**DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT**

**Office of Federal Housing Enterprise Oversight**

**12 CFR Part 1750**

**RIN 2550–AA02**

## Risk-Based Capital

**AGENCY:** Office of Federal Housing Enterprise Oversight, HUD.

**ACTION:** Final rule.

**SUMMARY:** The Office of Federal Housing Enterprise Oversight (OFHEO) is directed by the Federal Housing Enterprises Financial Safety and Soundness Act of 1992 to issue a risk-based capital regulation for the Federal Home Loan Mortgage Corporation and the Federal National Mortgage Association (collectively, the Enterprises). The regulation specifies the risk-based capital stress test that will be used to determine each Enterprise's risk-based capital requirement and, along with the minimum capital requirement, to determine each Enterprise's capital classification for purposes of possible supervisory action.

**EFFECTIVE DATE:** September 13, 2001.

**FOR FURTHER INFORMATION CONTACT:** Edward J. Szymanoski, Acting Associate Director, Office of Risk Analysis and Model Development; Dorothy J. Acosta, Deputy General Counsel; or David A. Felt, Associate General Counsel, Office of Federal Housing Enterprise Oversight, 1700 G Street, NW., Fourth Floor, Washington, DC 20552, telephone (202) 414–3800 (not a toll-free number). The telephone number for the telecommunications device for the deaf is (800) 877–8339.

**SUPPLEMENTARY INFORMATION:**

## I. Introduction

### *A. Background*

The Office of Federal Housing Enterprise Oversight (OFHEO) was established by title XIII of the Housing and Community Development Act of 1992, Pub. L. No. 102–550, known as the Federal Housing Enterprises Financial Safety and Soundness Act of 1992 (1992 Act). OFHEO is an independent office within the U.S. Department of Housing and Urban Development (HUD) with responsibility for examining and regulating the Federal Home Loan Mortgage Corporation (Freddie Mac) and the Federal National Mortgage Association (Fannie Mae) (collectively, the Enterprises) and ensuring that they are adequately capitalized. The 1992 Act expressly directs OFHEO's Director (the Director) to issue a regulation establishing the risk-based capital standard.[1]

Fannie Mae and Freddie Mac are government-sponsored Enterprises that engage in two principal businesses: investing in residential mortgages and guaranteeing securities backed by residential mortgages. The securities the Enterprises guarantee and the debt instruments they issue are not backed by the full faith and credit of the United States and nothing in this document should be construed otherwise.[2] Nevertheless, financial markets treat Enterprise securities more favorably than securities issued by comparable firms. The market prices for Enterprise debt and mortgage-backed securities (MBS) and the fact that the market does not require that those securities be rated by a nationally recognized rating statistical organization suggest that investors perceive that the government implicitly guarantees those securities. Factors contributing to this perception include the Enterprises' public purposes, their Congressional charters, their potential direct access to U.S. Department of Treasury (Treasury) funds, and the statutory exemptions of their debt and MBS from otherwise mandatory investor protection provisions.[3]

### *B. Statutory Requirements for Risk-Based Capital*

The final rule implements the 1992 Act's requirement to establish, by regulation, a risk-based capital ''stress test'' to determine the amount of capital each Enterprise needs to survive a ten-year period characterized by large credit losses and large movements in interest rates (stress period).[4] The 1992 Act also provides that, in order to meet its risk-based capital standard, each Enterprise is required to maintain an additional 30 percent of this amount to protect against management and operations risk.[5] The level of capital[6] required under this standard for an Enterprise will reflect that Enterprise's specific risk profile at the time the stress test is run.

The 1992 Act requires that the stress test subject each Enterprise to large credit losses on the mortgages it owns or guarantees. The rates of default and severity that yield these losses must be reasonably related to the highest rates of default and severity of mortgage losses experienced during a period of at least two consecutive years in contiguous areas of the United States that together contain at least five percent of the total U.S. population (benchmark loss experience).[7] The 1992 Act also prescribes two interest rate scenarios, one with rates falling and the other with rates rising.[8] The risk-based capital amount is based on whichever scenario requires more capital for the Enterprise. In prescribing the two scenarios, the 1992 Act describes the path of the ten-year constant maturity yield (CMT) for each scenario and directs OFHEO to establish the yields on Treasury instruments of other maturities in a manner reasonably related to historical experience and judged reasonable by the Director.

Congress provided OFHEO significant discretion to determine many aspects of the risk-based capital test. This flexibility is evidenced by section 1361(b), which states that ''[i]n establishing the risk-based capital test under subsection (a), the Director shall take into account appropriate distinctions among types of mortgage products, differences in seasoning of mortgages, and any other factors the Director considers appropriate.''[9] The subsection further states that other non-specified characteristics of the stress period, ''such as prepayment experience and dividend policies, will be those determined by the Director, on the basis of available information, to be most consistent with the stress period.''[10] The statute also provides OFHEO flexibility in establishing other aspects of the stress test, including ''the rate of default and severity,''[11] the yields on Treasury securities relative to the ten-year CMT yield,[12] and the definition of ''type of mortgage product.''[13]

[1] 12 U.S.C. 4513(b)(1).

[2] *See* Federal Home Loan Mortgage Corporation Act, section 306(h)(2) (12 U.S.C. 1455(h)(2)); Federal National Mortgage Association Charter Act, section 304(b) (12 U.S.C. 1719(b)); and 1992 Act, section 1302(4) (12 U.S.C. 4501(4)).

[3] *See, e.g.,* 12 U.S.C. 24 (authorizing unlimited investment by national banks in obligations of or issued by the Enterprises); 12 U.S.C. 1455(g), 1719(d), 1723(c) (exempting securities from oversight from Federal regulators); 15 U.S.C. 77r–1(a) (preempting State law that would treat Enterprise securities differently from obligations of the United States for investment purposes); 15 U.S.C. 77r–1(c) (exempting Enterprise securities from State blue sky laws).

[4] 12 U.S.C. 4611.

[5] 12 U.S.C. 4611(c)(2).

[6] For purposes of the risk-based capital standard, the term ''capital'' means ''total capital'' as defined under section 1303(18) of the 1992 Act (12 U.S.C. 4502(18)).

[7] 12 U.S.C. 4611(a)(1).

[8] 12 U.S.C. 4611(a)(2).

[9] 12 U.S.C. 4611(b)(1).

[10] 12 U.S.C. 4611(b)(2).

[11] 12 U.S.C. 4611(a)(1).

[12] 12 U.S.C. 4611(a)(2).

[13] 12 U.S.C. 4611(d)(2).

The 1992 Act requires that, initially, the stress test not provide for the conduct of new business by the Enterprises during the stress period, except to fulfill contractual commitments to purchase mortgages or issue securities. Four years after the final risk-based capital regulation is issued, OFHEO may modify the stress test to incorporate assumptions about additional new business conducted during the stress period.[14] In doing so, OFHEO is required to take into consideration the results of studies conducted by the Congressional Budget Office and the Comptroller General of the United States on the advisability and appropriate form of new business assumptions. The 1992 Act requires that the studies be completed within the first year after issuance of the final regulation.[15]

*C. Rulemaking Chronology*

OFHEO has issued a series of **Federal Register** notices soliciting comment on the development of the risk-based capital regulation. The first notice, an Advance Notice of Proposed Rulemaking (ANPR),[16] sought public comment on a number of issues relating to the development of the regulation.[17] OFHEO received 17 comments on the ANPR from a variety of interested parties, including other Federal agencies, Fannie Mae, Freddie Mac, trade associations, and financial organizations. OFHEO considered these comments in the development of two subsequent Notices of Proposed Rulemaking (NPRs), each addressing different components of the risk-based capital regulation. The first Notice of Proposed Rulemaking (NPR1) [18] addressed two issues: (1) The methodology for identifying the benchmark loss experience, and (2) the use of OFHEO's House Price Index (HPI) to update original loan-to-value ratios (LTVs) and to determine house price appreciation paths during the stress period.[19] NPR1 included OFHEO's responses to all of the ANPR comments that related to those two areas.[20] The second Notice of Proposed Rulemaking (NPR2) proposed the remaining specifications of the stress test, including how the HPI would be used and how losses predicted by the stress test would be calibrated to the benchmark loss experience.[21] In addition, OFHEO issued a notice soliciting reply comments to provide interested parties an opportunity to respond to other commenters that addressed NPR2.[22]

OFHEO received comments from 11 commenters on NPR1 and 48 commenters on NPR2. These commenters included Fannie Mae, Freddie Mac, housing and financial trade associations, financial services companies, housing advocacy groups, and other interested parties. Approximately 12 commenters, including the Enterprises, GE Capital Mortgage Corporation, Mortgage Insurance Companies of America, The Consumer Mortgage Coalition, and the Mortgage Bankers Association of America submitted reply comments to NPR2.

The final rule reflects OFHEO's consideration of all of the comments on NPR1 and NPR2, including the reply comments. A summary of the comments by topic and OFHEO's response is set forth below in III., Comments and Responses.

## II. Summary of the Stress Test

*A. Overview*

OFHEO's risk-based capital regulation is part of a larger regulatory framework for the Enterprises that includes a minimum capital requirement and a comprehensive examination program. The purpose of this regulatory framework is to reduce the risk that an Enterprise will fail by ensuring that the Enterprises are capitalized adequately and operating safely, in accordance with the 1992 Act. The 1992 Act requires OFHEO to develop a stress test that simulates the effects of ten years of adverse economic conditions on the existing assets, liabilities, and off-balance-sheet obligations of the Enterprises. OFHEO issued for comment two proposals that implement this requirement.

This summary describes the stress test adopted in the final rule after considering extensive comments from interested parties on the risk-based capital proposals. It includes changes made to the stress test to address the concerns of the commenters where possible and appropriate. These changes are consistent with applicable statutory requirements and with OFHEO's obligation to promote safety and soundness of the housing finance system and to ensure the Enterprises' ability to fulfill their important public missions. These changes are discussed in section III., Comments and Responses. In addition, the final rule includes technical and clarifying changes to the risk-based capital proposals.

The final rule describes a stress test that meets the statutory requirements of the 1992 Act and captures accurately and appropriately the risks of the Enterprises' businesses. The stress test determines, as of a point in time, how much capital each Enterprise would require to survive the economically stressful conditions outlined by the 1992 Act. At a minimum, the stress test will be run quarterly using data on interest rates, housing markets, and an Enterprise's assets, liabilities, off-balance-sheet items, and operations. The stress test is comprised of econometric, financial, and accounting models used to simulate Enterprise financial performance over a ten-year period called the ''stress period.'' The final regulation determines the risk-based capital requirement by computing the amount of starting capital that would permit an Enterprise to maintain a positive capital position throughout the stress period (stress test capital) and adding 30 percent of that amount to cover management and operations risk.

*B. Data*

OFHEO uses data from the Enterprises and public sources to run the stress test. The stress test utilizes data that characterize, at a point in time, an Enterprise's assets, liabilities, and off-balance sheet obligations, as well as data on economic conditions, such as interest rates and house prices. OFHEO obtains data on economic conditions from public sources. The Enterprises are required to submit data to OFHEO at least quarterly for all on- and off-balance-sheet instruments in a specified format, which is input directly into the computer model. This data submission is called the Risk-Based Capital Report (RBC Report) and serves as the financial ''starting position'' of an Enterprise for the date for which the stress test is run.

[14] 12 U.S.C. 4611(a)(3)(B) and (D).

[15] 12 U.S.C. 4611(a)(3)(C).

[16] Risk-Based Capital, ANPR, 60 FR 7468, February 8, 1995.

[17] The comment period for the ANPR ended on May 9, 1995, and was extended through June 8, 1995. Risk-Based Capital, Extension of Public Comment Period for ANPR, 60 FR 25174, May 11, 1995.

[18] Risk-Based Capital, NPR1, 61 FR 29592, June 11, 1996.

[19] 61 FR 29616, June 11, 1996.

[20] The comment period for NPR1 ended on September 9, 1996, and was extended through October 24, 1996. Risk-Based Capital, Extension of Public Comment Period for NPR1, 61 FR 42824, August 19, 1996.

[21] Risk-Based Capital, Second Notice of Proposed Rulemaking (NPR2), 64 FR 18084, April 13, 1999. The agency extended the comment period twice. The first extension was until November 10, 1999 (64 FR 31756, June 14, 1999), and the second extension was until March 10, 2000 (64 FR 56274, October 19, 1999).

[22] Risk-Based Capital, Solicitation of Reply Comments, 65 FR 13251, March 13, 2000.

As a part of the RBC Report, the Enterprises report aggregated data from groups of loans having similar risk characteristics. The loans within these groups share common values for a set of classification variables. For single family loans, classification variables are original interest rate, current interest rate, original loan-to-value ratio (LTV), mortgage age, Census Division, loan size, status as securitized or unsecuritized, status as government or conventional loan, and product type (e.g. fixed rate, adjustable rate, balloons). Classification variables for multifamily loans are product type, original interest rate, current interest rate, original LTV, debt coverage ratio (DCR);[23] book of business designation,[24] status as securitized or unsecuritized, status as Government or conventional loan, status as interest only or amortizing, and a ratio update flag, which indicates whether LTV and DCR were updated at acquisition. Both single family and multifamily ARM loans are also classified by index, rate reset period, payment reset period, and cap type. These distinctions are associated with different risk characteristics. In this way, over 24 million loans can be aggregated into the minimum number of loan groups that captures important risk characteristics.

Loan groups of new mortgages are also created to simulate the fulfillment of commitments to purchase and/or securitize mortgages that are outstanding at the start of the stress test. The stress test adds new single family mortgages in one of four product types: 30-year fixed-rate, 15-year fixed-rate, one-year CMT adjustable-rate, and 7-year balloon. The percentage of each type added is based on the relative proportions of those types of loans securitized by an Enterprise that were originated during the six months preceding the start of the stress period. The mix of characteristics of these new loans also reflects the characteristics of the loans originated during the preceding six months. All new mortgages are considered to be securitized.

In the down-rate scenario, described below, the stress test specifies delivery of 100 percent of the loans that the Enterprise is obligated to accept under outstanding commitment agreements. These loans are added during the first three months of the stress period. In the up-rate scenario, described below, only 75 percent of these loans are added and deliveries are phased in during the first six months of the stress period. The new loan groups are then treated like the loan groups reported by the Enterprise in the RBC Report.

Because of the smaller number and greater diversity of the Enterprises' nonmortgage financial instruments, the stress test projects these cash flows at the individual instrument level, rather than at a group level. The RBC Report includes the instrument characteristics necessary to model the terms of the instruments, which include both investment and debt securities and derivative contracts.

*C. Stress Test Conditions*

1. Benchmark Loss Experience

To identify the stressful credit conditions that are the basis for credit losses in the stress test, (benchmark loss experience), OFHEO uses a methodology based on historical analysis of newly originated, 30-year, fixed-rate, first-lien mortgages on owner-occupied, single family properties. Using this methodology, OFHEO identifies the worst cumulative credit losses experienced by loans originated during a period of at least two consecutive years in contiguous states comprising at least five percent of the U.S. population, as required by the 1992 Act. Loans originated in Arkansas, Louisiana, Mississippi and Oklahoma in 1983 and 1984 currently serve as the benchmark loss experience. These loans (benchmark loans) had an average ten-year cumulative default rate of 14.9 percent and an average ten-year loss severity of 63.3 percent. The loss rate (default incidence times loss severity in the event of default, without considering the effect of credit enhancements) for this region and time period was 9.4 percent. OFHEO will continue to monitor loss data and may choose to establish a new benchmark loss experience if a higher loss rate for a different region and time period is determined using this methodology.

When the single family models of default and prepayment are applied to the benchmark loans, using the pattern of interest rates from the benchmark time and place, losses are close to those of benchmark loans. The difference results from the fact that OFHEO based its single family default and prepayment models on all Enterprise historical loan data, not just the limited data for benchmark loans for which the losses were particularly severe. This difference provides the basis for calibration factors for each LTV category, which the stress test applies to adjust the single family default rates upward or downward, making them more consistent with the benchmark loss experience. However, because the stress test simulates the performance of an Enterprise's entire mortgage portfolio at a point in time and includes loans of all types, ages, and characteristics, overall Enterprise mortgage loss rates in the stress test can be lower or higher than the loss rates for benchmark loans, even with the calibration adjustment.

Because there were very few Enterprise multifamily loans in the benchmark region and time period, the stress test uses patterns of vacancy rates and rent growth rates that are consistent with the benchmark time and place to determine property income, a key factor in determining defaults for multifamily loans. In this way, the stress test relates the performance of multifamily loans to the benchmark loss experience.

2. Interest Rates

Interest rates are a key component of the adverse economic conditions of the stress test. The 1992 Act specifies two paths for the ten-year Constant Maturity Treasury yield (CMT) during the stress period. During the first year of the stress period, the ten-year CMT:

- Falls by the lesser of 600 basis points below the average yield during the nine months preceding the stress period, or 60 percent of the average yield during the three years preceding the stress period, but in no case to a yield less than 50 percent of the average yield during the preceding nine months (down-rate scenario); or
- Rises by the greater of 600 basis points above the average yield during the nine months preceding the stress period, or 160 percent of the average yield during the three years preceding the stress period, but in no case to a yield greater than 175 percent of the average yield during the preceding nine months (up-rate scenario).

The ten-year CMT changes in twelve equal monthly increments from the starting point, which is the average of the daily ten-year CMT yields for the month preceding the stress period. The ten-year CMT stays at the new level for the remainder of the stress period.

The stress test establishes the Treasury yield curve for the stress period in relation to the prescribed movements in the ten-year CMT. In the down-rate scenario, the yield curve is upward sloping during the last nine years of the stress period; that is, short term rates are lower than long term rates. In the up-rate scenario, the Treasury yield curve is flat for the last nine years of the stress period; that is,

[23] DCR is the ratio of net operating income to mortgage payment for a specific property.

[24] "Old book" loans are those originated before 1988 for Fannie Mae and before 1993 for Freddie Mac. All other multifamily loans are considered "new book" loans.

yields of other maturities are equal to that of the ten-year CMT.

Because many different interest rates affect the Enterprises' business performance, the ten-year CMT and the Treasury yield curve are not the only interest rates that must be determined. For example, current mortgage rates impact prepayment rates; adjustable-rate mortgages periodically adjust according to various indexes; floating rate securities (assets and liabilities) and many rates associated with derivative contracts also adjust; and appropriate yields must be established for new debt and investments issued during the stress test. Thus, the stress test requires rates and indexes other than Treasury yields for the entire stress period. Some of the key rates that are used in the stress test are the Federal Funds Rate, London Inter-Bank Offered Rate (LIBOR), Federal Home Loan Bank 11th District Cost of Funds Index (COFI), and the Enterprise Cost of Funds. The stress test establishes these rates and indexes using an average of the ratio of each non-Treasury spread to its comparable CMT (the proportional spread) for the two-year period prior to the start of the stress test. Indexes of mortgage interest rates are calculated using the average absolute basis-point spread for the same two-year period.

3. Property Values

The 1992 Act requires OFHEO to consider the effect of loan ''seasoning,'' which is defined as the change in LTVs over time.[25] The analogous multifamily measure is current debt-service-coverage ratio (DCR).

For single family loans, the stress test updates the original LTV to the start of the stress period, using the amortized loan balance and a house price growth factor for the period between origination and the start of the stress period. The house price growth factor is derived from OFHEO's House Price Index (HPI) for the Census Division in which the property is located. The stress test then applies the pattern of house price changes from the benchmark time and place to compute changes in property values during the stress period. The HPI values represent average property value appreciation. In simulating mortgage performance, the stress test also captures variations from average house price movements, called dispersion. For this purpose, the stress test uses dispersion parameters for the Census Division containing most benchmark states, which OFHEO published along with the HPI for the third quarter, 1996.

[25] 12 U.S.C. 4611(d)(1).

Multifamily property values are not updated in the stress test. LTV at loan origination is the only variable that measures property values directly in the multifamily model. If the original LTV is unknown, LTV at loan acquisition is substituted. The effect of seasoning on multifamily loans is captured by projecting changes in property income during the stress period, based upon rent and vacancy indexes consistent with the benchmark time and place.

When the ten-year CMT increases by more than 50 percent over the average yield during the nine months preceding the stress period, the stress test takes general price inflation into consideration. In such a circumstance, adjustments are made to the house price and rent growth paths during the stress period that correspond to the difference between the ten-year CMT and the level reflecting a 50 percent increase in the ten-year CMT. The stress test phases in this increase in equal monthly increments during the last five years of the stress period.

*D. Mortgage Performance*

To simulate mortgage performance during the adverse conditions of the stress period, the stress test uses statistical models that project default, prepayment and loss severity rates during the stress period. These models simulate the interaction of the patterns of house prices, residential rents, and vacancy rates from the benchmark time and place with stress test interest rates and mortgage risk characteristics, to predict the performance of Enterprise loans throughout the stress test. The default and prepayment models calculate the proportion of the outstanding principal balance for each loan group that defaults or prepays in each of the 120 months of the stress period. As described below in further detail, the models are based on the historical relationship of economic conditions, mortgage risk factors, and mortgage performance, as reflected in the historical experience of the Enterprises.

1. Single Family Default and Prepayment

The single family mortgage performance models were estimated using available historical data for the performance of Enterprise loans in the years 1979–1999. To simulate defaults and prepayments, the stress test uses a 30-year fixed-rate loan model, an adjustable-rate loan (ARM) model, and a third model for other products, such as 15-year loans and balloon loans. Each of the three single family models was separately estimated based on data for the relevant product types[26] and includes a calibration adjustment by LTV category, so that the results properly reflect a reasonable relationship to the benchmark loss experience, as described earlier.

All three single family models simulate defaults and prepayments based on the projected interest rates and property values, as described above, and variables capturing the mortgage risk characteristics described below. Certain variables are used only in prepayment equations. The single family default and prepayment variables are listed in Table 1.

TABLE 1.—SINGLE FAMILY DEFAULT & PREPAYMENT VARIABLES

| Variables for All Single Family Models | Single Family Default Variables | Single Family Prepayment Variables |
|---|---|---|
| Mortgage Age | X | X |
| Original LTV | X | X |
| Probability of Negative Equity | X | X |
| Burnout | X | X |
| Occupancy Status | X | X |
| Relative Spread | ..... | X |
| Yield Curve Slope | ..... | X |
| Relative Loan Size | ..... | X |
| Product Type (ARMs, Other Products only) | X | X |
| Payment Shock (ARMs only) | X | X |
| Initial Rate Effect (ARMs only) | X | X |

• Mortgage Age—Patterns of mortgage default and prepayment have characteristic age profiles; defaults and prepayments increase during the first years following loan origination, with a peak between the fourth and seventh years.

• Original LTV—The LTV at the time of mortgage origination serves as a proxy for factors relating to the financial status of a borrower, which reflects the

[26] Historical data sets for the ARM and other single family product models were pooled with data for 30-year fixed-rate loans to capture performance differences specific to product types relative to 30-year fixed-rate loans.

borrower's future ability to make loan payments. Higher original LTVs, which generally reflect fewer economic resources and greater financial risk, increase the probability of default and lower the probability of prepayment. The reverse is true for lower original LTVs.

• Probability of Negative Equity—Borrowers whose current loan balance is higher than the current value of their mortgaged property (reflecting negative borrower equity) are more likely to default than those with positive equity in their properties. The probability of negative borrower equity within a loan group is a function of (1) house price changes (based on the HPI), and amortization of loan principal, which together establish the average current LTV, and (2) the dispersion of actual house prices around the HPI value. Thus, even when the average current LTV for a loan group is less than one (positive equity), some percentage of the loans will have LTVs greater than one (negative equity).

• Burnout—This variable reflects whether a borrower has passed up earlier opportunities to refinance at favorable interest rates during the previous eight quarters. Such a borrower is less likely to prepay the current loan and refinance, and more likely to default in the future.

• Occupancy Status—This variable reflects the higher probability of default by investor-owners compared with that of owner-occupants. The RBC Report specifies the proportion of investor loans for each loan group.

• Relative Spread—The stress test uses the relative spread between the interest rate on a loan and the current market rate on loans as a proxy for the mortgage premium value, which reflects the value to a borrower of the option to prepay and refinance.

• Yield Curve Slope—This variable measures the relationship between short and long term interest rates. The shape of the yield curve, which reflects expectations for the future levels of interest rates, influences a borrower's decision to prepay a mortgage.

• Relative Loan Size—This variable reflects whether a loan is significantly larger or smaller than the State average. Generally, lower balance loans are less likely to refinance (and therefore prepay) because refinancing costs are proportionately larger, and the interest savings are proportionately smaller, than a larger balance loan.

• Product Type—The differences in performance between 30-year fixed-rate loans and other products, such as ARM and balloon loans, are captured by this variable.

• Payment Shock—This variable captures the effect of increasing or decreasing interest rates on the payments for ARMs. Although a borrower with an ARM loan may still have positive equity in the mortgaged property, the borrower may be unable to make a larger monthly payment when interest rates increase, resulting in increases to ARM default and prepayment rates. Conversely, decreasing interest rates make it easier for borrowers to make monthly payments, resulting in lower ARM default and prepayment rates.

• Initial Rate Effect—Borrowers with ARM loans with a ''teaser rate'' (an initial interest rate lower than the market rate) may experience payment shock even if market rates do not rise, as the low teaser rate adjusts to the market rate over the first few years of the loan. The stress test includes a variable which captures this effect in the first three years of the life of the loan.

2. Multifamily Default and Prepayment

The stress test uses a statistical model for multifamily default and a set of simple rules for multifamily prepayment. The default model was estimated using historical data through 1999 on the performance of Enterprise multifamily loans. As with the models of single family mortgage performance, the multifamily default model simulates the probability of default based on stress test conditions and loan group risk characteristics. To account for specific risks associated with multifamily loans, these loans are grouped somewhat differently than are single family loans and have somewhat different explanatory variables, to characterize stress test conditions. To characterize stress test conditions, the multifamily model specifies interest rates, rent growth rates, and vacancy rates.

The following variables are factors in determining the probability of default for multifamily loan groups:

• Mortgage Age—As with single family loans, the risk of default on multifamily loans varies over their lives.

• New Book Flags—These variables capture the performance differences between the Enterprises' original multifamily programs and their current, restructured programs. The reduced default risk under the ''new book of business'' is more pronounced for fixed rate loans than for balloon loans and ARMs, which are flagged separately.

• Current DCR and Underwater DCR Flag—Rental property owners tend not to default unless a property's debt coverage ratio (DCR) is less than one, indicating insufficient net cash flow to service the mortgage debt. The stress test updates the DCR of multifamily loans during the stress period using rent and vacancy indexes consistent with the benchmark loss experience. The higher the DCR, the less likely that the borrower will default. Conversely, a DCR below one indicates that the borrower cannot cover the mortgage payment, significantly increasing the risk of default.

• Original LTV—As with single family loans, the risk of default for multifamily loan borrowers is greater for higher original LTV loans than for lower original LTV loans.

• Balloon Maturity Risk—When a balloon mortgage matures, the borrower is required to pay off the outstanding balance in a lump sum. This variable captures the greater risk of default in the year before a balloon mortgage matures.

• Ratio Update Flag—This variable captures the decreased probability of default if the DCR and LTV were either calculated at loan origination, or recalculated at Enterprise acquisition, in accordance with current Enterprise standards.

To project prepayment rates for multifamily loans, the stress test implements a simple set of prepayment rules. In the up-rate scenario, multifamily loans do not prepay. In the down-rate scenario, two percent of multifamily loan balances prepay each year if they are inside the prepayment penalty time period. Outside the prepayment penalty period, multifamily loans prepay at an annual rate of 25 percent.

3. Loss Severity

Loss severity is the net cost to an Enterprise of a loan default. The stress test uses the costs associated with different events following the default of a mortgage to determine the total loss or cost to an Enterprise. Loss severity rates are computed as of the date of default, and are expressed as a percentage of the unpaid principal balance (UPB) of a defaulting loan.

In general, losses are composed of three elements associated with loan foreclosure and disposition (sale) of the property: loss of principal, transactions costs, and funding costs. Transaction costs include expenses related to foreclosure, property holding costs (real estate owned or REO costs) and disposition costs. For single family loans, transactions costs are fixed percentages based on historical averages computed from Enterprise data. For multifamily loans, transactions costs are based on the average costs through 1995 from Freddie Mac old book loans (*See* Footnote 24).

Loss of principal is the amount of defaulting loan UPB, offset by the net proceeds of the sale (disposition) of the foreclosed property. For single family loans, sale proceeds of foreclosed properties are a fixed percentage of defaulting UPB, based on benchmark recovery rates for real estate owned as a result of loan defaults (REO).[27] For multifamily loans, sale proceeds are a fixed percentage of the defaulting UPB, based on REO recovery rates from Freddie Mac old book loans through 1995.

Since foreclosure, property holding, disposition and associated costs occur over time, the stress test calculates loss severity rates by discounting the different elements of loss back to the time of default, based on stress period interest rates. This discounting also captures losses associated with funding costs, including passthrough interest on sold loans, at appropriate interest rates. For single family loans, the timing of each element is based on averages for the benchmark loans; for multifamily loans it is based on the average for Freddie Mac Old Book loans, using REO data through 1995. The loss severity rates are used in the cash flow components of the stress test to calculate credit losses for the Enterprises.

*E. Other Credit Factors*

1. Mortgage Credit Enhancements

A portion of Enterprise mortgage losses are offset by some form of credit enhancement. Credit enhancements are contractual arrangements with third parties that reduce Enterprise losses on defaulted loans. By including the effect of mortgage credit enhancements, the stress test more realistically reflects Enterprise risks related to mortgage defaults and credit losses during the stress period.

The stress test captures many types of credit enhancements, with differing depths and methods of coverage, for both single family and multifamily loans. The stress test divides mortgage credit enhancements into two categories—loan limit and aggregate limit. Loan limit credit enhancements cover a specified percentage of losses on individual loans with no limit on the aggregate amount paid under the contract. This category includes mortgage insurance for single family loans and loss-sharing agreements for multifamily loans. Aggregate limit credit enhancements cover losses on a specified set of loans, up to a specified aggregate amount. This category includes limited and unlimited recourse to seller/servicers, indemnification, pool insurance and modified pool insurance, cash or collateral accounts, third-party letters of credit, spread accounts, subordination agreements, and FHA risk-sharing.

The amount by which credit enhancements reduce monthly loss severity rates is based on information reported by the Enterprises in the RBC Report for the level of coverage for both loan limit and aggregate limit credit enhancements for each loan group. The stress test applies loan limit credit enhancements first. Then aggregate limit credit enhancements are applied to the remainder of the loss balance, up to the contractual limit. The stress test reduces the loss severity rate for a specific loan group based on the combined loan limit and aggregate limit credit enhancements associated with loans in that group.

2. Counterparty Default

In addition to mortgage credit quality, the stress test considers the creditworthiness of companies and financial instruments to which the Enterprises have credit exposure. These include most mortgage credit enhancement counterparties, securities held as assets, and derivative contract counterparties.

For these contract or instrument counterparties, the stress test reduces—or applies ''haircuts'' to—the amounts due from these instruments or counterparties according to their level of risk. The level of risk is determined by public credit ratings at the start of the stress test, classified into five categories: AAA, AA, A, BBB and unrated/below BBB. When no rating is available or the instrument or counterparty has a rating below BBB (below investment grade), the stress test applies a 100 percent haircut in the first month of the stress test, with the exception of unrated seller/servicers, which are treated as BBB, and unrated, unsubordinated obligations of government sponsored enterprises, which are treated as AAA. For other categories, the stress test phases in the haircuts monthly in equal increments until the total reduction listed in Table 2 is reached five years into the stress period. For the remainder of the stress period the haircut applies.

TABLE 2.—STRESS TEST FINAL HAIRCUTS BY CREDIT RATING CATEGORY

| Ratings Classification | Derivative | Non-derivative |
|---|---|---|
| AAA | 2% | 5% |
| AA | 4% | 15% |
| A | 8% | 20% |
| BBB | 16% | 40% |
| Unrated/Below BBB [1] | 100% | 100% |

[1] Unrated, unsubordinated obligations issued by government sponsored enterprises other than the reporting Enterprise are treated as AAA. Unrated seller/servicers are treated as BBB. Other unrated counterparties and securities are subject to a 100% haircut applied in the first month of the stress test, unless OFHEO specifies another treatment, on a showing by an Enterprise that a different treatment is warranted.

Because the stress test does not model currency exchange rates through the stress period, the stress test reflects the associated risk by modeling the debt and the swap as a single debt transaction that pays the dollar-denominated net interest rate paid by the Enterprise, and no haircut is applied.

*F. Cash Flows*

For each month of the stress period, the stress test calculates cash flows for every loan group and individual instrument reported in the RBC Report and applies the haircuts to cash flows to reflect the credit risk of securities and counterparties. These cash flows are used to create pro forma financial statements that reflect an Enterprise's total capital in each month of the stress period.

1. Mortgage Cash Flows

The cash flow component of the stress test applies projected default, prepayment, and loss severity rates net of credit enhancements to amortized loan group balances to produce mortgage cash flows for each month of the stress period. Cash flows are generated for each single family and multifamily loan group. For retained loan groups, cash flows consist of scheduled principal, prepaid principal, defaulted principal, credit losses, and interest. For sold loans, cash flows consist of credit losses, guarantee fee income, and float income.

2. Mortgage-Related Security Cash Flows

Because losses on sold loans are absorbed by the Enterprises directly and are not passed through to security holders, no additional credit losses are

[27] Recovery rate is the proportion of defaulted UPB that is recovered through the sale of the property.

reflected in cash flows calculated for an Enterprise's own mortgage-backed securities (MBSs) held as investments. Cash flows for single-class MBSs issued by an Enterprise and held as investments consist only of principal and interest payments. Cash flows for mortgage securities not issued by the Enterprise consist of principal and interest payments and credit losses based on haircuts according to rating level. Principal payments are calculated by applying default and prepayment rates that are appropriate for the loans underlying the MBS. The stress test specifies that defaulted and prepaid principal and scheduled amortization are passed through to investors. Interest is computed by multiplying the security principal balance by the coupon rate.

Multiclass mortgage securities such as Real Estate Mortgage Investment Conduit securities (REMICs) and stripped MBS (strips) are treated in the same manner as single class MBS. The stress test generates cash flows for the underlying collateral, usually single-class MBSs, and applies the cash flow allocation rules of the particular multiclass security to determine cash flows of the specific class(es) held by an Enterprise. In generating cash flows for mortgage-linked derivative contracts, where the notional amount of the contract is based on the declining principal balance of a specified MBS, the stress test applies the terms of each contract and tracks the appropriate changing balances. The stress test generates cash flows for mortgage revenue bonds by treating each bond as a single-class MBS backed by 30-year, fixed-rate single family mortgages maturing on the bond's stated maturity date.

3. Nonmortgage Instrument Cash Flows

The stress test calculates cash flows for securities that the Enterprises hold as assets, or have issued as liabilities. The stress test also generates cash flows for derivative instruments such as interest rate swaps, caps, and floors. For nonmortgage investments, outstanding debt securities, and liability-linked derivative contracts, payments of principal and interest are calculated for each instrument based on contractual terms and stress test interest rates. For fixed-rate asset-backed securities, the stress test applies a 3.5 percent collateral prepayment speed; for floating-rate securities a two percent speed is applied in both interest rate scenarios.

For each month during the stress period that a security is subject to early redemption (put/call), the stress test calculates the effective remaining yield-to-maturity [28] of that instrument and compares it to the yield of a replacement security, under the given stress period interest rate scenario. If the yield on the replacement instrument is more than 50 basis points below the cost of the existing instrument, the call or cancellation option is exercised. The stress test applies a similar rule to derivative contracts that are subject to cancellation.

*G. New Products or Activities*

Given the continuing evolution and innovation in the financial markets, OFHEO recognizes that the Enterprises will continue to develop and purchase new products and instruments and engage in other new activities. To the extent that the current stress test treatments are not applicable directly, OFHEO will combine and adapt current stress test treatments in an appropriate manner in order to ensure that the risks of these activities are adequately captured in the risk-based capital requirement. For example, OFHEO might employ the mortgage performance models and adapt its cash flow components to simulate accurately the loss mitigating effects of credit derivatives. Where there is no reasonable approach using existing combinations or adaptations, the stress test will employ an appropriately conservative treatment, consistent with OFHEO's role as a safety and soundness regulator. Similarly, the Director has discretion to treat an existing instrument as a new activity if OFHEO determines there have been significant increases in volume that change the potential magnitude of the risk of the instrument, or where other information indicates that the risk characteristics of the instrument are not appropriately reflected in a treatment previously applied.

An Enterprise that has a new activity is encouraged to suggest a treatment which will be considered by OFHEO. The Enterprise will also be able to comment on OFHEO's treatment before it is used for a final capital classification. The public will have a subsequent opportunity to submit views on these treatments, which will be considered for future stress test applications.

*H. Other Off-Balance-Sheet Guarantees*

In addition to guaranteeing mortgage-backed securities they issue as part of their main business, the Enterprises occasionally provide guarantees for other mortgage-related securities to enhance the liquidity and appeal of these securities in the marketplace. These securities, notably single family and multifamily whole-loan REMIC [29] securities and tax-exempt multifamily housing bonds, represent a small part of the Enterprises' businesses and have a significant level of credit enhancement that protects the Enterprises from losses. Consequently, the stress test does not explicitly model the performance of these securities, but uses an alternative modeling treatment. As a proxy for the present value of net losses on these guarantees during the stress period, the outstanding balance of these instruments at the beginning of the stress period is multiplied by 45 basis points. The resulting amount is subtracted from the lowest discounted monthly capital balance for the calculation of stress test capital, as described below in II.K., Calculation of the Risk-based Capital Requirement.

*I. Alternative Modeling Treatments*

The stress test also assigns alternative modeling treatments to any items for which data are incomplete, and any on- or off-balance sheet items for which there is neither a specified treatment in the final regulation nor a computationally equivalent proxy. An alternative modeling treatment is a series of rules that assigns simple, appropriately conservative assumptions, based on the interest rate scenario, to an asset, liability, or off-balance-sheet item in the stress test. Missing data elements are assigned a conservative default value. This treatment will only be needed for extremely unusual items or when all the necessary data for modeling an instrument are not included in the RBC Report.

*J. Enterprise Operations, Taxes and Accounting*

The stress test simulates the issuance of new debt or purchase of new investments, exercise of options to retire debt early or cancel derivative contracts, payment of dividends by the Enterprises, operating expenses, and income taxes. The stress test computes Federal income taxes using an effective tax rate of 30 percent. Estimated income tax is paid by the Enterprises quarterly in the stress test.

When necessary, the stress test simulates the issuance of new debt or

[28] Yields are calculated based on the outstanding principal balances for securities and notional amounts for derivative contracts.

[29] Real Estate Mortgage Investment Conduit (REMIC) securities are multiclass mortgage passthrough securities. The classes of a REMIC security can take on a wide variety of attributes with regard to payment of principal and interest, cashflow timing, (un)certainty and maturity, among others.

purchase of new investments by an Enterprise. A mix of short- and long-term debt is issued in months when there is a shortfall of cash. New short-term debt is six-month discount notes at the simulated Enterprise Cost of Funds. New long-term debt is five-year debt, callable after the first year, at the five-year Enterprise Cost of Funds, plus a 50 basis-point premium for the call option. Short- and long-term debt issuance is targeted to achieve and maintain a total liability mix of 50 percent short-term debt and 50 percent long-term debt. Excess cash is invested in one-month securities bearing the six-month Treasury rate.

Capital distributions are made during the stress period. If an Enterprise's core capital [30] exceeds the minimum capital requirement in any quarter, dividends on preferred stock are paid based on the coupon rates of the issues outstanding. Common stock dividends are paid only in the first four quarters of the stress period. The amount paid is directly related to the earnings trend of the Enterprise. Generally, if the trend is positive, the dividend payout ratio is the same as the average of the four quarters preceding the stress test. Otherwise, dividends are based on the dollar amount per share paid in the last quarter preceding the stress test. Share repurchases are made in the first two quarters of the stress period, based on the average stock repurchase for the four quarters preceding the stress test. No capital distribution is made if core capital is below the minimum capital requirement. If a capital distribution would cause core capital to fall below the minimum capital requirement, the distribution is made only to the extent of the core capital that exceeds the minimum capital requirement.

Operating expenses decline during the stress test as the Enterprise's mortgage portfolios decline, but the decline is not strictly proportional. The baseline level from which they decline is the average monthly operating expenses of the Enterprise for the three months preceding the start of the stress test. In each month of the stress test, the amount of the decline is determined by computing a base amount comprised of a fixed component and a variable component. The fixed component is one third of the baseline level, and the variable component begins as the remaining two thirds of the baseline level and declines in direct proportion to the decline in the UPB of the combined portfolios of retained and sold loans during the stress period. The base amount is further reduced by one-third, except that this further reduction is gradually phased in during the first 12 months of the stress test.

To the extent possible, the stress test makes use of Generally Accepted Accounting Principles (GAAP). However, the stress test does not reflect certain securities and derivatives at their fair value, as required by the Financial Accounting Standards Board's Statement of Financial Accounting Standard (FAS) Nos. 115 and 133. In the first month of the stress test, these assets are adjusted to an amortized cost basis.

*K. Calculation of the Risk-Based Capital Requirement*

The stress test determines the amount of capital that an Enterprise must hold at the start date in order to maintain positive capital throughout the ten-year stress period (stress test capital). Once stress test capital has been calculated, an additional 30 percent is added to protect against management and operations risk. This total is the risk-based capital requirement.

In order to calculate stress test capital, the capital balance for each month is discounted back to the start of the stress period, using capital as calculated in the pro forma financial statements and interest rates for both stress test scenarios. The stress test uses the six-month Treasury rate when the Enterprise is a net lender and the six-month Enterprise Cost of Funds when the Enterprise is a net borrower. The lowest discounted monthly capital balance is then decreased as described above to account for certain items given alternative modeling treatments, including the other off-balance-sheet obligations described above in II.H., Other Off-Balance-Sheet Guarantees. This lowest discounted monthly balance, if positive, represents a surplus of initial capital, that is, capital that was not ''used'' during the stress period. If negative, it represents a deficit of initial capital. The lowest discounted monthly balance is then subtracted from the Enterprise's initial capital. The resulting amount is the smallest amount of starting capital required to maintain positive capital throughout the stress period.

For example, if an Enterprise holds starting capital of $10 billion and the lowest discounted monthly balance is $1 billion (representing a positive capital balance in the worst month of the stress period), then the amount of starting capital necessary to maintain positive capital throughout the stress period is $9.0 billion. If, on the other hand, the lowest discounted monthly balance is −$1 billion (representing a negative capital balance in the worst month), the necessary starting capital to maintain positive capital throughout the stress period is $11.0 billion.

Finally, required starting capital is multiplied by 1.3 to complete the calculation of the risk-based capital requirement required by the 1992 Act.

**III. Comments and Responses**

The final rule reflects OFHEO's consideration of all the comments on NPR1 and NPR2, including responses from those commenters who replied to the initial comments on NPR2. After careful review and analysis of the comments, OFHEO determined that a number of recommendations had merit. OFHEO accepted these recommendations and made changes in the stress test accordingly. In other cases where commenters recommended changes, OFHEO did not accept the specific suggestion, but modified the stress test to address the commenters' concerns. Other recommendations proved to be contrary to the 1992 Act, did not offer a better alternative to the existing stress test, or had merit but required further study before they could be implemented.

The commenters on NPR1 and NPR2 included the Enterprises, financial services and housing-related trade associations, financial service companies, affordable housing groups and agencies, a governmental agency, a private rating agency and several individuals.

Trade associations commenting included American Bankers Association (ABA), America's Community Bankers (ACB), Consumer Mortgage Coalition (CMC), Mortgage Bankers Association of America (MBA), Mortgage Insurance Companies of America (MICA), National Association of Home Builders (NAHB), National Association of Realtors (NAR), Credit Union National Association (CUNA), National Bankers Association (NBA), National Association of Real Estate Brokers (NAREB), and National Home Equity Mortgage Association (NHEMA).

Financial services companies commenting included GE Capital Mortgage Corporation (GE Capital), Chase Manhattan Mortgage Corporation, Charter One Bank, Goldman Sachs, Newport Mortgage Company L.P., J.P. Morgan & Co. Incorporated, Bear Stearns & Co. Inc., Morgan Stanley Dean Witter (Morgan Stanley), Lehman Brothers, Salomon Smith Barney, Triad Guaranty Insurance Corporation, Merrill Lynch, Promentory Financial Group LLC, PW

[30] Core capital, as defined at 12 U.S.C. 4502(4) consists of par value or stated value of outstanding common, and perpetual, noncumulative, preferred stock, paid-in capital, and retained earnings, determined in accordance with Generally Accepted Accounting Principles.

Funding Inc., Amresco Capital, L.P., Golden West Financial Corporation (World Savings), Countrywide (Mid-America Bank FSB), American International Group Inc. (AIG), the Federal Home Loan Bank of Chicago, and WMF Group.

Affordable housing groups and agencies included The Enterprise Foundation and the Local Initiatives Support Corporation, National Center for Community Self Help, National Council of State Housing Agencies (NCSHA), Association of Local Housing Finance Agencies, Nebraska Investment Finance Authority, Neighborhood Housing Services of America, Inc., National Association of Affordable Housing Lenders (NAAHL), PT & Associates Community Development Consulting, National Neighborhood Housing Network, National Community Reinvestment Coalition, and Coalition on Homelessness & Housing in Ohio.

Other commenters included Office of Thrift Supervision, Fitch ICBA, Nelson Yu, O'Melveny & Myers LLP, and L. William Seidman.

A summary of the comments and OFHEO's responses are set forth below, by topic.

*A. Approach*

Commenters generally agreed on the basic premises underlying OFHEO's proposal to implement a risk-based capital requirement for the Enterprises: the importance to the nation's housing finance system of financially strong Enterprises, and the appropriateness of the weight the 1992 Act places on a risk-based capital requirement to protect the Enterprises' capital adequacy. The views of commenters, however, diverged on the question of whether a stress test, such as the one proposed in NPR2, provided the best approach to setting a risk-based capital requirement for the Enterprises. Among the commenters who agreed that a stress test was the best approach, the views diverged on the question of how the stress test should be implemented. The general comments on OFHEO's approach are discussed below by topic.

1. Bank and Thrift Approach

a. Comments

Some commenters suggested that OFHEO take an overall approach to capital regulation similar to that emerging among the bank and thrift regulators and the Basel Committee on Banking Supervision. The suggestions of these commenters included using ratios to set capital requirements for credit risk and Value at Risk (VaR) methodologies for market risk rather than a stress test. One Enterprise and one commenter, however, noted that although VaR methodology is a valuable analytical tool, it is not appropriate for determining risk-based capital as prescribed by the 1992 Act.

The approach evolving in the bank regulatory community applies ratios to categories of on- and off-balance-sheet items to derive capital requirements, but also begins to incorporate VaR and other methodologies that financial institutions employ in their proprietary models. The approach, which is outlined in the June 1999 report by the Basel Committee on Banking Supervision (Committee) titled ''A New Capital Adequacy Framework,'' also puts more emphasis on supervisory review and greater market discipline based on expanded disclosure of risk. The June 1999 report discusses a new capital framework consisting of three ''pillars'': minimum capital requirements, a supervisory review process, and market discipline.

The three pillars approach to bank regulatory capital seeks to improve the relationship of bank capital requirements to risk that was set out in the 1988 Accord. The 1988 Accord was itself a major departure from the simple leverage ratios applied by regulators to total assets. It introduced a capital framework that applied ratios to broad categories of assets according to their relative riskiness as reflected by type of instrument (e.g., residential mortgages, commercial loans, or lines of credit) or by obligor (e.g., sovereign government, national bank, or industrial company). At the time the Accord was introduced, the Committee recognized the limitations inherent in quantifying credit risk by applying ratios to such broad categories of assets. The Committee also recognized that credit risk was only one element of the risk profile of a financial institution. Subsequent enhancements, most notably permitting the use of proprietary models to calculate a supplemental capital requirement reflecting the market risk of a large financial institution's trading portfolio, have continued to improve the process of quantifying risk and calculating an appropriate level of capital based on risk.

In January of 2001, the Committee published for comment a proposal embodying the three pillars to replace the 1988 Accord.[31] The proposal is intended to be a more risk-sensitive framework containing a range of new options for measuring both credit and operational risk. Key elements of the proposal were a refinement of the minimum capital requirement to make it more risk-sensitive, a greater emphasis on the bank's own assessment of its risk, and a decision to treat interest rate risk under the second pillar, the supervisory review process.The proposal described a ''foundation'' or standardized approach to credit risk, which was a refinement of the 1988 approach to minimum capital, and an ''advanced'' internal ratings-based approach for banks that meet more rigorous supervisory standards. The latter made use of internal estimates, subject to supervisory review, but stopped short of permitting banks to calculate their capital requirements on the basis of their own portfolio credit risk models. Separate disclosure requirements were set forth as prerequisites for supervisory recognition of internal methodologies for credit risk, credit risk mitigation techniques, and asset securitization. The Committee indicated that similar disclosure prerequisites would attach to the use of advanced approaches to operational risk.

After reviewing the comments on the January 2001 proposal, the Committee announced in June of 2001 that the proposal needs further adjustment to maintain equivalency between the two approaches and to ensure that the capital incentives are appropriate to encourage banks to adopt the more advanced approaches.[32] The Committee reaffirmed its support for the three pillars approach and announced that it would release a complete and fully specified proposal for an additional round of consultation in early 2002, with a target implementation date of 2005.

b. OFHEO's Response

Although the 1992 Act requires a risk-based capital standard for the Enterprises that is based on a stress test, OFHEO's overall approach to regulation is broadly parallel to the three pillars approach proposed by the Committee. OFHEO already pursues a ''multidimensional'' approach to regulating the Enterprises' capital, as one commenter urged. OFHEO's minimum and risk-based capital requirements are quantifiable capital requirements, which are the goals of the Committee's first pillar; OFHEO employs risk-based examination and

[31] Committee on Banking Supervision, ''Overview of the New Basel Capital Accord,'' Bank for International Settlements, Basel, Switzerland (January 2001). A copy of this document can be obtained from the BIS website at *http://www.bis.org.*

[32] See press release of June 25, 2001, ''Update of the New Basel Accord.'' A copy of this document may be obtained on the BIS website at *http://www.bis.org.*

oversight of the Enterprises that provides the type of oversight contemplated in the second pillar; and OFHEO is currently reviewing the Enterprises' public disclosures to determine whether they would provide an adequate basis for market discipline as contemplated in the third pillar.

Although OFHEO will follow with interest the Committee's progress in developing a new regulatory capital framework and, where appropriate, consider incorporating aspects of this new framework into its regulation of the Enterprises, OFHEO believes that its stress test is appropriate to implement the statutory requirements and ties capital more closely to risk than either the current Basel Accord or recent proposals. The current capital adequacy regime for large banks quantifies credit risk by applying ratios to risk-weighted asset and off-balance-sheet amounts and quantifies market risk only to the extent of the interest rate risk in the banks' trading portfolios. In refining the treatment of credit risk, the Committee's three pillars approach would continue to rely on ratios. Interest rate risk would be addressed under the second pillar, the supervisory review process. By contrast, OFHEO's stress test simultaneously captures credit risk and interest rate risk of an Enterprise's entire business.

