	64.02	67.57	74.32	79.28	79.35	79.39	79.30



Loss Rates		Fixed Rate 15 Year Streamline Refinance Mortgages								by Credit Subsidy Endorsement Cohort						
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1990	187.45	46.14	41.03	32.30	37.27	14.66	61.56	15.47	54.53	85.65	n/a	n/a	n/a	n/a	n/a	
1991	n/a	22.83	22.61	53.56	47.46	58.97	60.14	40.15	102.45	169.37	n/a	n/a	n/a	n/a	n/a	
1992	n/a	23.50	20.22	33.61	12.76	46.89	77.74	66.41	77.53	114.56	181.35	193.84	n/a	n/a	n/a	
1993	n/a	19.01	26.80	35.31	33.70	48.88	64.93	61.80	41.78	66.67	96.52	39.77	12.54	43.42	n/a	
1994	21.16	18.02	27.53	38.67	52.61	54.66	62.76	53.98	64.15	38.28	69.86	118.90	173.01	295.84	0.00	
1995	60.43	6.47	33.92	45.76	38.63	33.65	35.00	57.67	50.49	71.42	63.04	190.54	n/a	94.03	96.45	
1996	n/a	48.45	53.01	37.85	56.26	34.40	42.55	29.33	69.24	120.23	102.60	190.57	90.61	94.38	90.11	
1997	n/a	37.75	48.10	49.49	65.53	36.17	56.15	82.94	34.50	124.23	86.76	93.72	97.52	93.06	82.56	
1998	0.00	23.15	28.97	32.88	46.16	42.20	33.15	37.96	164.79	138.56	237.50	93.29	88.83	78.16	71.32	
1999	n/a	38.95	30.10	30.36	35.35	38.54	38.32	45.23	85.29	29.44	89.92	89.78	79.06	72.44	72.72	
2000	n/a	11.17	42.03	33.50	34.83	60.74	86.34	83.60	64.47	88.49	91.91	83.40	76.97	77.25	76.41	
2001	n/a	27.84	37.63	40.22	44.33	48.87	66.23	65.75	79.34	78.24	72.71	72.67	72.84	71.92	71.79	
2002	n/a	27.32	31.06	37.12	46.22	57.39	48.54	79.36	78.53	71.00	70.53	75.05	74.03	74.09	74.10	
2003	n/a	25.22	30.42	39.11	49.12	57.50	74.68	73.73	66.37	63.16	69.98	72.61	72.56	72.54	72.49	
2004	12.44	29.94	32.87	55.50	61.43	75.50	75.08	66.18	62.83	66.10	72.17	73.88	73.99	74.10	72.94	
2005	0.00	35.04	48.11	48.37	87.11	86.33	75.85	67.66	66.67	67.44	74.07	76.63	76.63	76.68	76.36	
2006	n/a	42.04	56.03	95.31	94.29	85.35	78.54	74.97	71.53	72.39	77.86	82.00	82.19	82.37	82.63	
2007	n/a	42.88	92.06	90.79	82.32	77.18	77.64	73.87	69.22	68.59	74.53	79.33	79.49	79.67	79.94	
2008	81.13	88.88	85.69	78.00	74.25	71.17	68.63	62.41	60.41	63.60	69.98	75.64	75.78	75.93	79.91	
2009	81.45	79.74	71.68	67.48	65.74	63.10	57.41	53.40	57.28	60.87	67.93	72.55	72.70	76.67	76.98	
2010	75.55	69.32	65.11	62.67	60.64	55.36	51.56	55.53	59.54	63.09	69.79	73.69	77.64	77.83	78.11	
2011	62.04	61.42	62.35	59.14	52.42	49.49	49.65	53.73	57.68	61.23	68.42	76.73	76.90	77.12	77.50	
2012	60.67	61.65	61.39	58.14	52.69	49.72	51.27	55.26	59.20	62.72	73.69	78.19	78.34	78.51	78.80	
2013	59.13	59.50	59.29	56.62	51.73	47.90	50.43	54.47	58.39	65.70	72.75	77.40	77.55	77.77	78.20	
2014	60.83	61.59	60.46	56.78	53.19	48.85	51.69	55.58	63.16	66.53	73.52	77.94	77.95	78.00	78.22	
2015	55.27	58.15	58.02	53.94	50.78	47.12	50.27	58.05	61.93	65.39	72.48	76.95	77.05	77.20	77.57	
2016	57.09	58.72	56.68	52.63	49.81	46.08	53.20	57.12	60.97	64.39	71.31	75.66	75.68	75.72	75.87	



Loss Rates		Adjustable Rate Mortgages by Credit Subsidy Endorsement Cohort																												
Book\Policy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1989	20.43	36.46	32.70	34.20	37.31	41.76	39.46	29.07	42.00	44.85	47.95	47.97	26.16	40.79	74.69	41.82	78.47	n/a	30.45	82.07	78.27	73.65	62.84	56.10	56.09	55.03	55.04	55.05	55.01	55.07
1990	n/a	23.18	36.75	45.68	39.11	28.40	37.11	59.05	55.91	37.58	35.51	47.01	46.13	64.95	11.34	131.52	39.49	n/a	21.14	77.78	72.78	61.96	55.39	55.34	54.28	54.27	54.31	54.24	54.25	54.15
1991	62.79	24.00	30.40	41.49	40.83	38.66	44.23	52.29	47.41	41.69	31.55	55.06	30.96	21.44	86.20	172.55	85.64	0.00	79.59	75.07	64.06	57.45	57.43	56.36	56.35	56.33	56.24	56.30	56.30	56.29
1992	20.45	33.11	33.73	35.42	36.34	43.81	47.30	45.25	41.59	37.38	23.46	31.93	29.08	23.92	37.88	62.88	81.21	73.53	69.16	58.12	51.36	51.39	50.33	50.35	50.36	50.32	50.40	50.42	50.45	50.54
1993	21.28	26.42	29.39	31.36	40.43	45.25	43.11	40.28	32.22	28.38	25.45	22.81	40.35	57.31	68.27	61.68	73.88	69.19	58.08	51.73	51.75	50.72	50.73	50.74	50.69	50.75	50.76	50.75	50.72	54.41
1994	10.28	24.94	28.53	35.29	40.17	37.12	32.44	28.39	25.85	24.45	21.67	39.63	31.88	56.67	66.66	72.84	68.40	57.36	50.62	50.65	49.59	49.61	49.62	49.58	49.65	49.66	49.68	49.71	53.53	53.62
1995	20.88	27.49	37.05	41.57	38.83	35.53	31.33	28.19	28.35	30.56	38.08	47.31	75.23	61.14	74.54	69.84	58.81	52.43	52.47	51.45	51.43	51.45	51.40	51.47	51.48	51.48	51.48	55.26	55.23	55.13
1996	26.88	40.16	37.74	35.43	33.70	31.12	28.56	23.71	28.49	35.07	45.53	60.40	69.60	73.67	69.25	58.29	51.56	51.62	50.60	50.63	50.66	50.63	50.71	50.73	50.76	50.78	54.59	54.61	54.64	54.70
1997	35.16	39.42	34.95	33.27	31.04	29.66	23.53	31.09	33.79	42.79	52.36	65.37	75.11	70.76	59.67	53.02	53.03	52.02	52.05	52.08	52.05	52.13	52.16	52.18	52.20	56.00	56.01	56.01	56.01	55.96
1998	37.76	33.99	30.13	29.47	28.90	25.31	29.62	33.23	46.44	56.32	59.09	75.69	71.87	60.22	53.35	53.40	52.37	52.41	52.45	52.44	52.53	52.56	52.59	52.62	56.43	56.45	56.48	56.49	56.50	56.49
1999	28.33	30.75	28.46	28.20	23.07	26.36	28.68	38.12	48.93	47.43	68.01	71.80	60.27	52.45	50.83	49.16	48.65	48.47	48.46	48.54	48.56	48.58	48.60	52.41	52.42	52.44	52.44	52.45	52.44	52.39
2000	23.92	29.47	27.96	28.40	27.89	32.65	35.70	47.86	50.92	66.50	71.53	64.66	55.23	52.95	50.31	49.66	49.19	48.96	49.05	49.09	49.12	49.15	52.97	53.00	53.02	53.05	53.08	53.10	53.14	53.22