OFHEO also believes that VaR methodologies that large banks use to evaluate the interest rate risk of their trading portfolios are not adequate to implement the requirements of the 1992 Act. VaR approaches are best used to evaluate risk over relatively short time periods and are, therefore, appropriate for evaluating trading portfolios. The Enterprises' asset portfolios, however, are not a ''trading book,'' as one commenter suggested. Rather, these portfolios are comprised largely of assets that are held to maturity. The Enterprises' actual trading portfolios are, in fact, a small part of the Enterprises' balance sheets. Further, although large banks continue to use VaR models for calculating day-to-day trading risk, since the disruptions in the global financial markets in 1997 and 1998, these banks increasingly have employed stress tests to measure their market exposure.[33] These banks found that VaR models were less able to measure risk under extreme market conditions than stress tests.

2. Proprietary/Internal Models

a. Comments

Some of the commenters who recommended the bank and thrift regulatory approach urged that OFHEO permit the Enterprises to use their proprietary models to determine interest rate risk. A number of other commenters contended that each Enterprise should calculate its own risk-based capital requirement using a stress test model specified by OFHEO but developed by the Enterprise. Each Enterprise would then report its risk-based capital requirement to OFHEO in the same manner as the minimum capital requirement is reported. All of these commenters suggested that OFHEO could ensure the integrity of the capital calculation process through its examination function. In arguing for the use of internal models, one commenter also noted that the risk-based capital proposals of the Farm Credit Administration (FCA) and the Federal Housing Finance Board (FHFB) also permit the use of proprietary and/or internal models to varying degrees.

Both Enterprises agreed that they should calculate their own risk-based capital requirement, contending that it is sufficient for OFHEO to publish the specifications for the model. They recommended that they should run the stress test as specified by OFHEO on their own internal systems, at least as a transitional measure. The Enterprises believe this would be the fastest and most efficient way to implement a risk-based capital rule that would produce capital numbers in a timely way.

Other commenters believed that allowing an Enterprise to calculate its own capital requirement using its proprietary models or a model that OFHEO specifies would undermine OFHEO's regulatory independence and impede the transparency of the stress test for third parties. These commenters felt that OFHEO must retain control of both the model and the process for determining the Enterprises' risk-based capital requirements to ensure the integrity of the calculation of risk-based capital.

The Congress has required FCA, which regulates the Federal Agricultural Mortgage Corporation (Farmer Mac), and FHFB, which regulates the Federal Home Loan Banks, to establish risk-based capital standards for the entities they regulate. The statutory requirements for FCA's risk-based capital regulation,[34] which parallel the requirements of the 1992 Act, include a ten-year stress test, a worse-case historical credit loss experience, and stressful interest rate scenarios. The FCA rule specifies the basic structure and parameters of the risk-based capital stress test and allows Farmer Mac to use FCA's spread sheet model or implement the stress test using an internal model built to FCA's specifications to determine its risk-based capital requirement.[35]

The statutory requirements for FHFB's recently adopted capital regulation,[36] which takes an approach similar to that of the bank and thrift regulators, are much less specific than either OFHEO's or FCA's, but direct FHFB to take OFHEO's stress test into consideration. In the FHFB rule, each Federal Home Loan Bank calculates its own risk-based capital charge.[37]

b. OFHEO's Response

The final rule continues to provide for capital classifications to be determined based on a stress test specified, developed, and administered by OFHEO. OFHEO believes this approach best fulfills the statutory purposes and maintains the integrity of the risk-based capital regulation. Allowing the Enterprises to use their proprietary models or models they develop based

[33] Committee on the Global Financial System, ''Stress Testing by Large Financial Institutions: Current Practice and Aggregation Issues,'' 14 Bank for International Settlements, Basel, Switzerland (April 8, 2000). A copy of this document may be obtained from the BIS website at *http://www.bis.org.*

[34] 66 FR 19048, April 12, 2001. FCA's rule determines stressful credit conditions by applying loss frequency and severity equations to Farmer Mac's loan-level data. From these equations, FCA's test calculates loan losses, assuming Farmer Mac's portfolio remains at a ''steady state,'' and allocates the calculated losses to each of the ten years. Interest rate risk is quantified using the results of Farmer Mac's interest rate risk shock-test to determine the change in the market value of equity (MVE). The change in MVE is posted to the first period in the stress test.

[35] In its notice of proposed rulemaking, FCA noted ''that because of the proprietary nature of specific, transaction loan level and financial data used in the risk-based capital stress test, it is unlikely that results of the test will be fully reproducible by parties other than Farmer Mac and us. Other parties, however, will be able to approximate the test results on an aggregate basis using publicly available information.'' 64 FR 61741, November 12, 1999.

[36] 12 FR 8262, Jan. 30, 2001; 12 CFR parts 915, 917, 925, 930, 931, 932, 933, 956, and 960.

[37] Capital to cover credit risk is calculated from leverage ratios that are based upon the credit ratings of counterparties and collateral supporting the credit. 66 FR 8313 (Jan. 30, 2001). Market risk capital is based on internal VaR models or stress tests and a determination of the amount by which the current market value of a Federal Home Loan Bank's total capital is less than 85 percent of the book value of total capital. *Id.* at 8317. Capital for operations risk is 30 percent of credit risk capital, although the FHFB may approve a lesser amount (not less than 10 percent) where the Federal Home Loan Bank obtains appropriate insurance or provides an acceptable alternative method for assessing and quantifying operations risk capital. *Id.* at 8318.

on OFHEO's specifications to calculate their own capital requirements could result in a weaker and inconsistently applied standard. However, each Enterprise will receive the source code for the stress test, which will enable it to compute its own capital requirement for internal purposes and to comment on its proposed capital classification.

Although FCA's statutory framework is similar to the 1992 Act, statutory interpretations that are appropriate for FCA's statute are not necessarily appropriate interpretations of the 1992 Act, and differences in regulatory responsibilities make the FCA approach unworkable for OFHEO. FCA is charged with developing a stress test for a single entity, while OFHEO regulates two entities, both of which must be subject to the same stress test.[38] Models that the Enterprises develop themselves would inevitably differ in their details, which could result in significant variations, and make it difficult to apply the stress test consistently to both Enterprises. In addition, the 1992 Act requires that the stress test be set forth in a regulation subject to notice and comment rulemaking,[39] that the risk-based capital regulation be sufficiently specific to permit someone other than the Director to apply the test,[40] and that OFHEO make the stress test model publicly available.[41] For these reasons, OFHEO concluded that the most practical way to comply with these statutory provisions was to develop and administer its own model on its own systems and apply the stress test even-handedly to both Enterprises.

Use of the FHFB approach is not viable for OFHEO under the 1992 Act, which requires a specific stress test, and does not provide the option of allowing each institution to design an appropriate risk-based capital test. The FHFB compared the agencies' approaches in the preamble to its final rule, noting that ''[f]or example, the GLB Act requires that the [FHFB] develop a stress test that rigorously tests for changes in interest rates, interest rate volatility and changes in the shape of the yield curve, while the statutory requirements governing Fannie Mae and Freddie Mac set forth specific scenarios for downward and upward shocks in interest rates.''[42] Other examples of statutory differences include the requirement in the 1992 Act that credit losses be related to the benchmark loss experience and an extensive list of factors that OFHEO must consider in designing the stress test. Further, the procedural requirements that the details of the stress test be published by regulation and made available to the public also make an internal models approach impractical for OFHEO.

OFHEO also finds that regulatory independence and rigor is best served by OFHEO's approach. The availability of the stress test on OFHEO's systems allows OFHEO greater flexibility to run the stress test whenever it may be needed. Maintaining the infrastructure to support the stress test also gives OFHEO the ability to independently test alternative risk scenarios in addition to the two stress test scenarios, which ensures the integrity of the stress test. This capability will also permit OFHEO to test possible improvements and adjustments to the stress test.

In sum, OFHEO concurs with the concerns of the commenters who recommended that OFHEO develop and maintain a single stress test model and require the Enterprises to provide the necessary data for the stress test. The Enterprises certainly may replicate that model from OFHEO's model specifications and computer code and use it to determine the capital impact of various business decisions. For the purposes of determining the capital classifications, however, OFHEO will run its own model using data submitted by the Enterprises. To alleviate some of the Enterprises' concern about the ability of the model to produce accurate capital numbers in a timely way, the final regulation establishes a standardized data reporting format for the RBC Report. This Report will enable OFHEO to produce capital numbers within the regulatory time frame. *See* sections III.B., Operational Workability of the Regulation and III.E., Enterprise Data.

3. Mark to Market for ''Tail Risk''

a. Comments

Two commenters said that OFHEO should consider losses beyond the end of the stress test period, either by marking to market remaining positions or otherwise requiring additional capital to cover the risk that remained at the end of the ten-year stress period. One Enterprise responded that marking to market to capture this ''tail risk'' would be contrary to the 1992 Act.

b. OFHEO's Response

The final regulation does not adopt the commenters' suggestions to require capital for on- and off-balance-sheet items that remain at the end of the ten-year stress period or to mark these items to their market value. The 1992 Act specifies that the stress period is ten years and that total capital must meet or exceed the amount of capital necessary to survive the stress period with positive capital. Marking to market balance sheet items that remain at the end of the 120 month period would bring into the stress test period earnings or losses beyond the ten-year period and would be inconsistent with the 1992 Act.

4. Additional Interest Rate Scenarios

a. Comments

Several commenters suggested that OFHEO study additional interest rate scenarios to ensure that smaller changes in interest rates do not result in risk-based capital requirements that are larger than the requirements generated by the interest rate scenarios in the 1992 Act. These commenters expressed concern that the risk-based capital rule will be inadequate unless OFHEO runs more than two interest rate scenarios. They also urged OFHEO to monitor any attempts by the Enterprises to take advantage of the limited number of interest rate scenarios in the stress test. The comment implies, for example, that an Enterprise could enter into inexpensive interest rate derivatives contracts that would allow the Enterprise to easily pass the two interest rate scenarios of the stress test. Under slightly different and possibly less stressful interest rate scenarios, these derivatives might be useless, but a stress test based on only two interest rate scenarios would not uncover this deficiency. To prevent this problem, the commenters said that OFHEO should run additional scenarios with a variety of assumptions, including combinations of smaller interest rate changes, more volatile interest rates, different yield curves, and alternative changes in house prices. They recommended that OFHEO set the risk-based capital requirement for an Enterprise at the highest amount generated by any additional scenarios. One Enterprise disagreed, saying that more moderate interest rate movements would probably result in lower capital requirements. The Enterprise also noted that OFHEO's examination process

[38] *See* 12 U.S.C. 4611(a) (''The Director shall, by regulation, establish *a* risk-based capital test for the Enterprises. When applied to an Enterprise, *the* risk-based capital test shall determine the amount of total capital for the Enterprise * * *'') (emphasis added). See also H.R. Rep. No. 102–206 at 62 (1991). ''Beyond these traditional capital ratios, the bill sets forth guidelines for the creation, in highly specific regulations, of a risk-based capital standard * * * *The* model, or stress test, will generate a number for each Enterprise, which will become the risk-based standard for that Enterprise.'') (emphasis added).

[39] 12 U.S.C. 4611(e)(1).

[40] 12 U.S.C. 4611(e)(2).

[41] 12 U.S.C. 4611(f).

[42] 66 FR at 8283.

ensures the integrity of Enterprises' risk management process.

b. OFHEO's Response

In response to these comments, OFHEO notes that the 1992 Act provides only two scenarios for the stress test and requires that risk-based capital be based on whichever of the two scenarios results in the higher capital requirement. Although OFHEO intends to run additional scenarios in order to monitor an Enterprise's capital adequacy, OFHEO does not need to modify the regulation to include scenarios beyond those specifically required in the 1992 Act. Moreover, it is not clear that specifying additional scenarios in the risk-based capital regulation would address the concerns of the commenters. If OFHEO were to add scenarios to the final rule, an Enterprise could simply enter into additional derivatives contracts that would hedge the new scenarios.

The 1992 Act specifies two interest rate scenarios, but it does not prohibit the running of additional scenarios as part of OFHEO's on-going monitoring of safety and soundness of the Enterprises. OFHEO can only test how well the results of the statutory scenarios reflect risk if OFHEO continues to run additional scenarios based on market conditions and other factors the Director considers appropriate. Should OFHEO discover any capital weakness when it runs additional scenarios, OFHEO has supervisory tools available to correct the situation. For example, if additional stress testing reveals that scenarios equally or less stressful than those in the 1992 Act would cause an Enterprise to fail the stress test, the Director may determine that grounds for discretionary capital reclassification exist under section 1364(b) of the 1992 Act. Similarly, a finding by the Director that an Enterprise is conducting itself in a way that threatens to cause a significant depletion of core capital would provide grounds for a cease and desist order.

*B. Operational Workability of the Regulation*

A broad theme of the comments was that OFHEO should move expeditiously to a final rule that is operationally workable. By operationally workable, most commenters meant that the regulation must provide for accurate and timely calculations of risk-based capital requirements. From a regulatory perspective, OFHEO agrees, because the risk-based capital requirement, together with the minimum capital requirement, serves as the basis for classifying the Enterprises as ''adequately capitalized'' or ''undercapitalized.'' OFHEO must determine these classifications as quickly as possible to minimize delays in identifying capital shortfalls. However, a number of commenters also expressed more specific concerns related to how the rule and the stress test that underlies it will operate in practice. These comments and OFHEO's responses to them are explained below.

1. Replicability and Transparency

To the Enterprises and some other commenters, the concept of operational workability meant that the stress test should be sufficiently transparent that the Enterprises can use it for internal planning and analysis. This level of transparency would allow the Enterprises to calculate capital numbers on their own systems with reasonable assurance that the results will closely mirror OFHEO's results. To certain non-Enterprise commenters, however, the concept of transparency meant complete replicability of OFHEO's results—that is, the ability of parties other than OFHEO and the Enterprises to run the stress test and to evaluate the potential impacts on Enterprise regulatory capital requirements of changes in the economy or Enterprise business mix. These commenters asserted that in order to promote market discipline, the stress test should be this transparent to third parties. They recommended that OFHEO release the computer code as well as the complete specifications of the stress test. A few commenters stated that the stress test could not be completely transparent without the release of Enterprise data, some of which may be proprietary.

OFHEO strongly supports a concept of operational workability that allows capital classifications to be determined in a timely manner, allows the Enterprises to use the stress test as a planning tool, is transparent to third parties, and allows capital classifications to be calculated in a timely manner. To this end, OFHEO, working with the Enterprises, has developed a standardized reporting format, the RBC Report, that will permit the reported data to be input into the stress test without manipulation and will work with the Enterprises to assist them in aligning their data systems with the reporting format so that they will be able to run the stress test on their systems and achieve the same result as the Director. This will permit timely classifications and will permit the Enterprises to anticipate what their capital classification will be. OFHEO's treatment of new activities, discussed below in III.B.3., New Enterprise Activities, is also designed to allow the Enterprises to understand the probable impact of new activities on their regulatory capital requirements. In addition, OFHEO will release to the Enterprises and other requesting parties a copy of the computer code. A stylized data set also will be made available to interested parties to permit them to understand the sensitivities and implications of the stress test.[43] This information will allow parties other than OFHEO to apply the stress test to any set of starting data in the same manner as OFHEO.

OFHEO disagrees, however, with commenters who suggest that third parties should be provided the actual starting position data that are input to the stress test. These data include Enterprise information that is not public and may be subject to legal prohibitions or restrictions on disclosure or may otherwise unfairly disadvantage an Enterprise if disclosed. Given the statutory protections for proprietary data included in the 1992 Act and elsewhere,[44] OFHEO believes that the requirement of the 1992 Act that others be able to apply the test in the same manner as the Director should not be read to require the release of proprietary data. OFHEO anticipates that the information it is supplying to the public about the model meets this statutory requirement and provides interested parties with a solid understanding of the interaction in the model of credit and interest rate stresses and an ability to understand the capital implications of changes in an Enterprise's risk profile. OFHEO strongly favors promoting market discipline. Because of the forward-looking nature of the stress test, OFHEO's periodic publication of the current capital numbers together with current capital classifications will promote such discipline.

2. Predictability v. Flexibility

The comments suggest that in order for the stress test to be useful to the Enterprises in their businesses, its results must be sufficiently predictable to permit it to be used as a planning tool, while sufficiently flexible to take into account new products or other innovations by the Enterprises. From these somewhat competing considerations flowed a range of comments concerning the frequency with which OFHEO should amend the

[43] The stylized data set will include a realistic mix of on- and off-balance sheet items of a hypothetical Enterprise. It will allow any interested party to run the test, to vary the mix of items, add or delete items, change starting interest rates, modify historical house price patterns, and understand potential impacts of these actions or events upon Enterprise capital.

[44] *See, e.g.,* 12 U.S.C. 4611(e)(3); 18 U.S.C. 1905.

regulation, the process that would be followed for changing the regulation, and the treatment of new activities and instruments, i.e., those for which the stress test does not currently prescribe a treatment.

Some commenters suggested that the final rule specify a process for routine updating of the stress test to incorporate industry improvements in risk management techniques. One commenter recommended specifying a threshold, expressed as a percentage of the minimum capital requirement, that would determine when changes require notice and comment. For changes that would not reach the threshold, the commenter recommended specifying a one-year implementation period and for changes that are proposed for notice and comment, a two-year period. Other commenters, including Fannie Mae, recommended severely limiting changes to create ''stability'' in the stress test. Freddie Mac recommended that OFHEO affirm that it would follow the Administrative Procedure Act (APA) when changes are made to the final regulation.

The final rule balances the concern for stability with the concern for flexibility, recognizing that the nature of the Congressional mandate and the dynamic nature of the Enterprises' businesses will require an ongoing assessment of how well the stress test achieves its objectives. To achieve its statutory objective of aligning capital to risk, the stress test necessarily must evolve as the risk characteristics of new and complex instruments and activities become better understood and modeling techniques more highly developed. Therefore, OFHEO cannot eliminate uncertainty about how the stress test might evolve without reducing the sensitivity of the stress test to risk. Sufficient discretion must be retained by the Director to respond to innovations as they occur. And yet, in its important particulars, there must be enough stability in the stress test to allow the Enterprises and others to predict with reasonable confidence the impact that changes in their business plans or the economy may have on their capital requirements.

OFHEO will continue to monitor and study changes in the Enterprises' businesses and the markets in which they operate. OFHEO also will evaluate new statistical data that become available to determine whether they have implications for Enterprise risks. These continuing efforts will, doubtlessly, suggest reestimation of the models and other changes to the stress test from time to time. However, OFHEO does not find it appropriate at this time to specify a process, beyond the APA, for routine updating of the rule or to commit in advance to limiting the size or frequency of changes to the rule. Only after the rule has been operational for a significant period of time can OFHEO assess whether there is a need for further rulemaking to specify a change process. In any event, OFHEO affirms that any future amendments to the regulation will comply with the APA.

3. New Enterprise Activities

a. Proposed Rule

Section 1750.21 of the proposed regulation and section 3.11 of the Proposed Regulation Appendix together were designed to implement the substantive risk-based capital requirements of the 1992 Act,[45] the notice and comment requirements of the APA,[46] and the replicability and public availability requirements of sections 1361(e) and (f) of the 1992 Act.[47] The quarterly capital calculations required by the 1992 Act[48] must, as accurately and completely as possible, capture the risks in the portfolio of each Enterprise. The requirement that classifications be done on not less than a quarterly basis is designed to ensure that changes in the risk profile of an Enterprise are captured frequently and reasonably close in time to when they are reflected on an Enterprise's books.

Given the dynamics of the marketplace and the Enterprises' business, it is not possible to construct a regulation that specifies a detailed model that could predict every new type of instrument or capture every new type of risk that might emerge from quarter to quarter. Therefore, to comply with the requirements of the 1992 Act, the proposed regulation included a provision, section 3.11 of the proposed Regulation Appendix, to address future instruments and activities, thus enabling each quarterly capital classification to be as accurate as possible. Section 3.11, together with other provisions in the regulation, was intended to help achieve that accuracy.

More specifically, section 3.11 of the proposed Regulation Appendix provided that the credit and interest rate risk of new activities and instruments would be reflected in the stress test by simulating their credit and cash flow characteristics using approaches already described in the Appendix. To the extent those approaches were not applicable directly, OFHEO proposed to combine and adapt them in an appropriate manner to capture the risk in the instruments. Where there is no reasonable approach using combinations or adaptations of existing approaches, the proposed stress test would employ an appropriately conservative treatment, which would continue until such time as additional information is available that would warrant a change to the treatment.

In addition to the substantive provisions of section 3.11 of the proposed Regulation Appendix, procedures were proposed in that section and in section 1750.21 of the regulation that would give the Enterprise involved advance notice of the treatment to be implemented and an opportunity to comment on it before it is implemented. Procedurally, proposed section 3.11 provided that an Enterprise should notify OFHEO of any pending proposal related to new products, investments, or instruments before they are purchased or sold or as soon thereafter as possible. The procedures in the proposed rule were also intended to encourage the Enterprise to provide OFHEO with any suggestions it may have as to an appropriate risk-based capital treatment for the activity or instrument. With the benefit of the information provided by the Enterprise, OFHEO would then notify the Enterprise of its estimate of the capital treatment as soon as possible.

Beyond these provisions, proposed section 1750.21 provided that the Enterprise would be notified of the proposed treatment when OFHEO provided the quarterly Notice of Proposed Capital Classification. After receiving that notice, the Enterprise would have thirty days to provide further comments to OFHEO. Those comments would be considered by OFHEO prior to issuing the final capital classification. Further, to ensure that the rest of the public could apply the test in the same manner as the Director, OFHEO planned to make the new treatment available to the public through an appropriate medium, such as the **Federal Register**, OFHEO's website, or otherwise. Comments from the public on these notices would be considered by OFHEO. Taken together, all of these provisions implement the procedural provisions of the 1992 Act and the APA, while assuring that the timely, complete and accurate capital classifications required by the 1992 Act are carried out.

b. Comments

Numerous comments addressed the capital treatment of new activities proposed in section 3.11 of the Regulation Appendix in NPR2. These

[45] 12 U.S.C. 4614, 4618.

[46] 5 U.S.C. 553.

[47] 12 U.S.C. 4611(e), (f).

[48] 12 U.S.C. 4614(c).

comments all urged OFHEO to adopt a clearly understood procedure that would be sufficiently flexible to allow the Enterprises to continue introducing new products. They emphasized that delay and uncertainty about treatments of new activities could frustrate introduction of innovative new products and business lines at the Enterprises.

The Enterprises both recommended that the process for new activities should allow them to understand as soon as possible the effect on capital of any new types of products or instruments that they introduce. Both Enterprises offered suggestions in the context of their recommendation that the stress test be run using their own infrastructures.[49] Although these suggestions differed in their details, both would allow the Enterprises to develop and implement capital treatments for new activities, subject to subsequent review and change by OFHEO.

Other commenters suggested that if OFHEO determined that a proposed treatment for a particular new activity would have a minimal impact upon total risk-based capital, that the treatment should be expedited and that no notice and comment process should be required. Treatments that would have a substantial impact on capital would be implemented using notice and comment procedures under the APA. One commenter suggested that a risk-based capital ''surcharge'' be applied ''on top of the normal capital requirements'' to account for any new activities until sufficient data could be compiled to determine the risk inherent in such activities. Another commenter recommended three modifications to the treatment of new activities in the NPR: first, that OFHEO use historical data from reliable sources and confer with bank regulators to determine the most appropriate treatments; second, that OFHEO use a transparent comment process, including review by a technical advisory board that would allow input on treatments of new activities from all interested market participants; and third, that the treatments for new activities should be incorporated timely into the stress test.

c. OFHEO's Response

The Enterprises' recommended approaches, in which they would implement capital treatments subject to subsequent OFHEO review, are not practicable within the framework of the final rule because OFHEO will run the stress test using its own computers and its own infrastructure. Nevertheless, OFHEO recognizes the importance of making timely decisions about the capital treatments for new activities. Before the risk-based capital amount of the affected Enterprise for a particular quarter can be calculated, those decisions must be made about all new activities introduced during that quarter. Accordingly, OFHEO has developed a process to make its own independent and informed determination of the appropriate capital treatment for new activities as early as possible, with input from the Enterprises, rather than relying upon their judgments for the first quarterly capital classification after a new activity reported in the RBC Report. OFHEO believes that this process (discussed below) will not impede the development or introduction of new products or other types of business innovation.

As discussed above, OFHEO received various recommendations regarding the appropriate notice and comment procedures for new activities. OFHEO has fully utilized notice and comment procedures, discussed at IC., Rulemaking Chronology, in promulgating this regulation and OFHEO included procedures in NPR2 that will provide ongoing notice and comment for treatments of new activities. In addition, the final rule modifies NPR2 to clarify that the Enterprises are encouraged to provide their recommendations regarding treatments of their new activities and that the broader public will be notified of treatments once they are included in a final capital classification. The public is encouraged to submit their views regarding such treatments, which will be considered by OFHEO on an ongoing basis.

OFHEO believes that public input in the development of rules is essential for sound and fair regulation of the Enterprises. At the same time, to comply with the 1992 Act, OFHEO needed to establish procedures for new activities that would permit the accurate and timely capital classifications required by the 1992 Act. Accordingly, the regulation provides for notice to the affected Enterprise and the public and for consideration of comments received, while it also ensures the ability of OFHEO to conduct continuous, timely and complete capital calculations.

As time passes and a significant volume of new activities has been addressed through the section 3.11 New Activities process, it may be appropriate to propose an amendment to the regulation, utilizing the notice and comment procedures of 5 U.S.C. 553, that would specify treatments for a group of new activities. Although the public will have had the opportunity to provide comments on individual activities on an ongoing basis, this additional process would enable OFHEO to benefit from supplementary comments that are framed in the context of a broader body of risks.

In response to the recommendation regarding an external technical advisory board, OFHEO does not consider it appropriate to require by rule that such a board review the treatment of all new activities. OFHEO is satisfied that the wide diversity of technical expertise of its staff, combined with the normal notice and comment process, will generally provide adequate analysis and review of new activities.

As to the comment suggesting a capital ''surcharge'' for new activities on top of the ''regular'' risk-based capital requirement, OFHEO believes that its approach to new activities is appropriately flexible to take into account the risks inherent in any new, untested activity. OFHEO anticipates that it will be able to model effectively many (if not most) new activities explicitly according to their terms or with combinations or adaptations of existing treatments. Where the risk of a new asset type cannot be captured adequately using specified treatments or combinations or adaptations of treatments, OFHEO may use an appropriately conservative fixed capital charge instead of or in addition to an existing modeling treatment. However, in a cash flow model (in contrast to a leverage ratio approach), a fixed capital charge may not be the best method to implement a conservative capital treatment for most instruments. In particular, applying a fixed capital charge for liabilities or for activities that are designed to reduce risk is rarely appropriate.

A more appropriate means of increasing the incremental capital associated with a particular asset in a cash flow model may be to apply a ''haircut'' to the cash flows from that asset, either directly or by otherwise specifying certain attributes that are relevant to the cash flows of these instruments.[50] A similar approach can be applied to instruments, such as derivative or insurance contracts that are designed to reduce risk. To the extent that a liability can not be modeled according to its terms, the appropriate approach is generally to

[49] *See* III.A.2., Proprietary/Internal Models.

[50] For example, requiring certain interest-bearing assets that are on the balance sheet to pay no earnings through the stress period could be an extremely conservative treatment, because the liabilities necessary to fund that asset would be paying interest throughout the stress period.

incorporate certain conservative assumptions about the amount of cash flow that will be required from the Enterprise.[51] For these reasons, OFHEO believes that the flexibility afforded by section 3.11 is preferable to the imposition of a surcharge for new activities.

In sum, the OFHEO has not altered its proposed approach to new activities, but, based upon the comments, determined that some clarification of that approach in the final regulation would be useful. Therefore, the final rule adopts § 1750.12 of the proposed regulation and section 3.11 of the proposed Regulation Appendix with some modifications. The revised definition of new activities in section 3.11.1.b of the Regulation Appendix clarifies that the section applies not only to new transactions and instruments, the most common new activities, but also other types of new activities. The term ''new activities'' is, therefore, defined broadly to include any asset, liability, off-balance-sheet item, accounting entry, or activity for which a stress test treatment has not previously been applied. This definition would include any such items that are similar to existing items, but that have risk characteristics that cannot be taken into account adequately with existing treatments. The definition further clarifies that an instrument or activity may be treated as a ''new activity'' if it increases in volume to such an extent, or if new information indicates, that an existing treatment does not account adequately for its risk.

In section 3.11.2.a, which replaces proposed section 3.11(c), the words ''are expected to'' have been replaced with the word ''shall'' and the phrase ''no later than in connection with submission of the RBC Report provided for in § 1750.12'' has been replaced with the phrase ''within 5 calendar days after the date on which the transaction closes or is settled.'' This requirement is also reflected in the regulation text at § 1750.12(c) in the final regulation. These changes are designed to address concerns that appropriate capital treatments of new products be determined as quickly as possible. Timely determinations of capital classifications and required capital amounts provide an early warning of a potential strain on an Enterprise's capital. They also serve the interests of many commenters who felt that delay and uncertainty about capital treatments of new activities could impede innovation at the Enterprises.

OFHEO anticipates that, ordinarily, the Enterprises will notify OFHEO of significant new activities well in advance of entering into the actual transactions and will provide draft documentation, anticipated cash flow analysis, and recommended capital treatments as that information is developed for the Enterprises' internal decision-making. For new activities that do not involve transactions, such as an accounting change, OFHEO anticipates that relevant information will be made available well before actual implementation of the new activity. This type of coordination will allow OFHEO to develop initial capital treatments at the same time that an Enterprise is incorporating the new instruments into its own internal models, reducing uncertainty about the capital impact of new activities and allowing the new treatments to be implemented quickly enough to facilitate timely capital calculation and classification. OFHEO anticipates that the Enterprises will incorporate into their internal systems and procedures for product development the process of obtaining the views of OFHEO as to the appropriate capital treatment of each new activity. However, OFHEO realizes that it might not always be possible for the Enterprises to provide notification to OFHEO of a new activity well before submission of the quarterly RBC Report. As with any federally-regulated financial institution, if an Enterprise were to market a new instrument or engage in some new business activity without coordinating with its regulator to determine, in advance, an appropriate initial capital treatment, that initial treatment would necessarily be conservative—that is, it would ensure, in the absence of complete information, that sufficient capital is set aside to offset any risks that may be associated with the new instrument or activity.

Section 3.11 as proposed in NPR2 has also been changed to include three new provisions that expressly state OFHEO's intentions in the implementation of this section. First, section 3.11.2.a encourages an Enterprise that is in the process of or has engaged in a new activity to provide OFHEO with its recommendations regarding the treatment of that activity when it first provides information regarding the activity to OFHEO. Any recommendations will be considered by OFHEO in developing the proposed capital classification. The Enterprise will have the opportunity to comment on that treatment in connection with its other comments on the proposed capital classification.

Second, section 3.11.3.d provides that after a treatment has been incorporated into a final capital classification, OFHEO will provide notice to the other Enterprise and the broader public of that treatment. OFHEO will consider any comments it receives from those parties regarding such treatment during subsequent quarters.

Finally, section 3.11.2.b provides that the stress test will not give an Enterprise the benefit associated with a new activity where the impact of that activity on the risk-based capital level is not commensurate with its economic benefit to the Enterprise. Although it is not expected that the Enterprises would want to deal in transactions or instruments that do not have legitimate business purposes, OFHEO must retain the authority to exclude such instruments from risk-based capital calculations should they occur.

4. Standardized Reporting

The Enterprises suggested that OFHEO specify a standardized RBC Report. Such specifications would include sufficiently detailed instructions to allow the Enterprises to aggregate the data in a format that can be input directly into the stress test. OFHEO agreed with this suggestion and has developed such a report. The report will shorten considerably the time needed to produce the risk-based capital requirements. It will also provide the Enterprises with more certainty in performing their own risk-based capital calculations.[52]

5. Capital Classification Process

a. Comments

The Enterprises requested that the regulation describe a practical and timely process for reporting risk-based capital and determining capital classifications. A number of specific suggestions were made. First, they both recommended that they would report stress test results quarterly along with the data used to run the stress test and OFHEO would then determine quarterly capital classifications based on the Enterprises' calculations. Freddie Mac also recommended that OFHEO classify an Enterprise as adequately capitalized if it meets the minimum capital requirement and quickly remedies a failure to meet the risk-based capital requirement before the classification is reported. Freddie Mac further recommended that OFHEO retain the discretion to specify when the quarterly

[51] If, for example, the amount of interest on a note was indexed to a volatile indicator that could not be modeled in the stress test, a conservative treatment might be to require that instrument to pay interest throughout the stress period at a rate significantly higher than the average return of the Enterprise on its assets during that period.

[52] *See* II.B., Data.

capital reports are due rather than specifying that they must be filed within 30 days of the end of the quarter. Finally, Freddie Mac recommended that the regulation require an Enterprise to amend a capital report only if a data input revision might result in a capital reclassification.

b. OFHEO Response

As noted above, OFHEO will run the stress test and determine capital classifications using its own systems using data reported by the Enterprises in a standardized format. The Enterprises may duplicate OFHEO's stress test calculations by running the stress test in the same manner as OFHEO. If an Enterprise believes there are discrepancies, it may comment on them during the 30-day response period following OFHEO's notice of proposed capital classification.

OFHEO did not adopt Freddie Mac's suggestion that the Enterprises be given an opportunity to remedy capital shortfalls before the capital classification is reported. Since the risk-based capital requirement is based on data submitted by the Enterprises as of a particular point in time, it is appropriate to determine whether an institution meets the standard as of that date for classification purposes. Although the classification could be accompanied by a description of any remedial actions an Enterprise has taken since the reporting date, it would not be possible to know with certainty that the remedial action brought the Enterprise into compliance with its risk-based capital standard without running the stress test again with new starting position data on its entire book of business.

The final regulation does not change the requirement that the RBC Report be filed within 30 days of the end of the quarter. OFHEO believes the RBC Report should be filed as promptly as possible after the end of quarter so that the capital classification can be determined promptly, and, in any event, within the same 30 days required for the minimum capital report. OFHEO recognizes that, initially, Enterprise preparation of the RBC Report will require more time and effort than is needed for the minimum capital report. Therefore, during the one year period following promulgation of the final rule, OFHEO will consider requests for an extension on a case-by-case basis.

OFHEO has determined that an amended RBC Report should be filed whenever there are errors or omissions in a report previously filed and not, as Freddie Mac suggested, only when the change would result in a different capital classification. In OFHEO's view, prudent monitoring of risk-based capital requires the reporting of all changes. The rule makes clear that the Enterprise is obligated to notify OFHEO immediately upon discovery of such errors or omissions and file an amended RBC Report within three days thereafter. In addition, the final rule clarifies that if there is an amended report, the computation of the risk-based capital level will still be based on the original report unless the Director, in his/her sole discretion, determines that the amended report will be used.

The final rule also requires the board of directors of an Enterprise to designate the officer who is responsible for overseeing the capital adequacy of the Enterprise as the officer who must certify the accuracy and completeness of the RBC Report.

NPR2 proposed to delete existing section 1750.5, which sets forth the capital classification procedure under the minimum capital rule, and replace it with a new subpart that would govern capital classification under both the minimum and risk-based capital rules. Subsequent to the publication of NPR2, OFHEO published a notice of proposed rulemaking entitled Prompt Supervisory Response and Corrective Action,[53] which includes a more comprehensive proposal related to capital classification than NPR2. Because OFHEO anticipates that the Prompt Supervisory Response and Corrective Action rule will be adopted prior to the first classification of the Enterprises under the risk-based capital rule, existing section 1750.5 is not deleted and proposed subpart C is not adopted in this final rule.

6. Interaction With Charter Act Provisions

Freddie Mac requested that OFHEO clarify the interaction of this risk-based capital regulation with the capital distribution provisions of Enterprises' respective Charter Acts during the one-year period following the effective date of the regulation. The Charter Act provisions are already in effect and have been since enactment of the 1992 Act.

During the one-year period after promulgation of the final rule, OFHEO will take into consideration the need for the Enterprises to adjust to the new rule, and will exercise its authority under the Charter Act provisions in a manner appropriate to the circumstances and consistent with OFHEO's intent to provide the Enterprises a one-year transition period to adjust to the risk-based capital requirement. During such period, there would be no impact on an Enterprise's ability to make capital distributions absent adequate prior notice to the Enterprise of its capital position and adequate opportunity to take reasonable and prudent steps to address any articulated deficiency.

7. Implementation

OFHEO has taken appropriate proactive measures to ensure a smooth implementation of the risk-based capital (RBC) rule and the computer code that implements the rule. These measures, which include independent verification and testing of the code, minimize the likelihood of unforeseen technical or operational issues. However, should any such issues arise, OFHEO has ample and flexible authority, which it will utilize to resolve them quickly.

a. Computer Code Enhancements

After publication of the RBC rule, OFHEO will make available to requesting parties the computer code that implements the technical specifications of the rule and a dataset representative of the Enterprises' businesses. OFHEO encourages feedback on the operation of the code by parties who utilize it, including suggestions for more efficient ways to code the technical specifications of the rule.

The computer code that implements the RBC rule will necessarily evolve over time as the businesses of the Enterprises evolve and as OFHEO builds efficiencies into the code to enhance its operation and utility. Also, as the Enterprises seek to adapt their systems to run the stress test internally, they may suggest alternative methods of coding the technical specifications of the rule that would enable them to compile their data submissions more quickly or produce results more efficiently. OFHEO will consider adopting a suggested change in the code provided it accurately reflects the computational instructions of the rule and can be applied accurately and fairly to both Enterprises. OFHEO will develop a process for the receipt, review, and disposition of suggested changes to the code.

In addition, OFHEO has the authority to make any changes it deems necessary to the code at any time, without notice and comment, as long as those changes are not inconsistent with the technical specification of the RBC rule. This authority allows OFHEO to address any technical or other problems that might arise in the operation of the code on a timely basis. Any changes to the code will be made available to the public.

[53] 66 FR 18694 (April 10, 2001).

b. RBC Rule Revisions

OFHEO will consider over time the need for formal amendments to the RBC rule after its effective date. If at any time after the effective date a need arises to amend the rule on an urgent basis, OFHEO has ample authority under the 1992 Act [54] to make such changes on a timely basis consistent with the APA. The Senate Report accompanying the 1992 Act makes it clear that Congress recognized that the stress test must necessarily evolve as the Enterprises' businesses evolve and contemplated that a variety of procedural options for quick action would be necessary to keep current the risk-based capital regulation. In regard to the risk-based capital regulation, the Report states that ''[t]he regulations must be sufficiently detailed to allow others to comment meaningfully on them and approximate closely their effects.'' It goes on to emphasize that ''[o]rders or guidelines may be used for some of the finer details to permit flexibility to make small changes on a rapid basis when necessary.'' [55]

The APA provides a variety of procedural options that would be available to remedy technical problems in the RBC rule, whether they are minor or significant. First, the Director may act quickly, without notice and comment, to make technical corrections, clarifications, or interpretations of the rule. This authority would permit most technical and operational problems to be remedied expeditiously. The Director would publish the correction, clarification, or interpretation of the rule in the **Federal Register** and make revisions to the code available. Second, should a more substantive change to the technical specifications be required, the Director may separately issue a direct final rule or a final rule on an interim basis with request for comment, either of which would take effect immediately. Third, the Director, in a separate rulemaking with a relatively short comment period, may propose amendments to the risk-based capital regulation and move quickly to a final rule amending the risk-based capital regulation. These and other administrative tools are available to address any technical or operational problems that may arise in the implementation of the rule.

*C. Implications*

OFHEO received extensive comments about the implications of the proposed risk-based capital rule from the Enterprises, financial service organizations, trade associations, and affordable housing advocacy groups. The commenters focused on three primary issues: (1) Whether the risk-based capital rule properly aligns required capital to economic risk, (2) whether the rule would increase the cost of home ownership generally; and (3) whether the rule would result in the Enterprises reducing their support for affordable housing. There was a diversity of opinion on these issues. Commenters also provided many specific recommendations with respect to the implications of the risk-based capital rule. OFHEO has responded to these recommendations under the specific topics to which they relate.

1. Aligning Capital to Economic Risk

The commenters generally agreed that a stress test is an appropriate method to align capital to risk. Nevertheless, some commenters, including the Enterprises, investment firms, and some trade associations, stated that OFHEO needs to improve the alignment of capital to economic risk and offered specific suggestions to accomplish this, which are discussed under the specific topics to which they relate. These commenters claimed that failure to align capital to economic risk may reduce the availability of certain products, create disincentives to risk sharing and risk reduction, and result in price distortions.

OFHEO continues to believe that the significant stresses that the regulation applies to the Enterprises' books of business are appropriate for determining the risk-based capital requirement and to align required capital closely to the economic risk. Nevertheless, many of the modifications to the regulation made by OFHEO align capital more closely to the economic risk, based in part on specific suggestions offered during the rulemaking process. These modifications are also discussed under the specific topics to which they relate. As a result of these changes, OFHEO believes that the final risk-based capital rule provides an even better mechanism for closely aligning regulatory capital to economic risk than the proposed rule.

OFHEO is charged with ensuring the continued viability of the regulated entities so that they can continue to carry out their important public purposes, including promoting affordable housing and a stable and liquid secondary mortgage market. As a financial regulator, OFHEO may have a different perspective on the types of risks that must be capitalized and the appropriate corresponding capital levels than the financial institutions it regulates. Prudent risk managers generally respond to increased risk by either increasing their capital in line with the increase in risk or by taking steps to reduce or hedge risk. Publicly traded companies, such as the Enterprises, will always be under pressure to obtain a competitive return on equity for their shareholders and to maintain a significant level of capital distributions. OFHEO's risk-based capital regulation provides a strong incentive for the Enterprises to resist excessive shareholder pressure for short-term returns and essentially requires the Enterprises to exercise the kind of prudent risk management that will ensure that they have sufficient capital to protect them in times of economic stress and volatility.

2. Effect on Home Ownership Generally

a. Comments

Commenters voiced significant disagreement about whether the risk-based capital rule would increase mortgage rates and the cost of home ownership generally. The Enterprises, Wall Street investment firms, and some trade groups expressed concern that the proposed regulation would require an Enterprise to hold what they termed an ''unreasonable'' amount of capital. These commenters asserted that requiring an ''unreasonable'' amount of additional capital would increase mortgage interest rates and thus decrease the affordability of a mortgage and the availability of funding for home purchases.

Other financial services organizations, including GE Capital, AIG, and CMC argued that higher capital requirements do not necessarily translate into higher mortgage interest rates. They noted that the Enterprises have several options other than passing along the cost of higher capital to lenders and ultimately home buyers. For instance, these commenters stated that the Enterprises could issue additional equity, take on less risk, or implement various risk mitigation activities. These commenters further noted that critics of the risk-based capital proposal focused only on the negatives, while ignoring the benefits of an effective risk-based capital standard, particularly the significant benefit of decreasing the risk of failure of the Enterprises. One commenter stated that OFHEO should err on the side of requiring more capital rather than less, given the Enterprises' size and importance to the U.S. economy.

b. OFHEO's Response

After a review and analysis of the comments, OFHEO concluded that the risk-based capital regulation, as

[54] 12 U.S.C. 4513, 4526, 4611.

[55] S. Rep. No. 102–262 (1992), p. 23.

modified, properly implements Congress' desire for the Enterprises to hold an appropriate level of capital to minimize the risk of failure of the Enterprises, increasing the likelihood that the Enterprises can continue to carry out their important public purposes. The significant credit and interest rate stresses mandated by the 1992 Act are designed to produce a capital requirement that encourages the Enterprises to manage risk appropriately and that results in a capital requirement that adequately reflects risk.

OFHEO does not agree that the rule would necessarily or even likely result in higher mortgage rates that would ultimately be passed along to consumers. First, OFHEO believes that the Enterprises will be able to meet the requirements of the regulation at relatively little or no cost, as discussed in NPR2.[56] Moreover, prices are not tightly tied to costs in any event. Second, because the Enterprises are subject to a stringent capital regulation, the financial markets may perceive that the Enterprises are less risky. Such a market assessment would likely be reflected in the pricing of the Enterprises' debt and equity, especially subordinated debt, which is particularly market sensitive. Third, even if the risk-based capital regulation were to have some minor effect on one Enterprise's cost of lending and that Enterprise attempted alone to pass this cost along through higher guarantee fees, that Enterprise would risk losing market share.

As noted by several commenters, an Enterprise has numerous cost-effective methods to offset any additional risk-based capital requirements and may adjust to the standard in ways that do not necessarily result in increased mortgage rates. OFHEO agrees with this observation and notes that an Enterprise has several options to accomplish this task. For instance, financial markets provide a wide array of sophisticated ways to manage interest rate risk, including callable long-term debt, caps and floors, swaps and swaptions, and interest rate derivative contracts. In addition, an Enterprise could reduce credit and interest rate risk by reducing the rate of growth of its asset portfolio, increasing the credit protection on riskier assets that it guarantees or holds in portfolio, or reducing the rate of growth of its mortgage guarantee business. An Enterprise may also respond to increased capital requirements by increasing capital by reducing share repurchases, adjusting dividends, or issuing new equity shares.

OFHEO therefore concludes that an Enterprise has broad latitude to select the method or methods to manage its risks and comply with the risk-based capital requirement without increasing mortgage rates. These various strategies will have different direct costs, but may well result in fewer credit and interest rate losses over time.

3. Effect on Affordable Housing

a. Comments

A number of commenters voiced significant disagreement about whether the risk-based capital rule would impair the Enterprises' efforts to promote the availability of mortgage funds to support affordable housing for low- and moderate-income Americans. The Enterprises, affordable housing advocacy groups, and some trade associations and financial firms expressed concern that the rule may cause the Enterprises to decrease the availability of funds used to purchase affordable housing. These commenters believed that the rule could impair the Enterprises' ability to serve low-income borrowers and hinder the financing of multifamily and rental properties. One commenter stated that the Enterprises should be awarded capital bonuses for engaging in affordable housing activities.

In contrast, other financial service organizations stated that there is no ''automatic'' conflict between having rigorous capital standards for the Enterprises and increasing the supply of funds for affordable housing. These commenters noted that HUD, not OFHEO, should address affordable housing issues through its affordable housing regulations.

b. OFHEO's Response

OFHEO continues to believe that the risk-based capital standard will not have a noticeable adverse affect on the Enterprises' ability to purchase affordable housing loans, particularly with respect to single family loans. OFHEO notes that the Enterprises obtain similar profitability from their affordable housing loans as their general loan portfolio. As OFHEO noted in NPR2,[57] the capital cost of single family loans meeting HUD's affordable housing goals is not materially different from the cost of other loans for equivalent loan-to-value (LTV) ratios. Although the stress test distinguishes among loans based on LTV ratios, it makes no specific distinctions with respect to loans to different income groups. Moreover, OFHEO has modified the single family model to calibrate defaults to the benchmark loss experience by LTV category, which should alleviate some of the commenters' concerns about the treatment of high LTV loans. *See* III.I.1., Single Family Mortgage Defaults and Prepayments. OFHEO further notes that the Enterprises' affordable housing programs are currently well run, and the Enterprises effectively mitigate increased risks associated with high LTV loans with credit enhancements. In addition, the final rule modifies the treatment of low-income housing tax credits, which some commenters considered to be punitive. *See* III.N., Accounting, Taxes, and Operating Expenses.

OFHEO disagrees with the comment that OFHEO should award capital bonuses to an Enterprise for engaging in affordable housing activities. OFHEO agrees with those commenters who stated that HUD's affordable housing regulations are the appropriate method for ensuring that sufficient attention is given to affordable housing. The purpose of the risk-based capital regulation is to ensure that the Enterprises' capital is properly aligned with risk. Even if the risk-based capital standard required additional capital related to a portion of the Enterprises' affordable housing activities, such a requirement would be consistent with ensuring that the Enterprises hold sufficient capital for the risks they take. Failure to align capital with the credit risk of particular loan programs could result in curtailment or cessation of those programs. Freddie Mac's early experience with multifamily loans is a case in point. Losses on that program caused Freddie Mac to cease multifamily lending altogether in the early 1990s.

*D. Benchmark Loss Experience*

In NPR1, OFHEO proposed the methodology to identify the contiguous areas containing five percent or more of the U.S. population that experience the highest rate of default and severity of mortgage losses for a time period of two or more years as required by the 1992 Act.[58] Losses experienced by loans in the identified time and place are referred to as the ''benchmark loss experience.'' The credit stress of the stress test must be reasonably related to the benchmark loss experience.

The proposed methodology involves four steps. The first step is to identify the benchmark loss experience using historical loan-level data submitted by each Enterprise. The analysis is based on currently available data of conventional, 30-year fixed-rate loans

[56] 64 FR 18114, April 13, 1999.

[57] 64 FR 18116, April 13, 1999.

[58] 12 U.S.C. 4611(a)(1).

secured by first liens on single-unit, owner-occupied, detached properties. The data include only loans that were purchased by an Enterprise within 12 months after loan origination and loans for which the Enterprise has no recourse to the lender. The second step is to organize the data from each Enterprise to create two consistent data sets. During this process, OFHEO separately analyzes default and severity data from each Enterprise. The third step is to calculate for each Enterprise the cumulative 10-year default rates and severity rates for each combination of States and origination years (State/year combination) by grouping all of the Enterprise's loans originated in that combination of States and years. In this step, hundreds of State/year combinations are calculated and analyzed. The fourth step is to calculate the ''loss rate'' by multiplying the average default rate for that State/year combination by the average severity rate. The State/year combination fulfilling the population and time requirements with the highest loss rate constitutes the benchmark loss experience. Using this methodology, OFHEO identified loans originated in 1983–1984 in the four State region of Arkansas, Louisiana, Mississippi, and Oklahoma (ALMO) as the current benchmark loss experience (''ALMO benchmark loss experience'').

In NPR2, OFHEO described how the benchmark loss experience would be used in the stress test and, building on the methodology proposed in NPR1, used the benchmark cohort of loans [59] to conduct simulations to demonstrate the sensitivity and implications of the proposed rule. As explained in NPR2, the equations used in the mortgage performance models are estimated based upon OFHEO's historical database of mortgage information to predict the most likely default and severity rates for any given group of mortgages under any given pattern of interest rates and house prices.[60] NPR2 also proposed methods of reasonably relating the credit stress of the stress test to the benchmark loss experience.

1. Methodology

Most commenters, including the Enterprises, mortgage insurers, and trade groups, generally stated that the proposed methodology was workable, but suggested changes. A number of commenters, who criticized the benchmark loss experience methodology based on NPR1, were significantly less concerned when they evaluated the issue in the context of NPR2. Freddie Mac concurred generally with OFHEO's methodology to identify the benchmark loss experience and specifically with the selection of the ALMO benchmark loss experience. Nevertheless, as discussed below, Freddie Mac stated that the historical data used to identify the benchmark loss experience should be adjusted or else the benchmark loss experience default and loss severity rates' loss rates would be overstated. Fannie Mae stated that while the methodology for identifying the benchmark loss experience has certain difficulties, such difficulties could be addressed by adjusting the default and severity models. GE Capital stated that because the proposed methodology is reasonable, any changes should wait until the next generation of the model.

Commenters had divergent views on whether the credit conditions identified by the methodology were sufficiently stressful. Some commenters claimed that the proposed methodology does not produce a benchmark loss experience that is stressful enough. These commenters asserted that the proposed methodology identified only a two-year origination period rather than a ten-year period for default and severity rates and that by averaging certain factors (e.g., time and Enterprises' default rates), the methodology resulted in an average rather than a worst case scenario. In contrast, other commenters, including the Enterprises, stated that the benchmark loss experience was more severe than any national experience and more severe than could be expected to occur in a diversified national economy.

The final regulation makes no changes in the proposed methodology for identifying the benchmark loss experience. In evaluating the commenters' suggestions for modifications, OFHEO's first priority was to implement the 1992 Act appropriately. Accordingly, OFHEO determined that it was appropriate under the statute to select the loans originated during a two-year period that had the highest ten-year cumulative default and severity rate (rather than selecting the two-year period that experienced the highest losses on all loans) and to average between the Enterprises. Further, because the purpose is to identify a regional benchmark loss experience and apply it to the nation as a whole, OFHEO did not consider the comments about geographic diversification to be relevant.

OFHEO also sought to balance the benefit of the recommended modifications with the associated costs. With respect to costs, adopting the recommended modifications would divert time and resources from modifications to the stress test in response to comments, delaying the issuance and implementation of the regulation. Based on an analysis of the proposed methodology in light of the related comments, OFHEO has concluded that implementing the commenters' recommendations for revising the methodology would at best provide only modest improvements in identifying a benchmark loss experience, and in some cases would provide little or no benefit. Consequently, OFHEO has decided not to modify the methodology at this time. The proposed methodology provides a reasonable method for identifying the region in which the Enterprises' mortgage loans experienced their worst credit losses.

2. Data Issues

The dataset used to identify the benchmark had certain limitations. Fannie Mae is unable to provide complete historical data for purposes of identifying the benchmark loss experience. Specifically, Fannie Mae has no loss severity data for retained loans originated before 1987 or for loans securitized under its swap program before 1991. In addition, a number of loans were misclassified by Fannie Mae. In NPR1, OFHEO concluded that, for the purpose of the benchmark analysis, it would be better to use the available data, than to speculate about the missing data or otherwise make adjustments to account for the missing or misclassified data.

Both Enterprises expressed concern that without making adjustments to account for the missing data, the benchmark loss experience calculation would overstate the actual default and loss severity rates. They were particularly concerned that these rates would be overstated for the ALMO benchmark loss experience in those years. Accordingly, they recommended that OFHEO introduce weighting and other techniques to adjust for the missing data. With respect to the missing swap program data, Freddie Mac recommended that OFHEO compare mortgages purchased under Fannie Mae's swap program with Freddie Mac's own program, and adjust the default rates accordingly. With respect to missing pre-1987 loss severity data, Freddie Mac recommended that OFHEO adjust the available loss severity data by weighting techniques to

[59] Those conventional 30-year fixed-rate loans in the State/year combination (i.e. loans originated in ALMO in 1983–1984) with the highest loss rate.

[60] *See* 64 FR 18118, April 13, 1999, for a more detailed description.

eliminate what it viewed as bias caused by assuming all loans were 30 year fixed-rate loans. The effect of this adjustment would lower loss severity rates in the benchmark loss experience.

After analyzing the comments, OFHEO has confirmed its original determination that it would be inappropriate to modify or otherwise ''adjust'' for the missing Fannie Mae historical data. It does not appear that Fannie Mae will ever be able to provide this data, and any attempt to adjust existing data based on assumptions about non-existing data would be speculative at best. Accordingly, OFHEO declines to introduce any additional weighting techniques or other assumptions to its initial decision to use the historical data as they exist. OFHEO believes that using the data as submitted by the Enterprises is appropriate, particularly given that the Enterprises' recommendations were based on speculative premises about how historical data would perform rather than empirical or other quantitative evidence.

3. Benchmark Region and Time Period

In NPR1 and NPR2, OFHEO stated that it would periodically monitor available data and reevaluate the benchmark loss experience using the methodology set forth in the Regulation Appendix. OFHEO noted that, using this methodology, it may identify a new benchmark loss experience in the future that has a higher loss rate than the one identified at the time of the regulation's issuance. It further noted that if such a benchmark is identified, OFHEO may incorporate the resulting new benchmark loss experience in the stress test.

Freddie Mac requested that the regulation specify not only the methodology to identify a benchmark loss experience, but also a specific benchmark loss experience, such as the ALMO benchmark loss experience for loans originated in 1983–1984. OFHEO has determined that it is more appropriate to include only the methodology in the regulation. The 1992 Act does not require that OFHEO specify a particular benchmark region and time period in the regulation. Moreover, given Congress' desire for the benchmark loss experience to represent a stressful credit environment, it would be inappropriate to reduce OFHEO's flexibility to identify a different benchmark loss experience if new data indicate that a change is appropriate.

4. Compactness

Freddie Mac suggested adding an additional criterion to the statutory criteria for identifying the benchmark loss experience. Specifically, Freddie Mac recommended that the regulation include what it termed a ''compactness'' requirement so that, in addition to the statutory requirement that the benchmark region comprise ''contiguous'' areas, the benchmark region would have to be a region in which a person could travel from any one State to any other State in the region, without traveling through more than one other State within the region.

OFHEO has determined that modifying the definition of the benchmark loss experience to include an additional compactness requirement is inappropriate and would be unworkable. As discussed in NPR1, OFHEO rejected options that would not provide for a reasonably compact benchmark region. For that reason, the proposed regulation specified States as the smallest geographic unit rather than using smaller geographic units such as zip codes and rejected a definition of ''contiguous'' that would include meeting at a point. It is possible that using smaller units could result in the equivalent of a gerrymandered benchmark loss experience in which it would contain only units with relatively more severe loss experience while excluding regions in the same State with a more benign loss experience. Freddie Mac's recommendation would impose an additional requirement that goes beyond what Congress specified and could preclude identification of an appropriately stressful credit environment. Moreover, the modification recommended by Freddie Mac might be difficult to determine and even unworkable, since there could still be numerous non-compact regions that would comply with Freddie Mac's recommended definition of compactness.

5. Population Requirement

Fannie Mae expressed concern that the ALMO benchmark loss experience may contravene the requirement that the benchmark loss experience contain at least five percent of the United States population, since it believed that the ALMO benchmark loss experience includes States that contribute significant parts of the population but may have few mortgage loans. That Enterprise was also concerned that the ALMO benchmark loss experience may not meet the five percent requirement over the entire stress period.

OFHEO has determined that neither concern is valid. First, the 1992 Act requires that the benchmark loss experience include ''contiguous areas of the United States'' containing at least five percent of the U.S. population. The statutory provision does not address the distribution of loans within that area or specify the designation of a ''State'' as a factor. Accordingly, it is the population of the identified area, not of a State or States within it, that is relevant in determining the benchmark loss experience. Second, the 1992 Act only addresses the population and not the number of mortgage loans. Congress could have specified loan volume as a criterion, but did not, and OFHEO declines to read such a specification into the statute. Third, the 1992 Act does not require that the population requirement be met during the entire stress period for the purpose of determining the benchmark loss experience. The statute only requires the stress conditions to persist for ''two or more years.'' The ALMO benchmark loss experience complies with the statute because it had over five percent of the United States' population in the two year period of 1983 and 1984. OFHEO further notes that a region experiencing significant credit stresses may very well experience a decrease in population. Including the additional limitations suggested by Fannie Mae would reduce the severity of the benchmark loss experience and the stress test as a whole, a result that was not intended by Congress. Based on these considerations, OFHEO concludes that each of Fannie Mae's arguments is without merit.

6. Improvements in the Underwriting

GE Capital, in its reply comments, expressed concern that OFHEO would be persuaded by the Enterprises' arguments that the benchmark loss experience should be adjusted to reflect improvements in their underwriting practices, subsequent to the benchmark period. GE noted that although the Enterprises have improved their underwriting techniques since 1986, these improvements may not serve to reduce the frequency of default rates, given regional recessions such as in California and New England that occurred after 1986.

OFHEO believes that it would be inconsistent with the 1992 Act and inappropriate to adjust the benchmark loss experience based on the view that the Enterprises have improved their underwriting. First, improved underwriting is not relevant to identifying the benchmark loss experience, i.e., the worst time and place for credit stress. Rather, Congress intended the benchmark loss experience to define a severe level of credit stress that the Enterprises should be able to survive during a ten year period. To

''adjust'' for improved underwriting would be inconsistent with the statute, since it suggests that the Enterprises could never experience such a level of credit stress again. In addition, periodic modifications based on changes in underwriting would be difficult to implement.

*E. Enterprise Data*

In NPR2, OFHEO explained that the stress test would utilize data characterizing an Enterprise's assets, liabilities, stockholders equity, and off-balance sheet items at a point in time (''starting position data''). Under the proposal, OFHEO anticipated that each Enterprise would submit all data for mortgages, securities, and derivative contracts at the instrument level. The proposed stress test aggregated individual loans into groups with common risk and cash flow characteristics, known as ''loan groups.''[61] Data for these loans groups, instead of individual loans, were used as inputs by the mortgage performance and cash flow components of the stress test. In addition to the loan groups for existing loans, the stress test created loan group data for mortgages expected to be added to the Enterprises' books of business as a result of commitments outstanding as of the reporting date, using a process that is discussed in the ''Commitments'' section of this preamble III. F., Commitments. With respect to nonmortgage financial instruments (investments, debt, and derivative contracts), NPR2 proposed to project their cash flows at the individual instrument level rather than at an aggregated level, because they are fewer and more diverse.

1. Comments

Only Freddie Mac and Fannie Mae commented on OFHEO's proposed treatment of Enterprise data for the stress test. Both Enterprises emphasized the complexity of the proposed data submission process. Freddie Mac stated that in its submission for the second quarter of 1997, it provided more than 600 million data elements to OFHEO, which OFHEO then ''translated'' into data sets. It stated that this process results in ''a substantial number of translation errors'' which could impair the accuracy and reliability of the stress test. Similarly, Fannie Mae attributed most of the difficulty in operationalizing the stress test to the use and handling of instrument-level data, since the regulation requires the exchange, management and application of data on hundreds of thousands of different instruments and contracts.

Because of these problems, both Enterprises recommended that they, rather than OFHEO, be responsible for compiling and, where appropriate, aggregating the data into a standardized report, which would then be submitted to OFHEO. Freddie Mac stated that OFHEO should eliminate the need to perform data file translations by requiring the Enterprises to report their data files in a standardized format that OFHEO specifies in a ''call-report-like'' approach. Similarly, Fannie Mae recommended that each Enterprise submit a RBC Report with standardized elements.[62] Both Enterprises stated that such an approach is similar to the one taken by other Federal financial regulators with their reporting and capital requirements.

2. OFHEO's Response

Consistent with the comments, OFHEO has decided to have the Enterprises compile, and, where appropriate, aggregate their data and submit it to OFHEO in a standardized format specified by OFHEO. To implement this approach, OFHEO has specified a RBC Report with instructions for aggregating and reporting data in a standardized format. OFHEO agrees with the commenters that the data submission process must result in the submission of complete and accurate inputs to allow for the reliable and timely generation of a risk-based capital number. OFHEO believes that the approach in the final rule will fulfill this goal, because it serves to increase the efficiency and transparency of the process and the timeliness of the capital classification. OFHEO further believes that the data submission process will continue to be reliable, because each Enterprise will be required to certify that its submission is complete and accurate. In addition, the compilation of such data by the Enterprises will be subject to examination by OFHEO. This approach will permit capital classifications to be more timely because the standardized data can be input directly into the stress test without the need for data translation by OFHEO.

The stress test makes provision for items reported by the Enterprises that do not fall into the categories specified in the RBC Report or items for which the data is incomplete. If the item is a new activity, it will be treated as specified in section 3.11, Treatment of New Enterprise Activities, of the Regulation Appendix. Otherwise, where there is no appropriate specified treatment in the Regulation Appendix, or where data required to model the item are missing and there is no computational equivalent for such data and no available proxy acceptable to OFHEO, the item will be given one of the conservative treatments specified in section 3.9, Alternative Modeling Treatments, of the Regulation Appendix, depending on whether the item is an asset, a liability, or an off-balance sheet item. The treatments vary in the up-rate and down-rate scenarios and prescribe values for missing terms needed to determine cash flows. It is necessary to make provision for such items in order to permit the stress test to operate with incomplete data and to take into account highly unusual items that cannot be accommodated by specific stress test treatments. OFHEO expects that there will be few of these items in any given quarter.

*F. Commitments*

1. Background

The 1992 Act specifies that during the stress period the Enterprises will purchase no additional mortgages nor issue any MBS, except that—

> [a]ny contractual commitments of the enterprise to purchase mortgages or issue securities will be fulfilled. The characteristics of resulting mortgage purchases, securities issued, and other financing will be consistent with the contractual terms of such commitments, recent experience, and the economic characteristics of the stress period.[63]

The term ''contractual commitments'' generally refers to binding agreements that the Enterprises enter into with

[61] For example, a loan group might include all 30-year fixed-rate mortgages for single family homes in the same geographic region, originated in the same year, with similar interest rates and LTVs, and held in an Enterprise's portfolio. Such a process would allow over 24 million loans to be aggregated into a smaller number of loan groups that capture the important risk characteristics. Even with aggregation, there would be thousands of loan groups.

[62] These recommendations were accompanied by recommendations that the Enterprises be allowed to use models they would develop to OFHEO specifications to compute their risk-based capital requirement and report it to OFHEO along with the RBC Report. This recommendation is discussed in III. B., Operational Workability of the Regulation.

[63] 12 U.S.C. 4611(a)(3)(A). The 1992 Act does provide for later amendment of the rule to address new business during the stress period, but not until after the risk-based capital regulation is final. The 1992 Act requires that, within one year after this regulation is issued, the Director of the Congressional Budget Office and the Comptroller General of the United States shall each submit to the Congress a study of the advisability and appropriate form of any new business assumptions to be incorporated in the stress test. 12 U.S.C. 4611(a)(3)(C). 12 U.S.C. 4611(a)(3)(B) authorizes the Director to consider these studies and make certain new business assumptions. However, that subparagraph does not become effective until four years after the risk-based capital regulation has been issued.

seller/servicers to purchase mortgages or to swap mortgages for MBS. The term also refers to agreements to sell such securities to investors.

In NPR2, OFHEO proposed to model commitments outstanding on the beginning date of the stress test by adding new loans to the books of business of the Enterprises during the first year of the stress test, using specified decision rules that govern the volume and characteristics of these new loans. To avoid the complexity of modeling the mix of securitized mortgages versus those purchased for portfolio (which is largely determined by seller/servicers, based on a number of market factors) NPR2 specified that all loans delivered under commitments would be securitized. Second, NPR2 specified that, in the down-rate scenario, 100 percent of all loans that the Enterprises are obligated to accept would be delivered and, in the up-rate scenario, 75 percent of those loans would be delivered. Third, the proposal specified that, in the up-rate scenario, loans would be delivered over the first six months of the stress test and, in the down-rate scenario, over the first three months, at the rates specified in Table 3.

TABLE 3.—MORTGAGE DELIVERIES BY MONTH OF THE STRESS TEST AS A PERCENTAGE OF TOTAL COMMITMENTS

| Months | Up-Rate Scenario | Down-Rate Scenario |
|---|---|---|
| 1 | 18.75% | 62.50% |
| 2 | 18.75% | 25.00% |
| 3 | 12.5% | 12.50% |
| 4 | 12.5% | 0.00% |
| 5 | 6.25% | 0.00% |
| 6 | 6.25% | 0.00% |
| Total | 75% | 100% |

Finally, OFHEO proposed that the mix of characteristics (type, term, LTV ratio, coupon, geographic location, and credit enhancements) of commitment loans would be based upon the characteristics in loans that were delivered for securitization within the immediately preceding six-month period.

2. Comments and Responses

a. General Comments

Only the two Enterprises commented upon the proposed treatment of commitments. Both Enterprises agreed with OFHEO's decision that all loans delivered under commitments would be securitized. On the other hand, both Enterprises expressed concern that the capital impact of commitments was too great and that the stress test may overstate the risks posed by outstanding commitments. They cautioned that such an overstatement could reduce the use of certain types of commitments.

Freddie Mac stated that OFHEO's approach was probably more complex than is warranted, but, nevertheless, would be operationally workable. However, Freddie Mac also stated that if its recommended changes in the modeling approach to commitments and adjustments to the benchmark loss experience are not made, the Enterprises will have strong economic incentives to reduce the use of longer term commitments and further that ''it is doubtful that commitments could support [NPR2] capital levels.'' Fannie Mae made similar comments, suggesting that ''the proposed regulation's failure to recognize behavioral differences among commitment types may unnecessarily restrict the widespread use of optional commitments.''

In response, OFHEO notes that its decisions about how to model commitments are not intended to promote or discourage the use of one type of commitment over another, or to encourage the use of commitments in general. To the extent that long-term commitments may have a greater capital impact than short-term commitments, that is due to the relative level of risk of each type of commitment. Further, if empirical analysis regarding commitments indicates that the stress test should be modified, OFHEO will consider doing so. However, in the absence of historical data from which to construct a statistical model of commitments, the final regulation includes a few straightforward and conservative decision rules, which reflect the conditions of the stress period and the operation of commitment agreements. These rules make the commitments model easily replicable and the impact of commitments on capital predictable.

b. Remittance Cycle

Freddie Mac pointed out that NPR2 proposes to set the remittance cycle for commitment loans to the shortest period used at each Enterprise, even though some loans delivered and securitized just prior to the start of the stress period might have different remittance cycles. The final rule responds to this comment by modeling the float period (the time between receipt of funds by the Enterprise and remittance to security holders), which is the relevant portion of the remittance cycle for securitized loans.[64] The float period is set using the average float days weighted by UPB for each commitment loan group category in the same proportions experienced by each Enterprise in securitized single family loans that were originated and delivered within six months prior to the start of the stress test.

c. Credit Enhancements

Freddie Mac pointed out that, although commitment loan groups used in the model carried credit enhancements based upon each Enterprise's history for the prior six months, the NPR did not specifically reference credit enhancements among the characteristics of the loan groups. The final rule clarifies that mortgage insurance credit enhancements will be assigned to the commitment loans in the same proportions experienced by each Enterprise in securitized single family loans that were originated and delivered within six months prior to the start of the stress test. OFHEO notes that credit enhancements other than mortgage insurance are not applied to commitment loan groups in the final rule. Given the change to contract-level detail in the modeling of credit enhancements in the final rule, assignment of other types of credit enhancements would have required OFHEO to include speculative assumptions about the terms of future credit enhancement contracts. Including these other enhancements would also have added excessive complexity to the model, given the relatively small number of loans that would be affected.

d. Alternative Delivery Assumptions

(i) Comments

Fannie Mae recommended alternative modeling assumptions that, it asserted, better distinguished between the different types of commitments than those treatments proposed by OFHEO.[65] Fannie Mae suggested that OFHEO erred by treating all outstanding commitments as the same type of contractual arrangement. Specifically, Fannie Mae stated that the specified percentages of loans delivered under commitments (fill rates) ignore the large number of optional commitments and suggested that fill rates of 50 percent in the up-rate and 75 percent in the down-rate would

[64] *See* sections 3.2.2.1, Loan Data and 3.6.3.7.2, Stress Test Whole Loan Cash Flow Inputs, of the Regulation Appendix which require float days as an input.

[65] Fannie Mae's NPR2 comment letter also included an ''Issue Brief'' authored by Ernst & Young LLP, which provided further detail supporting Fannie Mae's recommendations.

be most appropriate. Fannie Mae also asserted that the three- and six-month delivery windows were unrealistically short and that deliveries in both scenarios were too front-loaded, suggesting instead periods of six and twelve months with deliveries spaced evenly across those periods. Fannie Mae further suggested that OFHEO refine the definition of ''commitment'' to reflect different levels of commitment in different agreements, although it did not explain precisely how this refinement should be reflected in the stress test.

(ii) OFHEO Response

OFHEO has studied the alternatives recommended by Fannie Mae and has concluded that they are no more precise or reasonable than those in the proposed regulation. First, contrary to Fannie Mae's assertion, OFHEO did not assume that all commitments were of the same type. Specifying less than 100 percent deliveries in the up-rate scenario is a recognition that some commitments are optional and that sellers under those commitments are not required to deliver all the loans specified in the agreement. Second, OFHEO determined that the front-loaded delivery schedule is appropriate because deliveries under individual commitment contracts tend to be concentrated in the early months of the contract. This decision rule also recognizes that at any point in time outstanding commitments are of differing ages. Some will only have a few days left during which a seller can deliver loans and some will have just recently been executed. Accordingly, outstanding commitments would begin to expire rapidly over the first few months of the stress test. Thus, even if deliveries were made evenly over the course of each individual commitment, the total deliveries would drop off quickly within the first few months of the stress test. Also, mortgage lenders do not enter into mandatory commitments for loans they are not reasonably certain they have in the pipeline and these loans are generally delivered within a few months. Loans under optional commitments also tend to be delivered early, because the commitments become outdated rapidly as the market changes and sellers negotiate new agreements.

OFHEO recognizes that the assumptions suggested by Fannie Mae in regard to both fill rates and delivery schedule are not necessarily wrong or unreasonable. However, in the absence of any data demonstrating the historical or current mix of outstanding commitment types, differences in deliveries under different commitment types, mix of loan types delivered under commitments, or the period of time over which deliveries under commitments actually occur, OFHEO will use the more conservative approach specified in the rule.

e. Mix of Loan Characteristics

Fannie Mae also recommended that OFHEO specify the mix of characteristics for loans delivered under commitments based on the mix of loans in an Enterprise's portfolio, rather than on the mix of recent deliveries. Fannie Mae expressed concern that basing the mix upon recent deliveries might weight one-time purchases of a particular loan type too heavily.

As discussed in detail in NPR2 in response to a similar comment from Freddie Mac on the ANPR,[66] OFHEO has seen no evidence that the mix in the current loan portfolio is a good proxy for the mix of loans delivered under commitments. Neither has OFHEO seen evidence of a one-time purchase so large that it would skew significantly or inappropriately the mix of loans delivered over six months. Also, this decision rule reflects recent changes in an Enterprise's business decisions and, in this sense, is more sensitive to risk than basing the mix on the total loan portfolio. Finally, the mix of loan characteristics has a limited impact on the capital requirement, because the Enterprises bear no interest rate risk on loans delivered under commitments, which are all securitized. For these reasons, OFHEO continues to view the recent deliveries as the best available indicator of the mix of characteristics of loans to be delivered in the stress test. Accordingly, this aspect of the commitments specification has not changed in the final rule.

f. Pair-off Fees

Fannie Mae also criticized the proposed stress test because it did not account for pair-off fees that would be paid on undelivered loans under mandatory commitments in the up-rate scenario. OFHEO has no data from the Enterprises indicating when, how often, or in what amounts pair-off fees are charged and no data indicating what percentage of commitment agreements provide for the payment of pair-off fees. Given the lack of these data, or even data indicating actual percentages of loans delivered under commitments, OFHEO had no basis upon which to include a credit for pair-off fees in the stress test and has not modified the proposed rule to do so.

[66] 64 FR 18165–18166, April 13, 1999.

g. Data

Although the final regulation's commitments specifications are little changed from those proposed, OFHEO views commitments as an area that is worthy of additional study and, therefore, is considering requiring the Enterprises to collect data about commitments that would allow empirical analysis in this area. For example, if the Enterprises had tracked delivery percentages and timing under commitments, a far more precise model, such as is suggested in Fannie Mae's comments, could be constructed. If these data had been tracked by commitment type and length of term, an even more sophisticated model would be possible. Such data and the analysis they would facilitate might provide OFHEO the basis upon which to modify the specifications in the existing commitments model or to develop a more finely-tuned model.

*G. Interest Rates*

Interest rates are a key component of the adverse economic conditions of the stress test. The ten-year constant maturity Treasury yield (CMT), as specified by the 1992 Act, provides the basis for the severe interest rate stress in the stress test. The stress test also incorporates a number of other interest rates, the levels of which will determine the volumes of mortgage prepayments and defaults; the cost of new debt issues and earnings on new investments; and rates paid or earned on assets, liabilities, and derivative contracts.

The 1992 Act specifies the path of the CMT for ten-year securities (ten-year CMT) for two interest-rate scenarios during the stress period.[67] However, for the determination of all CMT maturities other than the ten-year CMT, the 1992 Act states only that they will change relative to the ten-year CMT in patterns and for durations that are reasonably related to historical experience and are judged reasonable by the Director.[68] For non-CMT interest rates, the 1992 Act simply states that characteristics of the stress period that are not specified will be determined by the Director, on the basis of available information, to be most consistent with the stress period.[69] Therefore, the final rule specifies the CMT yield curves and the spread relationships between CMT series and other interest rates that will determine the levels of all interest rates in the stress test.

[67] 12 U.S.C. 4611(a)(2).

[68] 12 U.S.C. 4611(a)(2)(D).

[69] 12 U.S.C. 4611(b)(2).

1. Proposed Rule

In NPR2, OFHEO proposed that the required changes to the ten-year CMT would occur in twelve equal monthly increments from the starting point for the ten-year CMT, which is the average of the daily ten-year CMT for the month preceding the stress period. As specified in the 1992 Act, the ten-year CMT would then remain at the new level for the last nine years of the stress period.

The proposed rule also established the Treasury yield curve for the stress period in relation to the movements in the ten-year CMT. In the down-rate scenario, the rule specified an upward sloping yield curve during the last nine years of the stress period. In the up-rate scenario, the rule specified a flat yield curve for the last nine years of the stress period, i.e., yields of other CMT maturities are equal to that of the ten-year CMT.

The stress test must project the levels for a number of non-CMT rates that affect the Enterprises' business performance. Some of these key rates are the Federal Funds rate, London Inter-Bank Offered Rate (LIBOR), Federal Home Loan Bank 11th District Cost of Funds Index (COFI), and Enterprise Cost of Funds rates. The proposed rule established these rates using Autoregressive Integrated Moving Average (ARIMA) procedures, a statistical estimation technique for projecting time series. The estimation is based upon each series' historical spread to the CMT with a comparable maturity. In addition, NPR2 specified that in projecting the Enterprise Cost of Funds rates, the stress test would add a 50-basis-point premium after month 12, representing the additional cost of borrowing that might be anticipated if an Enterprise were undergoing financial stress.

2. Comments and Responses

OFHEO received many comments on the NPR2 interest rate specifications from the Enterprises, mortgage industry trade groups, investment banking firms, and a major bank. Some comments criticized the Treasury yield curve specifications, suggesting that other curves would be more consistent with historical averages. Most commenters said the specifications for non-CMTs were unnecessarily complex. Both Enterprises objected to the use of the DRI Agency Cost of Funds rates, suggesting that the quality control for that index was inadequate. These comments are discussed in detail below.

a. Specification of the Flat Yield Curve in the Up-Rate Scenario

(i) Comments

The Enterprises and an investment bank criticized OFHEO's proposal to transition to a flat yield curve in the last nine years of the stress test in the up-rate scenario. These commenters agreed that the yield curve historically tends to flatten or invert immediately after upward interest rate shocks, but they asserted that the yield curve resumes a more normal upward sloping shape during extended periods of stable rates. Both Enterprises questioned OFHEO's analysis of historical yield curve data and submitted studies supporting their conclusions. More specifically, Fannie Mae stated that OFHEO misdirected the analysis by assuming that yields would remain constant during the last nine years of the stress test and that OFHEO based its analysis on regression equations that were misspecified. The Enterprises also argued that the flat yield curve would slow prepayments inappropriately by eliminating any refinancing incentive. Freddie Mac suggested that the flat yield curve distorts the cost of new debt in the stress test by creating inappropriately high refunding costs. Fannie Mae argued that by potentially increasing short-term Treasury yields by more than the increase in the ten-year CMT, the flat yield curve specification imposes more stress than Congress intended in the 1992 Act. No commenter objected to use of the yield curves specified in the down-rate scenario, although Freddie Mac stated that the curve was steeper in the last nine years of the stress period than suggested by historical experience.

(ii) OFHEO's Response

The 1992 Act includes two requirements concerning stress period CMTs other than the ten-year CMT.[70] First, the other CMTs must move in patterns and for durations relative to the ten-year CMT that the Director determines are reasonably related to historical experience. Second, these movements must be judged reasonable by the Director. The second requirement is more general, providing that the resulting yield curves should be reasonable within the context of the stress test and the overall purposes of the 1992 Act.

After reviewing the comments, OFHEO has determined that it should not alter the yield curves specified in NPR2. As mentioned above, the commenters agreed that yield curves tend to flatten when interest rates increase sharply and tend to steepen when rates decline sharply. The regulation reflects this general historical tendency in both interest rate scenarios during the first year of the stress period. Because the magnitude and speed of the stress test changes in the ten-year CMT exceed historical experience, it is reasonable to project that yield curve changes would be unusually large. OFHEO was also guided by the requirement that the ten-year CMT remain constant during the last nine years of the stress period. Such constancy is far different from any historical period. OFHEO has determined that a constant yield curve during the last nine years is the most reasonable and consistent approach, and, as discussed in the preamble to NPR2, best ties capital to risk.

To select the constant yield curves, OFHEO examined historical average yield curves and observed that the curves were consistently flatter the more ten-year CMT yields increased and consistently steeper the more ten-year CMT yields decreased. Given the large size of the yield changes in the stress test, OFHEO selected yield curves that approximated the bounds of historical experience. OFHEO further supported that choice with simple regression equations that illustrated the pattern observed.[71]

Fannie Mae argued that the specified yield curves in both scenarios are the most stressful ever observed. However, OFHEO's analysis of the shapes of historical yield curves indicated that more severely sloped yield curves have occurred than those that OFHEO chose for the stress test. In periods where interest rates have declined sharply, yield curves with slopes steeper than 0.77 were observed. In periods where interest rates rose rapidly, yield curves have frequently inverted. Although these yield curves have not persisted for periods of many years, severe interest rate shocks have also not persisted.

It is important to note that, in addition to historical analysis, the selection of the actual yield curves in the stress test also took into account the role of interest rates in the stress test. In

[70] "Yields of Treasury instruments with other terms to maturity will change relative to the 10-year constant maturity Treasury yield in patterns and for durations that are reasonably related to historical experience and are judged reasonable by the Director." 12 U.S.C. 4611(a)(2)(D).

[71] The constant terms in the regression equations were misreported in the preamble to NPR2 as 0.86. The correct estimates were 0.67 for the full sample and 0.66 for the estimation based on quartile averages. However, the projections of yield curves under stress test conditions were based on the correct coefficients. Further, OFHEO determined upon review that the regression equations were appropriately specified as described in footnote 148 in NPR2. 65 FR 18148, April 13, 1999.

this regard, consistent with the requirement in the 1992 Act that the Director judge interest rates to be reasonable,[72] it is appropriate and reasonable within the context of a stress test to specify yield curves that remain more stressful than the average yield curve. Accordingly, OFHEO has selected curves that have been observed frequently in the past, but, as applied in the regulation, are unusually stressful for an extended period.

The Enterprises argued, in effect, that the flat yield curve adds additional risk to their portfolios in the up-rate scenario of the stress test by raising the cost of short term debt by a greater amount and percent than the increase in the ten-year CMT. They seek an approach that recognizes a discount for short-term debt, which would lower the capital requirement in the up-rate scenario. OFHEO disagrees. The 1992 Act does not suggest that other interest rates should not move more than the ten-year CMT.

For all the above reasons, OFHEO has determined that the most reasonable means of relating the yield curve to historical experience recognizes the general direction of yield curve changes during changing interest rate environments without attempting to fine tune that historical analysis throughout the ten years of the stress period. Accordingly, OFHEO has further determined that, given the design of the stress test, a yield curve that transitions during the first year to a flat curve for the last nine years of the up-rate scenario and to an upward sloping yield curve for the last nine years of the down-rate scenario best meets the dual requirements of the 1992 Act.

b. Specification of Non-Treasury Rates

(i) Use of ARIMA Methodology

Numerous commenters criticized the proposed use of ARIMA models to project non-Treasury rates during the stress period. For a variety of reasons, the commenters all concluded that ARIMA models were too complex and inaccurate to be relied upon to project non-Treasury rates in a stress test. The models were argued to result in volatile and unpredictable projections that would be difficult for parties other than OFHEO to replicate. Freddie Mac recommended that OFHEO project non-Treasury yields based on the average spread over the appropriate CMT for the period two years prior to the beginning of the stress test. No commenter favored the proposed ARIMA approach to projecting non-Treasury interest rates.

OFHEO agrees that a different method of modeling non-Treasury rates is appropriate. The final rule, therefore, discontinues use of the ARIMA models. Instead, OFHEO will use the average spread between each non-Treasury rate and its comparable maturity CMT for the two-year period just prior to the beginning of the stress test. This approach presents several advantages over use of ARIMA models. First, it is easily implemented, and replicable by parties other than OFHEO. Second, it is far less likely to impose large, erratic and unpredictable swings in interest rate spreads. Finally, it is consistent with the use of a fixed specification of the Treasury yield curve, rather than a varying curve based on a statistical model.

(ii) Proportional and Absolute Spreads

Several commenters suggested that OFHEO consider whether it was more appropriate to project certain non-Treasury rates based upon the historical spreads in basis points between those rates and the corresponding maturity CMT than to project the rates based on their historical proportional relationships.

For nonmortgage interest rates, OFHEO found that proportional spreads correlated better historically than absolute spreads. However, for mortgage rates in the stress test, which are calculated from two-year averages of the Bloomberg indexes for conventional 30-year fixed rate loans and conventional 15-year fixed rate loans, OFHEO found that absolute spreads provided a better correlation.

For these reasons, the final rule continues to use proportional spreads to determine all interest rate series in the stress test, except mortgage rates. In modeling mortgage rates, the final rule bases the calculations upon absolute spreads.

c. Data Sources

Both Enterprises commented that DRI McGraw-Hill's (DRI) Federal Agency Cost of Funds, which is the series used in the proposed regulation to calculate the Enterprise Cost of Funds during the stress period, was inappropriate for that purpose. OFHEO also notes that the DRI series has been discontinued since the publication of NPR2.

Because the DRI series was discontinued, OFHEO has specified a different index for calculating the Enterprises' Cost of Funds. The only commercially available index suitable for this purpose is the Bloomberg Generic Agency Cost of Funds. As an alternative, OFHEO considered developing its own index of the Enterprises' Cost of Funds. OFHEO has determined that developing its own index is the preferable option, because OFHEO has no control over the content, methodology, quality and availability of the Bloomberg index. However, development of such an index will take considerable time and OFHEO will, therefore, utilize the Bloomberg index in place of the DRI index until OFHEO develops a more appropriate index.

3. Yields on Enterprise Debt

a. Comments

A number of commenters, including both Enterprises, objected to the proposed method for calculating the interest rates at which the Enterprises issue new debt after the first year of the stress period. The Enterprises' borrowing rate in NPR2 included the addition of a 50-basis-point premium to the projected Agency Cost of Funds after the twelfth month of the stress period. Some commenters suggested there should be no premium at all on Enterprise debt costs. These commenters suggested that the debt markets would react differently to an undercapitalized Enterprise than to other undercapitalized businesses for varying reasons, including the Enterprises' special Federal status and the confidence that investors in the debt market would have in the regulatory oversight of the Enterprises. Both Enterprises argued that the premium should be applied to all non-Treasury interest rate series rather than only to the Enterprises' debt costs. The Enterprises each submitted studies from consultants that offered a number of reasons to support eliminating the debt premium. Implicit in the Enterprises' comments was an assumption that the economic conditions of the stress period would affect other borrowers as much or more than the Enterprises. One Enterprise suggested that the debt markets would not require a premium, because investors would recognize that the 30-percent multiplier for operations and management risk would never be exhausted. To support these arguments, commenters submitted historical analyses to show that when the spreads between Enterprise debt rates and Treasury yields have widened, other non-Treasury debt spreads have widened as much or more, even at a time when Fannie Mae had negative net worth.

Commenters also pointed out that applying a fixed-debt premium at a fixed point in the stress test does not take into consideration the condition of the Enterprise at the start of the stress test. They suggested that one year into

[72] 12 U.S.C. 4611(a)(2)(D).

the stress test an Enterprise may appear financially strong to investors and that a debt premium would not be demanded by the market. The debt premium was also criticized for failing to distinguish between premiums on long- and short-term debt. Commenters argued that the markets always demand a larger premium on long-term debt.

b. OFHEO's Response

OFHEO does not agree with the assumption of commenters that investors will be so confident that the Federal government would support Enterprise debt that the debt market will ignore the financial condition of the company. To incorporate such an assumption into the stress test would amount to the modeling of an implied federal guarantee of Enterprise debt. The ''implied'' guarantee is, at most, a market perception and not a legal obligation of the Federal government. There can be no assurance that Congress would act to prevent loss to investors, and market perceptions, therefore, may change. Further, it would be particularly inappropriate to include such an assumption in a stress test designed to ensure that the government is never called upon to deal with a default by an Enterprise. To do so would weaken the regulatory structure on the grounds that the public perceives the structure to be strong-an imprudent course for any regulator.

Similarly, OFHEO disagrees with the argument that the stress test should assume that the market would not demand a premium because the Enterprises have a financial regulator and are subject to stringent risk-based and minimum capital standards. Although OFHEO anticipates that its existence and the capital regulations it issues will create public confidence that the Enterprises will continue to be adequately capitalized and operated safely and soundly, OFHEO will not presume that the mere existence of this regulatory structure would prevent a deterioration in the market for an Enterprise's debt when the Enterprise is undercapitalized. Among other things, the increased regulation of the Enterprises has also imposed clearer capital requirements and greater disclosure regarding their operations—a trend that OFHEO expects to continue. It is, therefore, possible that investors will be more sensitive to capital inadequacies at the Enterprises than they were in the past.

OFHEO was not convinced by arguments that the market would not demand a premium because investors would rely on the implied Federal guarantee or the regulatory structure, and was not persuaded by commenter's arguments, based on sparse historical data, that other spreads would widen by as much or more than those of government sponsored enterprises. Nevertheless, relevant historical data to support a new debt premium are also sparse. There has been only one, relatively brief, period of time in the early 1980s when one of the Enterprises experienced financial stress approaching the magnitude specified in the stress test. The only other similar event involved the Farm Credit system in the mid-1980s. In addition, it is conceivable, as some comments noted, that events that cause a widening of the spread between the Enterprises' debt rates and Treasuries might also cause other spreads to widen. These spreads have an important effect on the value of hedging instruments and some Enterprise asset returns.

In light of these considerations, OFHEO has determined that there is too little historical experience on which to determine definitively whether other spreads to Treasuries would widen as much as the Enterprises' spreads or to base an estimate of how much the Enterprises' spreads would widen. Consequently, OFHEO has decided not to include a premium on new debt in the final rule. The final regulation does, however apply a 50-basis-point call premium to new five-year callable debt. The cost of new debt is a likely area for future research and for refinement of the rule, because assumptions about these various other spreads may comprise an area of significant risk to the Enterprises.

*H. Property Valuation*

In order to update origination LTVs to the start of the stress test and to account for changes during the stress period, OFHEO proposed property valuation methodologies for single family and multifamily loans. Because these methodologies were different for single family and multifamily loans, comments and responses related to property valuation are discussed separately for single family and multifamily loans.

1. Single Family

In NPR1, OFHEO proposed to use its House Price Index (HPI) to calculate property values for the purpose of determining current LTVs for Enterprise loans as of the starting date of the stress test. For this purpose, OFHEO proposed to use the HPI of the Census Division in which the loan originated along with the related volatility parameters. In NPR2, OFHEO proposed to determine house price growth rates during the stress test using its HPI values from 1984 to 1993 for the West South Central Census Division, the division in which most of the ALMO benchmark states are located,[73] along with the volatility parameters for the Census Division in which the loan was originated.

The HPI utilizes a repeat transactions estimation process based on a stochastic model of individual housing values. The indexes estimated using this process represent a geometric mean. Along with the HPI, OFHEO publishes the factors needed to adjust the indexes from geometric to arithmethic means (the Goetzman correction), an adjustment needed for some applications of the HPI.[74] However, OFHEO proposed to use the HPI without the Goetzman correction in the stress test.

The 1992 Act requires that if interest rates rise by more than 50 percent of the average ten-year CMT for the nine months prior to the start of the stress test, losses must be adjusted to account for general inflation. The stress test proposed by NPR2 implemented this requirement by increasing house prices by the amount the ten-year CMT, after the upward shock in interest rates, exceeds the average ten-year CMT for the nine months prior to the start of the stress period. This amount is compounded over the remainder of the stress period for a cumulative inflation adjustment. The adjustment is applied over the last 60 months of the stress period.[75]

The comments related to the use of the HPI in the stress test and comments on the inflation adjustment are discussed below.

a. HPI Issues

Comments related to the use of the HPI in the stress test focused on four issues—(1) The use of a geometric index instead of an arithmetic index; (2) the restriction of the database to loans financing single family detached properties, where the loans were eventually purchased or guaranteed by the Enterprises; (3) the HPI volatility parameters used during the stress period; and (4) the procyclical effect of the methodology on the capital requirement.

(i) Geometric Mean

The Enterprises objected to OFHEO's decision not to use the HPI without the Goetzman correction for stress test

[73] The West South Central Division includes all of the ALMO states except Mississippi.

[74] A geometric mean of a group of n numbers is the nth root of their product, whereas the arithmetic mean, which Freddie Mac uses in its house price index, is the simple average of the numbers.

[75] *See* section 3.4, Property Valuation of NPR2, 64 FR 18236, April 13, 1999.

purposes. However, NAHB noted that, for the purpose of meeting the requirements of the 1992 Act, OFHEO's index is superior to other house price indexes, including the Conforming House Price Index published by the Enterprises, which uses an arithmetic mean.

OFHEO continues to believe that a geometric index is more appropriate for the stress test than an arithmetic index, primarily because a geometric index approximates a median value, whereas an arithmetic index results in an average value. Because housing values are distributed lognormally (i.e., skewed to the right), the median is a better measure of central tendency for a loan-level analysis, such as that reflected by the single family default and prepayment model, than the average. By definition, the average for a lognormal distribution that is skewed to the right will always lie above the median because the average in effect gives more weight than the median to ''outliers,'' in this case, loans that are experiencing appreciation far in excess of the majority. Therefore, the average will always be higher than the actual appreciation rates experienced by the majority of the individual loans. A geometric index results in values that are far closer to median and therefore gives far less weight to outliers. For the purpose of a stress test, OFHEO does not think it is appropriate to update property values using appreciation rates that are higher than those experienced by the majority of loans. Consequently, the final regulation continues to use the HPI without the Goetzman correction.

(ii) HPI Database

(a) Comments

A number of other commenters asserted that the house price vector used in the stress test is not stressful enough, resulting in losses that are understated relative to the benchmark loss experience, especially for low-LTV loans. These commenters noted that the house prices in the HPI for the West South Central Census Division from 1984–1993 evidence a 12 percent initial decline before increasing, while Moody's, Fitch, and other rating agencies use at least a 30 percent decline before increasing. They assert that this weaker decline in house prices is attributable to the exclusion from the HPI database of transactions involving single family homes that are not detached (i.e., condos, planned unit developments and 2–4 family homes) and the exclusion of foreclosure sales. The result, in the opinion of some commenters, is that the capital requirement is understated and biases are introduced in favor of low-LTV loans and older loans, which result in understated default rates. Some commenters who criticized the use of the HPI recommended that OFHEO use a different house price vector, such as one used by one of the rating agencies, and also calibrate single family default and prepayments rates to the benchmark by LTV ratio. (See further discussion of calibration to the benchmark loss experience in III.I.1.g., Relating Stress Test Default Rates to the Benchmark Loss Experience.)

Freddie Mac and Fannie Mae, in their reply comments, took issue with the comment that the HPI is biased upward because foreclosure sales are not included in the HPI database. Freddie Mac pointed out that, although foreclosure sales are not included in the database, the sale of the foreclosed property in an REO disposition is included if such a transaction results in a mortgage that an Enterprise buys. Freddie Mac further observed that the overall stringency of the stress test depends on whether the default and severity models are appropriately calibrated to the benchmark and that a more severe path of house price appreciation would lower the calibration constant used to ensure that the default and severity models produce credit loss in line with the benchmark loss experience, rather than make the stress test more severe.

(b) OFHEO's Response

OFHEO continues to believe that it is appropriate to use an index based on Enterprise data rather than rating agency assumptions to determine house price growth rates during the stress test. As noted in the ANPR and NPR1, OFHEO believes that the direct correspondence of the Enterprise database to the segment of the housing market served by the Enterprises make that database a more appropriate basis for determining a house price appreciation path for Enterprise loans during the stress period.

OFHEO also believes that the HPI is the most appropriate index available for establishing property values during the stress test, notwithstanding the restriction of the database to transactions involving single family detached homes. OFHEO restricted the database to single family detached loans because it is the dominant mortgage product and because the markets for PUDs, condos and 2–4 family homes have different behavioral characteristics. The impact of their exclusion is likely to be small because the Enterprises buy few of these loans.

OFHEO does not believe that the lack of foreclosure sales in the database makes the HPI unsuitable for use in the stress test. Even if the data on which the HPI is based resulted in an upward bias to house prices that understated default rates relative to the benchmark loss experience, the calibration of the default and severity rates to the benchmark loss experience would compensate for it.

(iii) Stress Test Volatility Parameters

To determine the path of house price appreciation during the stress period, NPR2 proposed to use the HPI for the West South Central Census (WSC) Division from the benchmark period (1984Q1 through 1993Q4), with the volatility parameters for the Census Division in which a loan was originated up to the start of and during the stress period. Although one commenter appeared to support this approach, others expressed concern that it would result in different capital requirements for otherwise identical loans in different Census Divisions. The commenters asserted that this would distort mortgage purchase incentives for the Enterprises and result in inconsistent treatment of consumers and inefficient economic outcomes. The Enterprises also expressed concern that the NPR2 approach, involving quarterly updates to Census Division volatility parameters, would make it difficult to anticipate the risk-based capital requirement and incorporate it into their operations. They urged OFHEO instead to apply fixed volatility parameters associated with the West South Central Census Division during the stress period.

The final regulation adopts the commenters' suggestionn to use the fixed volatility parameters associated with the West South Central Census Division. The final rule uses the West South Central volatility parameters as published in the Third Quarter, 1996 HPI Report, both in updating property values to the start of the stress test and in projecting changes in property values during the stress period.

(iv) Procyclicality

A number of commenters argued that the use of OFHEO's repeat transactions HPI to update LTV ratios for loans as of the start of the stress test may result in volatility that may understate Enterprise capital needs in times of house price ''bubbles'' [76] and possibly exacerbate house price declines. Higher levels of house price appreciation result in a lower probability of negative equity

[76] ''House price bubbles'' refers to the tendency of the rate of house price growth to accelerate before a decline.

(and hence lower default levels), which results in a lower capital requirement. (Conversely, lower levels of house price appreciation result in a higher probability of negative equity and hence higher default levels.) Thus, it was argued, the capital requirement would be lower during boom years and higher during recessionary periods. The commenters asserted that during periods of low or negative rates of house price growth, higher capital requirements would constrain the ability of the Enterprises to buy mortgages, potentially contributing to further housing value declines. To reduce this procyclicality in the capital requirement, the commenters recommended that OFHEO use a two-year moving average of HPI values rather than the HPI value in a single quarter to update LTVs to the start of the stress test.

In their reply comments, both Fannie Mae and Freddie Mac supported the idea that required capital should be high when economic risks are high. Fannie Mae agreed that use of a moving average would dampen the effects of rapid house price movements while still ''relating capital to broad-based and long-term risk.'' Freddie Mac did not support the use of a two-year moving average, citing factors that would mitigate excessive procyclicality. First, it was argued, booms and busts tend to be regional rather than national phenomena, and the Enterprises' portfolios are highly diversified, which limits their exposure to regional downturns and upturns. Second, Freddie Mac asserted that the Enterprises will manage their capital to provide stability in the secondary market for residential mortgages through the business cycle. Lastly, Freddie Mac noted that the minimum capital requirement and discretionary reclassification authority of the Director will ensure that the Enterprises maintain a minimum level of capital.

OFHEO did not adopt the commenters' suggestion to use a moving average of HPI values in the final rule. While a moving average would dampen both upward and downward short-term trends in home values and allow longer-term trends to have greater influence, OFHEO believes that the use of current LTVs determined by the HPI values in the quarter preceding the start of the stress test makes the test more effective as an early warning device. Smoothing the path of house price appreciation by using a moving average would allow an Enterprise to delay building capital needed to meet requirements of the stress test based on actual house price levels at the start of the stress test.

b. Inflation Adjustment

(i) Comments

The Enterprises and several other commenters argued that specifying an inflation adjustment based on the difference between the ten-year CMT after the stress test interest rate shock and the average ten-year CMT for the nine months prior to the stress test and applying the inflation adjustment over the last five years of the stress period results in inflation adjustments that are too low. The Enterprises stated that house prices generally keep pace with inflation under stress scenarios, and recommended that the inflation adjustment be 75 percent to 100 percent of the increase in the ten-year CMT, not just the component in excess of a 50 percent increase in the ten-year CMT, citing studies by consultants hired by Freddie Mac.[77] The Enterprises and some other commenters favored beginning the inflation adjustment as soon as the ten-year CMT is 50 percent above its average yield of the preceding nine months, rather than waiting until the last five years of the stress period. Fannie Mae argued that the intent of the inflation adjustment is that credit losses in the up-rate scenario should be lower than credit losses in the down-rate scenario at least when interest rates increase by more than 50 percent.

(ii) OFHEO's Response

The final regulation makes no change to the inflation adjustment. The assertion that the adjustment should be 75 to 100 percent of the total increase in the CMT is based upon hypothetical models and conjecture regarding the macroeconomic nature of such interest rate increases. These hypothetical models and presumed relationships among variables would result in inflation adjustments that would greatly reduce the credit stress in the up-rate scenario. As discussed above, many commenters have asserted that house prices are not stressful enough compared to those considered stressful by the rating agencies, which specify house price drops of 30 percent of more.

The 1992 Act recognizes that high interest rate environments are often characterized by high levels of general inflation that would exert upward pressure on house prices and mitigate some of the price decline that results from the interest rate shock. For this reason, an additional inflation adjustment for large increases in interest rates is required. However, this requirement should not be interpreted as implying that house price growth rates should increase in the full amount of the increase in interest rates. Economic conditions that drive stressful scenarios may cause house prices to deviate from the rate of general inflation for extended time periods. Typically, the immediate impact of interest rate increases is to dampen housing demand, which results in declining housing prices. Declining house prices discourage new construction, but the supply adjustment proceeds quite slowly as the existing housing stock deteriorates. The supply of land cannot adjust, so higher interest rates would continue to be associated with lower land values. Thus, it would not be unreasonable to observe a prolonged period of time in which the price of housing deviates sharply from other prices. For example, the crisis in the oil markets in the early 1980's caused substantial house price declines of approximately 12 percent in the West South Central Census Division during a period when the Bureau of Labor Statistics Consumer Price Index (CPI) rose by 19 percent. After housing prices in that area turned upward in 1989 and rose through 1993, they were only two percent higher than a decade earlier, while the CPI had risen 44 percent.

Lastly, an adjustment to house prices such as that recommended by the Enterprises would negate the credit stress of the benchmark loss experience. OFHEO believes that this is not consistent with Congressional intent and does not agree that the purpose of the inflation adjustment was to ensure that losses are greater in the down-rate scenario than in the up-rate scenario.