2001	25.02	28.18	29.65	28.37	29.73	39.94	55.89	55.92	68.93	70.41	64.30	61.38	58.21	54.14	51.50	50.22	49.81	49.60	49.67	49.73	49.77	53.59	53.63	53.65	53.68	53.69	53.69	53.67	53.61	53.39
2002	17.50	26.78	26.56	27.52	37.52	43.51	50.30	69.30	70.63	62.90	60.64	62.59	58.33	54.46	51.14	49.38	48.61	48.17	48.26	48.32	52.13	52.15	52.17	52.19	52.20	52.22	52.23	52.23	52.23	52.20
2003	12.63	23.27	26.33	34.65	43.99	48.43	68.96	70.92	63.13	57.67	62.98	61.19	57.57	53.83	51.27	50.24	49.71	49.55	49.61	53.43	53.46	53.48	53.50	53.52	53.53	53.55	53.56	53.57	53.56	53.52
2004	9.91	20.18	34.45	44.16	48.12	67.57	69.01	61.46	57.08	57.23	61.14	58.97	55.38	51.70	49.52	48.93	48.58	48.57	52.40	52.43	52.45	52.47	52.49	52.50	52.52	52.53	52.55	52.56	52.58	52.62
2005	24.93	34.52	45.69	47.92	63.89	64.39	57.29	53.16	54.75	54.37	58.53	57.19	53.15	48.59	46.17	45.23	44.70	48.33	48.30	48.31	48.32	48.32	48.32	48.33	48.32	48.32	48.31	48.28	48.22	48.03
2006	39.01	45.15	47.39	60.73	58.91	52.12	50.39	53.18	54.30	54.66	58.71	58.27	53.73	49.51	47.02	45.73	48.91	48.63	48.53	48.47	48.46	48.47	48.49	48.50	48.51	48.52	48.53	48.53	48.52	48.49
2007	20.85	44.58	56.64	52.53	45.78	45.29	50.00	51.45	52.87	53.30	56.29	56.30	52.78	48.75	46.53	49.32	48.54	48.12	47.91	47.69	47.70	47.72	47.73	47.74	47.75	47.75	47.75	47.75	47.73	47.66
2008	12.12	51.47	44.32	36.91	38.43	45.17	46.81	49.00	48.75	49.11	48.00	51.28	45.53	42.97	46.47	46.23	46.17	46.10	46.11	46.13	46.14	46.16	46.17	46.18	46.19	46.19	46.18	46.15	46.06	
2009	45.55	41.40	36.06	37.12	41.26	41.56	43.66	41.95	43.76	38.96	43.55	41.86	41.41	45.26	45.31	45.35	45.39	45.42	45.46	45.48	45.51	45.53	45.56	45.57	45.59	45.60	45.60	45.59	45.57	45.47
2010	36.20	36.23	34.81	35.14	36.68	35.42	36.99	34.67	34.64	32.96	35.98	41.80	45.63	45.67	45.71	45.74	45.78	45.81	45.83	45.86	45.88	45.90	45.92	45.94	45.96	45.97	45.99	46.00	46.00	44.95
2011	28.68	32.27	31.76	32.65	33.20	32.48	34.32	30.34	33.15	29.48	35.15	45.37	45.40	45.43	45.46	45.49	45.52	45.54	45.56	45.58	45.60	45.62	45.63	45.65	45.66	45.67	45.67	45.68	44.66	44.60
2012	25.10	30.12	29.10	31.05	29.71	30.83	28.72	28.96	28.97	27.77	37.15	43.66	43.68	43.70	43.72	43.74	43.76	43.78	43.79	43.80	43.81	43.82	43.83	43.83	43.84	43.84	43.84	42.83	42.80	43.76
2013	28.01	31.95	32.00	34.14	31.74	33.13	29.32	32.45	29.90	35.20	41.36	47.10	47.14	47.18	47.22	47.25	47.28	47.31	47.33	47.36	47.38	47.40	47.42	47.43	47.44	47.45	46.46	46.46	47.45	47.40
2014	26.58	29.00	29.34	29.69	28.00	28.66	25.98	29.49	32.10	33.06	39.17	44.98	45.02	45.06	45.10	45.13	45.16	45.19	45.22	45.24	45.26	45.28	45.30	45.31	45.33	44.34	44.35	45.34	45.33	45.29