2. Multifamily Loans

For multifamily loans, OFHEO did not propose to use the HPI or any other repeat-sales or repeat-transaction index to update property values because of the inadequacies of any available property valuation indexes. To overcome this lack of a property valuation index, OFHEO proposed to use an earnings-based method to update property values and income. OFHEO proposed to base the property value on property net operating income (NOI) divided by a capitalization rate, which discounted

[77] Macroeconomic Advisers estimated the impact on home prices of the range of inflation outcomes using a structural model of housing sector. *See* Macroeconomic Advisers, LLC, ''House Prices under Alternative Interest Rate Paths'' (January 18, 1999). At the request of Freddie Mac, Michael Darby analyzed the economic scenario most consistent with the stress period and concluded that the inflationary environment that would be most consistent with the interest rate path described in the 1992 Act would result in an inflation adjustment 75 percent as large as the increase in interest rates. *See* Michael Darby, ''Consistent Macroeconomic Conditions for a Risk-Based Capital Stress Test'' (June 6, 1997).

the expected earnings stream while holding property-specific characteristics constant.

OFHEO proposed to update property NOI using expected rent growth and vacancy rates. Rent growth was derived from the rent of primary residence component of the CPI and multifamily vacancy rates were taken from the rental property vacancy rate series published by the Bureau of the Census (Census Vacancy Series). Because Enterprise purchases of multifamily loans are heavily concentrated in Metropolitan Statistical Areas (MSAs), MSA indexes were used, where available. However, the CPI rent index is only available for one MSA in the ALMO region during the benchmark period (1984–1993) and the Census Vacancy Series covering the ALMO region were not available prior to 1986. Therefore, in order to capture the economic conditions affecting multifamily loans in the ALMO benchmark loss experience, OFHEO turned to non-governmental sources of data published by the Institute for Real Estate Management (IREM). OFHEO used statistical relationships between IREM and CPI data and IREM and rental vacancy data to create government-equivalent series for the ALMO benchmark region and time period. Volatility estimates for rental rate inflation and vacancy rates were used to calculate the dispersion of multifamily property values, in much the same way volatility measures for the HPI series were used to measure dispersion of property values for single family loans.

a. Comments

Numerous comments criticized the proposal to update property values using the proposed capitalization rate model. Only Freddie Mac commented upon the specific choice of indexes for the projection of multifamily rents and vacancies in the stress test. Freddie Mac criticized OFHEO's proposal to utilize the combined CPI and IREM rental indexes as indicative of economic conditions in the benchmark region and time period, citing the relative paucity of multifamily data from the ALMO region in the relevant time frame. Freddie Mac noted that the proposed rule created little stress for multifamily loans, because it resulted in substantial increases in collateral values during the stress period. Fannie Mae likewise noted that the proposed model resulted in increases in property values, contrary to Fannie Mae's own experience in the southern California recession from 1991–1995, when property values declined significantly. Despite their criticisms of the property valuation component of the multifamily model, neither Enterprise suggested changing the method of computing rent growth or vacancy rates for the benchmark region and time period. Instead, they suggested other changes to the model, which included dropping any updating of property values during the stress period.

b. OFHEO Response

The comments criticizing the proposal to update property values are discussed in III.I.3.a.i., Negative Equity and Current LTV Variables, but for present purposes it is sufficient to note that OFHEO has decided not to update multifamily property values in the stress test. Nevertheless, the rental and vacancy indexes continue to play a key role in modeling changes in NOI and have a material impact on the debt service coverage ratio, a key variable in the revised multifamily default model. Because of the importance of these indexes in determining the values for this variable, OFHEO believed it important to consider certain modifications in the computation of these indexes, as discussed below.

After additional analysis, OFHEO found a better proxy for the rental growth rates in the ALMO benchmark region and time period than the government-equivalent series created from IREM data. That series is replaced in the final rule with the population-weighted (1990 Census) average of monthly rent growth rates [78] of Metropolitan Statistical Areas (MSAs) in the West South Central Census Division. CPI indexes are available for two Consolidated MSAs (CMSAs) and one MSA in that region—the Dallas/Fort Worth CMSA, the Houston/Galveston/Brazoria CMSA, and the New Orleans, MSA. OFHEO has found the Texas MSAs to be more reflective and representative of the stressful real estate market in the ALMO region during the benchmark period than the IREM rental data.

Because the rent growth and vacancy rates are used together in the stress test to determine NOI, OFHEO further determined it necessary to use a method consistent and compatible with the rent growth computation to compute the vacancy rates for the ALMO benchmark region. Therefore, in the final rule, ALMO benchmark region vacancy rates are modified from NPR2 in much the same manner as the rent price indexes. Like the corresponding rent price indexes, ALMO benchmark region vacancy rates are calculated using the population-weighted (1990 Census) average of annual vacancy rates for all the MSAs in the West South Central Census Division. Vacancy rate data are available for the Dallas, Houston, and Ft. Worth, Primary MSAs (PMSAs) and the New Orleans, San Antonio, and Oklahoma City, MSAs for 1986 forward. To create vacancy rate data for the ALMO benchmark region and time period for the first two years of the stress test, the ratio of the rental vacancy rates of the ALMO benchmark region and time period to U.S. rental vacancy rates for 1986 (16.8 percent versus 7.3 percent) was assumed to hold in 1984 and 1985. That ratio was applied to the U.S. rental vacancy rate in 1984 and 1985 to estimate vacancy rates in the ALMO benchmark region in those years.

These changes to the stress test rent growth and vacancy rates make the multifamily model more consistent with the single family model, because both models now use the same Census Division as a proxy for the property valuation indexes in the benchmark region and time period.

*I. Mortgage Performance*

In order to determine how mortgages would perform under the stress test, NPR2 proposed econometric models to simulate conditional rates of default, prepayment, and loss severity for each month of the stress period.[79] To reflect the significant differences in the nature of single family loans and multifamily loans, NPR2 proposed somewhat different models for single family and multifamily loans. Consequently, the comments and responses related to mortgage performance are discussed separately for single family loans and multifamily loans.

1. Single Family Mortgage Defaults and Prepayments

To account for the interaction of default and prepayment,[80] NPR2 proposed jointly estimated models of default and prepayment for three categories of loans. To reflect differing behavioral characteristics of these loans, NPR2 proposed three separate pairs of default and prepayment equations for

[78] Due to the extreme volatility of monthly changes in MSA rental indexes, monthly rent growth was calculated as the twelfth root of the year over year change in the rental indexes for each MSA. Due to different base years, population-weighted averages of the resulting MSA rent growth rates were taken to compute benchmark loss experience rent growth.

[79] The term ''default rate'' is used hereafter in this document to refer to ''conditional default rate,'' unless otherwise specified. The term ''conditional default rate'' refers to the percentage of loan principal outstanding at the start of a period that will default during that period.

[80] Default and prepayment represent options that borrowers choose between when they stop making regular monthly payments on a mortgage. The likelihood of one option being chosen affects the likelihood of the other being chosen.

30-year fixed rate mortgages (30FRMs), adjustable rate mortgages (ARMs), and all other types of single family products (Other SF Products). All three models treat the default and prepayment decisions as options, and they were jointly estimated using the multinominal logit statistical estimation method. The explanatory variables used in the proposed default equations for all three models were age, age squared, LTV at origination, probability of negative equity, occupancy status, and burnout.[81] Product type was also used as a variable in the Other SF Products Model to account for the different default behavior of the different types of products. The explanatory variables used in the proposed prepayment equations were age, age squared, LTV at origination, probability of negative equity, occupancy status, burnout, relative spread, the slope of the yield curve, season of the year (average effect), and relative loan size. For the Other SF Products Model, an additional variable, product type, was used to take into account the differences in prepayment behavior of the various types of products.

In order to reasonably relate default rates to the benchmark loss experience, OFHEO proposed to use a single calibration constant to calibrate the default function to the benchmark loss experience, so that under interest rates associated with the benchmark loss experience, the stress test would project ten-year cumulative default rates for a pool of loans with the characteristics of the benchmark sample that are comparable to the ten-year cumulative default rates of the benchmark loss experience. A similar calibration was made for loss severity rates.

Comments on these models are discussed below by topic.

a. Modeling Approach

The Enterprises found the joint modeling approach to be appropriate and ''essentially sound.''[82] Although the Enterprises had specific concerns about the models, they suggested that, rather than revising their specification or reestimating them, OFHEO could address their concerns by other model adjustments, discussed below in this section by topic. A number of other commenters questioned the joint modeling approach, primarily because it explicitly reflects the potentially offsetting effects of interest rate and credit stresses. Some of these commenters suggested that a better approach would be to evaluate the capital impacts of credit and interest rate risk separately. GE Capital and MICA expressed concern that OFHEO's model understates losses relative to the benchmark, produces inconsistent loss rates in the up- and down-rate scenarios, and permits the Enterprises to overcompensate in hedging one type of risk to offset another type of risk.

GE Capital and MICA proposed two alternative approaches to address their concerns, both of which involved elimination of the proposed default and loss severity calibration constants, adding new LTV-based calibration constants, and substituting Moody's triple-A regional home price decline for the West South Central HPI during the stress period. The first approach would calibrate the model to the benchmark using interest rates associated with the down-rate scenario. The other would calibrate the model using the interest rate path associated with the benchmark loss experience with a small prepayment calibration for high LTV loans.

OFHEO continues to believe that a joint approach to single family mortgage performance is both consistent with statutory direction and appropriate for regulatory purposes. The 1992 Act contemplates the calculation of a risk-based capital requirement based on interest rate and credit stresses experienced simultaneously. The sum of the effects of each experienced separately is not the same as the effects of the two experienced together. The 1992 Act also requires that stress test losses be reasonably related to the benchmark loss experience. OFHEO's model achieves this by calibrating stress test losses to the benchmark loss experience using the interest rates of the benchmark period and house price growth rates of the benchmark period in the West South Central Census Division, which includes most of the states of the ALMO region. Substituting the Moody's house price path for the house price path of the benchmark period and calibrating the mortgage performance models using an interest rate path other than that of the benchmark period would sever the ''reasonable relationship'' of stress test losses to benchmark loss experience. The final rule does, however, eliminate the single calibration constants and apply LTV-specific calibration.constants. These issues are further addressed by the discussions that follow.

b. Data Issues

The models proposed in NPR2 were estimated using all or a random sample of all historical data the Enterprises had available for loans they purchased and retained or securitized in the years 1979–1995, with origination years from 1979–1993.[83] This dataset had certain limitations. It did not, for example, include the last paid installment date for Freddie Mac defaulted loans,[84] or any data for loans securitized under Fannie Mae's swap program. In addition, it did not reflect loan performance for most of the 1990's. In spite of these data issues and their relationship to some of the concerns expressed about the default and prepayment models, commenters generally agreed that OFHEO need not reestimate the models proposed in NPR2 using a more up-to-date and more complete historical data set and should not further delay the final rule to do so.

Since the comment period closed, the Enterprises have provided updated and improved data to OFHEO. Working with this new data, OFHEO determined that certain model shortcomings, some identified by commenters and some by OFHEO, were best addressed using this more recent dataset. Consequently, OFHEO reestimated the single family models using ten percent random samples from a dataset comprised of loans that were originated in the years 1979–1997 and acquired by the Enterprises in the years 1979–1999. In addition to significantly increasing the number of loan observations, the new dataset remedies several data deficiencies noted in NPR2. The dataset includes the last paid installment date for both Enterprises and Fannie Mae securitized loan data from 1991-forward. OFHEO's testing of various model specifications using this updated dataset revealed that several variables that previously demonstrated explanatory significance were no longer statistically significant predictors of default, and these variables were dropped from the estimation of the model. In addition, other specifications of the models were changed slightly to address commenters' concerns. These changes are discussed below by topic.

[81] Season of the year and relative loans size were used in the estimation of the default equations, but omitted in the simulation to achieve average seasonal effect and average loan size.

[82] According to Fannie Mae, ''the level of detailed econometric modeling of loan performance is unmatched among risk-based capital regulations applicable to financial institutions.''

[83] The ARM equation used all available data; the fixed-rate 30-year and other single family products models used ten percent random samples.

[84] In NPR2, OFHEO noted that information was not available from Freddie Mac on the last-paid installment date for defaulted loans in the historical data used to estimate the model and that the date of disposition of a foreclosed property had been used for Freddie Mac's loans. The last-paid installment date was used for Fannie Mae, 64 FR 18174, April 13, 1999.

*See also* III.I.1.q, Summary of Changes in this section.

c. Mortgage Age

The single family default and prepayment equations proposed in NPR2 specified the age variable as a quadratic function—that is, each equation contained two continuous age-related variables, age and age-squared. MICA and GE Capital suggested that the proposed treatment of loan age results in the understatement of default rates on ''seasoned loans'' (loans outstanding for a year or more).[85] Using MICA data and extrapolating what they characterized as ''benchmark loss experience default rates for seasoned loans'' from information about the benchmark loss experience published in NPR1, these commenters inferred that the stress test default rates were understated relative to the benchmark loss experience, especially for high LTV loans, both ''seasoned'' and newly originated. They also pointed out that industry data shows conditional default rates remaining constant or even continuing to rise after a loan reaches 4.5 years of age, rather than conforming to the shape of a quadratic function. Two other commenters suggested that OFHEO use standard aging curves for mortgage default and prepayment in its stress test instead of specifying age as a quadratic function.[86] In contrast, Fannie Mae stated its belief that OFHEO's ''model should capture the relative performance of both (seasoned and unseasoned) loans.''

After considering the issue raised by the comments, OFHEO concluded that a categorical mortgage age variable would account for age-specific differences in conditional rates of defaults and prepayments in Enterprise data better than the continuous variables, age and age squared. Consequently, the final rule treats age as a categorical variable with nine age categories-six that correspond to each of the first six years of a loan's life (when defaults and prepayments tend to change rapidly) and three additional categories representing loans aged seven to nine years, ten to twelve years, and older than twelve years.

d. Relative Spread (Mortgage Premium Value)

In NPR2, OFHEO proposed to use relative spread—the difference between the coupon rate on a loan and the current market rate, divided by the coupon rate—as an explanatory variable in the prepayment equations. Relative spread is a proxy for ''mortgage premium value,'' the value to a borrower of the option to prepay and refinance. Mortgage premium value is an important factor in determining prepayment rates. When the borrower's rate is higher than the market rates, there is an incentive to prepay. OFHEO recognized in NPR2 that there is a theoretical basis for also using mortgage premium value as a variable in default equations. However, OFHEO did not include relative spread as a variable in default equations, but relied instead upon the burnout variable, which reflects whether a borrower has passed up an earlier opportunity to refinance at favorable interest rates, to measure the influence of interest rates on default.[87]

(i) Comments

Both Enterprises asserted that the proposed default equations do not adequately capture the influence of interest rates on the default rate, leading to an overstatement of losses in the up-rate scenario. According to the Enterprises, the proposed stress test does not capture the historically inverse relationship between interest rates and conditional default rates. That is, conditional default rates tend to decline in rising interest rate environments and rise in declining interest rate environments.[88] Neither Enterprise recommended the use of a mortgage premium value in the default equations, but both Enterprises asserted that failure to take the ''mortgage value effect'' into account resulted in an overstatement of credit losses in the up-rate scenario. Although they recognized that the burnout variable can partially explain why borrowers with loan rates higher than current market rates might be more likely to default than borrowers with loan rates lower than market, the Enterprises believe that the burnout variable does not adequately capture the relationship between defaults and changes in interest rates. As an alternative to using mortgage premium value as a variable in the default equations, Fannie Mae suggested that OFHEO specify an earlier and larger inflation offset or adjust up-rate default rates by a constant multiplicative factor of 0.7. Freddie Mac noted that precise measurement of mortgage value effect is very difficult in the extreme up-rate scenario of the stress test, but agreed that ignoring mortgage value effect resulted in very conservative default rates in the up-rate scenario.

(ii) OFHEO's Response

The inclusion of a mortgage premium value (relative spread) variable in default/prepayment models is consistent with a pure option theory of borrower behavior. In any month, borrowers can be thought of as having an option to default and an option to prepay. The decision to exercise or not exercise either of those options would depend partly on the mortgage premium value. The relevance of the mortgage premium value is based on an implicit assumption that a borrower would be able to replace the existing mortgage with a new one at current market rates. That assumption is generally justified in the case of prepayments, but not in the case of defaults. Accordingly, OFHEO decided not to include a mortgage premium variable in the default equation.

OFHEO disagrees with the Enterprises' view that the relationship between default rates in the two different interest rate scenarios is inappropriate. Those differences reflect the combined effects of very different prepayment rates and of different conditional default rates, which are affected by the burnout variable and the inflation adjustment to house price growth in the up-rate scenario. Each of these effects is properly measured, consistent with statutory requirements. The Enterprises' assertion that there are other ways that interest rates should affect default rates is not adequately supported. Any relationships between interest rates and default rates not accounted for by the factors that are incorporated in the stress test may reflect past correlations between interest rates and such factors as unemployment rates or underwriting practices (which OFHEO has determined should not be incorporated in the stress test) or correlations between interest rates and inflation rates in a way that is inconsistent with the specific provision of the 1992 Act describing how the relationship between interest rates and default rates should be accounted for.

[85] The commenters use the term ''seasoned'' as it is commonly used in the trade to mean loans that are not newly originated, rather than in the statutory sense of changes in LTV ratios over time.

[86] The commenters did not define ''standard aging curves.''

[87] *See* 64 FR 18132, April 13, 1999.

[88] Freddie Mac attributes this phenomenon to two factors: burnout and mortgage value. However, as Freddie Mac also points out, their separate effects are difficult to disentangle. Burnout refers to the adverse selection that occurs in a declining interest rate environment as many borrowers who can qualify for refinancing do so, leaving the remaining borrowers, many of whom cannot quality for refinancing because of poor credit or poor financial condition, with a higher conditional probability of default. In a declining interest rate environment the mortgage will have a premium value (relative spread will be positive). Borrowers who are able to prepay benefit from doing so, and those who are unable to prepay will have a higher conditional probability of default.

e. Burnout

The ''burnout'' variable reflects whether a borrower has passed up an earlier opportunity to refinance at favorable interest rates. It captures the tendency of the most responsive and creditworthy borrowers to prepay first, leaving a remaining sample of borrowers with a lower prepayment probability and higher default probability. The burnout function specified by OFHEO in NPR2 was a simple binary function; the borrower either missed prepayment opportunities over the prior eight quarters or did not.

(i) Comments

Commenters criticized the burnout specification as inadequate to capture the complex relationships between the current LTV, the economic environment, and the burnout phenomenon. In addition, commenters asserted that a binary function can cause large and sudden increases in conditional default rates on new loans in the quarter in which it is introduced, resulting in significant variability in the capital requirement. Fannie Mae attributed the sudden increases in conditional default rates to the combination of the binary function of the burnout variable and the large coefficient (weight) assigned to it. To remedy this, Fannie Mae suggested that the impact of burnout on defaults should be delayed until two years into the stress period and ''smoothed out'' by phasing in its effect over eight quarters. Still others recommended that OFHEO respecify the variable to phase in the burnout effects over a range of interest rates and over a longer period, eliminating the abrupt transition to burnout status that creates potential variability of the capital requirement.

(ii) OFHEO's Response

The final rule does not respecify the burnout variable over a range of interest rates or a longer period, or delay consideration of burnout until two years into the stress period, as suggested by commenters. The final rule does, for newly originated loans, phase in the effect of burnout once it is detected. Burnout is detected if the market rate is 200 basis points below the coupon rate in any two quarters out of the first eight quarters of loan life. Once burnout is detected, its effect is phased in over the first eight quarters after origination by multiplying the default and prepayment weights associated with burnout by an adjustment factor less than one. The adjustment factor is zero in the first two quarters of the loan's life, 25 percent in the third and fourth quarters, 50 percent in quarters five and six, 75 percent in quarters seven and eight, and 100 percent thereafter. For example, if rates drop by 200 basis points for the two quarters immediately after a loan is originated, that loan, if not prepaid, would be considered burned out in the third quarter of its life. Rather than applying the full effects of burnout suddenly, 25 percent of the default and prepayment weights associated with burnout would be applied in the stress test for those quarters corresponding to the third and fourth quarters of the loan's life, 50 percent in the fifth and six quarters of the loan's life, and so forth. This change will make the transition to burned-out status less abrupt for newly originated loans.

f. Occupancy Status

Occupancy status is used as an explanatory variable in the single family default and prepayment equations proposed by NPR2. However, the proposed stress test uses a single coefficient that reflects the average occupancy status across all loans, resulting in a specification that investor properties compose the identical fraction of all types of Enterprise mortgages, regardless of their characteristics.

This simplification was criticized by both Enterprises as not reflective of reality. They noted that investor loans have substantially lower LTV distributions than owner-occupied properties, and that 2–4 unit properties, which were assigned to the owner-occupied loan groups in the proposed regulation, exhibit characteristics more similar to investor properties. They suggested that OFHEO use occupancy status as a classification variable in forming stress test loan groups, use the coefficients estimated from the models or assign investor-owned properties a more appropriate multiplier, and allocate investor properties to their proper LTV categories. They also suggested that two-four unit properties and second homes be assigned to the investor-owned loan groups.

OFHEO did not adopt the commenters suggestion to use occupancy status as a classification variable because it would have doubled the number of loan groups and increased the time required to calculate the risk-based capital requirement significantly. However, the final rule responds to commenters' concerns by adjusting the model coefficient for each loan group by a fraction reflecting the actual percentage of investor-owned loans in that loan group, rather than using a single fraction reflecting the average occupancy status across all loans in the Enterprise portfolio. The final rule adopts the suggestion to assign 2–4 unit properties and second homes to the investor-owned percentage.

g. Season of the Year and Loan Size

One commenter noted that season of the year and loan size [89] were used as explanatory variables in the estimation of the model, but not in the stress test simulation, and that unemployment was not used as a variable in either. The commenter urged OFHEO to re-estimate the model without the season variable, include employment as a variable, and conduct further research on the relationship between loan size and probability of prepayment and default, stating that the size of the UPB has proved an important factor influencing the likelihood of prepayment.

As explained in NPR2,[90] season of the year and relative loan size were used in estimating the model but excluded in the simulations to achieve an average size and average seasonal effect. Using a specification for seasonality other than an average seasonal effect in the default simulation would have created quarterly volatility in default rates with no particular safety and soundness benefits. With respect to relative loan size, the models OFHEO estimated for NPR2 demonstrated that larger loans tended to have faster prepayment speeds, but the effect on default was small and inconsistent. Furthermore, loan size is not needed to make the distinctions required by statute. Weighing these factors, OFHEO concluded that using a specification other than average loan size in default simulations would have resulted in complexity not warranted by the additional benefit that would be derived.[91] Finally, OFHEO did not include the employment rate as an explanatory variable because the stress test includes only macroeconomic variables that are specified by the 1992 Act and employment rate is not among them. Furthermore, as noted in NPR2, the effect of macroeconomic variables such as unemployment are captured through the process of relating the stress test to the benchmark loss experience.[92]

In the course of testing different specifications of the re-estimated model, OFHEO found that these variables were

[89] OFHEO used relative loan size in estimating the model. Relative loan size is the ratio of the original loan amount to the average-sized loan purchased by the Enterprises in the same state and in the same origination year.

[90] 64 FR 18134–35, April 13, 1999.

[91] Including relative loan size as a classification variable would have resulted in a sevenfold increase in the number of loan groups.

[92] 64 FR 18135, April 13, 1999.

not statistically significant as predictors of default. Consequently, in the final rule, seasonality and loan size are not used in the estimation of the default equations. However, they remain significant predictors of prepayment and continue to be used in estimating prepayment equations. In the prepayment simulation, season of the year continues to be omitted to achieve average seasonal effect, but relative loan size is used as an explanatory variable to predict prepayment.

h. Relating Stress Test Default Rates to the Benchmark Loss Experience

Many commenters, including the Enterprises, asserted that the stress test overstates default rates on high-LTV loans; some commenters asserted that it also understates default rates on low-LTV loans. This effect was attributed to using a single calibration constant for all single family loans rather than calibrating each LTV category to the benchmark loss experience. One commenter suggested that a single calibration constant will result in an incorrect forecast of credit losses for any mix of business that differs from the mix in the benchmark loss experience cohort of loans. The commenters recommended calibrating to the benchmark loss experience by LTV category. In addition, Fannie Mae suggested that OFHEO adjust default rates on higher LTV loans to below those of the benchmark loss experience to reflect improved underwriting.

The final rule addresses the commenters' concerns by calibrating defaults to the benchmark loss experience by LTV category rather than using a single calibration constant. The benchmark default rates by LTV category to which stress test defaults are calibrated are set forth in Table 4.

TABLE 4.—ALMO BENCHMARK DEFAULT RATES BY LTV AT ORIGINATION

| LTV Category | Default Rate |
|---|---|
| 0 < LTV <= 60 | 2.2% |
| 60 < LTV <= 70 | 3.5% |
| 70 < LTV <= 75 | 7.9% |
| 75 < LTV <= 80 | 9.4% |
| 80 < LTV <= 90 | 16.4% |
| 90 < LTV | 26.4% |

OFHEO did not adopt Fannie Mae's suggestion to adjust default rates on higher LTV loans to below the benchmark loss experience in order to reflect improved underwriting because, as explained in NPR2,[93] to do so would be inconsistent with the statutory direction to subject current books of business to the credit stress of the benchmark loss experience.

i. Adjustable Rate Mortgages (ARMs)

(i) Comments

Some commenters asserted that the proposed ARM default model is insensitive to payment shock and consequently understates defaults. ''Payment shock'' refers to the increased likelihood of default or prepayment when the interest rate on an ARM loan increases and the decreased likelihood of default or prepayment (sometimes called ''payment benefit'') when the interest rate decreases.

(ii) OFHEO's Response

OFHEO agreed with the commenters that adding a payment shock variable would enhance the ARM model. In the course of making this change, OFHEO discovered that a data issue needed to be addressed to remove a potential bias in the re-specified ARM model. Specifically, Freddie Mac has not been able to provide historical data with sufficient computational details (such as identification of the ARM index and rate or payment caps) for ARMs that defaulted or prepaid before 1995, and Fannie Mae has captured its historical data in such a way as to make the computational details for many of that Enterprise's ARM products difficult to model and in some cases ambiguous. The lack of computational detail in the available data results in an underrepresentation of ARM defaults and prepayments among records with these details. To address this issue, OFHEO has modified the treatment of ARM loans in the final regulation as described below.

The final rule respecifies the ARM model for default and prepayment rates as a multinomial logit model using an estimation dataset that pools 10 percent random samples of long-term ARM (original terms of more than 20 years) and 30FRM loans that were originated in the years 1979 through 1997 and acquired in the years 1979 through 1999. This methodology is similar to the methodology used to model 15FRM loans, balloon loans, and other single family mortgage products. This approach allows the sample to be drawn from all available data with no underrepresentation of defaulted and prepaid ARM loans.

The revised ARM model captures average differences in default and prepayment performance for ARM products relative to 30FRM loans while controlling for risk factors common to both types of loans. The respecified ARM model includes the same set of explanatory variables as the respecified 30FRM default and prepayment models, along with three additional variables (described below) unique to ARMs. Some of the explanatory variables common to both models, such as probability of negative equity, burnout, and relative spread, were approximated for ARM products because the information needed to replicate historical ARM coupon rate adjustments and mortgage payment adjustments was not available in the historical dataset. For example, the probability of negative equity was based on the UPB amortized as if the loan rate were fixed at the original rate, and relative spread and burnout were based on the differences between the original loan rate and the current market rate for 30FRM.

For these reasons, the effect on loan performance of subsequent ARM rate and payment adjustments is reflected in the respecified ARM model through the use of three additional explanatory variables unique to ARM products—a binary ARM product variable (which simply indicates whether the loan is an ARM product or not), a payment shock variable, and an initial rate effect variable (which captures the loan performance effects of ARM teaser rates in the first three years of a loan's life).[94] Computationally, the payment shock variable captures the effects of the interaction between the ARM product variable and relative spread. OFHEO believes that this serves as a reasonable proxy for payment shock. Similarly, the initial rate effect variable captures the interaction between the ARM product variable and the first three loan age categories, representing loan age up to 3 years. All three new variables are used in both the default and prepayment equations in the respecified ARM model.

Because the payment shock variable is defined in terms of the relative spread between the initial rate and market rate, the coefficients (weights) for the payment shock variable can be interpreted as ''ARM adjustments'' to the coefficients for relative spread estimated from pooled 30FRM and ARM data. Similarly, the coefficients for the initial rate effect variable can be interpreted as ARM adjustments to the first three age coefficients, which are

[93] 64 FR 18118–18119, April 13, 1999.

[94] Even when market interest rates are not rising, teaser rates (below market initial rates) can cause payment shock effects in ARMs as the low initial rate adjusts to the market rate.

also estimated from the pooled data. The ARM product variable coefficient can be interpreted as a fixed effect that further distinguishes ARM product performance from that of the pooled loans in the dataset.

All variables in the final ARM model were found statistically significant with reasonable interpretations for all variable weights. The initial rate effect, which captures teaser rate effects, shows an increase in the probability of default for ARMs during the first three years of the loan term relative to the remainder of the loan term. Finally, the payment shock variable predicts relatively higher ARM default and prepayment rates in an up-rate scenario as monthly payments rise, and relatively lower ARM default and prepayment rates in a down-rate scenario as monthly payments decline.[95]

j. Credit Scores

Several Wall Street firms commented that the failure of the default specification to take credit scores into account is inconsistent with the goal of the stress test and suggested that OFHEO elicit proposals from the Enterprises to incorporate credit scoring in the risk calculation. Other commenters, including one of the Enterprises, supported OFHEO's decision not to incorporate credit scores in its mortgage performance models at the current time, but suggested that OFHEO monitor the composition of mortgage credit scores to assure that OFHEO's default projections continue to reflect the credit quality of Enterprise mortgages.

The final regulation does not take credit scores into account. Although borrower creditworthiness is not among the loan characteristics required by the 1992 Act to be considered, as more data becomes available on the predictive validity of credit scores, OFHEO will consider whether credit scores can be taken into account in a way that would improve the stress test.

k. Additional Risk Characteristics

Some commenters suggested that the failure of the model to recognize the additional risk characteristics of loans such as subprime, ''Alternative A,'' manufactured housing, and home equity loans could result in inadequately capturing the risk in Enterprise portfolios if these types of loans comprise a significant portion of the portfolio. One commenter suggested adding a surcharge to the risk-based capital calculation for second mortgage lending and subprime lending because of higher levels of fraud and collateral valuation issues encountered in such lending.

The final regulation makes no changes in the proposed regulation to explicitly take into account unique features of such loans. However, when OFHEO determines that a loan has such unusual features or risk characteristics that it is essentially a different product from similar loans for which a treatment is specified, and that the specified treatment does not adequately reflect the risk to the Enterprises, the Director has the discretion to treat such loans as new activities subject to section 3.11, Treatment of New Enterprise Activities, of the Regulation Appendix.

l. Aggregation of High LTV Loans

The proposed stress test groups all loans with LTVs over 90 percent into the same LTV category. One commenter stated that this aggregation resulted in a prepayment rate that is too high for the category and suggested that distinctions should be made among 95 percent, 97 percent and over 97 percent LTV loans. The final regulation does not adopt this suggestion because there are too few observations of over 90 percent LTV loans in the historical database to construct a reasonable model for these high-LTV loans. In developing the stress test OFHEO sought to achieve a balance between operational workability and precision. Striking such a balance necessarily involves some grouping of sparsely populated categories. When more data become available, OFHEO will consider making finer distinctions.

m. Structured Mortgages

The proposed stress test does not differentiate between a first mortgage made coincident with a second lien (together, a structured loan) and one without. A number of commenters noted that failure to distinguish loans based on this characteristic understates the true credit risk and thus understates the required capital for structured loans.[96] Commenters suggested that the default frequency for structured mortgages should be based on the current LTV of the combined loans.[97] However, Freddie Mac argued that, given current industry data practices, there is no reliable way to distinguish an 80–10–10 mortgage[98] from other 80 percent LTV mortgages and that the increased credit risk of 80–10–10 loans is offset by improvements in credit scores and other credit risk factors.

OFHEO recognizes that there may be a risk distinction between a first mortgage on a property that is also subject to a second lien mortgage and one that is not. However, modifying the stress test to capture that additional risk would require that the Enterprises be able to identify those first mortgages that are also subject to a second lien. Currently, the Enterprises are unable to do that in all cases. Although no change has been made in the final regulation to respond to the concern, OFHEO will require the Enterprises to collect combined current LTV information for structured mortgages to analyze for possible use in future modeling.

n. Product Categories

The Other Fixed-Rate Products Model proposed in NPR2 included five categories of mortgage products to distinguish their different risk characteristics—20-year fixed-rate mortgages, 15-year fixed-rate mortgages, balloon loans, Government loans, and second lien loans. However, in the re-estimation of the Model, OFHEO found that the inclusion of the second lien loans as a separate product category caused the coefficients associated with the 20-year fixed-rate mortgages and the 15-year fixed rate mortgages to be statistically insignificant. As a result, OFHEO eliminated the second lien data from the re-estimation. In the stress test, loans with the second lien product code will be assigned the coefficient weights from the Other Fixed-Rate Products Model, using the government loan coefficient weight for government loans and the balloon loan coefficient for non-government loans. In addition, certain fixed-rate mortgage products with variable payments over time (such as graduated payment mortgages and growing equity mortgages) are no longer treated as ARMs as they were in NPR2, because they are not affected by changes in market interest rates. Like other non-standard fixed rate products, these loans, many of which are past their scheduled payment adjustment periods,

[95] These effects are relative. For example, the model predicts ARM prepayments will rise during a down-rate scenario, but not by as much as 30FRM prepayments are predicted to rise in the same scenario.

[96] Under NPR2, the first mortgage of a structured loan is treated as an 80 percent LTV loan without taking into account the second lien loan. However, in modeling the second lien loan, the stress test takes into account the existence of the first lien loan and assigns the second lien loan the combined LTV. The commenter's suggestion implies that because the first mortgage is not also given the combined LTV, the capital requirements for the structured loan are understated.

[97] The comment implies that the first lien mortgage should also be assigned the combined LTV.

[98] An 80–10–10 loan is a loan with an 80 percent LTV first mortgage, a 10 percent LTV second lien, and a 10 percent down payment.

are assigned the balloon loan coefficient weight.

o. Prepayment Rate Levels

(i) Comments

A number of commenters, including the Enterprises, stated that the stress test produces unreasonably low prepayment rates in the up-rate scenario. One commenter suggested that, based on the commenter's analysis of historical data, prepayment speeds in the up-rate scenario should be roughly double those proposed by OFHEO. The commenter attributed the difference to factors that OFHEO may not have taken into account, such as the nonassumability of conventional mortgage loans since 1985 and the long-run positive correlation of home price inflation with rising interest rates. As a result, the commenter supported a conservative prepayment speed assumption of 100–120 PSA [99] or 6–7 CPR [100] in the up-rate scenario or, alternatively, the adoption of a specific prepayment rate for the up-rate scenario. Other commenters argued that prepayment speeds in the up-rate scenario were implausible because termination rates (prepayment rates plus default rates) would be below historical mobility rates.

Some of the commenters attributed the low prepayment rates in the up-rate scenario to the fact that the data used to estimate the model are from a period when mortgage assumptions were common and interest rates were generally falling. Hence, the commenters argued, the data used are not representative of the mortgages currently owned by the Enterprises (and, therefore, presumably insufficient to establish prepayment rates for the up-rate scenario). These commenters suggested that OFHEO calibrate prepayments to the benchmark loss experience and adjust the prepayment rates upward in the up-rate scenario to reflect the introduction of due-on-sale clauses in Enterprise mortgages and to be more consistent with results from homeowner mobility studies. One commenter noted that historical parameters will underestimate prepayments in the future because technological improvements have reduced the cost and inconvenience of rewriting and prepaying loans and suggested that OFHEO correct for the underestimation. Some commenters thought that prepayment rates in the down-rate scenario were too high, and some thought they were too low. Freddie Mac thought prepayment rates in the down-rate scenario were reasonable, noting that OFHEO's probability of negative equity variable dampens the effect of large refinancing incentives by capturing the effects of the falling house price environment in the down-rate scenario and that prepayment rates for loans with high original LTVs in falling house price environments will be far lower than those of low LTV loans in good house price environments.

Two commenters noted that the stress test does not produce prepayment rates for the benchmark cohort that match actual historical rates. One of those observed that the stress test produces prepayment rates that are significantly higher than the mortgage industry experience for the benchmark region and time period. The other commenter noted that it is important for prepayment speeds not to be overstated in the down-rate scenario or understated in the up-rate scenario because the linkage of default and prepayment characteristics associated with the joint modeling approach may ''inadvertently magnify the dollars at risk.'' The commenter suggested further study of this issue. Another commenter suggested that prepayments in the stress test should be calculated based upon house prices growing at normal historical levels, rather than using the house price path of the benchmark loss experience.

(ii) OFHEO's Response

The final rule does not adopt the commenters' recommendations for modifying the prepayment equations. Implicit in a number of these comments is a belief that patterns of prepayment, like patterns of defaults and losses, should be consistent with those of the benchmark loss experience. However, the 1992 Act only requires that defaults and loss severities be consistent with those of the benchmark loss experience. Characteristics of the stress period other than those specified by the statute, ''such as prepayment experience and dividend policies'' are to be determined by the Director ''on the basis of available information, to be most consistent with the stress period.[101] OFHEO's approach, which reflects prepayment patterns based on all available historical data, is appropriately conservative. OFHEO believes that, in order to represent the interest rate risk of the Enterprises realistically, the stress test simulation of prepayments should reflect overall historical prepayment patterns rather than reflecting only borrowers' prepayment behavior associated with the benchmark loss experience. Historical patterns have evolved over time and take into account more recent patterns of prepayment, which are more sensitive to interest rate changes than the prepayments of the benchmark loss experience.

With respect to concerns about low prepayment speeds in the up-rate scenario, OFHEO believes that scenario represents an unprecedented combination of events—a severe nationwide recession combined with high interest rates. Borrowers would have no incentive to prepay unless they moved, but mobility rates would be unusually low. The cost of switching to a mortgage with a much higher interest rate would greatly discourage moving, and limited job availability would provide little incentive. Similar conditions, though on a lesser scale, occurred nationwide during the early 1980s. Turnover rate estimates provided by Salomon Smith Barney in its comment show an average annual rate of 4.3 percent in 1981–1983. Given the more severe conditions in the stress test, the slightly slower prepayment speeds generated by the stress test model are quite reasonable.

Similarly, the commenter's concern about data incorporating assumable loans is misplaced. The Enterprises' historical data from before 1986 is a relatively small portion of the overall dataset because comparatively few loans were purchased from those origination years, and the Enterprise data are incomplete. Furthermore, mortgage rates in the early 1980s were unusually high, so assumability would not have had a large effect on prepayment. The dataset contains few loans originated in 1979. Any small effect on the results may be offset by the unavailability of ARM and balloon loans in the early origination years. Borrowers who expect to prepay more often select these loan types, which tends to lower prepayment rates on 30-year fixed-rate loans, but that effect is absent from early loan data.

p. Seasoned Loan Purchases

The stress test proposed in NPR2 made distinctions among loans based on their age through the age variables and their changes in LTVs (by amortizing mortgage balances and updating property values), but made no distinction between loans purchased or guaranteed by an Enterprise shortly after their origination, and loans purchased or guaranteed after having been held for a period of time by the originator.

Freddie Mac criticized the lack of distinction between loans purchased or

[99] This measure of prepayment speed is derived from the prepayment model of the Public Securities Association, (PSA), which is an industry standard for measuring prepayment speeds.

[100] CPR refers to ''conditional prepayment rate,'' a commonly used method of expressing prepayment speeds on an annualized basis.

[101] 12 U.S.C. 4611(b)(2).

guaranteed just after origination and ''seasoned purchases,'' (loans purchased or guaranteed when they are at least 12 months old). Freddie Mac stated that its ability to screen loans with ''substandard performance'' from seasoned purchases lowers their risk relative to loans purchased near the time of origination and suggested that OFHEO identify seasoned purchases as a separate category and, ''based on analysis,'' reduce their defaults in that category by 30 percent relative to loans having otherwise similar characteristics.

In the absence of any empirical evidence that a reduction in default rates is appropriate for seasoned loan purchases, and in view of the increased complexity that would result from adding another data element, the final rule does not adjust default rates downward for seasoned loan purchases. However, should credible evidence become available in the future that demonstrates that there is a significant difference between the default rates for seasoned loan purchases and the default rates for newly originated loan purchases, OFHEO will consider whether the additional complexity that would result is warranted.

q. Summary of Changes

In the final rule, the following changes are made to the proposed single family default and prepayment models:

- The models are reestimated using a more recent and complete dataset.
- A categorical age variable replaces the continuous age and age squared variables
- Investor-owned fractions are calculated for each loan group and used to adjust the investor-owned coefficient.
- Season of the year and relative loan size are dropped as explanatory variables in the estimation of default equations.
- Default rates are calibrated to the benchmark loss experience by LTV category.
- The ARM model, which has been respecified and reestimated on a data set of pooled 30FRM and ARM loans, captures the average effects of payment shock and other performance factors relative to 30 FRM loans while controlling for risk factors common to both types of loans.

2. Single Family Loss Severity

NPR2 proposed to calculate loss severity during the stress period as a percentage of the defaulting principal balance at the time of loan default. Three components of loss severity were considered—loss of loan principal, transactions costs, and funding costs. Loss of loan principal is the Real Estate Owned (REO) sale price less the loan balance, based on normal loan amortization, at the time of default. Transactions costs comprise foreclosure/legal costs, property holding and disposition costs, and for sold loans, four months of interest at the security pass-through rate. Funding costs, the Enterprises' cost of funding a loan between the time of default and sale of the foreclosed property, were captured by discounting all costs and revenues based on time of receipt during the foreclosure/REO disposition process.

NPR2 proposed an econometric model to estimate loss of loan principal, fixed parameters for transactions costs and time intervals for determining funding costs, and funding rates based on stress period interest rates. The econometric model, estimated using all available historical data for loans entering REO status, calculates the loss of loan principal as a function of median house price appreciation rates reflected by the HPI, and house price volatility. The model includes a single calibration constant, to produce results consistent with the ALMO benchmark loss experience.

In the proposed stress test, property holding and disposition costs and foreclosure/legal costs are based on averages from all available data on Enterprise REO properties. The four months of loan interest the Enterprises must pass through to MBS investors for defaulted loans is calculated at the MBS passthrough rate. Funding costs are determined by discounting all loss severity elements by the six-month Federal Agency Cost-of-Funds rate to produce the present value of each element in the month of default. The time intervals used in the discounting process are based on benchmark REO loans.

a. Comments

Commenters criticized the complexity of the proposed methods for calculating the loss of loan principal and funding costs, the fact that the approach did not consider pre-1987 Fannie Mae loss severity data, the calibration of the loss of loan principal rates to the benchmark loss experience using a single constant term rather than by LTV category, and the inconsistent treatment of the components of loss severity in their relationship to the benchmark loss experience. (Only loss of loan principal and the timing of loss severity revenues and costs were based on the benchmark loss experience.)

The Enterprises suggested that OFHEO extract loss of loan principal estimates and funding costs directly from the benchmark loss experience and use those in the stress test. They suggested (1) extracting loss severity rates for three LTV ranges directly from the benchmark loss experience, (2) subtracting from the resulting loss rates benchmark funding costs, (3) making adjustments for pre-1987 Fannie Mae REO data (which Fannie Mae has only recently made available), (4) adding back new fixed funding costs (rather than using the present value approach used to identify the benchmark loss experience) based on the interest rate scenario (down- or up-rate) and relative LTV, and (5) make specified adjustments for loan age and product type, also considering LTV.

GE Capital and MICA criticized OFHEO's approach to loss severity in the context of broader concerns about stress test mortgage losses being lower than those implied by the ALMO benchmark loss experience, inconsistency between loss rates in the up- and down-rate scenarios, and the offsetting of some credit stress by interest rate stress. To eliminate concerns about inconsistency between the interest rate scenarios and the offsetting of credit stress by interest rate stress they proposed an approach to loss severity rates that would be insensitive to differences in the two interest rate scenarios. To address concerns about overall mortgage losses, they proposed using LTV category-specific calibration constants in the econometric model. They proposed a calibration process that substituted the Moody's AAA regional home price decline and an alternative interest rate path for the benchmark house price and interest rate paths. Details of their proposal for mortgage performance modeling are summarized earlier in III.I.1.a., Modeling Approach.

b. OFHEO's Response

Upon review of the approach included in NPR2 and the related comments, OFHEO determined that the modeling of loss of principal balance could be greatly simplified. While the final regulation does not adopt the commenters' specific suggestions, it modifies the calculation of loss of loan principal and reduces its variability.

Rather than using an econometric model to estimate loss of loan principal calibrated to the benchmark loss experience, the final rule specifies loss of loan principal as a function of median house price appreciation rates reflected by the HPI, and the average ratio of actual sale prices of benchmark REO to values based on projected HPI changes. The final rule eliminates use of the HPI volatility parameters, and since it directly relates loss of loan principal

to the benchmark loss experience, requires no model calibration.

The final rule continues to apply the present value approach proposed in NPR2 to determine funding costs. OFHEO does not agree that funding costs should be fixed, since they would not be consistent with the widely varying interest rate conditions associated with the two stress test interest rate scenarios. OFHEO believes the funding costs should be directly determined by stress test interest rates.

The final rule continues to apply NPR2 approaches to transactions costs and the time intervals used to determine funding costs. However, as a result of including previously unavailable Fannie Mae data on foreclosure costs in the calculation of average historical REO holding and disposition costs, the average foreclosure costs decreased from 5 percent to 3.7 percent and the REO holding and disposition costs increased from 13.7 percent to 16.3 percent.

As discussed earlier in III.I.1.a., Modeling Approach, the 1992 Act contemplates stress test results that reflect the interaction of interest rates with mortgage performance. OFHEO believes the differences in mortgage performance in the two stress test interest rate scenarios are consistent with the 1992 Act.

3. Multifamily Loan Performance

NPR2 utilized two multifamily default models and five multifamily prepayment models to capture the behavior of loans purchased under different programs and at different stages in their life cycles. The models were estimated using historical data through 1995 on the performance of Enterprise multifamily loans. NPR2 proposed one default model for ''cash'' programs and another for loans acquired under ''negotiated'' transactions (NT loans). The proposed prepayment models allowed for appropriate distinctions between fixed- and adjustable-rate loans, between fully-amortizing and balloon loans, and between loans that are within yield maintenance or prepayment penalty periods (i.e., periods during which restrictions and/or penalties for prepaying a loan apply) and those that are not. The models also provided for some balloon loans to survive beyond their stated maturity dates. All of the multifamily default and prepayment models were estimated with historical rent and vacancy rates. Simulations were based upon rates in the ALMO benchmark loss experience to create stress test conditions. To determine loss severity on multifamily cash loans, NPR2 used average cost and revenue components from all historical multifamily real estate owned (REO) from which severity data was available, which consisted of Freddie Mac loans originated in the 1980s. On NT loans that included repurchase agreements, the loss severity rate was set at an historical rate adjusted for the seller/servicer claim rate on 90-day delinquent loans and was set on FHA loans at three percent of UPB.

a. Multifamily Default Model

The proposed rule used the following variables to determine default rates in the cash model: [102]

- Joint Probability of Negative Equity and Negative Cash Flow—Used to capture the probability of a particular loan incurring concurrent negative cash flow and negative equity.
- Mortgage Age and Age Squared—Used to capture change in the risk of default as loans age.
- Program Restructuring—Used to capture difference between default risk of original multifamily programs and current, restructured programs.
- Balloon Maturity Risk—Used to capture the added risk of default as the balloon maturity date approaches.
- Value of Depreciation Write-offs—Used to capture effect on default rates of the value of certain tax benefits.

Many commenters addressed the methodology proposed to calculate multifamily loan defaults. Some of these comments expressed concern that the multifamily default levels not be so high as to impact negatively upon the Enterprises' low income housing programs and their ability to meet housing goals. Other comments viewed the multifamily model as insufficiently stressful and suggested major modifications to avoid creating perverse incentives and anomalies in the final rule. Others suggested that the proposed rule should take into consideration the differences between Fannie Mae's Delegated Underwriting and Servicing (DUS) loans and loans from other programs. A significant number of comments also discussed the appropriateness of specific variables proposed to determine default rates. These comments and OFHEO's responses are summarized below by topic.

(i) Negative Equity and Current LTV Variables

A primary concern of numerous commenters was the methodology in the proposed rule for updating property values from loan origination through the stress period, which affected the Joint Probability of Negative Equity and Negative Cash Flow variable (JP) and its balloon-maturity counterpart (BJP). The model established current property values by projecting the net operating income of each property and capitalizing these cash flows to project price changes for the collateral properties. The capitalization rates that were used to determine property values were based upon ten-year constant maturity Treasury yields.

Commenters criticized this method of capitalizing the net operating income as inappropriate for a number of reasons. Some commenters suggested it resulted in large increases in property values in the down-rate scenario in contrast to the commenters' historical experience. Some commenters argued that any realistic capitalization rate model should take into consideration numerous factors other than current interest rates, such as local housing inventory and the marketability of particular neighborhoods. Furthermore, commenters were concerned that the proposed methodology incorporates implicit assumptions about economic parameters (such as variance, covariance and distribution of rents, vacancy rates and property values) that were untested, but had significant impact on default rates. Largely as a result of these concerns about the capitalization rate model, all commenters to address the issue suggested that OFHEO find an alternative to the JP variable.

After considering these comments and further analyzing the NPR2 approach, OFHEO decided to eliminate the calculation of the probability of negative equity from the multifamily model, thereby eliminating the JP and BJP variables and the need to update property values throughout the stress test. OFHEO concluded that the capitalization rate estimation proposed in NPR2 was not sufficiently robust, given the significant impact it could have on multifamily default rates. Because the probability of negative equity comprised part of the JP and BJP variables, those variables could not be used and the model in the final rule replaces JP and BJP with variables related to property cash flow, property value, and balloon risk.

The first of these variables is the natural logarithm of the current debt-service-coverage ratio (current DCR).[103]

[102] Because the NT model has been dropped from the final rule, it is not described. *See* 64 FR 18136–18139, April 13, 1999, for a description.

[103] OFHEO used the log transformation on DCR and LTV to capture the non-linear effects of these variables. In other words, the incremental effect on the risk of default of a change in DCR (LTV) was

Current DCR is the ratio of the net operating income on the property to the debt-service payments. Current DCR is updated in essentially the same way as in NPR2 but with a newly-constructed rent and vacancy rate series. The second is an Underwater DCR indicator variable (UDCR), which indicates that property cash flow is negative because current DCR has declined below 1.00. The third is the natural logarithm of LTV at loan origination or, if origination information is unavailable, at Enterprise acquisition (LTV).[104] The fourth is a balloon maturity flag or indicator (BM) that indicates a balloon loan within twelve months of maturity.