2015	24.47	28.56	29.08	30.52	27.66	29.94	25.41	32.95	35.52	31.78	37.10	43.96	43.98	44.00	44.01	44.02	44.03	44.04	44.05	44.06	44.06	44.07	44.08	44.08	43.09	43.09	44.08	44.08	44.06	44.03
2016	28.57	31.03	31.24	31.10	30.06	31.98	31.69	35.65	38.48	34.68	40.20	46.82	46.85	46.88	46.90	46.92	46.94	46.96	46.97	46.99	47.00	47.01	47.02	46.04	46.05	47.05	47.05	47.05	47.05	47.04



Loss Rates		Adjustable Rate Streamline Refinance Mortgages										by Credit Subsidy Endorsement Cohort																		
Book\Po	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1992	n/a	5.61	26.82	18.33	25.55	41.28	47.64	40.40	37.67	56.19	27.65	25.43	28.27	n/a	n/a	62.02	64.77	68.57	64.07	53.01	46.50	46.52	45.48	45.52	45.57	45.77	45.93	45.94	45.92	45.84
1993	20.30	31.64	41.63	38.84	45.58	48.53	40.62	43.00	22.01	40.97	28.74	33.30	148.90	n/a	67.45	65.75	69.52	65.09	53.98	47.36	47.38	46.32	46.35	46.39	46.40	46.57	46.61	46.65	46.70	50.60
1994	32.84	37.77	39.44	44.93	48.76	43.76	38.87	27.75	19.63	17.88	67.61	61.60	102.64	n/a	90.11	70.41	66.15	54.83	48.24	48.25	47.22	47.27	47.31	47.30	47.45	47.61	47.66	47.72	51.61	51.85
1995	47.56	37.77	41.38	46.41	40.54	43.20	25.63	11.43	6.44	8.19	0.00	4.24	88.52	140.07	70.95	66.20	55.35	49.30	49.44	48.53	48.58	48.67	48.71	48.86	49.20	49.95	50.15	53.96	53.65	53.29
1996	0.31	33.76	38.00	35.37	26.78	23.96	19.01	29.45	49.97	14.45	11.58	58.81	45.50	73.44	69.57	58.43	51.51	51.66	50.69	50.84	50.96	51.02	51.18	51.29	51.40	51.52	55.43	55.60	56.00	56.39
1997	37.19	39.51	32.44	32.02	26.15	18.63	24.94	20.27	25.19	46.29	45.31	51.39	72.89	68.69	57.82	51.29	51.60	50.83	51.04	51.27	51.44	51.71	51.93	52.14	52.34	56.32	56.51	56.87	57.84	58.34
1998	31.55	28.93	27.25	23.89	18.46	19.52	21.73	27.92	23.32	24.33	46.51	72.33	68.37	57.14	50.50	50.69	49.80	49.92	50.06	50.14	50.33	50.45	50.58	50.70	54.60	54.70	54.80	55.06	55.59	55.62
1999	n/a	21.90	25.09	19.30	19.28	34.87	29.93	37.38	76.94	87.31	64.42	67.31	56.27	48.90	48.00	46.86	46.77	46.92	47.01	47.20	47.34	47.47	47.60	51.52	51.64	51.76	51.87	52.04	52.47	52.70
2000	13.98	29.86	24.22	24.81	31.51	24.76	29.18	57.83	60.25	64.94	70.57	62.91	54.34	52.88	51.25	51.05	51.07	51.00	51.41	51.61	51.81	52.01	55.98	56.16	56.33	56.53	56.71	57.06	57.77	58.05
2001	n/a	29.93	32.30	33.50	27.38	43.71	42.65	55.10	66.70	68.88	62.75	60.17	57.22	53.18	49.69	48.10	47.07	46.36	46.87	47.06	47.24	51.20	51.37	51.53	51.67	51.79	51.90	52.19	52.87	52.87
2002	13.13	24.68	26.30	28.82	35.86	44.40	50.53	69.55	69.21	62.00	61.27	63.84	59.31	55.49	51.24	48.50	46.83	45.86	46.18	46.31	50.19	50.27	50.36	50.45	50.53	50.61	50.69	50.81	51.17	51.39
2003	20.50	24.19	26.80	31.70	43.46	46.11	66.99	67.63	60.12	56.22	62.23	60.83	57.54	53.09	49.44	47.88	45.96	46.06	46.38	50.26	50.36	50.45	50.53	50.62	50.70	50.81	50.91	51.07	51.48	51.64
2004	13.41	21.97	33.81	45.30	47.79	65.68	67.05	59.73	55.46	56.24	61.29	59.93	56.53	52.05	49.41	48.07	46.95	46.95	50.92	51.02	51.11	51.19	51.28	51.37	51.45	51.54	51.62	51.82	52.22	52.47
2005	23.96	32.71	44.29	52.67	62.70	63.97	57.13	52.43	54.71	54.60	61.03	58.80	55.32	50.71	47.76	46.46	45.31	49.13	49.35	49.51	49.64	49.77	49.91	50.06	50.20	50.34	50.48	50.82	51.48	51.66
2006	19.82	39.21	47.58	56.01	57.06	50.10	47.34	49.03	50.19	54.08	58.48	58.28	53.62	48.77	45.14	43.56	45.56	46.13	46.35	46.52	46.68	46.85	47.01	47.17	47.33	47.49	47.66	47.94	48.53	49.06
2007	n/a	47.00	56.32	52.71	46.16	46.19	50.30	51.70	52.89	53.41	56.49	55.17	50.84	45.56	44.55	47.42	47.91	48.04	48.18	48.31	48.44	48.58	48.71	48.85	48.99	49.13	49.28	49.50	50.10	50.74
2008	54.40	56.35	47.55	40.90	44.18	49.90	50.97	53.20	51.37	53.31	50.30	55.28	47.85	46.12	49.88	49.93	49.97	50.02	50.06	50.11	50.15	50.20	50.24	50.27	50.31	50.34	50.36	50.37	50.44	50.50
2009	55.53	47.01	43.30	45.13	48.48	48.59	50.57	48.82	51.47	45.96	52.51	48.78	48.48	52.34	52.41	52.48	52.55	52.61	52.67	52.72	52.77	52.82	52.86	52.90	52.94	52.97	52.99	53.00	53.12	53.25
2010	45.86	41.53	40.42	41.90	44.13	41.63	44.79	41.90	42.49	40.43	43.44	48.41	52.27	52.35	52.43	52.50	52.58	52.65	52.72	52.79	52.86	52.93	53.00	53.07	53.15	53.23	53.31	53.41	53.68	53.06
2011	33.77	38.69	38.66	41.03	39.53	40.91	40.03	38.91	39.86	37.04	43.44	52.70	52.76	52.82	52.88	52.94	52.99	53.04	53.09	53.14	53.18	53.23	53.27	53.31	53.34	53.38	53.42	53.45	52.56	52.67
2012	30.00	34.90	35.68	38.20	35.50	38.94	34.83	37.29	34.13	35.74	45.80	51.58	51.71	51.83	51.96	52.08	52.20	52.32	52.44	52.56	52.68	52.79	52.90	53.01	53.12	53.22	53.32	52.42	52.88	54.42
2013	31.85	35.10	36.49	38.70	36.04	38.62	33.42	37.43	33.84	40.02	46.19	52.10	52.20	52.31	52.42	52.52	52.62	52.72	52.81	52.91	53.00	53.08	53.17	53.25	53.33	53.41	52.49	52.58	53.89	54.15
2014	30.30	34.05	36.97	37.03	36.57	35.99	34.13	37.51	37.98	40.34	46.53	52.29	52.36	52.42	52.47	52.53	52.58	52.63	52.68	52.72	52.76	52.81	52.85	52.88	52.91	51.97	52.01	53.04	53.15	53.28
2015	30.26	34.32	37.04	35.96	36.96	35.52	34.31	41.94	40.87	40.51	46.78	52.45	52.53	52.60	52.67	52.74	52.81	52.88	52.94	53.01	53.07	53.14	53.20	53.26	52.34	52.39	53.43	53.52	53.80	53.91
2016	29.09	32.33	35.33	32.65	35.15	33.51	35.99	40.33	40.29	38.82	45.09	50.80	50.89	50.98	51.06	51.14	51.22	51.29	51.36	51.43	51.49	51.55	51.61	50.68	50.73	51.77	51.82	51.86	52.05	52.31