In combination, current DCR, UDCR, and LTV capture essentially the same mortgage performance factors the JP variable was designed to capture—the effects of negative equity and negative cash flow on default probability. Current DCR captures the expected inverse relationship between debt-service-coverage ratio (net operating income relative to mortgage payment) and default risk. Larger surpluses of net operating income over the amount required to service debt represent larger borrower cushions to weather possible increases in vacancy rates arising from stressful economic conditions, such as the stress test. UDCR captures the additional risk of default when current DCR is negative. LTV captures the lower risk of default associated with greater borrower equity early in the life of the loan. Larger amounts of borrower equity at origination or acquisition appear to serve as a cushion in delaying possible negative equity in situations of property value deterioration caused by any number of primarily local or regional phenomena.[105]

The fourth variable, a balloon maturity flag or indicator (BM) has taken the place of the BJP variable. It captures additional risk of default, resulting primarily from the borrower's inability to refinance during the twelve months prior to balloon maturity. In the final rule, conditional default rates reflect higher risk in the twelve months prior to balloon maturity as a result of the balloon maturity flag, but balloon loans are not extended at maturity as they were in NPR2.[106] Although OFHEO realizes that the Enterprises commonly permit balloon term extensions to qualified borrowers, particularly when the market rate of interest exceeds the original note rate and a reversal of the rate trend is expected in the short term, OFHEO also finds it inappropriate to model this practice in the stress test given the restrictions on new business imposed by the 1992 Act. Accordingly, and consistent with the procedure for single family loans, in the final rule, multifamily balloon loans which mature during the stress test will pay off at maturity.

OFHEO determined that the definition of the term ''seasoning'' in the 1992 Act must be applied differently to multifamily loans than to single family loans.[107] The definition appears to have been crafted to apply only to single family loans, because it defines ''seasoning'' as the change in LTV of mortgage loans based upon changes in a specific single family house price index or another equivalent index of OFHEO's choosing. At this time, there are no indexes of multifamily property values available that meet the standards of quality, authority, and public availability in the 1992 Act. Therefore, in NPR2, OFHEO defined an equivalent index of multifamily property values imputed from existing rental and vacancy indexes in combination with the capitalization rate model discussed above. However, OFHEO is now persuaded by the commenters not to use this approach. Accordingly, the final rule does not attempt to adjust LTV for multifamily loans directly as it does for single family loans. Rather, to account for differences in seasoning among multifamily loans, the stress test updates DCR over time.

The seasoning requirements of the 1992 Act are intended to require OFHEO to take into account the impact of changes in the housing market on mortgage losses.[108] Congress recognized that changes in house prices, as measured by widely available and reliable indexes, provide an important measure of the direction of the single family housing market. However, the 1992 Act also requires OFHEO to take into account differences in types of mortgage loans,[109] and applying single family seasoning to multifamily loans would not take into account the important differences between these loan types. Because multifamily loans are commercial rather than residential loans, updating property DCR provides a good measure of the impact of changes in the multifamily housing market (and, therefore, of ''seasoning'') on multifamily defaults. Therefore (and in contrast to single family lending, where DCR is not applicable), in multifamily lending, change in DCR is the most direct determinant of the continuing viability of a loan.

OFHEO has determined that the intent of the statute to take both seasoning and product differences into account is best effected as to multifamily loans by updating DCR through the stress period using the government indexes that best represent rent growth and vacancy rates from the ALMO benchmark region and time period.

(ii) Use of Actual Debt-Coverage Ratio

The Enterprises commented that OFHEO should use actual data on income and expenses from annual operating statements along with mortgage-payment information to establish the DCR of multifamily properties as of the start of the stress test. OFHEO agrees that actual data is preferable to the process proposed in NPR2 of updating origination DCR using historical rent growth and vacancy rates to impute net operating income as of the start of the stress test. The final rule is modified accordingly. Thus, for multifamily loans that have property-level operating statements, the most recent available actual net operating income figures from these statements will be divided by the current mortgage payment and the resulting DCR will be reported in the Risk-based-capital Report, to be used to establish DCR immediately prior to the stress period.

For properties for which the Enterprises at present lack annual operating statements, the stress test uses origination DCR as DCR immediately prior to the stress period. If origination data is also lacking, the stress test uses acquisition DCR as DCR immediately prior to the stress period. If both origination and acquisition data are lacking, the final rule specifies a DCR immediately prior to the stress period of 1.10 for Old Book loans and 1.30 for

found to be greater at low DCR (high LTV) than at high DCR (low LTV).

[104] *See supra* note 103.

[105] For loans missing origination LTV, acquisition LTV is used. If both are unavailable, 80 percent and 90 percent, respectively, are used for New Book and Old Book loans. These figures represent the mean origination/acquisition LTV of loans with such data.

[106] In NPR2, loans already past their maturity dates at the start of the stress test were extended three years and loans not yet past their maturity dates at the start of the stress test were extended five years. In both cases, the remaining loan balance was amortized at the then-current market interest rate over the original amortization term.

[107] The 1992 Act defines ''seasoning'' at 12 U.S.C. 4611(d)(1). The Act provides that ''the Director shall take into account * * * differences in seasoning of mortgages * * * the Director considers appropriate.'' 12 U.S.C. 4611(b)(1).

[108] 12 U.S.C. 4611(b)(2).

[109] ''[T]he Director shall take into account appropriate distinctions among types of mortgage products * * * the Director considers appropriate.'' 12 U.S.C. 4611(b)(1).

New Book loans.[110] OFHEO anticipates that these treatments are sufficiently conservative to cause the Enterprises to begin collecting accurate DCR data on all multifamily loans for which it is possible to do so. If OFHEO finds these treatments not to be sufficiently conservative for that purpose, it will reconsider the appropriate DCR levels for loans with missing DCR data.

(iii) Age and Age Squared Variables

Only the Enterprises commented directly upon the inclusion of the two age variables, age and age squared, in the default model. Although neither Enterprise recommended specifically that these variables be eliminated from the model, neither included them in its list of recommended variables. Freddie Mac suggested that the age variables are likely substituting for other variables or capturing measurement problems and are unlikely to be related to the aging effects that they are intended to capture. Fannie Mae commented that the age variables increase default rates to an unexpected degree. As an example, Fannie Mae suggested that a 13 percentage point difference in ten-year default rates is too great between a cash 80 percent LTV, 1.25 DCR, 15-year, balloon loan that is newly originated and the same loan that is four years old.

OFHEO disagrees with the Enterprises' criticisms of the age variables and has retained them in the multifamily model because they are highly reliable predictors of default. Additionally, they reflect the pattern of actual defaults in Enterprise data (defaults increase at a decreasing rate with loan age). OFHEO recognizes that the significance of the age variables in the multifamily default model may be substituting for omitted or mismeasured variables. However, there also is evidence that the aging effect may be a credible discriminator of default risk in and of itself.[111] The lack of detailed and consistently measured operating statement and property condition data render further investigation of the underlying reasons for the significance of the age variables on multifamily default risk difficult.

(iv) Operating Expense Ratio

NPR2 calculated DCR with expenses as a fixed share (47.2 percent) of the gross potential rents. Fannie Mae commented that a fixed expense ratio increases the volatility of net operating income and recommended that OFHEO modify the constant expense factor to reflect the reality that the components of property level operating expenses are not all fixed shares of gross income. Fannie Mae suggested that OFHEO reflect this mixture either by reducing the change in net operating income in response to a change in vacancy rates or by utilizing actual net operating income values from the annual operating statements Fannie Mae receives on multifamily loans.

After consideration of these comments, OFHEO concluded, from both the literature and the limited availability of data, that neither of the Fannie Mae approaches should be accepted. OFHEO recognized that property level operating expenses and its components may not remain fixed shares of gross rents over time. However, OFHEO is unsatisfied with current approaches and data available for modeling the inflation in multifamily property expenses and its components. One study divided operating expenses into four fixed-share components—labor costs, utilities, insurance and taxes, and construction materials—and modeled growth in each with indexes that would reflect the inflation in each component.[112] Property-level variances around the mean were also measured, the author concluding that it would be surprising if operating expenses varied from one year to the next by amounts as large as those observed. Other approaches to modeling property level operating expenses or its components would have required the use of simplifying assumptions that cannot be tested regarding component shares of total operating expenses and related indexes approximating respective growth rates. OFHEO has found insufficient evidence that any of these methods provided improved estimates over the NPR2 approach.

OFHEO also considered Fannie Mae's suggestion to use actual observations of net operating income from the Enterprises, where available, to estimate the model. OFHEO found this suggestion unpersuasive because the percentage of loans with annual DCR in the estimation dataset was just 14 percent. In terms of observations for each year in the life of each loan, the percentage of records with annual DCR dropped to 9.7 percent, with very few of those having three or more consecutive annual DCR observations (3.7 percent of total loan-year records). Further complicating the estimation process was the fact that annual DCRs are not calculated by the Enterprises in the same way as are origination/acquisition DCRs. While the Enterprises typically calculate the latter using conservative assumptions of vacancy rates, rental and other income, expenses, replacement reserves and the like, the former represent actual data from operating statements, unadjusted for normal variations from year to year or deviations from market rates. In sum, the data were too sparse and dissimilar for use in constructing a reasonably robust model.

Accordingly, in estimating the multifamily default model for the final rule, OFHEO utilized the NPR2 expense constant for all loan observations and did not use Enterprise actual net operating income to update DCR for estimation purposes.

(v) Use of Two Default Models

Both Enterprises commented upon OFHEO's proposal to use two default models, one for negotiated transactions (NT) and one for cash purchases. Freddie Mac recommended that the distinction between the two categories of loans be dropped because it is too difficult to define, explaining that Freddie Mac was unable to replicate the classification of its own loans that OFHEO used in NPR2. Fannie Mae echoed these comments, targeting the NT equation, in particular, as poorly specified and not a useful guide to multifamily loan performance. No comments were received supporting the use of two default models. However, both Enterprises and several other commenters supported the general concept of distinguishing between multifamily programs or regimes in the stress test. All commenters on the subject concurred that the underwriting and servicing practices of the Enterprises underwent major and permanent changes beginning in 1988 (Fannie Mae) and in 1993 (Freddie Mac), which should be reflected in the stress test. Comments from seller/servicers of the Enterprises urged OFHEO to give credit for improvements in multifamily loan management in order to avoid imposing inappropriately large marginal capital costs on this portion of the Enterprises' business. In addition, seller/servicers in Fannie Mae's DUS program suggested that DUS loans get special treatment to reflect what they felt were more rigorous guidelines, loss-sharing provisions, and reserve and reporting requirements in that program.

In considering the need for two default models, OFHEO studied the changes in the Enterprises' multifamily businesses, analyzed the comments, and conducted additional modeling research

[110] New Book and Old Book loans are discussed *infra,* 3.a.v., Use of Two Default Models.

[111] Edward I. Altman, ''Zeta Analysis and Other Attempts to Classify and Predict Business Failures,'' *Corporate Financial Distress and Bankruptcy: A Complete Guide to Predicting and Avoiding Distress and Profiting from Bankruptcy* (1993).

with recently provided data that is far more complete than that previously provided.[113] OFHEO concluded that the distinction between NT and cash purchases was no longer sufficiently important to require two models. Accordingly, OFHEO has replaced the two-model approach with one multifamily default equation that distinguishes between the performance of loans with indicator variables that apply a multiplier to adjust the loans' relative default rates.

One of these indicator variables, the New Book Flag (and its product adjustment factors, the New ARM Flag and the New Balloon Flag), like the program restructuring variable in NPR2, distinguishes loans acquired in 1988 and after at Fannie Mae and in 1993 and after at Freddie Mac (New Book loans) from loans acquired earlier (Old Book loans). It reflects the fact that during 1988 and 1993, Fannie Mae and Freddie Mac, respectively, implemented significant permanent changes in their methods and standards for underwriting and servicing multifamily loans. Loans acquired after these dates that constitute defensive refinances of Old Book business remain classified as Old Book. The New Book Flag has a greater impact on default rates than the NPR2 program restructuring variable, due to use of additional data in estimating the model and the decision to eliminate the adjustments to Old Book loan LTVs and DCRs that are used in NPR2.[114]

In re-evaluating the performance of multifamily New Book versus Old Book loans, however, OFHEO discovered that the full effect of the New Book benefit applies only to fixed-rate fully amortizing loans. For ARMs, the reduction in New Book default risk is significantly less than for New Book loans in general. Likewise, but to a lesser extent, fixed-rate balloon loans do not exhibit the full effect of reduced New Book default risk. These effects are reflected in the multifamily default model.

The other program indicator variable, the Ratio Update Flag, is used to identify newly originated loans and seasoned acquisitions on which DCR and LTV have been updated using conservative measures such as market-rate minimum vacancy rates, minimum actual historical other income, forward-looking trended expenses, and minimum replacement reserves, management fees, and capitalization rates.[115] After re-calculation of DCR and LTV, the Enterprises screen these loans for minimum acceptable DCR and maximum acceptable LTV ratios for purchase or securitization. OFHEO found that New Book loans that were subjected to the aforementioned type of ratio update process performed better than those that were not. Loans with neither origination nor acquisition DCR are treated as not having undergone the ratio update process.

(vi) Tax Reform and the Depreciation Write-off Variable

No commenters objected directly to the Depreciation Write-off variable (DW) but, for a number of reasons, OFHEO found it inappropriate for the multifamily default model in the final rule. First, the capitalization rate model, which was criticized by commenters in conjunction with the Joint Probability of Negative Equity and Negative Cash Flow variable (JP), was also used to construct the return on equity portion of the weighted average debt and equity discount rate in the DW variable. Because OFHEO decided to drop the JP variable from the multifamily default model, largely because of concerns about the capitalization rate model, it would have been inappropriate to retain the DW variable. Second, the available data on value of depreciation write-offs suffered from the same lack of regional and sub-market variation criticized in the capitalization rate model.[116]

(vii) Use of External Benchmarks

Several commenters asked OFHEO to allow external benchmarks and industry standards to serve as tests of reasonableness for the multifamily model results until sufficient reliable data become available to build a more sensitive and detailed model. In most cases, OFHEO agrees with the commenters that external benchmarks and industry standards may be used for assessing the reasonableness of multifamily stress test default rates. For this reason, OFHEO has compared its simulated stress test results with those provided by the Enterprises in their comments and consulted rating agency and related analyses. However, there exist far fewer studies of the determinants of multifamily default than single family default. Still fewer studies analyze defaults under stressful economic conditions—and none examines multifamily defaults through a period of time as stressful as the stress test. Notwithstanding these limitations, OFHEO found that for fixed-rate loans both of these avenues provide confirmation that OFHEO's model results are reasonable.

For multifamily ARM default rates, however, there are no studies involving stressful economic environments that OFHEO found of adequate quality and authority to be useful for comparison. For these loans, OFHEO looked to whether the default rates on the loans appear reasonable, given their extreme sensitivity to interest rates and compared the model's results to the limited data that is available regarding multifamily ARM performance under economic stress. This analysis confirmed the reasonableness of the ARM model.

These tests of reasonableness employed by OFHEO are discussed below.

(a) Results Provided by the Enterprises

The Enterprises provided, in their comments, computations of cumulative multifamily default rates for two

[113] The Enterprises recently provided data on 40,247 loans. Those loans were combined with pre-1991 Fannie Mae data received in earlier submissions less loans with missing origination dates, leaving 42,334 loans that were used for analysis. Of the 42,334 loans, 58 percent (24,743 loans, primarily seasoned-at-acquisition ARMs) had neither origination nor acquisition DCR data. In NPR2, the missing values were populated by reverse-engineering DCR from the capitalization rate model and origination/acquisition LTV. In the final rule, the cap rate model is not used. Instead, five random samples of the loans with missing origination and acquisition DCR were taken. Each random sample was combined with the 42 percent of loans that were not missing origination/acquisition DCR. All samples produced similar model estimation results; however, the one with the best goodness of fit was selected as the analysis data set. As in NPR2, in creating loan-year records from loan-level data, records prior to the year of Enterprise acquisition were removed to avoid left-censoring bias. Also, prepayments were right-censored in the year of loan termination. *See* C.B. Begg and R. Gray, "Calculation of Polychotomous Logistic Regression Parameters Using Individualized Regressions," *Biometrica* (1984).

[114] The New Book flag is the reciprocal of the program restructuring variable in NPR2, but it has the same affect. The New Book Flag decreases the default rate on New Book loans, while the program restructuring variable increased the default rate on Old Book loans. The larger impact of the New Book Flag coefficient in the final rule reflects four additional years of loan performance that show lower default rates, all else being equal, for New Book loans in general than were indicated previously. Another reason for the larger absolute value of the coefficient on New Book loans is that adjustments to Old Book data were not made in the final rule. In NPR2, origination/acquisition DCR was adjusted downward and origination/acquisition LTV was adjusted upward for Old Book loans. Freddie Mac commented that it was not the case that every Old Book loan had an overstated DCR and an understated LTV. OFHEO concluded that the adjustment proposed in NPR2 was not appropriate for every Old Book loan and that it did not resolve Old Book data integrity issues. Therefore, the final rule does not use the NPR2 adjustments to the Old Book loans.

[115] The ratio update process may have been performed by the Enterprise itself or under delegated authority by a qualified seller/servicer either at loan origination or at Enterprise acquisition.

[116] *See* Table 34 of NPR2, 64 FR 18203, April 13, 1999 (National values for depreciation write-offs, 1983–1995).

specific newly originated fixed-rate products—the 15-year fixed-rate balloon (Fannie Mae) and the ten-year fixed-rate balloon (Freddie Mac)—as examples of rates that they considered to be reasonable for managing multifamily risk. Both Enterprises used the NPR2 rent and vacancy scenario to produce the results and each stated that the default rates assumed zero prepayments and were for 30-year amortization loans with eight percent coupons. The respective default rate tables were divided into cohorts by current DCR immediately prior to the stress test and origination LTV. Fannie Mae's results were generated using the NPR2 cash default model. Freddie Mac's results were generated using a different model that was specified explicitly, including coefficients (some of which Freddie Mac estimated and others of which Freddie Mac assumed).[117]

OFHEO replicated the tables of default rates provided by Fannie Mae and Freddie Mac, using the multifamily default model in the final rule, along with the newly constructed rent and vacancy scenario. Under the same assumptions of zero prepayments, an 8 percent coupon, 30-year amortization, newly originated product immediately preceding the stress test, OFHEO obtained results similar to those provided by Fannie Mae for the 15-year balloon and to those provided by Freddie Mac for the 10-year balloon. For example, for a loan with a 1.20 DCR immediately prior to the stress test and an 80 percent origination LTV, Fannie Mae suggested an 18 percent cumulative conditional default rate for the 15-year balloon and Freddie Mac recommended a 21 percent cumulative default rate for the 10-year balloon. OFHEO's multifamily default model in the final rule produced cumulative conditional default rates for the 15-year balloon and for the 10-year balloon of 26 percent and 30 percent, respectively, for the non-ratio-updated products and of 15 and 18 percent, respectively, for those products that underwent the ratio-update process.

OFHEO believes that the consistency with which its model results tracked those provided by Fannie Mae and Freddie Mac for the products and DCR/LTV combinations they supplied helps confirm the reasonableness of OFHEO's model results. Fannie Mae suggested, however, that their tabular default rates (or ones like them) be used directly for all loans with a balloon year multiple of 3.0 at maturity for balloon loans and that various other indicators of default risk such as product-type, book of business, and loan age be ignored. OFHEO did not accept this suggestion, because evidence from various default studies as well as actual observed default rates of Fannie Mae's own portfolio of multifamily loans show that default rates do vary significantly by product type, age, and factors other than current DCR, origination LTV and balloon maturity risk. OFHEO has captured those other risk factors while ensuring the reasonableness of model results.

(b) Rating Agency and Related Analyses

Rather than targeting stressful economic conditions, most studies of the determinants of multifamily default have estimated models over whatever time period data are available, which may or may not contain a period of economic stress. As a result, OFHEO turned to the rating agencies for industry norms with regard to cumulative default rates of multifamily loans under stress. Each rating agency's methodology for assessing credit risk is similar to the others', although some focus on DCR as the primary determinant of default and others on both DCR and LTV. Though they share their methodologies in print and on the internet, the rating agencies often do not report subordination levels for large groups of loans outside of specific security transactions. Fitch IBCA is the exception.

Fitch IBCA studied 18,839 loans in 33 commercial transactions issued between 1991 and mid-1996.[118] The database was composed of two distinct subgroups, loans from Resolution Trust Corporation (RTC) transactions and conduit loans,[119] and a default was defined as a delinquency of 60 or more days on a mortgage payment or a delinquency of 90 or more days on a balloon payment. Without regard to CMBS property type,[120] Fitch found average annual default rates of 4.37 percent and 1.97 percent, respectively, for RTC and conduit loans. Fitch described the differential (36 percent versus 18 percent over ten years, assuming no prepayments) as possibly attributable to qualitative differences between the pools or the result of other factors such as seasoning (RTC loans are described as highly seasoned; conduit loans are described as typically newly-originated at the time of securitization). The average annual default rate on multifamily properties was 3.9 percent. This finding translates to a 32.8 percent cumulative default rate over 10 years, assuming no prepayments.

In another report, Fitch ICBA posts a table of single-A recession default probabilities by DCR category, adjusted to reflect stressful economic conditions, but not the mix of collateral and structural characteristics in the loans.[121] The default probabilities ranged from a low of 20 percent (>1.75 DCR) to a high of 80 percent (<0.49 DCR), with 40 percent representing the maximum cumulative default probability for positive (>1.00 DCR) cash flow loans.

A study of the commercial mortgage holdings of the life insurance industry finds that book value credit losses averaged 76 basis points per year over the 1972–1996 period, with an annualized volatility of ±31 basis points.[122] Using this study's assumed 30 percent loss severity rate, ten-year default rates are roughly equivalent to a maximum of 34 percent.

The studies cited above represent those that OFHEO believes best represent cumulative multifamily default rates under stressful economic conditions. Nevertheless, the studies are not entirely comparable to the stress test because they may not have analyzed loan performance over a period of time as stressful as the stress test. Additionally, they either did not address the type of multifamily product analyzed or stated specifically that only fixed-rate loans were included. Therefore, the range of cumulative default rates of 30–40 percent would not be applicable to multifamily ARMs. Further, the studies defined default more broadly than does the stress test. The stress test defines default as a foreclosure rather than a 60- or 90-day delinquency. This discrepancy means that, all else equal, the 30-40 percent default rate range found in the studies would be lower if OFHEO's narrower default definition were used. Because

[117] OFHEO tested Freddie Mac's model with the same Enterprise data used to estimate OFHEO's multifamily default model in the final rule. OFHEO found poorer overall goodness of fit results than those achieved with OFHEO's multifamily default model. OFHEO's multifamily default model in the final rule had a Hosmer-Lemeshow (HL) goodness of fit statistic of 32.192; (72.0 percent concordant, 24.2 percent discordant, 3.8 percent tied) compared with an HL statistic of 122.62; (63.3 percent concordant, 28.4 percent discordant, 8.3 percent tied) for Freddie Mac's model. Lower HL statistics indicate better goodness of fit. *See* David W. Hosmer, Jr. and Stanley Limeshon, *Applied Logistic Regression* (John Wiley & Sons 1990).

[118] ''Trends in Commercial Mortgage Default Rates and Loss Severity—1997 Update,'' *Structured Finance* (July 20, 1998).

[119] The term ''conduit loans'' refers to loans, most of which are newly originated, that are securitized by mortgage conduits, which generally are brokers.

[120] The data included loans on commercial property other than multifamily projects, *e.g.,* shopping centers or office buildings.

[121] ''Performing Loan Securitization Update,'' *Structured Finance* (March 16, 2000).

[122] Michael Giliberto, ''A Performance Benchmark for Commercial Mortgages,'' *Real Estate Finance* (Spring, 1997).

the rating agency and related studies, to varying degrees, include products of various levels of seasoning and quality, the range of results may be interpreted as a weighted average of default rates for a diversified portfolio of multifamily loans.

Taking the above factors into consideration, OFHEO found the rating agency findings are consistent with the results of OFHEO's multifamily default model in the final rule. Assuming zero prepayments, OFHEO finds a cumulative conditional default rate of 39 percent for a typical Enterprise fixed-rate loan.[123] Further, OFHEO finds that it is reasonable and appropriate to allow default rates in the stress test to vary with product type, product quality, and loan age. As a result, OFHEO has determined that the default rates derived directly from the application of the multifamily default model in the final rule to Enterprise fixed-rate loans will be used, without further adjustment or calibration.

(c) Multifamily ARM Analysis

The Enterprises did not provide default rates considered reasonable for managing multifamily ARM business, and OFHEO found no comparable rating agency or related analyses specifically addressing ARM default rates in stressful economic environments. However, OFHEO also did not model multifamily default rates separately for fixed-rate and ARM product in the final rule. The default models are identical. In their implementation, ARM loans default at higher rates than fixed-rate loans, all else equal, even if interest rates are held stable.[124] However, when interest rates ramp up (plummet) in the first year of the up-rate (down-rate) stress test, ARM loans experience payment shock (reductions), pushing current DCR lower (higher) at any level of NOI. In sharp contrast, fixed-rate loans, which by definition have constant payments, exhibit changes in current DCR that are driven only by changes in NOI. OFHEO finds that this is perfectly consistent with the stress test interest-rate environment mandated in the 1992 Act.

Assuming no prepayments, OFHEO finds a cumulative conditional default rate for a typical Enterprise ARM loan of 29 percent in the down-rate scenario and 97 percent in the up-rate scenario.[125] OFHEO found that ARM down-rate default rates are consistent with fixed-rate default rates, which are in turn consistent with data provided by the Enterprises and with rating agency analyses.

OFHEO also believes that the range of ARM up-rate default rates is not unreasonable given the experience of certain multifamily loans historically. OFHEO tested for the highest level of defaults observed for Federal Housing Administration (FHA) and Enterprise multifamily loans originated in 1979–1992 in contiguous states comprising five percent or more of the U.S. population for a period of two or more consecutive years. The worst weighted average default experience found in the FHA data was for 12 loans originated in 1987–88 in New England (CT, MA, ME, NH, RI, and VT) at 78 percent. The worst default experience for Enterprise multifamily loans—fixed-rate (289 state-year combinations), ARM (six state-year combinations) and combined (two state-year combinations)—was 100 percent. The third-highest level of Enterprise multifamily default experience was for six loans originated in 1979–80 (AR, CO, LA, MT, OK and WY) at 87 percent while the seventh-highest level of ARM default experience for the Enterprises was for six loans originated in 1984–86 (CT, MA, ME, NH, RI, VT) at 91 percent. OFHEO found these statistics useful in that they substantiate the fact that default rates of the magnitude found in the up-rate scenario for multifamily ARMs have indeed occurred and would be likely to recur in an economic environment such as the stress test. As a result, OFHEO has determined that the default rates derived directly from the application of the multifamily default model in the final rule to Enterprise ARM loans will be used, without further adjustment or calibration.

b. Multifamily Prepayment Model

The proposed rule used the following variables to determine prepayment rates for multifamily loans:

- Mortgage Age Variables—Used to capture change in the risk of prepayment as loans age.
- Relative Spread—Used to reflect the value to the borrower of the option to prepay and refinance.
- Current LTV—Used to capture the incentive for borrowers to refinance in order to withdraw equity from rental property.
- Probability of Qualifying for Refinance—Used to reflect the likelihood that a property financed by a balloon loan would qualify for a new loan, based on minimum requirements of 80 percent LTV or less and 1.20 DCR or more.
- Pre-balloon Refinance Incentive—Used to give extra weight to the relative spread in the two years prior to the balloon maturity to capture additional incentive to prepay balloon loans after the date the yield maintenance period ends, but before the balloon maturity date.
- Conventional Market Rate for Mortgages—Used to reflect the incentives for borrowers with ARMs to refinance into fixed-rate mortgages.
- Years-To-Go in the Yield-Maintenance Period—Used to capture the declining cost of yield maintenance to the borrower in the later years of the yield-maintenance period.

(i) Comments

Many comments addressed the proposed multifamily prepayment models. None were supportive of the proposed approach. Several of these comments suggested that the data are too limited to support the five separate models used in NPR2. The Enterprises and others expressed a view that the proposed rule incorporated incorrect assumptions about the cost to the borrower (and, therefore, about prepayment of loans) throughout the yield-maintenance or prepayment penalty period. Commenters also argued that the prepayment models were overly complex in the number of variables and the treatment of those variables. Most of these commenters contended that only a small percentage of loans prepay during the yield maintenance or prepayment penalty periods and, of those that do, virtually all are required to pay yield maintenance fees or prepayment penalties, which are designed to

[123] Using Enterprise data, OFHEO defined the typical Enterprise multifamily loan as a ten-year fixed-rate balloon loan, with an origination LTV of 80 percent and a current DCR at the start of the stress test of 1.20. Roughly 86 percent of Enterprise fixed-rate loans are from the New Book and 65 percent of fixed-rate loans qualify for the Ratio Update Flag. The mean age of fixed-rate loans at the start of the stress test is 48 months. The current DCR and origination LTV ranges represent the highest frequency distribution category for Enterprise fixed-rate loans. OFHEO produced the default rates using those ranges along with the mean loan age and share of New Book and Ratio Update loans (in lieu of 1 and 0 for those flags). In practice, those flags would either be 1 or 0.

[124] The New ARM Flag retracts much of the reduction in default risk that the New Book Flag conveys.

[125] Using Enterprise data, OFHEO defined the typical Enterprise multifamily ARM loan as one indexed to the 11th District Cost of Funds, with periodic rate caps and floors of two percent, annual payment caps of 7 percent and a 1.25 negative amortization limit, an origination LTV of 80 percent and a current DCR at the start of the stress test of 1.20. Roughly 50 percent of Enterprise ARM loans are from the New Book and 3 percent of ARM loans qualify for the ratio update treatment. The mean age of ARM loans at the start of the stress test is 91 months. The current DCR and origination LTV ranges represent the highest frequency distribution category for Enterprise ARM loans. OFHEO produced the default rates using those ranges along with the mean loan age and share of New Book and Ratio Update loans (in lieu of 1 and 0 for those flags).

compensate an Enterprise for loss of interest income. These comments suggested that, by not taking prepayment provisions properly into account, the stress test overstated prepayments, particularly in the down-rate scenario. The Enterprises both recommended that the final rule eliminate much of the complexity of the proposal in favor of using fixed prepayment percentages per month. Freddie Mac recommended zero percent in the up-rate scenario and, in the down-rate scenario, zero percent within yield maintenance or other prepayment penalty periods and 25 percent per year outside such periods. Fannie Mae recommended a similar approach, suggesting prepayments in the up-rate scenario of 0.02 percent per month and, in the down-rate scenario, 0.2 percent per month within prepayment penalty periods and two percent per month outside those periods.

(ii) OFHEO Response

OFHEO has considered the comments, studied the operation of the yield maintenance provisions in Enterprise multifamily loans agreements and reviewed the literature regarding multifamily prepayments. Given the limitations of Enterprise data, OFHEO has concluded that a prepayment model would not provide greater precision or risk sensitivity than a fixed schedule of prepayments in the two interest rate scenarios. OFHEO has also determined that the yield maintenance and other prepayment penalty provisions in Enterprise multifamily loans are sufficient either to discourage prepayments during prepayment penalty or yield maintenance periods or to ensure that the Enterprises are entitled to the specified compensation. However, modeling these various prepayment provisions would add additional complexity to the model, which OFHEO finds unwarranted given the small number of times yield maintenance or prepayment penalties are required to be paid.

OFHEO agrees with Freddie Mac with regard to the lack of multifamily prepayments in the up-rate scenario. Fannie Mae suggested there should be only negligible prepayments (0.02 percent per month) in the up-rate scenario. OFHEO recognizes that it is not cost effective for multifamily borrowers to prepay their mortgages at positive spreads of the market interest rate from the note rate and, as a result, they are highly unlikely to do so, particularly when yield maintenance or other prepayment penalties are involved. As a result, OFHEO will use zero prepayments in the up-rate scenario for multifamily loans.

OFHEO disagrees with Freddie Mac's recommendation of zero prepayments in the down-rate scenario inside prepayment penalty periods. Freddie Mac's recommendation of zero prepayments in the up-rate scenario (both inside and outside prepayment penalty periods) and in the down-rate scenario inside prepayment penalty periods suggests that Freddie Mac believes that Enterprise loans never prepay within yield maintenance or prepayment penalty periods. OFHEO recognizes that yield maintenance and other types of prepayment penalty provisions are effective deterrents to multifamily prepayments, as they raise (sometimes significantly) transactions costs, thereby requiring a larger drop in interest rates, all else equal, to trigger a prepayment decision. However, one study contends that prepayments do occur during yield maintenance and other prepayment penalty periods and should be priced for.[126] This study examined five different types of prepayment penalty structures finding that yield maintenance is the most effective type of the prepayment penalty structures studied. Also, Enterprise data provided to OFHEO for analysis show that just over seven percent of loans that prepaid had prepaid within their prepayment penalty periods.[127] Since Enterprise data are not sufficiently detailed to delineate different prepayment structures at this time, it is likely that the observed prepayments may be more related to one type of structure than to another or to the length of time remaining before the expiration of the penalty altogether. OFHEO also would expect the number of prepayments to be larger regardless of the prepayment penalty structure if the loan interest rate, taking into account prepayment penalty fees, was strongly in the money, as it would be in the down-rate scenario. As a result, OFHEO has specified 2 percent per year prepayments inside yield maintenance and other prepayment penalty periods during the down-rate scenario. This percentage allows marginally fewer prepayments than recommended by Fannie Mae (0.2 percent per month or 2.37 percent per year) due to the fact that OFHEO is not modeling the fee income generated by the limited number of prepayments inside prepayment penalty periods in the down-rate scenario.

OFHEO generally agrees with Freddie Mac's and Fannie Mae's respective recommendations of 25 percent per year and 2 percent per month (21.5 percent per year) prepayments outside of yield maintenance and prepayment penalty periods in the down-rate scenario. One study found that the most important determinant of multifamily prepayment was the ratio of the mortgage note rate to the current market interest rate.[128] Using coefficients provided in the study and assuming a newly originated loan (because parameter estimates for the age function were not provided), OFHEO found a 29 percent per year prepayment rate for multifamily loans outside of yield maintenance and other prepayment penalty periods, confirming the reasonableness of Fannie Mae's and Freddie Mac's estimates. Additionally, in the Enterprise data, OFHEO found extreme differences in multifamily prepayments during and after prepayment penalty periods. This observation is supported by a study that finds that prepayments are typically close to zero within prepayment penalty periods, then spike up in a ''hockey stick'' fashion as soon as the prepayment penalty period expires.[129] Further, another study found that, in general, multifamily and other commercial borrowers are more ''ruthless'' or have greater interest rate sensitivity than, for example, single family borrowers, making them more likely to prepay at any given level of negative spread between market rates and note rates, particularly when transactions costs such as prepayment penalties are not at issue.[130] For these reasons, OFHEO has decided to specify 25 percent prepayments per year outside yield maintenance and other prepayment penalty periods in the down-rate scenario. This specification is consistent with the mid-point of the 21 percent to 29 percent range provided by

[126] Qiang Fu, Michael LaCour-Little and Kerry Vandell, ''Multifamily Prepayment Behavior and Prepayment Penalty Structure'' (Working Paper, December 21, 1999).

[127] According to Enterprise data through 1999 submitted to OFHEO for analysis, 15 percent of Enterprise multifamily loans have yield maintenance or other prepayment penalty provisions. Of those, 9 percent (660 loans) terminated in or before 1999—the last recorded year of data. Of those that terminated, 113 loans had prepaid through 1999. Of those, 8 loans (7.1 percent) prepaid within their prepayment penalty periods and 105 loans (93 percent) prepaid outside their prepayment penalty periods. The remaining 547 were loans that had not prepaid as of the end of 1999.

[128] Qiang Fu, et al., *supra* n. 126.

[129] Jesse M. Abraham and Scott Theobald, ''A Simple Prepayment Model of Commercial Mortgages,'' *Journal of Housing Economics* (1995).

[130] James R. Follain, Jan Ondrich, and Gyan Sinha, ''Ruthless Prepayment: Evidence from Multifamily Mortgages,'' 41 *Journal of Urban Economics* (1997).

Freddie Mac, Fannie Mae and in the literature.

c. Multifamily Loss Severity Calculation

To determine loss severity rates on all conventional multifamily loans, other than NT loans covered by repurchase agreements, NPR2 used the same cost and revenue elements and discounting procedures used for conventional single family loans, except that property values were not updated to determine the loss of loan principal balance. The cost and revenue components were averages from Freddie Mac real estate owned (REO) originated in the 1980s. Loss severity rates on NT loans subject to repurchase agreements were set at a fixed rate based upon Enterprise historical experience and seller/servicer claim rates for 90-day delinquent multifamily loans. For FHA loans, the severity rate was set at three percent of UPB to reflect the cost of assigning defaulted loans to the Department of Housing and Urban Development.

Several comments addressed the loss severity calculations proposed in NPR2.[131] In general, commenters did not object to the methodology employed by OFHEO. They did, however, suggest that the loss severity rates arrived at with this approach were higher than industry averages and recommended that OFHEO simply apply a uniform severity rate to all multifamily loans. At a minimum, commenters recommended that OFHEO assess loss severity rates against industry standards as guidelines for reasonableness, as they had similarly suggested for multifamily default rates. Specifically, Fannie Mae and Freddie Mac commented that the data available to OFHEO, primarily Freddie Mac Old Book loans, were an inappropriate sample to estimate multifamily loss severity. Because of changes in the Enterprises' current loan programs, they contended, the severity rates to be expected on newer loans would be significantly lower than reflected in the data.

OFHEO rejected the suggestion that a uniform severity rate be applied to each multifamily loan in each period of both the up- and down-rate scenarios. Throughout the stress test, rental vacancy rates increase to a peak of 17.5 percent and rent growth is negative for over twenty consecutive months. In an economic situation replicating the ALMO benchmark region and time period, the revenue and cost components of multifamily REO while in inventory, as well as recovery rates on REO sales, would not remain fixed. Studies have shown that multifamily property values fall significantly during regional economic recessions, leading to lower recovery rates on REO.[132] Likewise, rental income would decline as vacancy rates rise. Further, some costs incurred during the REO holding period, such as attorney's fees, would likely remain fixed while others, such as property operating expenses, may shrink as tenants vacate; they may also remain the same or increase as landlords attempt to attract new tenants to replace those that have vacated. OFHEO concluded that fixed loss severity rates for Enterprise multifamily REO would not reflect the requirement that severity rates in the stress test be reasonably related to the conditions of the benchmark loss experience.

OFHEO also concluded that updating the NPR2 methodology with additional data from the Enterprises would not be consistent with the 1992 Act. Given the requirements of the 1992 Act that the stress test must reflect a worst-case loss experience, single family loss severity rates are calculated using cost components, where available, for the ALMO benchmark loans. It would, therefore, be inappropriate to update the multifamily loss severity components simply because newer data from better economic scenarios reflect lower losses. In contrast, OFHEO found it appropriate to update the data used to estimate the multifamily default model, because the model imposes benchmark conditions through the use of ALMO benchmark rent growth and vacancy rates.

OFHEO has determined to use the revenue and cost components of multifamily loss severity as well as the REO recovery rates as published in NPR2, as they represent worst-case Enterprise losses.[133] A simple adding up of the costs components of those figures (without considering discounting, credit enhancements or passthrough interest on sold loans), yields a loss severity rate of 54 percent. OFHEO did, in fact, find higher loss severity rates. Fitch IBCA found loss severity rates ranging from 32 percent to 58 percent on bulk sales of RTC assets. Additionally, and in that same report, Fitch explains that Freddie Mac reports that, if a default occurs, on average 45 percent of the loan balance is lost. Actual Freddie Mac loss severities, however, ranged from 8 percent in the Northeast to 52 percent in Alaska. Finally, in describing Fannie Mae's 70–75 percent recovery rates on multifamily REO, Fitch concludes that their historical loss information did not include recoveries during adverse market conditions.[134]

OFHEO has simplified the loss severity calculation in the final rule. The six separate loss severity calculations proposed in NPR2 are replaced by one loss severity equation, which eliminates the redundancy in the first four equations. Those equations differed only in that one of them accounted for passthrough interest on sold loans and one did not. Similarly, one of them accounted for loss-sharing receipts on loans covered by loss-sharing agreements and one did not. Passthrough interest on sold loans and loss-sharing receipts remains part of the loss severity calculation. However, the final rule simply calculates four months of passthrough interest on sold, but not on retained loans, and loss-sharing receipts, if applicable, are included with other forms of credit enhancements.

In addition, the separate methodology used in NPR2 for arriving at loss severity for NT loans with repurchase agreements has been eliminated in the final rule. OFHEO determined that the NPR2 loss severity of 39 percent for these loans, arrived at by multiplying a 70 percent historical foreclosure rate by 56 percent (the share of Freddie Mac's 90-day delinquencies that end in foreclosure or other costly loan resolutions), is no longer applicable. OFHEO determined that the correct place to account for the potential cure rate of 90-day delinquent loans (as opposed to those that ultimately would end in foreclosure), is in the multifamily default model, rather than in the loss severity calculation. Appropriately, OFHEO included a correction there.[135]

[131] NPR2 actually proposed six severity treatments: (1) retained cash loans without recourse, (2) sold cash loans without recourse and NT loans without repurchase, (3) retained cash loans with recourse, (4) sold cash loans with recourse, (5) NT loans with repurchase, and (6) FHA loans. The NT distinction has been eliminated in the final rule, as discussed above at III.I.3.a.i., Negative Equity and Current LTV Variables and no comments were received about the three percent severity rate imposed upon FHA loans. For these reasons, references to the NPR2 approach are to the first four treatments, unless otherwise indicated.

[132] "Commercial Mortgage Stress Test Research," *Structured Finance* (October 23, 1998); "Trends in Commercial Mortgage Default Rates and Loss Severity—1997 Update," *Structured Finance* (July 20, 1998).

[133] For simplicity, foreclosure costs and operating losses are added together as net REO holdings costs.

[134] "Commercial Mortgage Stress Test Research," *supra,* note 132.

[135] In multifamily default modeling, the default event for NT loans repurchased by seller/servicers must be a 90-day delinquency, as OFHEO was not supplied with information regarding the final resolution of these loans. OFHEO adjusted for the broader definition of defult for NT loans (90-day delinquency) relative to the one used for all other multifamily loans (foreclosure) by undersampling NT defaults for inclusion in the historical estimation data set prior to model estimation. A stratified random sample of loans missing both origination and acquisition DCR was taken for

Continued

For FHA loans, the final rule retains the severity rate of three percent of UPB that was proposed in NPR2 to reflect the cost of assigning defaulted loans to the Department of Housing and Urban Development.

*J. Other Credit Factors*

To reflect counterparty or security defaults during the stress period, NPR2 proposed to reduce the payments from each counterparty or security to the Enterprises by an amount, or ''haircut,'' determined by the public credit rating of the counterparty or security. These haircuts were phased in linearly over the 120-month stress period beginning in the first month. OFHEO received a considerable number of comments on the level, timing, and calculation of the haircuts, which are discussed below by topic.

1. Haircut Levels for NonDerivative Counterparties and Securities

For all securities and counterparties except derivative contract counterparties, NPR2 proposed ten-year cumulative haircuts of ten percent for counterparties and securities rated triple-A, 20 percent for double-A, 40 percent for single-A, and 80 percent for triple-B and below and for unrated counterparties or securities. These haircuts were based on a consideration of Moody's 1998 study of corporate bond defaults, Standard and Poor's (S&P) approach to rating structured mortgage securities, and Duff & Phelps' (D&P) approach to evaluating credit supports provided by mortgage insurance companies. [136]

a. Comments

A number of commenters, including the Enterprises and several Wall Street firms, disagreed with OFHEO's methodology, asserting that the resulting haircuts were too severe and not representative of historical experience. In particular, they suggested that OFHEO's proposed haircuts were greater than those that would be implied by the Great Depression, citing the 1958 study of corporate bonds by W. Braddock Hickman.[137] These commenters concluded that the default rates implied by OFHEO's haircuts were too high.

Freddie Mac questioned the appropriateness of basing stress test haircuts on S&P's approach, because S&P uses it to evaluate structured finance securities. Structured finance transactions, Freddie Mac asserted, require credit support levels to cover risks not faced by the Enterprises because in such transactions there is little ongoing risk management capability, no diversification across pools, and no ability to retain earnings. Instead, Freddie Mac recommended basing the haircuts on both default and recovery rates. It suggested developing default rates by 1) comparing mortgage default rates associated with the benchmark loss experience to average mortgage default rates, stating that the former are roughly three times higher than the latter, and 2) applying this multiple to Moody's average ten-year cumulative corporate bond default rates since 1970. Freddie Mac provided an analysis supporting cumulative haircuts of 1.2 percent for triple-A, 1.5 percent for double-A, 2.3 percent for single-A, and 6.6 percent for triple-B and below and unrated, and recommended that these haircuts be adjusted downward by at least 30 percent in the up-rate scenario, to reflect general price inflation. Freddie Mac suggested that OFHEO assume a 50 percent recovery rate for defaulting mortgage insurers, citing the liquidation of a mortgage insurance company in the 1980's, and a 50 percent liquidation value for defaulting securities, citing Hickman and Moody's. The Moody's study used defaulting bond prices as the basis for evaluating recoveries; the Hickman study evaluated actual recoveries for bond defaults resolved before 1944, and January 1, 1944, prices for bonds trading below their amortized book value at that time.

Fannie Mae objected to OFHEO's reliance on rating agency approaches because it believes they are inconsistent with the data in the post-1970 period and not reasonably related to the benchmark loss experience. Based on its own analysis, Fannie Mae recommended default-based haircuts of three percent for triple-A, four percent for double-A, eight percent for single-A, and twelve percent for triple-B and below and unrated, and suggested that first-year defaults should not exceed 0.50 percent for triple-A-rated and 1.0 percent for double-A and single-A rated credits. Citing Hickman and Moody's, Fannie Mae described its suggested default rates as ''very conservative and substantially in excess of bond default performance over the benchmark time period'' Fannie Mae further suggested that these haircuts be reduced by an assumed liquidation value of 50 percent for securities, to account for recoveries, and by insurance premiums and servicing fees, to offset losses on insurer and recourse counterparty defaults. Another commenter pointed out that servicing fees under Fannie Mae's multifamily DUS program include a substantial risk premium.

In general, GE Capital supported OFHEO's haircut proposal except for the treatment of interest rate and currency derivative contract counterparties, which is discussed below under III.J.2., Derivative Contract Counterparties. In its reply comments, GE Capital pointed out that OFHEO's haircuts are consistent with rating agency discounts of reinsurance benefits, but noted that by imposing them over time, OFHEO's haircuts are far less than those discounts. MICA also supported OFHEO's haircuts but argued that triple-A and double-A mortgage insurers should be treated more favorably than other counterparties, with no distinctions between triple-A and double-A rated mortgage insurers. (*See* section III.J.5., Mortgage Insurer Distinctions below.)

In their reply comments, GE Capital and MICA criticized the way the Enterprises used the Hickman and Moody's studies to suggest lower haircut levels. They noted that the Enterprises included data from the Hickman study on defaults only for large issues, which are generally substantially lower than for smaller issues of the same rating, and that the Enterprises had insufficient basis for their extrapolation of ten-year default rates from quadrennial data. They also questioned the Enterprises' exclusion of earlier corporate default experience in their reliance on Moody's average default rates since 1970. GE Capital

inclusion in the estimation data set. Those loans sampled were overwhelmingly NT (68 percent), seasoned-at-acquisition (64 percent), and ARMs (63 percent). By contrast, loans with either origination or acquisition DCR were overwhelmingly non-NT (90 percent), newly-originated at Enterprise acquisition (80 percent), and fixed-rate mortgages (95 percent). A 10 percent stratified random sample of loans missing both origination/acquisition DCR yielded 2,498 loans (157 defaults and 2,303 non-defaults). The default sample wsa reduced to 126 loans based upon an estimated cure rate of 30 percent for the portion of the loans missing both origination and acquisition DCR that were NT.

[136] ''Historical Default Rates of Corporate Bond Issuers, 1920–1997,'' Moody's Investors Service, February 1998; S&P's Structured Finance Criteria,'' Standard & Poor's Corporation, 1988; and ''Evaluation of Mortgage Insurance Companies,'' Duff & Phelps, November, 1994. The Moody's study, which showed cumulative default rates over various time horizons for each rating category, suggests that the ten-year cumulative default rate roughly doubles for each one-level drop in rating category. In rating structured mortgage securities, S&P discounts the claims-paying ability of mortgage insurers in a double-A stress environment by 20 percent for double-A-minus-rated mortgage insurers, and 60 percent for single-A-rated insurers. In rating mortgage insurers in a triple-A stress environment, D&P discounts double-A rated reinsurers by 35 percent, single-A-rated reinsurers by 70 percent, and triple-B-rated reinsurers by 100 percent.

[137] W. Braddock Hickman, *Corporate Bond Quality and Investor Experience*, National Bureau of Economic Research (1958).

pointed out that using an average observation plus three standard deviations would be a more statistically valid method of establishing stress test default rates than using a multiple of three, and would result in default levels significantly higher than those suggested by the Enterprises but lower than those reflected in the haircuts proposed by NPR2.

Neither GE Capital or MICA favored reflecting recoveries, primarily because they regard the Enterprises' assumptions as questionable and unsupported by authoritative data.[138] Both disagreed that defaulted bond prices serve as a proxy for recovery rates on mortgage credit enhancements and questioned whether mortgage insurance premiums (especially if paid up front) or servicing rights would offset losses on mortgage credit enhancements to any significant extent.

World Savings asserted that the haircut differentials between triple-A, double-A and single-A ratings in NPR2 were too great, citing Moody's and S&P's rating definitions. It proposed haircuts for these ratings of five percent, ten percent, and fifteen percent, respectively, with significantly larger haircuts applied to lower-rated institutions, particularly those with non-investment grade ratings.

b. OFHEO's Response

In NPR2, OFHEO pointed out certain conceptual similarities between its approach to discounting for counterparty risk and those of the rating agencies, but did not rely on rating agency methodologies for default levels. For example, OFHEO's use of haircuts to reflect losses due to counterparty failure is similar to the methodology of Moody's, S&P and D&P.[139] OFHEO's approach is also similar to that of S&P and D&P in that in the proposed stress test, failing counterparties meet some but not all of their obligations (i.e., over time, haircuts increase to a maximum level), rather than meeting all of their obligations until the counterparty fails (i.e., haircuts are constant over time). OFHEO also observed that Moody's 1998 bond study revealed that default rates roughly double for each drop in ratings and employed a similar relationship in defining haircuts for the various rating categories. OFHEO does not believe that consideration of these concepts is inappropriate for the purposes of the stress test, regardless of the purpose for which the rating agency methodologies were developed. With respect to default levels, OFHEO noted in NPR2 that the default levels reflected in maximum haircuts included in NPR2 are higher than recent experience and, according to Moody's 1998 study, six to ten times the average ten-year cumulative default levels from 1920 through 1997.

In the course of evaluating the recommendations for lower haircuts, OFHEO reviewed Moody's 2000 bond study,[140] as well as the Hickman study. According to Hickman, the worst four-year cumulative default rates for investment grade corporate securities were 6.2 percent (1932–35) and 7.0 percent (1912–15).[141] In order to compare these rates with the historical average, OFHEO extrapolated ten-year rates consistent with these four-year rates, which were 21.0 and 23.7 percent, respectively.[142] These rates are 4.3 and 4.9 times greater than the historical average ten-year rate for the period from 1920–1999 of 4.85 percent from the Moody's study. As shown in Table 5 below, the default levels the Enterprises proposed as a basis for stress test haircuts (which they recommended be reduced by 50% to account for recoveries) reflect significantly lower multiples of Moody's average historical 10-year cumulative default rates than the extrapolated ten-year default rates that occurred during the most stressful periods identified by Hickman. Based on this analysis, OFHEO concluded that while the default rates reflected in the haircuts included in NPR2 were high, the default rates proposed by the Enterprises are too low.

TABLE 5.—COMPARISON OF HISTORICAL 10-YEAR CUMULATIVE DEFAULT RATES WITH THOSE RECOMMENDED BY THE ENTERPRISES AS A BASIS FOR STRESS TEST HAIRCUTS

| Rating | (A) Moody's Average Rates 1920–1999 [1] | (B) Freddie Mac's Recommended Haircuts | (B)/(A) | (C) Fannie Mae's Recommended Haircuts | (C)/(A) |
|---|---|---|---|---|---|
| AAA | 1.09% | 2.3% | 2.1× | 3.0% | 2.8× |
| AA | 3.10% | 2.9% | 1.1× | 4.0% | 1.3× |
| A | 3.61% | 4.7% | 1.3× | 8.0% | 2.2× |
| BBB | 7.92% | 13.2% | 1.7× | 12.0% | 1.5× |

[1] "Historical Default Rates of Corporate Bond Issuers, 1920–1999," Moody's Investors Service, January 2000, at 27.

With respect to the relationships among cumulative default rates for credits in different rating categories, the Moody's data for 1920–1999, as reflected in the table, show cumulative defaults roughly tripling between the triple-A and double-A categories, increasing by 15% from double-A to single-A, and then doubling from single-A to triple-B, rather than doubling in every case.

Haircuts included in the final rule reflect consideration of the relationship between cumulative default rates in normal and stressful times, the ameliorating effect of phasing in haircuts over time, mixed commenter opinion with respect to recoveries, the potential for insurance premiums or servicing fees to partially offset losses on mortgage credit enhancements, as well as the relationships among cumulative default rates for credits in different rating categories. OFHEO

[138] However, MICA supported lower haircuts for triple-A- and double-A-rated mortgage insurance companies relative to any other counterparties, regardless of rating, as discussed below under "Rating Categories."

[139] On June 1, 2000, D&P merged with Fitch ICBA. The merged company is called "Fitch."

[140] "Historical Default Rates of Corporate Bond Issuers, 1920–1999," Moody's Investors Service, January 2000.

[141] Hickman, at 189.

[142] These rates were extrapolated by multiplying Hickman's 4-year cumulative default rates from 1932–1935 and 1912–1915 by the ratio of Moody's historical average 10-year rate from 1920–1999 of 4.85 percent to Moody's historical average 4-year rate of 1.43 percent. (Moody's, at 27.)

determined that the haircuts proposed in NPR2 should be reduced and phased in more quickly. In the final rule, maximum haircuts for securities and counterparties other than derivative contract counterparties are lowered from 10 to 5 percent for those rated triple-A, from 20 to 15% for double-A, from 40 to 20 percent for single-A, and from 80 to 40 percent for triple-B. They are phased in linearly over the first five years of the stress period and remain constant thereafter.

2. Derivative Contract Counterparties

In recognition of the routine use of collateral pledge agreements with interest rate and foreign-currency derivative contracts, NPR2 proposed haircuts for derivative contract counterparties[143] that are lower than haircuts for other counterparties. Collateral posted under these agreements is continuously re-evaluated, which limits an Enterprise's risk exposure. For counterparties to interest rate contracts and foreign currency derivative contracts that fully hedge their corresponding exchange rate exposure, NPR2 proposed ten-year cumulative haircuts of two percent for triple-A-rated counterparties, four percent for double-A-rated counterparties, eight percent for single-A-rated counterparties, and 16 percent for counterparties rated triple-B and below and unrated counterparties. In the case of derivative contracts that fully hedge the foreign exchange risk of foreign-currency-denominated debt, NPR2 proposed that the stress test increase the amount in dollars owed by an Enterprise by the derivative haircut percentage. (*See* section III.J.4., Foreign Exchange Risk) below for a discussion of the treatment of any unhedged foreign exchange risk.)

a. Comments

Freddie Mac and Morgan Stanley suggested eliminating the haircuts for derivative contracts entirely, stating that counterparty risk for derivative contracts would more properly be characterized as management and operations risk, and should therefore be subsumed in the 30 percent management and operations risk add-on. Fannie Mae and Freddie Mac proposed, alternatively, that OFHEO apply minimum capital treatment to derivative contract exposure rather than attempting to model cash flows. On the other hand, a number of commenters supported applying the proposed haircuts for mortgage credit enhancement counterparties to interest rate and foreign currency derivative contract counterparties. GE Capital was among these commenters, but favored applying NPR2's haircut for triple-A derivative contract counterparties to contracts collateralized by cash or Treasury securities as of the start of the stress test, to the extent of such collateral coverage.

b. OFHEO's Response

OFHEO rejects the idea that derivative contract counterparty exposure constitutes a management or operations risk, since the magnitude of these exposures, even as mitigated by collateral pledge agreements, is driven by interest rate, credit, and foreign currency risk factors. OFHEO disagrees that minimum capital treatment is appropriate for derivative contract counterparty exposure for two reasons. First, for interest rate derivative contracts, exposure and related collateral requirements likely will vary dramatically between the up- and down-rate scenarios. A simple leverage ratio would not capture such fluctuations. Second, the amount of collateral pledged at the start of the stress test, an important determinant of the minimum capital requirement, will have little relationship to future exposures or the related collateral requirements of derivatives contracts throughout the stress test. For this second reason, OFHEO also disagrees with GE Capital's suggestion that the stress test apply lower haircuts to collateralized exposure on interest rate derivative contracts as of the start of the stress test.

The final rule retains the haircuts for derivative contract counterparties proposed in NPR2 for securities rated triple-A, double-A, single-A and triple-B. Like other haircuts, they are phased in linearly in the first five years of the stress period. Haircuts for derivative contract counterparties are now higher relative to the haircuts applied to other counterparties as a result of the reduction in haircuts for those other counterparties in the final rule, but they remain substantially less than haircuts for nonderivative counterparties.

For certain derivative contract counterparties, the practical difficulties of modeling the instruments according to their terms require the use of simplifying assumptions. (*See,* e.g. discussion under section III.J.4., Foreign Exchange Risk.) For these few instruments, no haircut is applied. When the simplifying assumptions are no longer needed, these counterparties will be subject to haircuts comparable to those for other derivative counterparties.

3. Rating Categories

NPR2 proposed applying haircuts based on public ratings and treating unrated counterparties and investments as if they were rated triple-B and below, the lowest haircut category. In the case of different ratings from different rating agencies, the lowest rating would be used.

a. Comments

Most commenters who addressed the issue supported the use of public ratings, but there was disagreement about OFHEO's treatment of below-investment-grade and unrated counterparties and securities. Some commenters suggested that no credit should be given in the stress test for enhancements provided by unrated or below-investment-grade counterparties. Although the Enterprises supported the rating categories OFHEO proposed, Fannie Mae, along with other commenters, asserted that the assignment of unrated seller/servicers to the triple-B category overstated counterparty risk, especially with respect to Delegated Underwriting and Servicing (DUS) lenders, whose agreements are typically supported by other credit enhancements, such as letters of credit. For these lenders, Fannie Mae suggested reliance on an Enterprise's internal rating classifications. Fannie Mae also suggested reliance on internal ratings when fewer than two ratings are available, or when additional contractual agreements supporting the counterparty obligation exist. In addition, Fannie Mae suggested that relationships with corporate parents might justify an assignment of a parent company's rating to its unrated seller/servicer subsidiaries (rather than the triple-B rating proposed for unrated seller/servicers) for purposes of the stress test. Both Fannie Mae and Freddie Mac recommended that, in the case of split ratings, the stress test apply the median.

b. OFHEO's Response

The final rule makes no change to the proposed treatment of split ratings because OFHEO believes that a conservative evaluation of risk is appropriate for regulatory purposes. Consistent with that belief, and in response to comments, the final rule

[143] For the purposes of the risk-based capital regulation, the term ''derivative contract'' refers only to interest rate, foreign currency, and similar derivative contracts for which values are easily determined; i.e., which can easily be marked to market. It does not include derivative securities or credit derivative contracts, for which markets are not sufficiently developed to facilitate accurate market valuations. (*See* III.K., Mortgage Credit Enhancements, for a fuller discussion of credit derivatives.)

introduces a new haircut category for nonderivative securities and counterparties (except seller/servicers and GSEs) that are rated below investment grade or unrated. The new haircut category recognizes the significant distinctions between the default experience of triple-B- and double-B-rated corporate bond issuers, as reflected in the Moody's data, and the fact that the lack of a public rating often reflects the speculative nature of the credit. The new haircut category is assigned a haircut of 100 percent and is applied in the first month of the stress period. The effect of applying a 100 percent haircut in the first month of the stress period is to write off as a loss below-investment-grade or unrated securities (except securities issued by GSEs), and to give no credit for credit enhancements or derivatives provided by below-investment-grade or unrated counterparties (except seller/servicers). However, to provide for investments that are unrated for reasons other than an inability to obtain a public rating, OFHEO reserves the right to make a different determination on an unrated counterparty or security that would otherwise be subject to the 100 percent haircut, on a case-by-case basis, if an Enterprise presents information about the investment that persuades OFHEO that a different rating is warranted.

The Enterprises do not currently contract with mortgage insurers or derivative contract counterparties that are below investment grade or unrated, and OFHEO has issued policy guidance [144] to the Enterprises emphasizing the importance of high-quality investments for their liquidity portfolios. OFHEO would view the practice of investing in below-investment-grade securities or contracting with below-investment-grade counterparties unfavorably. The introduction of the new haircut category should have little impact on the Enterprises' capital requirements as they currently conduct their businesses, but it will make the risk-based capital regulation consistent with OFHEO's regulatory policy on below-investment-grade investments.

Under the final rule, unrated seller/servicers continue to be treated as if they were rated triple-B, in recognition of the ongoing nature of the Enterprises' relationship with seller/servicers and the contractual leverage available to the Enterprises to manage their exposure to counterparty risk, as well as the credit protection afforded by servicing income and mortgage insurance premiums.

[144] OFHEO Director's Advisory, *Non-mortgage Liquidity Investments,* PG–00–002 (Dec. 19, 2000).

OFHEO rejected the recommendation to use internal Enterprise ratings for unrated seller/servicers, for reasons articulated in NPR2.[145] Neither the Enterprises' internal ratings methodologies nor the ratings themselves are publicly available, and they may not be consistent with each other. OFHEO also declines to assign the rating of a parent company to its unrated seller/servicers subsidiary, just as the NRSROs will not impute a corporate parent's rating to a derivative dealer or credit enhancement counterparty in the context of rating a securities transaction. To do so would require OFHEO itself to ''rate'' the entity, considering the nature and extent of a parent's liability for an entity's obligations.

OFHEO recognizes the desirability of making finer risk distinctions between unrated seller/servicers in a risk-based capital regulation. Therefore, following adoption of this regulation OFHEO will evaluate alternative approaches for assessing the risk of unrated seller/servicers, including establishing criteria under which Enterprise internal ratings could be used, and encouraging the attainment of a NRSRO rating by seller/servicers.

In response to comments that NPR2 did not reflect adequately the risk-mitigating requirements of the DUS program, OFHEO notes the following. DUS lenders, like all seller/servicers, benefit from this favored treatment in addition to the general reduction in haircut levels. Further, the letters of credit that DUS lenders typically post to back up their loss sharing agreements will be modeled, providing a significant offset to the haircut. In addition, DUS lenders are among those who benefit from the inclusion of two variables in the multifamily default model, the New Book indicator and the Ratio Update Flag. The New Book indicator captures the lower default probability for loans acquired under the Enterprises' current multifamily lending programs compared to loans acquired under early loan programs. The Ratio Update Flag reflects the lower default probability for loans on which the underwriting ratios have been reviewed and adjusted at acquisition to Enterprise standards. The effect of these various elements of the stress test is to create substantially lower losses on loans from the DUS or similar programs than on loans that share none of the risk mitigating factors of DUS loans.

An exception to the new haircut category is also made for unrated securities issued by other GSEs. NPR2 stated that the stress test reflects no credit losses on securities issued by Ginnie Mae or the Enterprises,[146] but did not address whether a haircut should be applied to payment due to an Enterprise from securities issued by another GSE. The final rule clarifies that this statement was not intended to apply to securities issued by another GSE held by an Enterprise as an investment (including a Fannie Mae security held by Freddie Mac or a Freddie Mac security held by Fannie Mae). Such unrated securities are treated as AAA-rated securities and haircut accordingly.

[145] 64 FR 18155, April 13, 1999.

To summarize, the haircuts used in the final regulation to discount for all counterparty risk are set forth by rating category and counterparty type in Table 6.

TABLE 6.—HAIRCUTS BY RATING CATEGORY IN FINAL RULE

| Ratings Classification | Derivatives | Non-derivatives |
|---|---|---|
| AAA | 2% | 5% |
| AA | 4% | 15% |
| A | 8% | 20% |
| BBB | 16% | 40% |
| Below BBB & Unrated [1] | 100% | 100% |

[1] Unrated, unsubordinated obligations issued by other GSEs are treated as AAA. Unrated seller/servicers are treated as BBB. Other unrated counterparties and securities are subject to a 100% haircut applied in the first month of the stress test, unless OFHEO specifies another treatment, on a showing by an Enterprise that a different treatment is warranted.

4. Foreign Exchange Risk

In NPR2, OFHEO proposed to model foreign currency derivative contracts that fully hedge the foreign exchange risk of liabilities issued in foreign currencies as synthetic dollar-denominated liabilities. Under the proposal, appropriate haircuts would be determined by increasing amounts of principal and interest due on the synthetic liabilities by the amount of the derivative contract haircut appropriate to the counterparty.[147] (Applying the same approach to contracts hedging

[146] *See id.*

[147] Theoretically, the haircut should be applied based on the amount of foreign currency to be paid to the Enterprise in the transaction. However, these amounts cannot be calculated, because foreign currency values are not projected in the stress test. Therefore, for purposes of computing a capital number for a currency swap, using the dollar side of the transaction is used as the basis to determine total cash flow haircuts.

foreign-currency-denominated assets, amounts received from a synthetic asset would be reduced by the same percentage.) To the extent foreign exchange risk exposure is not fully hedged, NPR2 proposed to assume an adverse percentage change in the value of the foreign currency versus the United States dollar equal to the amount of the percentage change in the ten-year CMT, which resulted in a significantly larger haircut.[148] OFHEO did not propose to apply netting provisions to foreign currency derivatives, because netting of all of a counterparty's derivative contracts would require the modeling of all of their cash flows. Accordingly, instead of modeling all cash flows for foreign-currency-denominated contracts, NPR2 simply adjusted the debt payment amounts.

a. Comments

Fannie Mae supported the modeling of foreign-currency-denominated debt and associated foreign currency swaps as synthetic dollar-denominated instruments, but commented that the resulting haircuts were excessive. It pointed to the lack of netting of payments within an individual swap and among payments across all swaps with a single counterparty, and the fact that the haircuts would be consistently applied, whether a derivative was ''in the money'' or out ''of the money.'' [149] The Enterprise suggested that for foreign exchange contracts, the minimum capital standard, which ''provides for generally higher capital charges for foreign exchange contracts than other types of derivative contracts,'' should apply. Fannie Mae also commented that OFHEO should delete from the final regulation the NPR2 treatment for unhedged foreign currency transactions, because none currently exist in Fannie Mae's book of business. Finally, Fannie Mae objected to a footnote in the preamble to NPR2 that indicated that the same type of treatment used for foreign currency derivatives would be applied to any instrument that was denominated in or linked to units or values that are not included in the stress test.[150] Fannie Mae stated that this footnote would create a bad precedent and that any such instrument should be dealt with on a case-by-case basis.

b. OFHEO's Response

The final rule does not adopt Fannie Mae's recommendation to employ netting within a swap or among all swap payments with a single foreign currency swap counterparty. The synthetic debt approach is inconsistent with netting because it effectively models only the dollar-denominated pay side of a swap, not the foreign-currency-denominated receive side. Without modeling both sides of a swap, netting of the payments associated with such derivatives is not feasible. OFHEO takes an appropriately conservative approach by treating foreign currency derivatives as always being ''in the money'' because, without explicitly modeling foreign currencies, there is no basis for determining whether a contract is ''in'' or ''out of the money.'' OFHEO also rejects the application of minimum capital treatment for derivatives for reasons discussed above at section III.J.2.b., OFHEO's Response. However, because foreign currency values are not projected in the stress test, OFHEO has decided not to apply haircuts to foreign currency swap counterparties by adding the haircut percentage to the pay side of the swap. As a simplifying assumption, no haircut is applied in the final rule. However, OFHEO continues to believe that some haircut is appropriate and will continue to explore whether some other methodology is more appropriate.

Notwithstanding Fannie Mae's comment that it currently has no unhedged foreign currency exposure, it is conceivable that unhedged positions could arise, because the Enterprises issue securities denominated in foreign currencies and use foreign currency derivatives to hedge the exchange risks associated with these securities. For this reason, the final rule retains a treatment for them. If the Enterprises follow their current policies and continue to use swaps to fully hedge all foreign currency risk, the treatment of unhedged positions in the regulation will be a moot issue. If these policies change, or through error or inadvertence are adhered to imperfectly, the regulation includes an appropriately conservative treatment to deal with any instruments that are left unhedged.

In regard to the footnote related to instruments that are denominated in, or linked to, units or values that are not included in the stress test, OFHEO will consider such instruments, including unhedged derivatives (other than standard interest rate or foreign currency derivatives) or other unusual instruments that appear at the Enterprises, on a case-by-case basis. Where the stress test includes a specific treatment or the capability to model the instrument according to its terms, OFHEO will do so. Other instruments may be accorded alternative modeling treatments in accordance with section 3.9, Alternative Modeling Treatments, of the Regulation Appendix. The footnote was intended to indicate that a treatment similar to that for unhedged foreign currency exposures would likely be appropriate for such instruments. If the instruments involve a new activity for an Enterprise, it should notify OFHEO as soon as possible of the existence of the transaction and request an estimated treatment in the stress test in accordance with section 3.11, Treatment of New Enterprise Activities, of the Regulation Appendix.

5. Mortgage Insurer Distinctions

NPR2 proposed haircuts that double for every decrease in rating category for all securities and counterparties, other than unhedged foreign currency derivative contract counterparties, without distinguishing between types of counterparties.

a. Comments

MICA and Triad GIC argued for preferred treatment for mortgage insurers rated triple-A and double-A over securities and other types of counterparties, and, along with Neighborhood Housing, opposed differentiating between mortgage insurers rated triple-A and double-A. MICA emphasized that mortgage insurance companies' ratings are based solely on their ability to manage and absorb mortgage credit risk losses in a stress scenario and cited the effectiveness of state insurance regulation. Several other commenters, including another mortgage insurer, urged OFHEO to maintain the distinction.

b. OFHEO's Response

OFHEO believes that NRSROs take into account all of the relevant risk characteristics when assigning ratings, including those cited by the commenters, and seek to maintain comparability of the ratings as risk indicators across industries. Therefore, in the absence of quantitative data demonstrating a better credit performance of mortgage insurance companies versus similarly rated

[148] NRP2 provided that in the event OFHEO finds that the foreign currency risk on any liability or derivative instrument has not been transferred fully to a third party, the stress test would model the instrument by creating significant losses in both the up-rate and down-rate scenarios. In the up-rate scenario, the stress test would apply an exchange rate that increases the value of the foreign currency against the dollar by the same percentage that interest rates increase. In the down-rate scenario, the stress test would decrease the exchange rate of the dollar proportionately with the decline in the 10-year CMT, creating a decrease in the value of the dollar similar to that in the up-rate scenario.

[149] A foreign currency swap is ''in the money'' when net funds are due to the Enterprise under the contract and ''out of the money'' when the Enterprise owes net funds under the contract.

[150] 64 FR 18158 n. 168, April 13, 2000.

entities and securities, OFHEO has not given preferential treatment to mortgage insurers in the final rule. The final rule also maintains the distinction between triple-A- and double-A-rated counterparties and securities because performance differences between the two are reflected in the data irrespective of the level of stress.

6. Rating Agencies

In NPR2 OFHEO proposed to use rating information from four NRSROs, S&P, Moody's, D&P, and Fitch ICBA, for all counterparties and securities other than seller/servicers. For seller/servicers, NPR2 proposed to use only rating information from S&P and Moody's for seller/servicers providing mortgage credit enhancements. Freddie Mac and Fitch ICBA recommended that the rule use credit ratings by all NRSROs for all counterparties, and OFHEO has adopted this approach in the final rule.

7. Collateralized Securities

Both Fannie Mae and Freddie Mac commented that the stress test should not haircut investments if (1) they are backed by collateral representing obligations of the U.S. Government (e.g., Ginnie Mae securities or FHA-insured loans) or of GSEs; and (2) the collateral is held by a trustee. Fannie Mae also suggested that haircuts for mortgage revenue bonds based on security ratings would be excessive, due to double counting the risk of any collateral guaranteed by the Enterprise.

The final rule continues to treat these investments consistently with other investments because OFHEO believes that NRSROs strive to achieve consistency in the risk assessments represented by their ratings. A rating reflects the rater's overall assessment of the likelihood an investor will receive all contractually required principal and interest. A rating of less than triple-A reflects the rater's perception of an element of risk in some aspect of a security or its structure, such as the legal structure or the role of a third party in the transaction, even when some or all of the collateral represents obligations of the Federal Government or a Government-sponsored Enterprise. Further, OFHEO does not believe the haircutting of MRBs results in material double counting of the credit risk of any Enterprise collateral. Rating agencies treat such collateral as triple-A, so the risk associated with any lower rating on the collateralized security reflects risk factors not related to the collateral.

8. Private Label Security Haircut

NPR2 proposed to apply haircuts to payments due to an Enterprise from private label securities (municipal, corporate and mortgage- or asset-backed) based on the security's credit rating, consistent with the treatment of all securities and counterparties other than interest rate and foreign currency derivative contract counterparties. Thus, the proposal would have subjected unrated securities to a haircut appropriate to a rating of double-B or below. In the final rule, private label securities, like all other securities, will be assigned a 100 percent haircut if they are rated double-B or lower or are unrated.

OFHEO did not adopt Freddie Mac's suggestion that unrated securities should receive haircuts based on the rating of the issuer, because there are circumstances in which the credit rating for an issuer might not be appropriate for an unrated security. For example, for many securities there is no contractual requirement for an issuer to provide credit support. Furthermore, evaluating contractual obligations of individual issuers for specific securities would add complexity to the stress test that would impede its operational workability and would not be justified by any marginal benefit derived.

*K. Mortgage Credit Enhancements*

NPR2 proposed to offset stress test losses with the credit enhancements used by the Enterprises.[151] NPR2 generally distinguished between ''percent denominated'' enhancements (e.g., primary mortgage insurance), where the coverage is based on a percentage of the loss incurred, and ''dollar denominated'' enhancements (e.g., pool insurance) where the coverage available is expressed as a specified dollar amount, which is applied to offset credit losses on a pool of loans until the coverage is exhausted.[152] For all credit enhancements, the available coverage was reduced by a ''haircut'' based on the counterparty's public rating.[153] (*See* III.J., Other Credit Factors.)

NPR2 proposed to apply credit enhancements at the loan group level.[154] Because pools of loans covered by a particular credit enhancement contract could be distributed among more than one loan group, NPR2 proposed simplifications in the treatment of such contracts. Specifically, for dollar-denominated credit enhancements, NPR2 proposed allocating amounts available under the contract to each affected loan group based on the ratio of the aggregate balance of loans in the loan group covered by the enhancement, to the aggregate balance of all loans covered under the contract. As proposed in NPR2, for each loan group, the proposed stress test aggregated funds available under all dollar-denominated credit enhancements subject to the same credit rating, applied the amounts available to loan group losses each month of the stress period, and tracked the balances of the funds allocated to each loan group throughout the stress period.

When loans are covered by more than one type of credit enhancement, the stress test proposed in NPR2 would apply percent-denominated credit enhancements first and then apply dollar-denominated enhancements to cover any remaining losses. In such cases, to determine ''haircuts'' for counterparty credit risk, the proposed stress test assigned the credit rating associated with the first level of credit enhancement for a given loan (usually primary mortgage insurance) to all secondary credit enhancements,[155]

[151] The Charter Acts prohibit the purchase of conventional single family mortgages with LTV ratios in excess of 80 percent unless: (1) The seller retains a participation interest of 10 percent or more; (2) the seller agrees to repurchase or replace the mortgage upon default; or (3) the amount of the mortgage in excess of 80 percent is insured or guaranteed. For reasons stated in NPR2, the proposed stress test did not, and the final stress test will not, recognize any credit enhancements on any such mortgages that do not meet one of these three conditions. When this statutory requirement is applicable and is met, the stress test will recognize all credit enhancements related to the loan. *See* 64 FR 18156, April 13, 1999.

[152] Percent-denominated credit enhancements included mortgage insurance and unlimited recourse and unlimited indemnification. Mortgage insurance coverage is a percentage of the gross claim amount and unlimited recourse and unlimited indemnification cover 100 percent of the net loss amount. All other types of credit enhancements currently used by the Enterprises were considered dollar-denominated. The final rule distinguishes between loan limit credit enhancements and aggregate limit credit enhancements, which correspond to the NPR2 designations of percent- and dollar-limit credit enhancements, respectively, except that in the final rule, for computational convenience, unlimited recourse and unlimited indemnification are treated as aggregate limit credit enhancements (limited to the aggregate original UPB of the covered loans).

[153] A ''haircut'' is a reduction in the credit enhancement coverage available that is based on the public rating of the provider to reflect the risk that the stress of the stress period will cause the provider to default on some of its obligations. *See* section III.J., Other Credit Factors for a discussion of haircuts.

[154] Loan groups are created by grouping loans of the same type, origination year, original LTV, original coupon, Census Division, and remittance cycle. (*See* section 3.1, Data, of the Regulation Appendix.)

[155] For example, if 50 percent of a loan group carried primary mortgage insurance with an AAA-rated carrier, haircuts associated with an AAA

Continued

which might differ from the haircut appropriate for the contract credit enhancement counterparty.

OFHEO believed this approach to modeling mortgage credit enhancements struck a balance between precision and practical implementation. OFHEO recognized that the approach could understate the benefits of some and overstate those of other credit enhancement contracts, but believed that the overall impact on stress test results would likely be minimal.

A common theme of the comments on the treatment of mortgage credit enhancements proposed by NPR2 was that mortgage credit enhancements should be modeled at a greater level of detail. Commenters expressed concerns about the impact of modeling simplifications, the failure to model revenue inflows into spread accounts, and the modeling of termination of credit enhancement coverage. In addition, several commenters made suggestions about how OFHEO should treat credit derivatives, including the Mortgage Default Recourse Note (MODERN) transaction that was introduced recently by Freddie Mac. NPR2 did not specify a treatment for credit derivatives, because, with the exception of the MODERN transaction, the Enterprises had not been using them. The cash flows from the MODERN transaction could be modeled like other instruments that are modeled according to their terms and did not present any unique issues. Comments on these issues are discussed below by topic.

1. Modeling Simplifications

a. Contract Detail

(i) Comments

Both Enterprises criticized the simplified treatment of dollar-denominated credit enhancements. Fannie Mae argued that the ''underlying parameters'' of contractual agreements between an Enterprise and the credit enhancement counterparty should be modeled, because in some cases the approach taken in NPR2 would not be consistent with economic risk. Fannie Mae supported the modeling of all credit enhancement contracts according to their terms. For example, in the case of a contractual agreement that provides for the statutory minimum level of primary mortgage insurance on a particular lender's loans with LTVs in excess of 80 percent and a supplemental dollar-denominated coverage in the form of a pool policy that applies to the entire pool, Fannie Mae suggested that the stress test should apply the primary coverage only to that lender's loans with LTVs greater than 80 percent and that the supplemental coverage should be applied in accordance with the terms of the contract.

Freddie Mac commented that OFHEO's simplified treatment of dollar-denominated credit enhancements would provide the Enterprises with the benefit of some coverage to which they would not be entitled, and would fail to provide the benefits of some overlapping coverage to which they would be entitled. Freddie Mac also criticized the simplified structure because it did not accommodate credit enhancement contracts with specialized features. Freddie Mac argued that the complexity necessary to model the contractual terms of credit enhancements explicitly is justified by the need to assess accurately the value of the mortgage credit enhancements because more than 30 percent of its portfolio is credit enhanced beyond primary mortgage insurance.

(ii) OFHEO's Response

In response to Enterprise comments, OFHEO explored a method of modeling dollar-denominated credit enhancements that tracks amounts available under such credit enhancements by contract, rather than by loan group, charging payments to an Enterprise made under any such enhancement against the related contract, regardless of which loan groups are involved. This approach required the creation of a finer aggregation of loans below the loan group level, called Distinct Credit Enhancement Combinations (DCCs). DCCs identify the principal amount of loans in a loan group that have equivalently identical credit enhancement arrangements. The creation of DCCs permits the aggregation across all affected loan groups of deposits into and payments from each individual credit enhancement and the consideration of its specific rating and application priority. OFHEO found, however, that the implementation of this treatment is exceedingly complex and greatly increases the time required to run the stress test. OFHEO will continue to explore how this more precise modeling might be done more efficiently, but found it impracticable to incorporate the method in the stress test at this time.

The final rule adopts a more limited use of DCCs. While it ensures that haircut levels for aggregate limit credit enhancements are consistent with specific counterparty ratings and application priority, it does not track deposits to and withdrawals from such enhancements at the contract level. Rather, the Enterprises report credit enhancement available balances adjusted for deposits that can reasonably be expected to be made during the stress period. These adjusted balances are prorated among DCCs, based on the ratio of covered loan UPB at the DCC level to the total UPB of loans covered under the credit enhancement contract. For each DCC, the stress test then separately tracks withdrawals from such prorated enhancement amounts under a given contract to offset covered losses.

With regard to Fannie Mae's concern over the treatment of primary mortgage insurance combined with pool insurance, the use of DCCs in the final rule ensures that mortgage insurance coverage is applied only to covered loans and that pool insurance or other aggregate limit credit enhancement is then applied to all loans covered by the contract.

b. Ratings Detail

A number of commenters pointed out that the assignment of the ratings of providers of primary credit enhancements to all supplemental enhancements almost always overestimates the total credit enhancement coverage where the primary layer is triple-A-rated mortgage insurance, and may understate credit enhancement coverage where the primary layer is an unrated seller/servicer. They asserted that this effect creates an incentive to provide a thin primary triple-A layer of credit enhancement, supplemented by an extensive and lower cost credit enhancement from a lower rated institution.

In NPR2, OFHEO recognized that the application of the ratings of the providers of primary credit enhancement to secondary credit enhancements could understate or overstate the creditworthiness of secondary credit enhancements, but thought the impact of this simplification would likely be small. Nevertheless, in considering the comments, OFHEO weighed the additional complexity that would result from taking into account the actual rating of the supplemental provider against the disadvantages and perverse incentives that the commenters pointed out and concluded that the proposed stress test should be modified. Accordingly, the final regulation takes into account the rating of the supplemental credit enhancement rather than assigning the credit rating of the primary credit enhancement provider.

rating would be applied to any subordinate credit enhancement coverage on those loans.

c. Cash Accounts

In NPR2, OFHEO proposed to model mortgage credit enhancements that take the form of cash accounts by aggregating them with all other dollar-denominated credit enhancements, netting applicable haircuts, and offsetting losses dollar for dollar until the amount of coverage is exhausted.

The final rule models cash accounts more explicitly. It does not aggregate them with all other dollar-denominated credit enhancements and does not apply haircuts. However, if the cash is permitted to be invested in securities with maturities longer than one year, the value of the account is discounted by 30 percent to reflect the risk that the value of the investments may be lower than par when they are required to be liquidated to offset losses. When these investments are sold prior to maturity, there is a risk that the price may be significantly less than par because of changes in interest rates or market conditions that occur between the time the investments are marked to market and the time they are liquidated. This treatment is consistent with the practice of rating agencies of requiring overcollateralization or applying a discount factor to achieve sufficient certainty that the market price at least equals the required amount of credit enhancement at any time.

2. Credit Enhancements Receiving a Cash Flow Stream

Some dollar-denominated credit enhancements—primarily spread accounts—are funded by a portion of each loan interest payment. The proposed stress test took into account the amount of cash in the credit enhancement account at the start of the stress test, but did not attempt to model cash flows into the account during the stress period. The Enterprises and others criticized this feature of the stress test.

In response to these comments, the final regulation allows the Enterprises to take account of these cash inflows by adjusting the available balance at the start of the stress test to reflect inflows that might reasonably be expected to occur during the stress period. These adjusted initial balances are then used to offset covered losses during the stress period.

3. Termination Dates

Freddie Mac noted that, although OFHEO stated in NPR2 that the coverage expiration date for credit enhancement contracts is required as an input, OFHEO's cash flow model did not actually take it into account.

This apparent inconsistency resulted from OFHEO's efforts to respond to the enactment of the Homeowner's Protection Act of 1998 (HPA) [156] shortly before NPR2 was published. The HPA, which applies to loans originated after July 1, 1999, provides for the automatic termination of mortgage insurance when the loan balance is scheduled to reach 78 percent of the original value of the property securing the loan,[157] if payments on the loan are current. However, the adjustment of the stress test to reflect this change was not yet accomplished when NPR2 was published on April 13, 1999.

As a result of events that have transpired since 1998, OFHEO has decided to modify the stress test to terminate mortgage insurance on all loans that amortize below 78 percent LTV. The public discourse surrounding the enactment of the HPA and the notification policies of many lenders have raised consumer awareness of the option to cancel, making it increasingly likely that those borrowers will cancel mortgage insurance as soon as it is possible to do so. Accordingly, the final regulation specifies that mortgage insurance is terminated for all loans, whenever originated, when the loan is amortized below 78 percent LTV. For other types of credit enhancements, the stress test takes contract expiration dates into account.

4. Treatment of Credit Derivatives

Credit derivatives are contractual instruments that link payment or receipt of funds to the credit losses (which could include a rating change on a security or a default that affects payments) on an underlying asset or pool of assets. Treatments for credit derivatives were not specified in NPR2. Nor did NPR2 specify counterparty haircuts for credit derivatives.[158] Commenters, therefore, questioned whether the treatment of interest rate derivatives was intended to apply to credit derivatives. If not, these commenters asked precisely how credit derivatives would be modeled and, specifically, what haircuts are appropriate for counterparties to these transactions.

A number of commenters addressed the general issue of how credit derivatives should be modeled. Also, several commenters addressed a type of instrument called a Mortgage Default Recourse Note (MODERN), which was used by Freddie Mac as part of a broader transaction to hedge mortgage credit risk. The MODERNs can be considered credit derivatives because the amounts of payments on them are ''derived'' from the performance of a fixed reference pool of mortgages, but do not flow through from the mortgages and are not secured by the mortgages. The two groups of comments, which raised different issues, are dealt with separately below.

a. Credit Derivatives in General

The use of credit derivatives to hedge credit risk of mortgages is a new practice at the Enterprises, which currently comprises an insignificant volume of transactions. However, OFHEO recognizes that, as happened with interest rate derivatives, this activity could grow significantly in the coming years. Therefore, the stress test must be sufficiently flexible to deal with these instruments appropriately as they arise. Credit derivatives are also far less standardized in type and form than interest rate derivatives. They can be structured to include only a small degree of counterparty risk to the Enterprises, like the MODERN transaction, or to create large exposure to counterparties. Depending upon their structures, these instruments can also create significant modeling complexities.

(i) Comments

The comments reflected two schools of thought on the general subject of credit derivatives. Commenters from the mortgage insurance industry recommended that these instruments be analyzed separately from other types of derivatives and as the subject of a separate rulemaking proceeding. They emphasized that the market for credit derivatives is still relatively small, that documentation is not standardized, and that counterparties do not come from a monoline industry dedicated to insuring mortgage credit losses. These commenters urged that OFHEO should use a cautious approach in assigning haircuts to counterparties in credit derivative transactions until the market for these instruments is better developed and subject to more specific regulations and protections. They also sought clarification that the discussion of the treatment of derivatives in NPR2 was intended to apply only to contracts that transfer interest rate risk.

[156] Pub. L. 105–216, 112 Stat. 897–910 (1998) (12 U.S.C. 4901–4910).

[157] FHA loans and ''high risk'' loans, as defined by the Enterprises, are exempt from this provision.

[158] The proposed rule provided a detailed description of the cash flows that would be modeled for interest rate derivatives and described treatments for foreign currency swaps. NPR2 also specified a schedule of ''haircuts'' that would be applied to net amounts due to an Enterprise from counterparties in derivative transactions. 64 FR 18157–18159, 18292–18296, April 13, 1999.

The Enterprises and two investment banking firms expressed a different view. They view the market and documentation for any credit derivatives the Enterprises might use as well developed and similar to that for interest rate derivatives. Fannie Mae commented that collateralized credit-linked securities or risk transfers with well-capitalized firms with diversified books of business can reduce overall risk exposure, because derivative contract counterparties may be able to absorb losses better than mortgage insurers.

(ii) OFHEO's Response

OFHEO considered all of these comments. The credit derivatives market is relatively small at present, as reflected in the minimal volume of these instruments at the Enterprises. Accordingly, OFHEO has decided that it would be inappropriate at this time to issue a blanket treatment that would be applicable to all credit derivatives.

OFHEO agrees with the mortgage insurers that, at present, credit derivatives should be analyzed separately from other derivatives. However, OFHEO will not assume that all credit derivatives necessarily raise structural concerns or weaknesses that require haircuts that are more conservative than those applied to counterparties in similar transactions. Nor does OFHEO agree that it is necessary to have an additional rulemaking proceeding to deal with these instruments if and when they arise at the Enterprises. As discussed below, OFHEO's analysis of the MODERN transaction revealed that credit derivatives can be structured in such a way as to offset an Enterprise's credit risk in much the same manner as mortgage pool insurance, and it is consistent with the purpose of the stress test to account for that transaction in much the same manner as pool insurance. Likewise, if counterparty and other risks associated with the instrument appear to be the same as those of an interest rate or foreign currency derivative, it will be treated in a similar manner. However, if those risks are significantly different, OFHEO will impose some other appropriately conservative treatment.

b. MODERN Transaction

The MODERN transaction was a unique form of mortgage credit enhancement, developed by Freddie Mac, that involved the sale of securities to investors. The MODERN transaction may be thought of as a ''credit derivative'' because payment to investors in the securities, as well as payments to Freddie Mac, are determined from the credit performance of a fixed pool of mortgages, which serves as a reference asset. The transaction required creation of a trust that is contractually obligated to pay amounts to Freddie Mac based on the amount of credit losses on the reference pool. As consideration, Freddie Mac pays the trust a fee or premium that, together with earnings on the trust principal, is used to make interest payments to purchasers of the bonds that are used to fund the trust, as well as any payments due to Freddie Mac. These securities are issued in several tranches. The principal of each security is reduced (together with future interest payments), according to the priority of its tranche, as amounts are required to cover losses on the reference pool. The bonds, which are issued by a special purpose corporation and are not marketed as Enterprise securities, are all rated single-A and below because they carry a high probability that their entire principal will not be repaid. For Freddie Mac, the MODERN transaction bears some similarity to mortgage pool insurance, because Freddie Mac receives variable payments, based upon the credit losses in a pool of mortgages, and makes fixed payments, analogous to premiums.

(i) Comments

Comments were divided as to the appropriate treatment for the MODERN transaction. Commenters from the mortgage insurance industry took the position that it involves greater counterparty risk than interest rate derivatives or mortgage insurance. Accordingly, those commenters recommended giving no credit or subjecting payments to Freddie Mac under MODERNs to greater haircuts than those applicable to other types of counterparties, such as mortgage insurers. Freddie Mac said that there is no counterparty risk in these transactions, and that the payments to Freddie Mac cannot be reduced from the amounts required under the contract due to financial failure of a counterparty. There is no more risk of nonpayment in the MODERN transaction, argued Freddie Mac, than in a mortgage-backed security or other asset-backed security where a trustee is obligated to make payments when, and in the amounts that are, due.

(ii) OFHEO's Response

After study of the MODERN transaction, OFHEO agrees that it does create some credit risk (i.e., risk of default by a counterparty) to the Enterprises. Although risk of loss may be low because the transaction is structured to provide significant collateral, OFHEO does not have the data necessary to analyze the adequacy of that collateral. OFHEO finds the transaction most similar, structurally, to mortgage pool insurance and will model it in a similar fashion, applying the haircut that would be appropriate to a mortgage pool insurance contract. However, future MODERN or other credit derivative transactions will be analyzed based upon their specific terms and similar treatments will not necessarily be found appropriate for them.

The final rule does not detail the specific treatment for the MODERN transaction because it presents no new features that cannot be modeled using the more general treatments that are specified. Like other transactions that are modeled according to their terms, cash flows on the MODERN transaction will be projected according to the terms of its instruments and will be haircut based upon the credit rating of the counterparty. Those terms are tied directly to credit losses of a pool of Enterprise mortgage loans, which is modeled like any other pool of loans in the stress test.

*L. New Debt and Investments*

The proposed stress test projected cash inflows and outflows for each month of the stress period in order to determine the net availability of cash. To the extent cash inflows exceed cash outflows in any month, NPR2 specified how an Enterprise would employ the excess funds. Conversely, to the extent that cash outflows exceed cash inflows in any month, NPR2 specified how an Enterprise would obtain the funds to cover the cash deficit. The net cash position for each of the 120 months of the stress period was calculated at the end of each month. Depending upon whether the cash balance at the end of a month was positive or negative, new debt or investment was added. Excess cash was invested in one month maturity assets at a rate equivalent to the six-month Treasury yield. If a cash deficit existed, new short-term debt was added. NPR2 specified that the Enterprises would issue all new debt as six-month discount notes at the six-month Federal Agency Cost of Funds rate plus 2.5 basis points to cover issuance cost.

Comments are discussed below by topic.

1. Length of Debt Term

a. Comments

The proposal to fund all cash deficits with short-term instruments received a number of comments, only one of which favored the proposal. Most commenters that addressed the issue recommended that OFHEO provide for a mix of long- and short-term debt instruments, to better reflect the rebalancing strategies of the Enterprises. The Enterprises both suggested that the rule be modified to add 80 percent long-term debt in the up-rate scenario and 20 percent long-term debt in the down-rate scenario. One commenter suggested that OFHEO allow the Enterprises to use their internal models to project the appropriate mix of debt, apparently presuming that OFHEO would adopt an internal models approach to setting risk-based capital.

b. OFHEO's Response

After consideration of the comments and further analysis of the issue, OFHEO determined that a more risk-neutral approach to establishing the mix of long- and short-term debt is available and practical and has implemented it in the final rule. That approach sets a 50–50 target mix of long- and short-term debt for an Enterprise's portfolio and projects issuance of debt each month that will move the Enterprise toward that target and maintain that mix once it is reached. The 50–50 mix was selected because an Enterprise cannot know from month to month whether interest rates will go up or down and OFHEO will not try to model Enterprise predictions.

Notwithstanding the contrary views of some commenters, OFHEO has found it neither practical nor desirable to attempt in the stress test to predict the reactions of Enterprise management to interest rate shocks. Both Enterprises adjust the mix of maturities in their debt portfolios frequently, based upon the anticipated duration of their assets. The Enterprises have different policies designed to mitigate interest rate risk by matching the durations of assets and liabilities. They use sophisticated computer models to provide insights into future interest rate patterns and to monitor duration mismatches in their portfolios. These models allow the Enterprises to adjust their issuance of liabilities and their derivatives positions daily to comply with their internal policies. However, as several commenters recognized, attempting to approximate this decision-making process in the stress test is impractical. Further, doing so would cause the stress test to create additional hedges and risks in the Enterprises' books of business, which, in OFHEO's view, is contrary to the intent of the 1992 Act. For those reasons, OFHEO has adopted an approach that is not biased toward long- or short-term debt in either interest rate scenario.

The practical difficulties associated with attempting to develop a simple rule that approximates the Enterprises' likely new debt issuance is illustrated by an analysis of the refunding rules suggested in their comments. The Enterprises suggest that new debt issuances be weighted heavily to the long-term in the up-rate scenario and to the short-term in the down-rate scenario. They contend that, given the impracticality of predicting funding decisions, this simple methodology would provide a reasonable approximation of their behavior. OFHEO disagrees that this methodology provides such a reasonable approximation. The suggested weightings may or may not reflect the way the Enterprises respond to a future interest rate shock, because they rebalance to achieve certain balances in their portfolios, not in their issuances. Accordingly, whether they issue long- or short-term debt depends as much upon their current debt, asset, and derivative positions as upon interest rate movements.

Another factor in each Enterprise's funding decisions is its expectations for interest rates. These expectations are based, at least in part, upon historical models that, particularly under the extreme conditions of the stress test, might project various outcomes, and would, almost certainly, not project exactly the paths specified in the stress test. In short, the Enterprises would have no way of knowing that interest rates were going to continue moving quickly in the same direction for a year and remain at an elevated or deflated level for another nine years. However, despite this uncertainty, the Enterprises' approach would add mostly long-term debt in the up-rate scenario, increasing vulnerability to interest rate declines without regard to the mix of liabilities in the existing portfolio. This approach would have the effect of locking in relatively lower interest rates early in the stress period and lowering debt costs (and, therefore, capital requirements) significantly. Similarly, adding mostly short-term debt in the down-rate scenario would allow an Enterprise to refinance with lower cost debt regardless of the Enterprise's existing maturity mix, although, as many commenters noted, an assumption that an Enterprise will utilize predominately short-term funding is not realistic. It should be noted, however, that OFHEO found the impact on capital of short-term funding in the down-rate scenario was small, because rapid prepayment of loans creates little need for new debt.

In sum, OFHEO adopted an approach that did not attempt explicitly to predict or simulate Enterprise responses to the interest rate shocks in the stress test. Instead, recognizing that any new debt will have some effect on interest rate risk, OFHEO chose an approach that reflects no bias toward long- or short-term debt in either interest rate scenario.

2. Specific New Debt and Investment Instruments

a. Investment Instruments

Fannie Mae suggested that specifying an investment instrument with a one-month maturity and a six-month rate is inappropriate, because such instruments do not exist.

The final rule adopts the proposed rule and specifies that all cash surpluses will be invested in one-month maturity assets with a six-month Treasury yield. Recognizing that the instrument specified does not exist in the marketplace, OFHEO chose it as a modeling simplification that simulates the effect of a series of investments made over successive months and ensures that each month there are instruments that mature and are replaced in the portfolio. Using a longer maturity would have resulted in greater fluctuations in cash surpluses from month to month, causing the Enterprises to borrow money in later months to cover instruments purchased with a temporary cash surplus.

However, using a one-month rate for new investments would ignore the fact that an Enterprise's actual return on new short-term investments is based upon a number of different maturities between one day and one year. The six-month rate was chosen as a reasonable approximation of the average rate earned on those maturities.

b. Debt Instruments

Fannie Mae recommended that OFHEO change the proposed short-term debt instrument from a six-month to a one-month maturity, but did not explain any benefits from such a change. Nevertheless, OFHEO analyzed whether, in light of other changes in the new debt approach, the short-term debt instrument should be changed. OFHEO determined not to change the instrument proposed in NPR2, because a six-month rate is more representative of the mix of short-term maturities issued by the Enterprises.

A few commenters recommended that the regulation specify ten-year bullet (no

call) debt as the long-term debt instrument. Fannie Mae suggested that OFHEO specify ten-year bullet debt as the long-term instrument during the up-rate scenario and, in the down-rate scenario, three-year debt callable in one year. OFHEO considered those options, but determined that a five-year bond callable in one year was most appropriate. The Enterprises issue a variety of debt with maturities greater than one year, but with average maturities generally far less than ten years. Also, they increasingly have come to rely upon callable debt to balance the prepayment optionality in their loan portfolios. For these reasons, OFHEO concluded that five-year callable debt was a more representative proxy for long-term Enterprise debt than ten-year bullet or three-year callable debt.

The Enterprises expressed concern that the regulation would not take into consideration the linkage of the-short term debt in their portfolios to interest rate swaps that result in effective long-term rates and maturities. The Enterprises create this long-term ''synthetic debt'' to take advantage of pricing anomalies in the debt and derivatives markets. The final rule clarifies that in determining the amount of short-term debt on the books of an Enterprise, the notional value of debt-linked fixed-pay swaps is deducted from the total amount of short-term debt and added to the total amount of long-term debt. This procedure effectively converts the affected short-term debt to long-term for purposes of the determining the mix of new debt.

3. Date of Issuance or Purchase

NPR2 specified that new debt is issued and new investments purchased at the end of each month of the stress period based upon the cash position at the end of the month. OFHEO determined that a more correct modeling convention is to issue the debt or purchase the investments at the midpoint of the month to reflect the fact that financial instruments mature throughout a month, not at month end. The final rule changes the issuance date to the 15th day of the month.

*M. Cash Flows*

1. Mortgage-Related Cash Flows

In NPR2, OFHEO described how the stress test would treat cash flows from mortgage-related instruments during the stress period. Under the proposal, the stress test would produce cash flows for single family and multifamily mortgage loans that are held in portfolio and cash flows for the same types of loans that are pooled into mortgage-backed securities (MBS) that are guaranteed by the Enterprise. For retained loans, the cash flows to the Enterprises are all the principal and interest payments on the loans, except for a portion of the interest payment retained by the servicer as compensation. For sold loans, these cash flows are guarantee fees received by the Enterprises and float income.[159] Cash flows, net of credit losses, are produced for each month of the stress period for each loan group using loan group characteristics and information on interest rates; default, prepayment, and loss severity rates; and third party credit enhancements.

Only Freddie Mac commented on the mortgage cash flow section of the stress test. Specifically, Freddie Mac recommended that OFHEO specify a different treatment for cash flows produced by adjustable rate mortgages (ARMs) and modify the remittance cycle for MBS. These comments and OFHEO's responses are discussed below.

a. Adjustable Rate Mortgages (ARMs)

In NPR2, OFHEO proposed to model ARM cash flows as if the loans all adjusted annually and as if they all had the same margins and caps. Under the proposal, all ARM loan groups were indexed to either the one- or three-year CMT or the 11th District COFI.

Freddie Mac alleged that the proposed approach failed to capture the impact of a substantial volume of ARM products that adjust monthly or every six months and have different margins and caps. These additional terms may result in extra income to the Enterprises.

Based on its analysis of ARM-related cash flows in light of Freddie Mac's comment, OFHEO has determined that it is appropriate to modify the stress test to model ARM cash flows according to their contract terms as reported in the RBC Report. This change reflects the importance of the full range of ARM products to the Enterprises, particularly in relatively volatile interest rate environments. Although the estimated default and prepayment rates for ARMs are averages for all ARM product types, for reasons described in III.I.1.h., Adjustable Rate Mortgages (ARMs), the stress test does capture the cash flow differences by ARM product type, thereby addressing Freddie Mac's comment. The respecified ARM model is capable of modeling cash flows from all ARM products whose terms are reported in the RBC Report according to those terms. This reflects the importance of these product types to the Enterprises, particularly in relatively volatile interest rate environments.

b. Remittance Cycles for Mortgage-Backed Securities (MBS)

In NPR2, OFHEO proposed to model only specific categories of MBS by including the float amount for three remittance cycles. Specifically, the stress test included remittance cycles only for Freddie Mac's Standard and Gold Programs and Fannie Mae's Standard Program. The stress test did not model additional programs.

Freddie Mac commented that under NPR2, only two of its three principal remittance cycles are modeled. Freddie Mac stated its general belief that where practicable, OFHEO should model the contractual terms or actual characteristics of an instrument or make reasonable simplifications.

Based on its analysis of MBS-related cash flows and in light of Freddie Mac's comment, OFHEO has determined that it is appropriate to modify the stress test to accommodate a wider range of remittance cycles, rather than limit the modeling to three specific cycles. Specifically, the final rule allows as an input, the number of float days in a remittance cycle, rather than a specified number of remittance cycles. The additional precision resulting from more refined modeling of MBS reflects the significant volume of these products and their importance to the Enterprises.

2. Nonmortgage Instrument Cash Flows

In NPR2, OFHEO specified the proposed treatment of cash flows from nonmortgage instruments during the stress period in two sections of the Regulation Appendix. Section 3.9.3, Debt and Related Cash Flows detailed how the stress test would produce cash flows for instruments such as debt, guaranteed investment contracts (GICs), preferred stock, debt-linked derivative contracts, and mortgage-linked derivative contracts. Similarly, section 3.9.4, Non-Mortgage Investment and Investment-Linked Derivative Contract Cash Flows detailed how the stress test would produce cash flows for instruments such as nonmortgage assets and investment-linked derivative contracts. The cash flows for debt, nonmortgage investments, and preferred stock included interest (or dividends for preferred stock) and principal payments or receipts. The cash flows for debt-linked, investment-linked, and mortgage-linked derivative contracts

[159] Float income is the earnings from the investment of principal and interest payments on sold loans during the remittance cycle for the period of time between the receipt of these payments from the servicer and the remittance of those payments, net of guarantee fees, to security holders. The length of time an Enterprise can invest these payments depends on the length of that period.

would include interest payments and receipts. NPR2 did not attempt to provide detailed descriptions of the cash flow calculations of all nonmortgage instruments that exist or might exist at the Enterprises. The examples that were provided were illustrative.

a. Comments

Only MICA commented on NPR2's proposed treatment of nonmortgage instrument cash flows. Although MICA generally agreed with the proposed method of generating cash flows, it recommended that American-style calls also be modeled. With American-style calls, the exact timing of the exercise of the call option is not always known because the nature of the American-style call allows the issuer to exercise its call at any time between the first call date and the final call date.

b. OFHEO's Response

American-style calls were modeled in NPR2, but, as a simplifying assumption, were treated as Bermudan-style calls, which are evaluated for exercise on each coupon payment date following the start date of the option. OFHEO agrees that it would be desirable to model American calls more precisely and is exploring how they might be precisely, but efficiently, modeled or whether a more appropriate simplifying assumption should be used. For now, the final rule continues to treat American-style calls as Bermudan-style calls.

In addition to the change made in response to the comments, OFHEO restructured the Appendix sections dealing with cash flows produced by nonmortgage instruments by combining the section of NPR2 dealing with debt with the section dealing with nonmortgage investment and investment-linked derivative contracts. OFHEO notes that this restructuring permits OFHEO to use a single modeling instruction for two types of instruments that have identical cash flows. That is, a fixed rate noncallable bond has the same cash flows whether it is modeled as a liability or an asset; the only difference is the party that receives the cash flow. The final rule also deletes instructions for specific types of instruments where more general provisions in the Appendix are sufficient to generate the necessary cash flows according to the terms of the instrument. In some cases, simplifying assumptions are made for certain instrument terms. These modifications serve to streamline the regulation.

While the final rule replaces specific modeling instructions with more general ones, the general instructions are more detailed in some respects than those proposed in NPR2. For example, the final rule specifies more detailed treatment of the options on nonmortgage instruments and cancellation rules on interest rate swaps.[160] Although NPR2 did not specifically mention call premiums and discounts, the final regulation specifies the manner in which the premiums and discounts for certain instruments are modeled. In addition, because the Enterprises use some interest-rate swaps to reduce the interest-rate risk associated with some callable debt they issue, OFHEO has decided to model put options associated with swaps so that those putable swaps are cancelled when the associated debt is called. Puts on Enterprise debt and calls on nonmortgage assets are still not modeled, given that would entail modeling the behavior of a third party that can exercise the option rather than the behavior of an Enterprise.

In the final rule, the more detailed general descriptions for noncomplex instruments are sufficient to provide an understanding of how each instrument is modeled. For some complex instruments, as with the description of the noncomplex instruments, industry standard methodology is used. In addition, the computer code that OFHEO plans to release after the rule is published will provide detail on the algorithms used.

*N. Accounting, Taxes, and Operating Expenses*

In NPR2, OFHEO proposed procedures for creating pro forma balance sheets and income statements, determining short-term debt issuance and short-term investments, calculating operating expenses and taxes, and computing capital distributions. The proposal explained the inputs and outputs for this component of the stress test. Inputs included an Enterprise's balance sheet at the beginning of the stress period, interest rates from the interest rates section, and information from the cash flow section. These inputs were used to produce as the output, the 120 monthly pro forma balance sheets and income statements for an Enterprise.

MBA, Fannie Mae and Freddie Mac commented on the proposed approaches related to taxes and accounting. Among the specific issues they raised were (1) the effective tax rate, (2) the adherence to generally accepted accounting principles (GAAP), (3) the treatment of non-interest earning assets, and (4) net operating losses. Several commenters, in addition to the Enterprises, commented on the proposed treatment of operating expenses. These comments and OFHEO's analysis of the comments are discussed below.

1. Effective Tax Rate

In NPR2, OFHEO proposed[161] to apply an effective Federal income tax rate of 30 percent when calculating the monthly provision for income taxes in the stress test. OFHEO noted that this tax rate is lower than the statutory rate set forth by the Internal Revenue Service. The Enterprises' lower overall tax rates are a result of tax exempt interest, tax deductions for dividends, and equity investments in affordable housing projects. OFHEO further noted that it may change the 30 percent income tax rate if the Enterprises' effective tax rate changes significantly over time or if the statutory income tax rate changes.

Fannie Mae was the only commenter to address the proposal to specify in the regulation a Federal effective income tax rate of 30 percent. Fannie Mae noted that this rate is lower than the current 35 percent corporate statutory rate because of the Enterprises' involvement in tax-advantaged activities, such as investing in tax-exempt mortgage revenue bonds and tax credits for affordable housing projects, but asserted that adopting a fixed tax rate would undermine the stress test's ability to relate the capital requirements dynamically to the evolving nature of the Enterprise's business. Accordingly, Fannie Mae recommended that the rule apply an effective tax rate based on recent experience, i.e., an effective tax rate equal to the average annual rate for each Enterprise over the most recent three calendar years.

OFHEO decided not to adopt Fannie Mae's recommendation. OFHEO has reserved in the regulation the discretion to change the 30 percent income tax rate if there are significant changes in Enterprise experience or changes in the statutory income tax rate. OFHEO believes that this addresses Fannie Mae's concern by allowing OFHEO the flexibility to make any reasonable adjustments to the rule, based on significant changes in circumstances.

[160] An interest rate swap is an agreement whereby two parties (counterparties) agree to exchange periodic streams of interest payments on obligations they have issued. The dollar amount of the interest rate payments exchanged is based on a predetermined dollar principal (often the face amount of the underlying instrument), which is called the notional principal amount. The dollar amount each counterparty pays to the other is the agreed-upon periodic interest rate multiplied by the notional principal amount.

[161] 64 FR 18297, April 13, 1999.

Fannie Mae's suggested approach would not have resulted in a significant increase in sensitivity to risk, but would have added unnecessary complexity to the stress test. Accordingly, OFHEO has adopted without modification the proposal in NPR2 with respect to the effective income tax rate.

2. Consistency With GAAP

In NPR2, OFHEO proposed to apply Generally Accepted Accounting Principles (GAAP) in the stress test to the extent that they are applicable and feasible.[162]

Only the Enterprises addressed the proposed accounting approach. Although Freddie Mac generally agreed that the stress test should apply GAAP to the extent possible, it mentioned several accounting treatments that it believed should be modified. Fannie Mae stated that the proposed regulation does not adhere to GAAP uniformly in describing the procedures to use to generate projected monthly financial statements. Accordingly, Fannie Mae recommended that OFHEO adopt a more generalized approach toward accounting methods that would establish basic guidelines for projecting stress test performance. Notwithstanding Fannie Mae's preference for a generalized approach, both Freddie Mac and it specifically requested that the stress test recognize Financial Accounting Standard (FAS) 115 [163] and FAS 133,[164] both of which require a portion of unrealized market value gains or losses on the balance sheet to be recorded in a new stockholder's equity account known as ''other comprehensive income'' (OCI).

OFHEO agrees with the Enterprises that, to the extent that GAAP is applicable, the risk-based capital regulation should adhere to GAAP. Accordingly, like the proposed rule, the final rule adopts accounting rules that are generally consistent with GAAP, although, in certain situations, complete adherence to GAAP is impractical given the stylized nature of the stress test. In those situations, such as with FAS 115 and FAS 133, the agency has determined that it is necessary to implement simplified procedures to allow the efficient and practical implementation of the stress test. For instance, it would be impracticable and unreasonably speculative to make mark-to-market adjustments over the ten-year stress test. Given the difficulties inherent in calculating future market values during the stress test, OFHEO has decided to recognize unrealized gains (losses) resulting from FAS 115 and FAS 133 and related OCI at the outset of the stress test. That is, the stress test does not reflect certain securities at their fair market values later in the stress test, as required by FAS 115 and FAS 133. Instead, these assets are adjusted to an amortized cost basis at the outset of the stress test. Similarly, gains and losses resulting from the termination of derivative instruments during the stress period are amortized on a straight-line basis over the same period used to calculate the gain or loss.

3. Treatment of Non-Interest Earning Assets

In NPR2, OFHEO proposed to convert to cash non-earning assets, such as miscellaneous receivables, real estate owned (REO), and general clearing accounts, by the end of the stress test's first year. NPR2 allowed other non-earning assets, such as investments in low income housing tax credits, to remain constant over the stress period, i.e., be carried over from quarter to quarter and earn no income.[165]

Three commenters stated that the treatment of non-interest earning assets in the stress test would penalize investments in affordable housing programs. Fannie Mae stated that investments in affordable housing should be converted to cash over the first six months of the stress period, thereby eliminating what it termed an ''artificial burden'' to this type of investment. Freddie Mac stated that these assets should be converted to cash when the Enterprises begin to show net losses to reflect the resulting elimination of associated tax benefits.

After reviewing the comments, OFHEO has decided to adopt the proposed rule with one modification. Investments in low income housing tax credits are converted to cash over the first six months of the stress period.

4. Net Operating Losses

In NPR2,[166] OFHEO proposed to have a Net Operating Loss (NOL) carryback period of three years so that an NOL for a current month would be ''carried back'' to offset taxes in any or all of the preceding three calendar years. OFHEO explained that this offset of the prior years' taxes results in a negative provision for income taxes for the current month. A period of 15 years was proposed for carry forwards.

MBA and Fannie Mae commented that the proposed three-year carry back period and 15-year carry forward periods for NOL tax offsets are no longer consistent with the current tax code. These commenters requested that these periods be changed to reflect the recent legislation which specifies periods of two and twenty years, respectively.

OFHEO has decided to modify the NOL carryback and carryforward periods to two and twenty years, respectively. This will allow the accounting procedures in the stress test to be consistent with the current tax code.

5. Operating Expenses

In NPR2, OFHEO proposed that the stress test calculate operating expenses, including those administrative expenses related to an Enterprise's salaries and benefits, professional services, property, equipment, and offices. Under the proposal, operating expenses would decline in direct proportion to the decline in the volume of each Enterprise's total mortgage portfolio (i.e., the sum of outstanding principal balances of its retained and sold mortgage portfolios). The stress test first projected how an Enterprise's mortgage portfolio would change during the stress period on a monthly basis. It then multiplied the percentage of assets remaining by one-third of the Enterprise's operating expenses in the quarter immediately preceding the start of the stress test to simulate the changed operating expenses in each month of the stress period. The resulting amount would be an Enterprise's operating expense for a given month in the stress period. OFHEO explained that the expense reduction pattern for the up-rate scenario would differ from the down-rate scenario, as would the pattern within each scenario, depending on changes in the characteristics of an Enterprise's total mortgage portfolio.

a. Comments

Commenters provided widely divergent views about the proposed treatment of operating expenses. Among the issues that they addressed were whether the proposed treatment would result in an appropriate capital requirement, whether the stress test should link operating expenses to the size of each Enterprise's mortgage portfolio, whether the stress test should model fixed and variable expenses separately, whether the stress test should exclude expenses associated with new activities, and whether

[162] Section 3.10.3.6 of the NPR2 Regulation Appendix, 64 FR 18298–18299, April 13, 1999.

[163] Financial Accounting Standards Board Statement of Financial Accounting Standard 115, *Accounting for Certain Investments in Debt and Equity Securities,* May 1993.

[164] Financial Accounting Standards Board Statement of Financial Accounting Standard 113, *Accounting for Derivative Instruments and Hedging Activities,* June 1998.

[165] 64 FR 18298, April 13, 1999.

[166] 64 FR 18297, April 13, 1999.

operating expenses should be tied to the previous quarter's operating expenses.

Commenters disagreed about the extent to which the proposed treatment of operating expenses would result in an appropriate capital requirement. The Enterprises and a Wall Street firm commented that the proposal would result in an excessive capital requirement. Freddie Mac stated that operating expenses constitute a relatively small portion of its total expenses but a disproportionately large component of its capital requirement under the proposal. In contrast, several trade associations and financial organizations stated that it would be more appropriate to model operating expenses in a manner that would result in a higher capital requirement. These differing views, which are discussed below, were reflected in specific recommendations for revising the stress test's modeling of operating expenses.

Commenters, for instance, disagreed about whether the stress test should link operating expenses to the change in the size of an Enterprise's mortgage portfolio during the stress test. The Enterprises stated that the stress test should not incorporate such a linkage, which they believe distorts risks. They were especially concerned that such a modeling approach would result in significantly different treatment for operating expenses depending on the interest rate scenario. Fannie Mae stated that the capital requirement in the up-rate scenario could be as much as $2 billion higher than the down-rate scenario. In contrast, other financial firms stated that operating expenses should remain constant rather than decline during the stress test. They noted that having operating expenses decline is inconsistent with the experience of a financial institution facing stressful conditions. They argued that such institutions typically experience an increase in operating expenses during stressful periods since more expenses are incurred to manage defaults and repossessed real estate.

Commenters also disagreed about whether fixed and variable expenses should be modeled together or separately. Both Enterprises stated that the stress test should model fixed and variable costs separately and then apply a fixed expense ratio against the projected mortgage portfolio balances. Under their recommended approach, the level of operating expenses would not vary based on the level of such expenses in the quarter preceding the stress test. Other commenters believed that the stress test should not separately model fixed and variable expenses, but rather should hold these expenses constant during the stress period.

Both Enterprises commented that the stress test should not consider expenses related to new business development, product innovation, and research, given the 1992 Act's ''no new business'' requirement.[167] Freddie Mac stated that under the no new business requirement, this portion of its operating expenses would drop nearly to zero during the stress period. Similarly, Fannie Mae stated that less than half of each company's current cost structure is devoted to maintenance and support of existing book-of-business balances.

b. OFHEO's Response

As the widely divergent comments indicated, there is no single ''correct'' way to model operating expenses, particularly in a stylized stress test which by necessity must incorporate simplifying specifications. In general, the Enterprises stated that the proposed treatment would result in unreasonably high capital requirements, whereas other financial institutions stated that the proposed treatment would result in unreasonably low capital requirements. OFHEO believes that the recommendation by both Enterprises to have a fixed expense ratio of between 1.5 and 2.0 basis points of unpaid principal balance (UPB) per year is unreasonably low. As one commenter noted, Enterprise expenses to outstanding MBS and portfolio balances have averaged over 7.0 basis points for the past ten years. Similarly, although there was intuitive appeal to the recommendation by financial institutions to hold the level of expenses constant throughout the stress period given the experience of financial institutions under stress, adopting such an approach here would have resulted in unreasonably high capital requirements relative to operating expenses.

After considering all of the comments, OFHEO has decided to adopt the NPR2 approach to operating expense, with some modification. In the final rule, the baseline operating expense level is the same as in NPR2, and operating expenses continue to decrease as the mortgage portfolios decrease, but the method of determining the amount of the decrease is modified. Rather than a strictly proportional decrease, the amount of the decrease in each month of the stress period is determined by calculating a base amount comprised of a fixed component and a variable component. The fixed component is equal to one-third of the baseline level and remains fixed throughout the stress period. The variable component at the start of the stress test is equal to two-thirds of baseline and declines in direct proportion to the decline in the UPB of the combined retained and sold mortgage portfolios. This base amount is further reduced by one-third, except that this further reduction is phased in during the first 12 months of the stress test.

In determining its treatment of operating expenses, OFHEO was careful to balance the competing concerns expressed by the commenters. Financial institutions facing extremely stressful conditions generally do experience an increase in operating expenses, and therefore the proportional reduction in all expenses that was contained in NPR2 may understate the expenses that would be expected under the conditions of the stress test. Nevertheless, OFHEO believes that holding all operating expenses constant, as suggested by some commenters, would have overstated operating expenses and that some reduction is appropriate over time, given the cessation of all new business in the stress test.

On balance, OFHEO believes that the formula in the final rule provides an overall expense experience that is consistent with the stress period. The gradual phase-in during the first 12 months of the stress period of the adjustment to the base amount reflects the fact that operating expenses would not be likely to change dramatically in the first few months of the stress period. At any given time, the Enterprises have numerous commitments and obligations that affect operating expenses, including those related to personnel and technological innovation. Upon entering a stressful period, it would take some time for an Enterprise to implement modifications associated with these commitments and obligations. OFHEO has determined that it would be inappropriate to adopt the Enterprises' recommendations to exclude expenses related to new business development, product innovation, and research. As discussed in NPR2,[168] OFHEO determined that it would be inconsistent with the 1992 Act and the overall purpose of the stress test for the model to attempt to reflect decisions that would be made by an Enterprise that was intentionally winding down its operations. Nevertheless, the one-third reduction in expenses incorporated in the final rule reflects that the

[167] 12 U.S.C. 4611(a)(3)(A) states that ''No other purchases of mortgages shall be assumed'' under the current rule, except for contractual commitments.

[168] 64 FR 18168–69, April 13, 1999.

elimination of new business would result in some permanent reduction in operating expenses.

*O. Dividends and Share Repurchases*

The proposed stress test specifies in each quarter of the stress period whether the Enterprise pays preferred and common stock dividends, and, if so, how much. For preferred and common stock, dividends are paid as long as an Enterprise meets the minimum capital requirement before and after the payment of these dividends. For preferred stock, the payments are based on the coupon rates of the issues outstanding. For common stock, dividends are paid in the first year of the stress period. The payments are based on the trend in earnings. If earnings are increasing, the dividend payout rate is equal to the average of the percentage payout of the preceding four quarters. If earnings are not increasing, then the amount of dividends paid is based on the preceding quarter's dollar amount of dividends per share. If a full dividend would cause the Enterprise to fall below its estimated minimum capital level, then a partial dividend is paid. The proposed stress test did not recognize other capital distributions such as repurchases of common stock or redemptions of preferred stock.

Fannie Mae and Freddie Mac were the only commenters on the proposed treatment of dividends.

1. Preferred Stock

With regard to preferred stock, Freddie Mac agreed with the proposal, stating that it appropriately differentiates between preferred and common stock and appropriately captures distinctions in the effects of different preferred stock structures on the extent to which such equity capital is available to absorb losses. Fannie Mae disagreed with the proposed treatment of preferred stock dividends, stating that it would be inappropriate to assume that the Enterprises would continue to pay preferred dividends and deplete capital reserves throughout the stress period when they might be classified as ''undercapitalized.'' [169] That Enterprise recommended that the stress test terminate all capital distributions at the end of the first year of the stress period.

The final rule adopts the NPR2 treatment of preferred dividends without change. After reviewing the comments on the payment of preferred stock dividends during the stress period, OFHEO has determined that it is appropriate for the stress test to distinguish between the two types of equity and allow the payment of preferred stock dividends in some circumstances in which common stock dividends are not paid. Such a distinction reflects the higher level of commitment that a corporation makes to investors when issuing preferred stock versus common stock, since preferred stockholders have a first claim on capital distributions.

2. Common Stock

With regard to common stock, both Enterprises agreed with the proposal to cease paying dividends after the first year of the stress test. They stated that such a treatment is appropriate and aligns dividends with the capital classifications and real economic incentives. Both Enterprises, however, offered recommendations to modify the proposed dividend rate for common stock. Freddie Mac recommended using a long-term industry average dividend rate specified in the regulation that would be approximately 25 percent of earnings rather than a rate based on dividend payments in recent quarters. That Enterprise believed that such an approach would simplify the regulation's operation by substituting a single fixed value for a process that would require collecting data on four prior quarters of dividend payments and earnings, calculating the payout ratio for each quarter, and averaging those ratios. Fannie Mae stated that it is inappropriate to rely on a one-year time frame in which payments could be overly volatile, especially if there were a one-time distribution. Fannie Mae recommended basing the payout rates on the most recent three-year period, claiming such a change would reduce unnecessary volatility in the capital requirement.

After analyzing the comments, OFHEO has determined that it is appropriate to adopt the payout rates as proposed in NPR2. OFHEO notes that between 1990 and 1999 Fannie Mae's dividend payout ratio ranged from a low of 16 percent in 1990 to a high of 35 percent in 1995; whereas, Freddie Mac's dividend payout ratio ranged from a low of 20 percent in 1994 to a high of 23 percent in 1990.

Given such wide ranges in dividend payouts by one of the Enterprises, it would be inappropriate to adopt Freddie Mac's recommendation to set by regulation a dividend payout ratio of 25 percent. OFHEO has also decided not to adopt Fannie Mae's recommendation to extend the time period used to determine the payout rate from one year to three years. While Fannie Mae is correct that its recommended approach would reduce volatility in the capital requirements, such an extended time period under the recommendation would make it more difficult for the stress test to identify quickly changing Enterprise dividend policy that might deplete an Enterprise's capital. Tripling the time period on which the dividend rate is based would be inconsistent with the need for the stress test to provide a timely early warning of potential capital deficiencies.

TABLE 7.—DIVIDEND PAYOUT RATIO FOR FANNIE MAE AND FREDDIE MAC

| Fannie Mae | 1999 | 1998 | 1997 | 1996 | 1995 | 1994 | 1993 | 1992 | 1991 | 1990 |
|---|---|---|---|---|---|---|---|---|---|---|
| Common Stock Dividend | 1.08 | 0.96 | 0.84 | 0.76 | 0.68 | 0.60 | 0.46 | 0.34 | 0.26 | 0.18 |
| Diluted EPS | 3.72 | 3.23 | 2.83 | 2.48 | 1.95 | 1.94 | 1.71 | 1.48 | 1.25 | 1.12 |
| Div. Payout Ratio | 29% | 30% | 30% | 31% | 35% | 31% | 27% | 23% | 21% | 16% |
| **Freddie Mac** | **1999** | **1998** | **1997** | **1996** | **1995** | **1994** | **1993** | **1992** | **1991** | **1990** |
| Common Stock Dividend | 0.60 | 0.48 | 0.40 | 0.35 | 0.30 | 0.26 | 0.22 | 0.19 | 0.17 | 0.13 |
| Diluted EPS | 2.96 | 2.31 | 1.88 | 1.63 | 1.42 | 1.27 | 1.02 | 0.82 | 0.77 | 0.57 |
| Div. Payout Ratio | 20% | 21% | 21% | 21% | 21% | 20% | 22% | 23% | 22% | 23% |

[169] Under the 1992 Act an Enterprise is undercapitalized if it does not meet its risk-based capital requirement but meets the minimum requirement, 12 U.S.C. 4614(a).

3. Share Repurchases

In the only comment that addressed other types of capital distributions, Freddie Mac recommended that the stress test count share repurchases as common stock dividends because an Enterprise could follow a strategy of making capital distributions either by dividends or share repurchases. It stated that without this modification, an Enterprise would have to hold more future capital if it made a capital distribution solely by way of dividend payments than if it made an identical distribution by way of share repurchases. Freddie Mac, while acknowledging that reducing dividends is more difficult than ceasing share repurchases, argued that such differential treatment is not warranted by small differences in risk presented by these two forms of capital distributions.

OFHEO has decided to include rules in the stress test addressing share repurchases during the stress period. OFHEO agrees that share repurchases are potentially significant capital distributions that should be reflected in the stress test. However, unlike common stock dividends that are paid for the first four quarters of the stress period, the stress test provides for share repurchases only during the first two quarters. OFHEO believes that this shorter period more closely reflects what would likely occur as the Enterprise begins to experience the adverse economic conditions of the stress test.

4. Oversight Responsibility

OFHEO emphasizes that there are significant differences between establishing a modeling decision for dividend payments and share repurchases in the risk-based capital regulation and acting on a dividend approval request from an Enterprise that is no longer adequately capitalized. Accordingly, provisions in the stress test that provide for the payment of dividends by an undercapitalized Enterprise in some circumstances and not others should not be interpreted as an indication of how OFHEO will act on any specific dividend approval request. Should the situation arise, OFHEO will evaluate any request for approval of a dividend payment on the basis of a case-by-case analysis of all the relevant facts and circumstances.

*P. Capital Calculation*

1. Background

In NPR2, OFHEO proposed procedures to calculate the amount of capital that an Enterprise would need just to maintain positive capital during the stress test. Under the proposal, once the stress test projects an Enterprise's capital at the end of every month in the ten-year stress period, the capital calculation process discounts the monthly capital balances back to the start date of the stress period. The Enterprise's starting capital is then adjusted by subtracting the lowest of the discounted capital balances to account for the smallest capital excess or largest deficit (i.e., subtracting a negative number in the case of a deficit). The factor used to discount a monthly capital balance is based on after-tax borrowing or investing yields as appropriate for that month and all previous months during the stress period. After the stress test ascertains the amount of capital necessary to maintain positive capital during the stress period it then multiplies the amount by an additional 30 percent to arrive at the risk-based capital requirement. The additional 30 percent is mandated by section 1361(c) of the 1992 Act to capture the management and operations risk of an Enterprise.

OFHEO stated in NPR2 that it was necessary to use a present-value approach to recognize that a dollar today is worth significantly more than a dollar ten years in the future, that is, a dollar of capital at the beginning of the stress period can be invested to return more in a later year. NPR2 employed selected discount rates that approximate an ''iterative approach'' also discussed in NPR2. An iterative approach would use a series of iterative simulations as it adjusted the Enterprise's balance sheet until it determined a starting level of capital necessary for an Enterprise just to maintain positive capital, but no more, throughout the stress period. Both approaches take into account the two different interest rate scenarios by applying different interest rates in the capital calculation for each scenario. Both approaches were designed to ensure that an Enterprise would have enough capital to survive the stress test regardless of when losses associated with management and operations risk might occur, even if that were the first day of the stress period. However, OFHEO proposed the present value approach because it is much simpler to design and replicate.

2. Comments

Fannie Mae and Freddie Mac were the only commenters to address the proposed method to calculate the risk-based capital requirement. Each Enterprise objected to the use of a present value approach. Instead, they each recommended that the stress test should base the amount of required risk-based capital solely on the maximum amount of total capital consumed during the stress period, i.e., subtracting the lowest stress-period capital level without discounting from the starting position total capital. Fannie Mae criticized the present value approach, claiming that it is contrary to the 1992 Act's ''directive'' to follow Generally Accepted Accounting Principles (GAAP), results in inappropriate incentives, and is contrary to standard industry practice. Freddie Mac stated that the present value approach distorts the assessment of capital and risk and raises timing issues, based on the assumption that management and operations risk is proportional to the interest rate risk and credit risk. That Enterprise stated that the proposed discounting method assumes that losses associated with management and operations risk occur at the very beginning of the stress test.

3. OFHEO's Response

The final regulation generally adopts the approach to calculating risk-based capital proposed in NPR2.[170] After reviewing the proposed method of calculating risk-based capital in light of the comments, OFHEO found the present value approach preferable to the approach suggested by the Enterprises. By discounting, the present value approach allows the capital calculation process to account for the time value of money. The time value of money is important because the stress period extends for ten years during which funds would be invested constantly and during which management and operations losses could occur at any time, including the beginning of the stress period.

OFHEO disagrees with each of the commenters' criticisms of its use of a present value approach. Specifically, OFHEO disagrees with the Enterprises' claim that basing the amount of capital required for the stress test on a capital consumption approach is more consistent with the statute or more appropriate from a risk management perspective than the discounting approach used by OFHEO. First, the approaches recommended by the Enterprises would not ensure that the Enterprises hold capital sufficient to survive the stress test if management and operations losses occurred at the beginning of the ten-year stress period; they would only provide such assurances if these losses occurred near

[170] As discussed in the Regulation Appendix, certain additional amounts relating to off-balance-sheet items addressed in section 3.9, Alternative Modeling Treatments, are included in the calculation of risk-based capital.

the end of that period. Second, OFHEO believes that a present value approach is appropriate because it requires an Enterprise to maintain a capital cushion for other risks when credit risk and interest rate risk are relatively low. Thus, an Enterprise is more likely to survive subsequent, more stressful periods. Third, OFHEO finds no merit to the claim that a present value approach is contrary to standard industry practices; clearly, present value theory is well established in finance and economics, both in academia and in industry. Fourth, in response to Freddie Mac's comment, the present value approach requires an Enterprise to have positive capital at any time during the ten-year stress period, even if a loss attributable to management and operations risk occurs at the beginning of the ten-year stress period.

## IV. Regulatory Impact

### *A. Executive Order 12866—Economic Analysis*

#### 1. Introduction

This rule implements the statutory direction to OFHEO in the 1992 Act to set forth in a regulation a risk-based capital test that applies prescribed credit and interest rate stresses to the Enterprises' businesses. Recognizing the novelty of this type of regulation, OFHEO issued a series of notices soliciting public comment. First, the ANPR sought public comment on a number of issues relating to the development of the regulation. These comments were considered in the development of the two subsequent NPRs addressing different components of the risk-based capital regulation. NPR1 related to the methodology for identifying the benchmark loss experience and the use of OFHEO's House Price Index in the stress test. NPR2 set forth the remaining specifications of the stress test. In addition, OFHEO published a Notice soliciting reply comments to provide interested parties an opportunity to respond to other commenters. Throughout the preambles of the NPRs and in OFHEO's responses to comment on the NPRs, OFHEO has provided justification for all of the choices that have been made and has explained the effects of those choices in the rulemaking. All plausible models and assumptions that were suggested by commenters or otherwise identified by OFHEO have been discussed in the rulemaking documents.

This regulation has been reviewed by the Office of Management and Budget (OMB) in accordance with Executive Order 12866, Regulatory Planning and Review (E.O. 12866). OMB has determined that this is an economically significant rule. OFHEO has conducted an economic analysis of the final rule in accordance with the E.O. 12866 and has concluded that there is adequate information indicating the need for the risk-based capital regulation and that the potential benefits to the Enterprises, the housing market, homeowners, and taxpayers, far exceed any potential costs that may result from compliance with this rule.

In making this determination, OFHEO took into account that the rule relies on performance objectives to the maximum extent possible in helping to ensure the adequate capitalization of the Enterprises. In addition, the economic analysis reveals that the decisions contained in this rule were based upon the best reasonably obtainable technical, economic, and other information germane to the subject matter of the rule. OFHEO considered a reasonable number of alternatives for each of these decisions and chose the most cost-effective alternative that achieves the purposes of the 1992 Act. All plausible models and assumptions that were suggested by commenters or otherwise identified by OFHEO have been discussed in the rulemaking documents.

In conducting its analysis, OFHEO has been guided by the principles of fair disclosure and transparency. In addition, the rule is implemented in a manner that, to the extent possible, provides transparency of the capital calculation process used by OFHEO, which will benefit the Enterprises and other interested parties. OFHEO has solicited comments on all aspects of the rule through the ANPR and two NPRs described above. To assist commenters in evaluating the rule, OFHEO provided technical information on its website, in addition to the extensive material included with the notices.

#### 2. Statement of Need for Proposed Action

The specificity of the statutory requirement to set forth a capital stress test in a regulation reflects a Congressional determination that there is a need for this regulation and that the benefits to be derived exceed any potential costs involved. The 1992 Act specifies key elements of that stress test, which is to be designed to identify the amount of capital that an Enterprise must hold at any given time in order to maintain positive capital for a ten-year period of economic stress. OFHEO concurs with the Congressional judgment that such a regulation is necessary in order to ensure that the Enterprises can continue to fulfill their important public purposes and to reduce the potential risk of the serious disruptions that could occur if one or both of the Enterprises experienced economic difficulties.

The Enterprises perform an important role in the nation's housing finance system. Issuances of debt and guaranteed mortgage-backed securities by the Enterprises have grown enormously in the past decade, providing more than half of the conventional financing of housing in the United States. The Enterprises are the largest sources of secondary mortgage market credit throughout the United States and fill a particularly important role in providing assistance in the areas of low- and moderate-income housing. Financial failure of an Enterprise could result not only in losses to investors in its securities, but also decreased public confidence in the securities of the other Enterprise and of the Federal Home Loan Banks, which are also Federal Government sponsored enterprises that provide a source of financing for housing. Such a failure also could cause decreased availability and increased cost of financing for persons seeking to purchase or refinance housing in the United States. For these reasons, public confidence in the financial health of the Enterprises will help to promote overall stability in the housing market, benefiting all homeowners and other participants in that market.

Although the current risk of an Enterprise failure is small, the continued financial stability of the Enterprises cannot be taken for granted. Over the past two decades, failures of financial institutions have been commonplace, including more than 2900 banks and thrifts and a number of securities firms. The risks associated with Fannie Mae and Freddie Mac differ in some important ways from those associated with banks, thrifts, and securities firms. However, Government sponsored enterprises are not immune to failure. Fannie Mae encountered serious financial difficulty in the early 1980s, recovering in large part because of a fortuitous decline in interest rates, and the Farm Credit System experienced serious problems later in the decade. Because of the Enterprises' key role and important public mission, Congress created OFHEO to ensure their safe and sound operation. The current combined debt and guarantee obligations of the Enterprises amount to nearly $2.5 trillion, and, unlike banks, thrifts, and securities firms, no Enterprise obligations are backed by an insurance fund that could contribute toward meeting creditor claims.

The risk-based capital rule (in conjunction with OFHEO's other regulatory tools) is intended to reduce the risk of financial failure of an Enterprise. The rule can contribute to that goal by requiring the Enterprises to hold more capital or take less risk than they otherwise would in some or most circumstances, particularly those circumstances in which the danger of failure is greatest. In circumstances in which some capital or risk adjustment is necessary, the rule gives an Enterprise the flexibility to choose whether more capital, less risk, or a combination of the two best suits its business needs.

Capital reduces the risk of insolvency by absorbing losses. For most firms, debt markets provide strong capital discipline, penalizing a firm that is excessively leveraged with higher borrowing costs. That discipline is largely lacking for the Enterprises because of their status as Government sponsored enterprises. This lack of normal market discipline is the type of significant ''market failure'' that is described in the Office of Management and Budget (OMB) ''best practices'' document (OMB Best Practices Guide).[171] It makes capital requirements particularly important for the Enterprises.

The statutory requirement to promulgate a risk-based capital regulation reflects a Congressional judgment that the market failure should be addressed through Government-mandated regulation. Enterprise debt securities receive favorable pricing in the market, due in part to the Enterprises' statutory Federal charters and advantages conferred thereby and the perception that the Federal Government would act to prevent an Enterprise's default. This perception, as well as the Enterprises' dominant position in the secondary market for conventional residential mortgage loans, lessens the market discipline that would apply if the Enterprises were not Government-sponsored enterprises. OFHEO views the Congressional direction to develop a risk-based capital regulation as intended, in part, to compensate for this lack of market discipline.

The market failure is significant, even though the Enterprises currently are well managed and profitable, because, if the Enterprises were to experience financial difficulties, disruptions could occur, with significant adverse effects on the housing and financial markets. Further, the market failure is significant because of the important public purposes served by the Enterprises and the need to avoid the expense to the taxpayer if intervention by the Federal Government were found to be necessary.

In summary, OFHEO is confident that the risk-based capital rule will perform effectively the role intended for it by the 1992 Act. It will promote the Enterprises' safety and soundness, thereby enhancing their ability to continue to carry out their public purposes.[172] These purposes include providing stability in the secondary market for residential mortgages and providing access to mortgage credit in central cities, rural areas, and underserved areas.

3. Examination of Alternative Approaches

a. Limitations Imposed by Statute

In developing the regulation, the Director of OFHEO (Director) has discretion with respect to a number of issues related to the stress test. However, the specificity of the 1992 Act provisions related to the risk-based capital stress test defines a general level of stringency and limits the alternative approaches available to OFHEO. OFHEO is directed to: (1) Identify default and loss severity rates that satisfy a specific statutory standard for credit stress (which OFHEO has termed ''benchmark'' rates) and (2) apply a stress test that subjects each Enterprise to a ten-year stress period with mortgage loss rates that are reasonably related to these benchmark rates. Interest rate shocks during the ten-year stress period are statutorily defined as well. During the first year of the stress period the ten-year constant maturity Treasury rate (CMT) must rise or fall by specified amounts. In both scenarios (rising or falling rates), the rate must remain constant for the remaining nine years of the stress period. The risk-based capital requirement is based upon the scenario that requires the higher capital amount at the beginning of the stress test for an Enterprise to maintain positive capital throughout the stress period.

Although the 1992 Act defines a general level of required stringency, OFHEO must make certain determinations reasonably related to historical experience and certain determinations consistent with the stress period. For example, the regulation must set forth the shape of the Treasury yield curve during the ten-year period. The statute provides that the curve should be reasonably related to historical experience and otherwise judged reasonable by the Director. OFHEO also has discretion to determine the levels of non-Treasury interest rates, the rates of mortgage prepayments, dividend payments, and many other factors, provided that they are consistent with the stress period. The 1992 Act also requires that the stress test be made public so that it may be run by interested persons in the same manner as the Director. This requirement, together with the need to apply the same stress test to both Enterprises and the need to protect proprietary Enterprise data from disclosure, imposed certain limitations on alternative approaches that were available to implement the statute.

b. Use of Performance-Oriented Approach

The risk-based capital regulation, as anticipated by the 1992 Act, is a performance-oriented standard. Rather than a uniform ratio-based standard applied to both Enterprises without regard to their individual risk profiles, the capital standards set by the regulation are specific to each Enterprise's particular risk profile. The stress test takes into account the risk characteristics of the particular assets and liabilities and off-balance sheet obligations of each Enterprise and predicts how these specific instruments will perform under stress. Because the stress test models the entire existing business of an Enterprise, and takes into account the actions the Enterprise has taken to offset risk, there are numerous options (other than adjusting the amount of total capital it holds) for an Enterprise to satisfy the requirements of the regulation. To the extent that an Enterprise uses these other options to manage its risk, its capital requirement will be lower than it otherwise would be.

c. Alternative Levels of Stringency

The 1992 Act defines the general level of stringency of the risk-based capital regulation by requiring the Enterprises to have enough capital to survive statutorily prescribed stress conditions for a period of ten years, plus an additional 30 percent for management and operations risk. Stress conditions this severe have not been experienced nationally for a comparable period of time since the Great Depression. Within these parameters, certain decisions left to the Director's discretion affect the relative stringency of the stress test. These include decision rules for modeling credit enhancements and

[171] *Economikc Analysis of Federal Regulations Under Executive Order 12866.* Office of Management and Budget (Undated document representing the result of two-year study to describe the ''best practices'' for preparing the economic analysis of a significant action called for by E.O. 12866).

[172] 1992 Act, section 1302(2) (12 U.S.C. 4501(2)).

derivatives (including how to take counterparty risk into account), the payment of dividends, operating expenses, the issuance of debt and the investment of excess funds, rates of prepayment (which are affected by property valuation assumptions), and how to calculate the capital needed to survive the ten-year stress period.

In developing these decision rules, OFHEO exercised its discretion in a manner that it deemed consistent with the stress conditions mandated by the 1992 Act. That is, OFHEO specified other stress test conditions that were consistent with the stringency of the conditions specified in the statute. In the yield curve specification, for example, OFHEO could have chosen yield curves that would have had the effect of either greatly mitigating or exacerbating the most likely economic impact of the statutorily imposed shocks to the ten-year rate. Instead, OFHEO selected curves in both scenarios that did not, in OFHEO's judgment, have either effect.

In general, OFHEO modeled instruments according to their terms, in order to reflect accurately their performance under the conditions of the stress period. In the few instances where, because of the unavailability of data or satisfactory modeling techniques, it was not possible to model instruments in this way, OFHEO employed conservative measures, which have the effect of discouraging large volumes of activities the risk of which could not be quantified with some precision in the stress test. It follows, therefore, that the more precisely instruments and activities can be modeled, the lower the amount of capital that generally will be required. However, precise modeling requires adequate data and careful research. Therefore, the rule is structured to encourage the Enterprises to maintain and deliver good data, which will allow OFHEO to provide accurate and timely assessments of the risks of all Enterprise business activities.

d. Alternative Effective Dates

The 1992 Act provides that the regulation shall take effect upon issuance, but provides a one-year period from the effective date before the supervisory authorities that are tied to the risk-based capital level take effect.[173] These provisions override the Administrative Procedure Act (APA) requirement for a 30-day delayed effective date for substantive rules [174] and do not give the Director discretion to alter the timetable. However, a subsequent Congressional enactment, the Small Business Regulatory Enforcement Fairness Act (SBREFA), delays the effective date for rules that OMB has determined to be ''major rules'' for at least 60 days from the date they are submitted to Congress for review or the date of publication, whichever is later.[175]

OFHEO believes that the language in the two statutes can be harmonized by regarding the one-year transition period in the 1992 Act as a *de facto* delayed effectiveness date that runs concurrently with the 60-day delay required by SBREFA. In any event, SBREFA provides a good cause exception to the 60-day delayed effective date, which OFHEO has determined is appropriate to this rule. Because the 1992 Act already provides a one-year delay in enforcement of the regulation, during which Congress could act to overturn the rule if it chose, no further purpose would be served by adding on to that period the additional 60 days from SBREFA.[176] The requirement in the 1992 Act that the regulation become effective immediately reflects a Congressional determination, with which OFHEO agrees, that the public interest in safe and sound Enterprises is best served by implementing the rule without delay. The effect of an additional 60-day delay in the effective date would be to prevent OFHEO from using certain of its prompt corrective action authorities to deal with a deficiency in risk-based capital until 14 months after publication of the rule. Given that Congress has determined that 12 months is sufficient time for the Enterprises to adapt to the rule, the public interest would not be served by extending that period. On the contrary, it would not be in the public interest to further delay the effective date of prompt corrective action authorities for longer than the one-year period specified in the 1992 Act. In short, OFHEO believes the Congress has provided an ample phase-in period for the implementation of this regulation and that further delay increases financial risk with no off-setting benefit to the general public or the Congress. It should be noted, however, that, after the end of this phase-in period, OFHEO has considerable discretion in its supervisory responses, depending upon the circumstances, in the event of a risk-based capital shortfall.

e. Alternative Methods of Ensuring Compliance

Alternative methods of compliance with reporting provisions were considered. Feeds of raw data from the Enterprises, which would be processed by OFHEO, were originally thought to be the least burdensome option, but ultimately were found by the Enterprises and OFHEO to be problematic. The Enterprises commented that the data normalization performed by OFHEO to ensure that comparable data was captured for both Enterprises resulted in data translation errors. They expressed concern that resolving these errors would consume so much time after the data was submitted that accurate capital classifications could not be produced with sufficient timeliness to be useful as a regulatory tool or useful to the Enterprises in their planning. The Enterprises suggested instead that they be allowed to process their data and run a stress test specified by OFHEO using their own internal systems. They would provide OFHEO with the capital numbers, which would be presumptively final, unless OFHEO found an error.

For reasons discussed in section III.A.2., Proprietary/Internal Models, OFHEO did not agree that presumptive finality should be accorded to the Enterprises' calculations of their risk-based capital requirements. However, OFHEO agreed that allowing the Enterprises to process most of the data required to run the stress test using their internal systems and to submit a report with the data appropriately aggregated in the standardized format specified by OFHEO (along with the raw loan data used in preparing the report) would eliminate the data normalization step and allow quicker capital classifications. The final rule, therefore, requires the Enterprises to submit a

[173] 12 U.S.C. 4611(e)(1), 4614(d), 4615(c).

[174] 5 U.S.C. 553(d).

[175] If a joint resolution of disapproval is passed by Congress during the 60-day period, the rule may be further delayed if the President does not sign the joint resolution of disapproval. 5 U.S.C. 801(a)(3).

[176] Provisions in the Enterprises' respective charter acts that limit capital distributions without the approval of the Director if an Enterprise does not meet its risk-based capital requirement do not include the one-year delay specified in the 1992 Act. However, OFHEO does not intend that the risk-based capital rule will require approval of ordinary-course dividend payments, share repurchases and redemptions that an Enterprise makes during the transition year. During that period, the rule would have no impact on an Enterprise's ability to make capital distributions absent adequate notice to the Enterprise of its capital position and adequate opportunity to take reasonable and prudent steps to address any articulated deficiency. *See, supra,* section III.B.6., Interaction with Charter Act Provisions. In any event, if an Enterprise fell short of its risk-based capital requirement during the first year after the rule's effective date, OFHEO would not withhold approval of capital distributions without careful consideration of the circumstances of the shortfall. These factors could include the causes of the shortfall and the likelihood it would soon be eliminated (or had already been eliminated).

Risk-Based Capital Report that contains the data required to run the stress test, aggregated by the Enterprises according to the stress test rules of aggregation specified by OFHEO. The stress test will be run by OFHEO using model-ready inputs submitted in the Risk-Based Capital Report. The accuracy and completeness of the Report, along with the raw data from which the Report is prepared, must be certified by the Enterprise official with responsibility for capital adequacy. The preparation of the Report, including the aggregation of data in a model-ready format, is subject to OFHEO's supervision and oversight, and appropriate penalties are available for false certification.

Methods of ensuring compliance with the substantive requirements of the rule—that is, ensuring that the Enterprises maintain adequate risk-based capital as determined under the rule—are largely prescribed by statute, based on the capital classification of the Enterprise. The 1992 Act requires that these classifications be determined at least quarterly and reported to the Congress annually. The Act provides OFHEO discretion to make more frequent capital determinations, but the alternative of substituting less frequent, random classifications, which is suggested in the OMB Best Practices Guide, is not an option under the statute. OFHEO does not presently find a need to specify by regulation the circumstances under which it might make determinations of capital classifications more frequently than quarterly. However, low capital levels, high risk activities, inadequacies in risk management techniques, or various adverse events external to the Enterprises are the types of concerns that could make more frequent capital classifications prudent.

The risk-based capital rule sets the standard and the procedure for determining whether an Enterprise is undercapitalized, but does not impose a specific sanction or remedial measure in the event of noncompliance. Those sanctions or other measures are not a subject of this rulemaking. OFHEO notes, however, that, under the 1992 Act, if an Enterprise fails to meet its applicable capital standard, it must submit a capital restoration plan for the approval of the Director. In addition, the Enterprise becomes subject to restrictions on capital distributions, only some of which may be waived or modified by the Director. Also, depending upon the severity of the undercapitalization, other enforcement tools are provided, some of which are mandatory.

f. Informational Measures

Executive Order 12866 contemplates that agencies should consider voluntary public disclosure systems as an alternative to other types of regulatory mechanisms. The 1992 Act does not allow for OFHEO to substitute such a voluntary system of financial disclosure for the mandatory risk-based capital determination. However, OFHEO agrees with the general implication in E.O. 12866 that financial disclosure enhances market discipline, and has chosen to publish its capital classifications of the Enterprises, together with their total and core capital levels and their respective risk-based, minimum, and critical capital requirements. Because the Enterprises' risk-based capital levels reflect the results of the stress test, and because the operation of the stress test is transparent to the public, OFHEO views the risk-based capital rule as an important step in providing greater public disclosure of financial risk at the Enterprises. Also, OFHEO is currently considering the extent to which disclosure of other financial data about the Enterprises may serve to improve market discipline without compromising information that, for legal or public-policy reasons, should remain non-public.

Given the legal structure of the Enterprises and their dominant position in the secondary market for conventional residential mortgage loans, there are also practical limits to the extent to which informational measures alone can provide sufficient market discipline to ensure their safety and soundness. The need for OFHEO and the other regulatory structures put in place by the 1992 Act arose in large part from the public perception that the Federal Government would intervene to prevent default by either of the Enterprises or by other Government-sponsored enterprises. Accordingly, Congress has made the determination that market discipline alone will be insufficient to prevent or serve as an early warning of Enterprise failure. To avoid the potential costs and disruptions that could occur in the event of the financial failure of an Enterprise, the 1992 Act established a regulatory system with sufficiently stringent capital requirements to prevent the insolvency of the Enterprises under extreme financial conditions. The risk-based capital regulation is a mandatory aspect of that system.

g. Market-Oriented Approaches

Within the bounds of the 1992 Act, OFHEO has chosen the most market-oriented alternative available. By requiring OFHEO to base capital upon a stress test that takes into consideration both interest rate and credit risk, the 1992 Act contemplates a rule that will provide great flexibility to the Enterprises to determine the most cost-effective means to match capital to risk. OFHEO has maximized the market orientation of the statute in the regulation by using models that make risk-based distinctions between many characteristics of the thousands of different instruments, programs and activities of the Enterprises. Because the risk-based capital rule is sensitive to these distinctions, it gives the Enterprises a broad array of options in the market—including altering the risk characteristics of their assets and liabilities, using different hedging strategies, and raising capital—to maintain compliance.

OFHEO has compared its risk-based capital regulation to the risk-based capital systems in use by other Federal financial institution regulatory agencies and has found that OFHEO's is the most market-oriented approach. In particular, the system in use by bank and thrift regulators, which is essentially a set of leverage ratios that are assessed against relatively broad categories of instruments, provides the regulated entities relatively few compliance options in the marketplace. Although a financial institution may adjust its portfolio to hold relatively fewer risky assets, these ratios do not take into account many risk-mitigating actions that an institution might take to hedge its risk.[177] Further, the 1992 Act already specifies separate leverage ratios in the form of minimum and critical capital levels, which OFHEO has implemented in its minimum capital regulation. Other systems in use for assessing financial institution risk, such as value-at-risk models, are designed to serve more limited purposes (such as assessing risk in a trading portfolio) and are inappropriate to determine capital for an entire financial institution involved in diverse business activities and are inconsistent with the statutory mandate for a stress test. For these reasons, OFHEO concluded that its risk-based capital rule utilizes the most market-oriented approach reasonably available

[177] The recent Basel proposal is more risk-sensitive than the current capital regime. It would provide for more consideration of credit risk hedges, although the credit risk part of the proposal is ratio-based. Committee on Banking Supervision, ''A New Capital Adequacy Framework,'' Bank for International Settlements, Basel, Switzerland (June 1999). A copy of this document may be obtained from the BIS website at *http://www.bis.org.*

to determine risk-based capital for the Enterprises.

h. Considering Specific Statutory Requirements

When a statute establishes a specific regulatory requirement and the agency has discretion to adopt a more stringent standard, E.O. 12866 provides that the agency should examine the benefits and costs of any more stringent alternative the agency proposes as well as the specific statutory requirement.

As explained above, OFHEO has proposed a standard that is consistent with the stringency provided for in the 1992 Act. The 1992 Act requires OFHEO to specify those elements of the stress test that are not specified or not specified fully in the Act, but in most cases, the specification must be either reasonably related to historical experience or consistent with the stress period. Within these statutory guidelines, OFHEO has significant discretion to make decisions about the assumptions and operation of the stress test. The specifications for some of these elements of the stress test have the potential to increase or decrease the overall stressfulness of the regulation. In each such case, OFHEO has chosen specifications that are consistent with the conditions of the stress period.

Yield curve specifications provide an example of a choice OFHEO made that is consistent with the conditions of the stress period. Both the flat yield curve in the up-rate scenario and the upward-sloping curve in the down-rate scenario are within the range of yield curves that have been experienced frequently. Some comments complained that these curves can result in short-term interest rates receiving a greater shock than long-term rates.[178] However, as explained in detail in the preamble to the final rule,[179] OFHEO found that such a result is most consistent with the changes in the ten-year rates, based upon historical experience. That is, when interest rates have risen precipitously in the past, yield curves have tended to flatten. When they drop precipitously, yield curves tend to steepen. Similarly, although yield curves never actually maintain a static slope over time, OFHEO found that maintaining a constant slope was most consistent with the 1992 Act's specification of a constant ten-year CMT and was the approach that best reflected the level of stringency intended in the statute.

4. Analysis of Costs and Benefits

a. Introduction

Executive Order 12866 provides that the issuing agency will establish a baseline against which the agency should measure a rule's resulting costs and benefits, including those that can be monetized and those that cannot. The agency must then explain how it weighed these costs and benefits in reaching its decision on the regulation. The Executive Order recognizes that in many cases the agency is required by statute to act notwithstanding the outcome of this cost-benefit analysis, but asks that it be performed nevertheless, so that the impact of the regulation can be understood and to show that the costs and benefits of any options that were available to the agency under the statute were weighed appropriately.

Executive Order 12866 also contemplates that, if a regulation is composed of a number of distinct provisions, the benefits and costs of these different provisions will be evaluated separately. The preambles to the final rule and the proposed rules break down the rule into such distinct provisions and detail the decision-making in each. These decisions typically were made after weighing the delays and costs of more precise modeling against the likely impact of that greater degree of precision on modeling. Because the number of decisions is large and the interaction effects of these decisions are extensive, it is impractical to analyze all possible combinations of possible decisions as to every provision in the rule. Therefore, only those provisions that OFHEO has found to be most significant or controversial have been targeted for analysis in this economic analysis.

b. Baseline

Because the risk-based capital regulation is mandated by Congress, OFHEO was faced with two choices for determining a baseline from which to measure costs and benefits of the regulation. OFHEO could either use a baseline scenario that assumes that the statutory requirement was absent, or a baseline that assumes that the statutory requirement is present but no regulation is adopted. For the purpose of this analysis, OFHEO chose the latter.

The Enterprises have stated publicly that they support the stress test that is embodied in the 1992 Act and implemented by the rule and that they would apply a stress test and maintain capital in compliance with the 1992 Act voluntarily in the absence of a rule. The baseline scenario assumes, therefore, that each Enterprise constructs a stress test, determines its risk-based capital requirement, and submits the information to OFHEO quarterly. However, these voluntary numbers, which are not produced pursuant to a risk-based capital rule, could not form the basis for the Enterprises' capital classifications. The 1992 Act requires that until one year after OFHEO publishes its risk-based capital regulation, OFHEO must base the capital classifications upon the minimum and critical capital levels only.[180] Consequently, capital classification and supervisory actions related to capital classifications would continue to be based on the minimum and critical capital requirements. The baseline scenario also assumes that, although no standardized risk-based capital data submission would be required, the same types of information would be made available to OFHEO for the purpose of its examination and supervisory responsibilities, including examining the stress tests constructed by the Enterprises and the accuracy of the internal capital requirements produced thereby.

c. Benefits of the Rule

The benefits of the final rule over the baseline scenario are numerous. They accrue to the Federal Government (and hence taxpayers), the Enterprises, homeowners, and capital market participants. The most obvious and important of these benefits to all four groups is a reduced risk of failure of the Enterprises. The Enterprises have a dominant position in the secondary mortgage market and are a major presence in the debt markets. Were either Enterprise to fail, the disruption to the housing and financial markets likely would be significant. It could affect the cost of financing for housing and the availability of new housing, particularly affordable housing. The regulation will reduce the risk of failure by providing objective, conservative, and consistent standards for capital at the Enterprises. It will provide maximum transparency, create greater comparability with the capital requirements for other financial institutions, and allow OFHEO to respond quickly to capital weakness at an Enterprise.

The economic distress of Fannie Mae in the 1979–1985 period was significant and the 1992 Act was, in part, a response to Congressional concern that,

[178] If the yield curve is upward sloping prior to the beginning of the stress test, short-term rates will move farther than long term rates in the up-rate scenario, and less than long-term rates in the down-rate scenario. If the yield curve is inverted or downward sloping, the opposite effect will occur.

[179] Section III.G.2.a., Specification of the Flat Yield Curve in the Up-Rate Scenario.

[180] 12 U.S.C. 4614(d).

but for a fortuitous change in interest rates, Fannie Mae might have collapsed, costing investors or the Government billions of dollars. Because of the growth of the Enterprises, a failure today could result in much greater loss. Depending on the response of the Government to such a failure, significant disruption to the financial and housing markets, significant burdens on taxpayers, or both would result. The losses resulting from the savings and loan crisis in the late 1980s, which ultimately were borne by the U.S. taxpayer, are estimated at more than $100 billion. However, the Enterprises have considerably more dollar exposure than the entire savings and loan industry had in 1986. Also, because of the central role of the Enterprises in the affordable housing market, an Enterprise failure could have adverse impacts on the availability and affordability of housing in many areas of the United States.

The regulation has another important public benefit. A capital standard is likely to be more conservative if it is determined objectively and consistently for both Enterprises in a transparent and evenhanded way by an agency of the Government responsible for their safe and sound operation than if it is determined voluntarily by each Enterprise. The Enterprises, by virtue of their structure, have far less incentive than OFHEO to make conservative choices in the construction of the stress test. They, like other privately owned financial institutions, are subject to shareholder pressure to increase earnings per share. In the absence of substantial market discipline (based on fear of insolvency), a simple way to increase earnings per share is to increase capital leverage, which reduces capital ratios. In addition, non-compliance with the risk-based capital rule subjects an Enterprise to statutory restrictions on capital distributions and to special supervisory measures that could be imposed by OFHEO. Further, in the baseline scenario, the capital requirement for each Enterprise would be determined by a model tailored to that Enterprise's business mix and methods, and there would be no comparability between the two capital standards even if the risk profiles were the same. In sum, shareholder pressures, competitive pressures, and the lack of a binding regulation would likely result in weak and inconsistently applied standards.

Government involvement in and approval of capital standards is essential to create public confidence that they are appropriately stringent, transparent, and fair. Government oversight and enforcement also foster public confidence that the Enterprises are complying with those standards. It is significant that, at least in the United States, Federal regulators determine the required capital levels for all federally regulated depository institutions. Given the sensitivity of econometric models to changes or variations in the economic analyses and assumptions that underlie them, the public would be appropriately skeptical of a system of risk-based capital standards based on stress tests designed, run, and monitored by the Enterprises themselves.

Further, although OFHEO's risk-based capital regulation falls within that class of regulations that the agency is required to issue notwithstanding the findings of the cost-benefit analysis, no commenters urged OFHEO to support a statutory change to allow self-regulation or eliminate the requirement for risk-based capital rules for the Enterprises. Rather, commenters generally agreed that well defined and stringent capital standards are important to ensuring the safety and soundness of the Enterprises. Moreover, as explained below, the costs of an effective risk-based capital rule are small relative to its significant and apparent public benefits.

A unique benefit of OFHEO's risk-based capital rule is its sensitivity to the credit and interest rate risk in each Enterprise's business. The marginal capital associated with the assets, liabilities and off-balance-sheet instruments of the Enterprises varies, not only based upon the characteristics of the particular instrument, but also based upon the mix of instruments in each Enterprise's portfolio.[181] The stress test also takes into account the economic conditions as of the date for which the stress test is run. For example, if housing prices have been rising prior to the as-of date, a given portfolio of seasoned loans will have a lower credit loss experience than if prices have been declining, all other factors held equal. Likewise, current interest rates may have a significant impact on the amount of capital required of an Enterprise, depending upon how well hedged the Enterprise is against interest rate risk.

The existence of a rule that complies with the statutory mandate for notice and comment and replicability will create greater transparency and promote more market discipline than a voluntary system. Further, because OFHEO will design and run the stress test, OFHEO may be able to act more quickly to deal with capital inadequacies that may arise. Also, the rule is forward-looking, which helps ensure that capital is built up as stressful economic periods develop, before losses occur. As a response to the regulation, OFHEO anticipates that the Enterprises may choose to build up a capital cushion during favorable economic conditions, when capital is inexpensive, to avoid having to raise capital or hedge risk in other ways during tough economic times. The Enterprises have, in fact, increased their capital levels since 1993 in response to the 1992 Act and in anticipation of OFHEO's capital rules. Another benefit of the rule is that it rewards risk reduction by the Enterprises with a lower capital requirement, providing appropriate incentives to the Enterprises to hedge risk.

The transparency of the stress test will improve the ability of market participants to evaluate each Enterprise's risk profile, risk management techniques, and capital adequacy. The existence of an independent and objective evaluation of capital adequacy and the knowledge that prompt supervisory action is available to correct deficiencies are likely to inspire greater investor confidence, which may lower the cost of debt and capital to the Enterprises. To the extent that these savings are passed along to consumers, the regulation may benefit homeowners with lower mortgage costs. To the extent they are not passed along, shareholders will benefit, offsetting, in part, any increase in capital costs. Most importantly, conservative, objectively determined capital standards mean that the Enterprises are more likely to be able to continue to perform their important public purposes, such as purchasing low- and moderate-income residential mortgage loans.

d. Costs of the Rule

OFHEO has also considered whether there are certain costs, tangible and intangible, associated with the regulation—that is, with a system of mandatory rather than voluntary compliance. First, there will be a reporting cost to the Enterprises. As a result of the need to report data in a standardized format there may an initial cost associated with the need to adapt existing computer systems to accommodate the periodic reporting within the regulatory time frames. However, these costs have largely been incurred already as OFHEO has worked with the Enterprises to obtain the data necessary to design and run the stress test.

[181] *See* NPR2 section II.B Sensitivity of Capital Requirement to Risk, 64 FR 18097 (April 13, 1999).

There will be personnel costs to the Enterprises associated with preparation and certification of the quarterly data submissions. However, similar reporting would be required of the Enterprises even in the absence of the risk-based capital regulation, because OFHEO would need much the same data in order to monitor closely the Enterprises' internal modeling of the stress test and to support OFHEO's research and analysis functions. Therefore, there is no certainty that reporting costs to the Enterprises under the regulation will be significantly higher than under the baseline scenario. Further, any possible cost savings to the Enterprises in the baseline approach would be offset by an increase in OFHEO examination time. This increase would occur because, in the absence of a risk-based capital regulation, OFHEO would need to spend considerably more examination resources than are currently budgeted to validate the computer models (including the databases upon which the models are estimated and operated) that the Enterprises construct to run their internal stress tests. Examination of the Enterprises' computer models will continue to be an important aspect of OFHEO's functions after the risk-based capital rule is implemented. However, if risk-based capital were to be determined based upon the output of a single internal model at each Enterprise, that model would require far more intense scrutiny than other business models. Further, OFHEO would still need to maintain its internal modeling capability in order to perform its research and analysis functions under the 1992 Act. The net result would be considerably more expense for OFHEO than the approach in the regulation.

It has been argued that under the voluntary system, the Enterprises might be freer to modify many aspects of the stress test as soon as new data become available, because they would not have to wait for a regulator to determine capital treatments as their businesses change. If this were true, it might allow them to align their capital with risk more quickly than under the regulation. OFHEO views this benefit of a voluntary system as speculative, at best. OFHEO would require sufficient internal controls at the Enterprises to insure that treatments of new activities were appropriately conservative and capital calculations accurate. Moreover, OFHEO has streamlined its procedures to deal with new activities and other modeling issues that arise in order to provide prompt decisions on appropriate treatments. It is not clear that internal systems at both Enterprises that are designed to do the same thing would be less expensive or time-consuming. It is clear, however, that the determinations made under such internal systems would lack the transparency of similar determinations made by OFHEO. It is also likely that the financial markets would have greater confidence in the objectivity and fairness of decisions of a Federal regulatory agency than in the internal decisions of the Enterprises. Greater confidence in the capital numbers could well reduce the overall cost of debt and capital to the Enterprises.

Each Enterprise could argue that its allocation of capital cost to various individual financial instruments would likely be different under a voluntary system, but each Enterprise allocates capital costs differently and bases those allocations upon numerous business considerations in addition to the capital regulations. OFHEO has found no basis for concluding that the rule would cause the Enterprises to change their internal capital allocations to impose any material additional cost on the various housing programs that comprise a primary mission of the Enterprises. Further, OFHEO has found that the capital requirements in the rule will not increase the cost of housing generally or create other costs to the housing market or the larger economy.

e. Costs and Benefits of Alternatives

The stress test contains many components and OFHEO considered numerous means to design and implement each of them. As explained in section IV.A.1., Introduction, the various combinations of these alternatives are so numerous that it would be impractical to discuss each possible combination. The preambles to the proposals and final rule examine the alternatives related to each individual decision discretely, and the preamble to the final rule analyzes the overall result for reasonableness and compliance with statutory intent. In addition, in the economic analysis below, OFHEO highlights selected issues that could have a significant impact on the amount of capital that an Enterprise might be required to hold and discusses the various alternatives considered as to these core issues.

(i) Determination of the Benchmark Loss Experience

A threshold issue in creating the stress test was determining the rates of default and severity ''that occurred in contiguous areas of the United States containing an aggregate of not less than 5 percent of the total population of the United States that, for a period of not less than 2 years, experienced the highest rates of default and severity of mortgage losses * * *'' [182] OFHEO considered numerous alternative statistical methodologies to make this determination. These included various methods for determining what constituted a ''contiguous area,'' different methods for measuring default and severity rates, different potential databases that could be used in the analysis, and different methods of averaging and weighting the data from the two Enterprises.

The 1992 Act provides no guidance to OFHEO as to how a ''contiguous area'' should be defined. OFHEO decided to define the term to mean a group of contiguous states. Under this definition each state in the area must share a common border with another state in the area—the states could not simply meet at a point. OFHEO considered using smaller units, such as the first two or three numbers of zip codes. In general, the smaller the unit that is used in the aggregation, the higher the benchmark loss rate that would be determined. By connecting pockets of severe losses with narrow parcels of land, OFHEO could have created an area with much higher loss rates than the benchmark loss experience that was identified in NPR1. However, commenters on the issue unanimously supported the use of states as the smallest geographic unit, and suggested that using smaller units would create computational difficulties and likely result in an area that would look ''gerrymandered.'' OFHEO found that conducting analysis at a state level is a common rating agency practice and was the most logical, efficient and reasonable approach to construct a benchmark area. Larger areas, such as Federal Home Loan Bank districts and Census Regions, were considered, but because each of these areas was comprised of a fixed group of states, they did not provide the same flexibility or range of potential areas as OFHEO's approach. Accordingly, they were less likely to identify an area of the country that had experienced sufficiently stressful economic circumstances to be appropriate for the stress test defined in the 1992 Act. OFHEO also considered a Freddie Mac suggestion that would have altered the formula for selecting areas for comparison to include a ''compactness'' requirement, but determined that this suggestion was inappropriate and unworkable. OFHEO disagreed with Freddie Mac that the proposed methodology did not result in reasonably compact areas. Moreover,

[182] 12 U.S.C. § 4611(a)(1).

Freddie Mac's suggestion would have imposed an additional requirement, ''compactness,'' that goes beyond what the 1992 Act specified and could well preclude identification of an appropriately stressful credit environment.

OFHEO also considered a number of options in deciding how to determine what event would constitute a default and how to measure the severity of a loss for purposes of the benchmark analysis. OFHEO considered including loans that had been subject to ''loss mitigation'' procedures (which ordinarily indicates that payments are not current on a loan), in addition to loans that resulted in preforeclosure sales, foreclosure, deed-in-lieu, or credit loss. OFHEO decided not to include loss mitigation events as defaults, because data were not adequate to identify them.

OFHEO considered whether to use loss severity rates in the benchmark analysis with or without the effect of mortgage insurance or other third-party credit enhancements taken into account. OFHEO determined that the purposes of the 1992 Act were better served by using loss severity rates without consideration of credit enhancements in determining where and when mortgage losses were highest. The Act requires OFHEO to identify the highest credit losses on mortgages, not the highest net credit losses to the Enterprises. Further, this methodology is more consistent with the stress test in the final rule, which first calculates losses on mortgages and then determines the extent to which those losses are reduced by credit enhancements.

OFHEO based the benchmark determination upon data on the Enterprises' loans. OFHEO considered using other loan data, including databases that were available on Federal Housing Administration loans and credit bureau data. As explained in NPR1, OFHEO decided that the Enterprises' loan data would be the most relevant source from which to determine a benchmark loss experience for the Enterprises. The quality and detail of those data are such that they reflect losses in recent periods as well as or better than data from any other sources. Moreover, using the Enterprises' data eliminates the problem of having to sift out loans that would not be eligible for purchase by the Enterprises or otherwise not be representative of the loans they purchase.

Having determined that the Enterprises' loan data were the best database for the analysis, OFHEO considered which group or groups of loans from that database would be used to compare the many different state/year combinations that meet the population and contiguity requirements. The Enterprise loan data include information on loans of many different types (fixed rate, adjustable rate, balloon, graduated payment, second mortgages, etc.), supported by various types of residential collateral (single-family detached homes, planned unit developments, condominiums, multifamily buildings, two-to four-unit homes, etc.). OFHEO considered which of these loan and collateral types would be appropriate to include in an analysis of the worst loss experience that met the statutory criteria. In order to have a common loan type for comparison among potential benchmark periods and areas, OFHEO limited its analysis to 30-year, single family, fixed-rate mortgages. This group of loans was chosen because the Enterprises historically have purchased large volumes of them and because they are relatively homogenous, meaning their terms and conditions are relatively uniform as compared to the other loan and collateral types.

OFHEO also considered whether to take the loan-to-value ratio (LTV) of loans into account in determining the benchmark, because this ratio is highly correlated with loan losses. A method of doing so, which OFHEO considered, would determine loss rates by various LTV ranges and then compute overall default or loss rates by assuming some standard distribution of LTV ratios and weighting the LTV-specific loss rates according to this distribution. OFHEO did not use either of these alternative methodologies. Instead, OFHEO decided to compute loss rates for candidate benchmark periods and areas on a dollar-weighted basis only, without regard to LTV, for three reasons. First, in many candidate periods and areas, there were too few loans in some LTV ranges to use the LTV-weighting approach. Second, OFHEO found no acceptable basis for using any specific, standardized LTV weights. Finally, OFHEO was concerned that the LTV weighting approach might be inconsistent with the 1992 Act, because it would not identify the part of the country where mortgage losses were highest.

Other methodological alternatives were considered by OFHEO in the procedures for combining the default and severity rates of the two Enterprises. OFHEO chose to calculate the default and severity rates for each Enterprise separately for each candidate period and area and to use the average of the experience of the two Enterprises. OFHEO also considered averaging the rates based upon the market share of the two Enterprises, as suggested by the Department of Housing and Urban Development, but finally determined that attempting to determine the historical relative market shares of the two Enterprises would be difficult. Further, OFHEO found the experiences of both Enterprises equally relevant to a determination of the highest rates of default and severity and, for this reason also, decided to weight their data equally.

(ii) General Modeling Approach

This discussion of the general modeling approach focuses on the macro-decisions made by OFHEO in the development of the stress test. Given the importance placed upon aligning capital to risk, OFHEO chose to model the Enterprises' books of business as precisely as possible. Examples of the decisions made by OFHEO that attempt to balance the costs against the benefits of precision are discussed below.

As a threshold matter, OFHEO chose to use a cash flow model that, to the extent possible, determines the cash flows for most instruments according to their terms, taking into account the availability of data and the need to avoid excessive complexity and regulatory burden. OFHEO could have chosen a simpler type of model that calculated gains and losses on most instruments as ratios of a few baseline instruments. For example, OFHEO could have assumed that losses on all other loan types were a fixed multiple of losses on a fixed rate, 30-year, owner-occupied mortgage loan. The benefit of such a model would have been its relative simplicity, but the costs of such an approach would have been a decrease in both the sensitivity of the stress test to risk and the usefulness of the stress test in aligning capital to risk.

Some commenters suggested that OFHEO adopt an approach similar to those adopted by the Farm Credit Administration (FCA) and the Federal Housing Finance Board (FHFB), which involve, to varying degrees, the use of internal proprietary models. OFHEO considered using internal models, but differences in regulatory responsibilities make the FCA and FHFB approaches unworkable for OFHEO. The entire statutory scheme governing the regulation of the Federal Home Loan Banks by the FHFB, including the Banks' ownership and capital structure, is very different from the regulatory framework established by the 1992 Act for the Enterprises. It is, therefore, reasonable to expect that a very different type of capital regulation would be required. The statutory language governing FCA's risk-based capital

regulations for the Federal Agricultural Mortgage Corporation is very similar to the language in the 1992 Act, but, because FCA's regulation applies to only one entity, FCA did not have the same concerns about consistency between Enterprises that OFHEO does. For the purpose of regulating Fannie Mae and Freddie Mac, OFHEO determined that the practical difficulties of implementing and monitoring proprietary, internal models that are consistent with OFHEO's statute more than offset any benefit associated with the use of such models. Most importantly, OFHEO believes that an independently constructed and administered stress test that measures risk consistently in both Enterprises is the best method to insure adequate capitalization of the Enterprises.

(iii) Interest Rates—Yield Curves Considered

The 1992 Act establishes the yield on the ten-year constant maturity Treasury (CMT) precisely, but for other CMTs requires only that they move in patterns and for durations relative to the ten-year CMT that are reasonably related to historical experience and that are determined to be reasonable by the Director. OFHEO interprets this latter requirement to require that the yield curves be reasonable within the context of the stress test and the overall purposes of the 1992 Act.

To select the yield curves, OFHEO examined historical average yield curves subsequent to significant interest rate movements and observed that they were consistently flatter the more the ten-year CMT yield increased and consistently steeper the more the ten-year CMT yield decreased. Consequently, OFHEO selected yield curves that reflect this general tendency. The yield curve in the up-rate scenario is flat for the last nine years of the stress period. In the down-rate scenario, the yield curve is upward sloping.

In selecting the yield curve for the stress test, OFHEO was guided by the general level of stringency of the statutorily prescribed interest rate changes and was mindful of the effect on the relative level of stress of holding the yield curve constant for a period of nine years. In the historical data, OFHEO observed more steeply sloping yield curves than the one selected in the down-rate scenario, and also observed that in periods of rapidly rising rates the yield curve is sometimes inverted. If OFHEO had chosen to hold the yield curve constant at these more unusual slopes, the stress test would have been more stressful than with the yield curves selected. Instead of these yield curves, which only exist for short periods of time, OFHEO selected yield curves that are more representative of a long-term average after a severe interest rate shock and that are, nevertheless, unusually stressful.

(iv) Interest Rates—50 Basis Point Premium on Enterprise Cost of Funds

Because the stress test at times generates a need for additional funding (for example, when Enterprise debt matures more quickly than loans in portfolio), it was necessary for OFHEO to adopt a decision rule about the rates at which new debt would be issued. NPR2 specified that after the first year of the stress period, a 50-basis-point premium would be added to the projected Agency Cost of Funds to reflect the premium that would be demanded by the market as a result of the credit and interest rate stress conditions. The proposal was based on a review of historical data, which showed a widening of greater than 50 basis points between Enterprise borrowing rates and the ten-year CMT in response to economic stress on another Government-sponsored enterprise. Upon consideration of the comments on this issue and after examination of the relevant historical data and the impact of the premium on capital requirements, OFHEO decided not to apply the premium to the Agency Cost of Funds in the final rule.

OFHEO was not convinced by arguments from commenters that the market would not demand a premium because investors would rely on the implied Federal guarantee and the Federal regulatory structure to prevent failure or because other spreads have allegedly widened by as much or more historically than Government-sponsored enterprises. The data are too sparse to support either of these conclusions. There has been only one, relatively brief, period of time in the early 1980s when one of the Enterprises experienced financial stress approaching the magnitude specified in the stress test. The only other similar event involved the Farm Credit System in the mid-1980s.

However, as some comments noted, it is possible that whatever events might cause a widening of the spread between the Enterprises' debt rates and Treasuries could also widen spreads of other interest rates and Treasuries. These spreads have an important effect on the value of hedging instruments and some Enterprise asset returns, and further consideration of these spreads may be appropriate. Current data are insufficient to determine appropriate spreads to the various non-Treasury rates in the stress test, and data for determining an appropriate debt premium are sparse. Consequently, OFHEO determined not to include a premium on new debt in the final rule at this time. This is, however, a likely area for future research and for refinement of the rule, because assumptions about these various spreads may comprise an area of significant risk to the Enterprises.

(v) Property Valuation—Inflation Adjustment

The 1992 Act requires that if interest rates rise by more than 50 percent of the average ten-year CMT for the nine months prior to the start of the stress test, losses must be adjusted to account for general inflation. The stress test implements this requirement by increasing house prices by the amount any ten-year CMT, after the upward shock in interest rates, exceeds a 50 percent increase in the average ten-year CMT from the nine months prior to the start of the stress period. This amount is compounded over the remainder of the stress period for a cumulative inflation adjustment and applied during the last 60 months of the stress period.

Some commenters argued that house prices should be increased by the entire amount of the increase in the ten-year CMT, rather than just the component in excess of a 50 percent increase. OFHEO rejected this alternative based on OFHEO's analysis of historical experience of housing prices during periods of general inflation (as explained in the section III.H.1.b., Inflation Adjustment) and because it would have essentially negated the credit stress of the benchmark loss experience.

(vi) Mortgage Performance—General

Models of mortgage performance comprise the central core of the stress test. Models were the most viable means of complying with the statutory requirements that the loss rates produced by the model be reasonably related to the benchmark loss experience and that appropriate distinctions be made among different types of mortgage products. These models calculate prepayment and default rates and the dollar losses associated with the defaults based upon various economic variables. The models were estimated from data on millions of loans that were purchased by the Enterprises between 1975 and 1999. Creating a model that produces reasonable projections of loss under a wide variety of economic conditions and starting portfolio positions was a complex task, which involved extensive

economic analysis and the examination and testing of many different variables. The decisions made by OFHEO in creating the models are discussed in detail in the preambles to NPR2 and the final rule. The most significant of these decisions are summarized below.

(vii) Modeling Conditional vs. Cumulative Rates

Among the threshold issues confronting OFHEO was whether to construct statistical models of conditional rates of loan defaults and prepayments or to adopt a less detailed approach, such as calculating only cumulative rates and distributing them in fixed percentages across the ten years of the stress period. A conditional rate of default or prepayment refers to the volume of loans that default or prepay during any period, expressed as a percentage of the total volume of loans surviving at the start of that period. The term ''surviving loans'' means those from the group that have not previously prepaid or defaulted. A cumulative rate of default or prepayment is the total percentage of a group of loans that default or prepay during the entire period being studied (such as the ten-year stress period). A group of loans studied over a ten-year period would have a single cumulative default rate, but would have 120 monthly conditional default rates.

Comments regarding this aspect of the model were mixed. In their comments regarding the ANPR, the Enterprises favored using a cumulative rate model of defaults, with Freddie Mac suggesting that a cumulative rate of default be extracted from the benchmark loss experience and the resulting default events be distributed evenly across the stress period. It was argued that the cumulative approach was much simpler and would avoid possibly overstating defaults in the up-rate scenario. Other commenters urged a model of conditional default rates that would take into consideration the differences in prepayment rates in high-rate and low-rate environments. After a conditional default and prepayment rate model was proposed in NPR2, the Enterprises did not object further.

The final rule uses conditional rather than cumulative default rates in the stress test. For single family mortgages, the final rule uses statistical models for the conditional rates of both default and prepayment. For multifamily mortgages, the final rule combines a statistical model of conditional default rates with simple rules for setting conditional prepayment rates. In NPR2, five separate statistical models of conditional multifamily prepayments were proposed. OFHEO considered comments about the adequacy of the data to support these models, whether the models accurately reflected costs incurred for prepayment within yield maintenance or prepayment penalty periods, and the overall complexity of the models, and decided that statistical models of conditional prepayment for multifamily mortgages would not provide greater precision or risk sensitivity than the simple set of prepayment rules implemented in the final rule.

The advantages of using conditional rates are numerous. This approach automatically accounts for the impact of prior defaults on the number of loans remaining active and subject to the risk of prepayment, and, conversely, the impact of prior prepayments on the number of loans remaining subject to the risk of default. This feature is essential to developing a reasonable representation of Enterprise mortgage cash flows across the different economic scenarios envisioned by the stress test. It also avoids potential numerical anomalies that might arise when total or annual defaults during the stress test are fixed, such as years in which total defaults would exceed total surviving loans due to high prepayment levels in the declining rate scenario of the stress test. Also, the periodic nature of mortgage payments, scheduled amortization, and the coupon adjustments on adjustable rate loans, all of which affect mortgage performance, require a model that predicts an exact number of default and prepayment events in each discrete time period of the stress test.

OFHEO believes that a statistical model of conditional defaults and prepayments is more accurate and more sensitive to stress test economic factors, and to the Enterprises' starting books of business, than are simpler methods that might be developed. Each quarter the test is applied, a statistical model can account for changes in economic conditions (such as the level and shape of the Treasury yield curve or recent trends in house prices) and the composition of an Enterprise's business since the last time the test was performed. That is, the rates of default and prepayment applied when the stress test is run are adjusted to reflect current circumstances. Such adjustments are particularly important because mortgage prepayment and default rates are highly time-dependent, characteristically increasing during the first years following origination, peaking sometime between the fourth and seventh years, and declining over the remaining years. However, this time-dependent pattern is itself affected by economic conditions.

Another advantage of modeling conditional default and prepayment rates is the support this approach provides for the proper treatment of loss severity. Loss severity is affected significantly by factors that affect the timing and amount of defaults in the stress test. Loss of loan principal balance, the single largest cost element in determining loss severity, is dependent upon house price declines, which are dependent upon economic conditions leading up to the date of default. Funding costs are also affected by the changing interest rates in the stress test. For all of these reasons, using conditional default and prepayment rates during each month of the stress period greatly improves the sensitivity of the stress test to risk factors.

(viii) Use of Joint Default/Prepayment vs. Total Termination Models

Another key issue for OFHEO was whether or not to use joint prepayment and default models, in which the conditional rates of default and prepayment interact statistically, or to use some simpler assumptions about how default and prepayment rates relate to each other in the stress test.

Fannie Mae favored the use of a statistical model that would determine only total terminations (defaults plus prepayments) in each of the two stress test scenarios. The Enterprise further commented that total defaults in each scenario be set at levels that occurred in the benchmark loss experience. Prepayments would be calculated by subtracting total defaults from total terminations. Fannie Mae viewed this approach as consistent with industry practice and asserted that it would be easier for the company to manage a capital standard based on such an approach than one based upon a joint statistical model.

Freddie Mac commented that a joint statistical model of default and prepayment rates would be preferable to total termination models in the stress test context because (1) joint models ensure that defaults and prepayments correctly ''add up'' to total mortgage terminations, (2) total termination models put undue focus on interest rate movements because default is a small part of total termination under normal conditions (an assumption Freddie Mac found unwarranted in a stress test environment), and (3) standard total termination models capture small effects such as seasoning that would unnecessarily complicate the stress test. However, Freddie Mac did not recommend that OFHEO use joint

statistical models in the stress test, asserting OFHEO would have difficulty using the data from the benchmark loss experience to estimate the models. Instead, Freddie Mac recommended estimating a statistical equation for prepayments based on historical data from a distressed region to factor prepayments into the stress test, while using cumulative default rates from the benchmark loss experience as the stress test default rates.

As discussed in greater detail in section III.I.1.a., Modeling Approach, the final rule uses joint statistical models in the stress test for single family loans, reflecting the recommendations of many other commenters.[183] In doing so, OFHEO recognized that models of mortgage performance are actually models of borrower behavior—individual borrowers' decisions whether to continue making monthly mortgage payments, to prepay, or to default. This ''options theoretic'' conceptual framework, which underlies the joint determination of defaults and prepayments, is the basis for nearly all mortgage performance research. In sum, the joint modeling approach is based on well known and accepted statistical methods that are widely applied in mortgage performance research. Researchers have found multi-choice statistical models to be necessary for this research, because the borrower's options to default or prepay are interrelated.

OFHEO considered the use of total terminations models, such as those recommended by Fannie Mae's comments on the ANPR, but found joint statistical models superior for theoretical reasons noted above and also for reasons cited by Freddie Mac in its comments. However, Freddie Mac's recommendation to estimate statistical prepayment equations using historical data from a distressed region while using the cumulative default rates from the benchmark loss experience was also determined by OFHEO to be inadequate for the purposes of the regulation. Instead, OFHEO addressed Freddie Mac's concern about the use of joint models—specifically, the difficulty of retaining a reasonable relationship to the benchmark loss experience—in OFHEO's decisions to adjust the underlying default and severity equations to replicate the benchmark loss experience, as noted below.

(ix) Relating Mortgage Loss Rates to the Benchmark Loss Experience

One of the challenges in developing a suitable model of mortgage performance was the statutory requirement that the stress test retain a reasonable relationship to the benchmark loss experience, while also taking into consideration a variety of variables such as house price changes, loan seasoning, and loan type. Ultimately, OFHEO chose to relate the stress test losses to the benchmark loss experience in two ways. First, the rule applies certain economic factors from the benchmark area and time period—specifically, house prices, rent growth rates and rental vacancy rates—in the stress test. Second, OFHEO applied the single family mortgage model to the loans used to determine the benchmark, broken down by loan-to-value ratio (LTV) category and using the actual interest rates from the benchmark period. The default and severity rates predicted by the model were then compared to the higher actual benchmark rates for each LTV category. Ratios of actual to predicted rates for each category are applied in the default and severity equations used in the stress test to increase credit losses to a level reasonably related to the benchmark loss experience.[184] Modeling the effects of differences in starting coupons and interest rates from the benchmark loss experience was possible because OFHEO's database allowed the models to be estimated based upon a broad and representative sample of historical mortgage performance data. The statistical equations therefore yield reasonable estimates that can be used to project mortgage prepayment under many different circumstances, including stress test interest rate scenarios.

There were many different alternatives that OFHEO could have selected to relate stress test loss rates to the benchmark loss experience. For example, comments on the ANPR suggested that OFHEO apply the cumulative default rate from the benchmark loss experience directly to the current books of business in the stress test. OFHEO considered this option, which seems simpler in concept than predicting conditional default probabilities. However, OFHEO determined that attempting to make adjustments to benchmark default levels to take into account the various factors specified in the statute and other appropriate factors would be more complex and less likely to yield reasonable capital requirements than the approach selected. OFHEO also considered an approach, which was proposed in NPR2, that would apply the same benchmark adjustment or calibration factor to all single family loans regardless of the LTV category. Although simpler than the final rule, this approach was criticized by many commenters for failing to take into consideration the mix of LTVs in the benchmark loss experience, because the difference between model predictions and the actual loss rates in the benchmark loss experience varied significantly between LTV categories. Accordingly, in the final rule, different benchmark adjustment factors are applied for each LTV category.

To summarize, the methodology OFHEO selected relates losses in the stress test to the benchmark loss experience in a manner that is reasonable within the context of the entire stress test. More specifically, the mortgage performance models, with the benchmark adjustments, not only generate loss rates that are consistent with the benchmark loss experience, but also produce reasonable loss rates under a wide variety of starting positions under both the up-rate and down-rate scenarios. No alternative has been suggested that, in OFHEO's view, would accomplish these objectives as well as the final rule.

(x) Single Family Mortgage Performance

(a) Default and Prepayment Variable Selection

In selecting appropriate variables to project single family default and prepayment rates during the stress test, OFHEO considered only variables that had strong intuitive as well as statistical causal relationships with mortgage defaults or prepayments. As reflected in Table 8, certain variables that strongly influenced prepayment behavior did help to explain defaults. All three single family models simulate defaults and prepayments based on projected interest rates and property values and on variables capturing the mortgage risk characteristics described below.

[183] OFHEO found it necessary to use a simpler methodology for multifamily loans. Because the multifamily model utilizes a set of prepayment rules, the model is ''joint'' only to the extent that conditional prepayment and default rates combine to determine loans that survive from year to year. Conditional rates of default and prepayment are determined separately. *See* section III.I.3., Multifamily Loan Performance.

[184] Multifamily loan data are too limited to allow an adjustment factor to be developed for those loans.

TABLE 8.—SINGLE FAMILY DEFAULT & PREPAYMENT VARIABLES

| Variables for All Single Family Models | Single Family Default Variables | Single Family Prepayment Variables |
|---|---|---|
| Mortgage Age | X | X |
| Original LTV | X | X |
| Probability of Negative Equity | X | X |
| Burnout | X | X |
| Occupancy Status | X | X |
| Relative Spread | | X |
| Yield Curve Slope | | X |
| Relative Loan Size | | X |
| Product Type (ARMs, Other Products only) | X | X |
| Payment Shock (ARMs only) | X | X |
| Initial Rate Effect (ARMs only) | X | X |

• Mortgage Age—Patterns of mortgage default and prepayment have characteristic age profiles; defaults and prepayments increase during the first years following loan origination, with a peak between the fourth and seventh years.

• Original LTV—The LTV at the time of mortgage origination serves as a proxy for factors relating to the financial status of a borrower, which reflects the borrower's future ability to make loan payments. Higher original LTVs, which generally reflect fewer economic resources and greater financial risk, increase the probability of default and lower the probability of prepayment. The reverse is true for lower original LTVs.

• Probability of Negative Equity—Borrowers whose current loan balance is higher than the current value of their mortgaged property (reflecting negative borrower equity) are more likely to default than those with positive equity in their properties. The probability of negative borrower equity within a loan group is a function of (1) house price changes (based on the HPI) and amortization of loan principal, which together establish the average current LTV, and (2) the dispersion of actual house prices around the HPI value. Thus, even when the average current LTV for a loan group is less than one (positive equity), some percentage of the loans will have LTVs greater than one (negative equity).

• Burnout—This variable reflects whether a borrower has passed up earlier opportunities to refinance at favorable interest rates during the previous eight quarters. Such a borrower is less likely to prepay the current loan and refinance, and more likely to default in the future.

• Occupancy Status—This variable reflects the higher probability of default by investor-owners compared with that of owner-occupants. The RBC Report specifies the proportion of investor loans for each loan group.

• Relative Spread—The stress test uses the relative spread between the interest rate on a loan and the current market rate on loans as a proxy for the mortgage premium value, which reflects the value to a borrower of the option to prepay and refinance.

• Yield Curve Slope—This variable measures the relationship between short and long term interest rates. The shape of the yield curve, which reflects expectations for the future levels of interest rates, influences a borrower's decision to prepay a mortgage.

• Relative Loan Size—This variable reflects whether a loan is significantly larger or smaller than the State average. Generally, lower balance loans are less likely to refinance (and therefore prepay) because refinancing costs are proportionately larger, and the interest savings are proportionately smaller, than a larger balance loan.

• Product Type—The differences in performance between 30-year fixed-rate loans and other products, such as ARM and balloon loans, are captured by this variable.

• Payment Shock—This variable captures the effect of increasing or decreasing interest rates on the payments for ARMs. Although a borrower with an ARM loan may still have positive equity in the mortgaged property, the borrower may be unwilling or unable to make a larger monthly payment when interest rates increase, resulting in increases to ARM default and prepayment rates. Conversely, decreasing interest rates make it easier and more desirable for borrowers to make monthly payments, resulting in lower ARM default and prepayment rates.

• Initial Rate Effect—Borrowers with ARM loans with a ''teaser rate'' (an initial interest rate lower than the market rate) may experience payment shock, even if market rates do not rise, as the low teaser rate adjusts to the market rate over the first few years of the loan. The stress test includes a variable which captures this effect in the first three years of the life of the loan.

OFHEO considered using a number of other variables in both the default and prepayment equations that had been suggested by commenters or that appeared to explain default or prepayment rates, but found them inappropriate for the stress test for various reasons. Unemployment rates were suggested by several commenters as an appropriate variable, but, as explained in the preamble to NPR2, OFHEO chose not to make assumptions about macroeconomic factors, such as unemployment, that are not specified or required by statute. To use unemployment as a variable, OFHEO would have to create a model of unemployment rates or apply simpler assumptions about unemployment rates through the stress period. OFHEO is not convinced that adding this additional complexity would improve the rule's sensitivity to risk or otherwise enhance the rule. Further, the macroeconomic factors of the benchmark area and time period are captured implicitly to some extent by relating default and prepayment rates to the benchmark loss experience. Where, however, the 1992 Act required OFHEO to consider economic factors, such as house prices and interest rates, and OFHEO found those factors strongly correlated with mortgage performance, OFHEO incorporated them as variables in the models.

The season-of-the-year variable, originally found useful in estimating the single family default model, did not improve results when the model was reestimated for the final rule. Another variable, relative loan size, which was found significant and included in the model for prepayments, was determined not to have a significant impact on defaults.

OFHEO considered comments suggesting that the LTV variable should provide for further disaggregation of high LTV loans. OFHEO also considered comments recommending the creation of variables to account for the use of credit scoring and for subprime lending, structured mortgages (in which a second mortgage is created coincident with the first), assumable loans, and loans that were seasoned (as opposed to newly-originated) at acquisition. Although there is good reason to believe that these factors influence mortgage performance, OFHEO found the data and research insufficient to incorporate any of these factors into the stress test at this time. For example, OFHEO expects that

automated credit scoring may result in lower default rates, but the lack of data regarding the impact of credit scoring during economic experiences equivalent to the benchmark loss experience makes it difficult to assess to what extent lower recent default rates observed on credit-scored mortgages would continue during such difficult times. As more data become available, OFHEO will explore the significance of these and other new variables and will continue to consider refinements to the variables that are included currently in the rule. Where appropriate, OFHEO will consider modifying the stress test to take them into account. OFHEO recognizes that to remain sensitive to risk, the stress test must constantly be reevaluated, updated, and refined to accommodate changes in the Enterprises' businesses and the state of the art in modeling and risk management. The research and analysis necessary to retain appropriate sensitivity to risk in the regulation is central to the mission of OFHEO.

(b) Respecification of ARM Model

OFHEO considered two general alternatives in the modeling of single family adjustable rate mortgages (ARMs). One possible approach was a simple model based upon fixed multiples of the 30-year fixed rate mortgage (FRM) performance. The other alternative required estimating a separate model for ARM performance. The fixed multiple approach, although simpler to apply and calculate, failed to take into account the very different default and prepayment patterns that apply to ARMs as compared to FRMs. In other words, it is inaccurate to assume that ARM prepayments and defaults will always be a fixed percentage higher or lower than on FRMs. Accordingly, OFHEO chose to develop a separate model of ARM performance that takes into account the variables, such as payment shock when rates adjust, that uniquely affect ARM performance.

In the final regulation, OFHEO reestimated and respecified the NPR2 ARM models using a pooled dataset of ARMs and 30-year FRMs in order to compensate for lack of computational detail in Enterprise data for ARM loans and to respond to comments about the insensitivity of the NPR2 ARM model to payment shock. This reestimation corrected an under-representation of ARM defaults and prepayments in the data on which the NPR2 model had been estimated. The respecified ARM model includes the same set of explanatory variables as the 30-year FRM model, along with three additional variables unique to ARMs. The additional variables account for differences in ARM performance relative to 30-year FRMs due to payment shock, initial (teaser) rate effects, and ARM product type (to capture other performance differences).

(xi) Multifamily Mortgage Performance

Modeling multifamily loans presented unique challenges for OFHEO, particularly in light of the lack of clear statutory guidance. When the 1992 Act was being considered by Congress, multifamily lending comprised a relatively small portion of the Enterprises' total business. In fact, Freddie Mac had discontinued multifamily lending altogether at that time. Consequently, no special provision was made for multifamily loans; the statute generally treated multifamily loans as just another type of single family loan. Through the 1990s, however, multifamily lending has grown in importance at both Enterprises and has become a key element in their strategies to meet affordable housing goals. What also became clear during that period is that multifamily loans perform very differently than single family loans. Default and prepayment behavior of commercial multifamily borrowers is affected by different factors than single family residential borrowers. Hence, models designed to simulate the performance of single family loans are not necessarily appropriate for multifamily loans and vice versa. Accordingly, OFHEO was required to build a stress test that complies with the requirements of the 1992 Act (which are oriented toward single family lending), but nevertheless includes a multifamily performance model that is sensitive to the risks associated with multifamily loans. OFHEO achieved this goal by basing the model on the same geographical region and time period used for the single family model, but exercising appropriate discretion to ensure that the stress level for multifamily loans is consistent with that for single family loans. OFHEO was particularly mindful of comments on NPR2 that highlighted inappropriately low loss rates for certain categories of multifamily loans, which would have had the effect of creating perverse business incentives for an Enterprise. The final rule is based upon a reestimated model that addresses these and other concerns raised by commenters, as further explained below.

(a) Multifamily Defaults

OFHEO considered many potential variables and combinations of variables in constructing the multifamily default model. Given the increasing importance of multifamily lending to the Enterprises, OFHEO sought to improve, where possible, upon previous models of multifamily loan loss behavior and has spent several years testing and evaluating the factors that affect losses on these loans. In this regard, OFHEO's proposed rule included the ''double trigger'' variable, which was designed to measure the likelihood that a particular loan was experiencing two important determinants of default, negative cash flow and negative equity, simultaneously. This variable was based upon the premise that a rational business person would be less likely to default on a loan so long as the property had either positive equity or positive cash flow. Although the underlying premise still appears sound, OFHEO found after further research, conducted in response to comments, that the proposed means of projecting multifamily property values during the stress period resulted in unrealistic volatility in property values and unreasonable loss projections for certain categories of loans. Accordingly, in the final rule, OFHEO has modified the multifamily default model to eliminate one of the ''triggers'' and uses current debt service coverage ratio or ''DCR,'' a measure of net cash flow, by itself as a variable. In addition, OFHEO has included a variable that adjusts for the increased probability of default when net cash flow is negative and a variable that reflects the direct relationship between LTV at loan origination and the subsequent likelihood of default. As explained in the preamble to the final rule, these three variables capture essentially the same mortgage performance factors that the double trigger was designed to capture, but avoided the difficulties of projecting multifamily property values over time.

OFHEO also recognized that additional variables were necessary to account for the fact that the Enterprises underwent major and permanent changes to their multifamily loan programs beginning in 1988 (Fannie Mae) and in 1993 (Freddie Mac). Freddie Mac, in particular, had losses so severe on early multifamily loans that it suspended its multifamily lending entirely until its programs could be completely overhauled. Fannie Mae's multifamily lending programs have undergone similar changes, but somewhat more gradually, since approximately 1988.

In NPR2, OFHEO employed two default models to distinguish between the Enterprises' loan programs—Negotiated Transactions (NT) and Cash. Further, a program restructuring

variable captured the improved performance of multifamily cash loans after the changes in loan programs described above. Commenters on these models recommended that the two-model approach be dropped, because the distinction between the two categories of loans was too difficult to define and replicate. All commenters on the subject concurred that the underwriting and servicing practices of the Enterprises underwent major and permanent changes that should be reflected in the stress test. These comments came not only from the Enterprises, but also from multifamily seller-servicers, who were concerned that imposing inappropriately large marginal capital costs on multifamily loans would adversely affect seller-servicers, who should be given credit for the many improvements they had made in originating and servicing multifamily loans.

In response to the comments, OFHEO created a single multifamily default model that utilizes two variables to distinguish between multifamily loan programs. The first of these variables distinguishes loans based upon their date of origination, crediting loans originated under more recent programs at both Enterprises with lower default rates.[185] The second variable identifies a subset of the newer loans that were purchased under certain programs at the Enterprises that include more rigorous and conservative underwriting and servicing policies. These loans receive additional favorable default treatment. OFHEO believes that the revised variables accomplish the purpose of distinguishing the less risky loan programs and product types from other more risky loan programs and product types better than the variables used in NPR2. OFHEO further believes that these variables create appropriate capital incentives for the Enterprises to improve risk-management in all their multifamily lending programs.

(b) Multifamily Prepayments

OFHEO considered two alternative means to model multifamily loan prepayments. In NPR2, OFHEO proposed five statistical models of prepayments that were used for different types of multifamily loans. These models were similar in some respects to the prepayment model used for single family loans. None of the comments supported this approach and many were highly critical of it. Commenters pointed out that multifamily loans are very different from single family loans and that assumptions that are incorporated into single family loan models may be inappropriate for multifamily loans. Commenters also argued that the prepayment models were overly complex in the number and treatment of variables. The Enterprises both recommended that the final rule eliminate much of the complexity of the proposal in favor of using fixed prepayment percentages for each month of the stress test.

OFHEO considered these comments, studied the operation of the prepayment model and reviewed the current literature regarding prepayments. Given the limitations in relevant data, OFHEO concluded that the commenters were correct, that a statistical model would not provide greater precision or risk sensitivity than a fixed schedule of prepayments for each of the two interest rate scenarios. Accordingly, the final rule adopts such a schedule.[186]

(c) Multifamily Loss Severity

To determine appropriate multifamily loan loss severity rates, OFHEO considered a number of alternatives. In NPR2, OFHEO proposed six separate calculations for different categories of loans. In estimating these calculations, OFHEO utilized data from Freddie Mac's multifamily loans originated in the 1980s. While agreeing with the general methodology, some commenters argued that it was inappropriate to use these Freddie Mac data to estimate severity rates. They suggested that OFHEO add more recent severity data to the sample used to determine severity rates. In developing the final rule, OFHEO considered this alternative, but decided to continue using the Freddie Mac data from the 1980s to determine loss severity rates. OFHEO concluded that these data represented an appropriately stressful experience from which to extract severity rates. To the extent that later loan programs have experienced lower severity rates, data are inadequate to determine how much of the difference is due to improvement in loan programs and how much is due to differences in economic conditions. OFHEO also considered, as an alternative to the NPR2 approach, reducing the six severity calculations to a single equation. In the final rule, OFHEO implemented this alternative, because it simplified the stress test with no demonstrable loss of sensitivity to risk.

(xii) Counterparty Haircuts

In addition to mortgage credit quality, the stress test considers the creditworthiness of companies and financial instruments to which the Enterprises have credit exposure. These include most mortgage credit enhancement counterparties, securities held as assets, and derivative contract counterparties. The stress test gives credit only to investment grade counterparties.

For these contract or instrument counterparties, the stress test reduces—or applies ''haircuts'' to—the amounts due from these instruments or counterparties according to their level of risk.[187] The level of risk is determined by public credit ratings at the start of the stress test, classified into five categories: AAA, AA, A, BBB and unrated/below BBB. When no rating is available or the instrument or counterparty has a rating below BBB (below investment grade), the stress test applies a 100 percent haircut in the first month of the stress test, with the exception of unrated seller/servicers, which are treated as BBB. For other categories, the stress test phases in the haircuts monthly in equal increments until the total reduction listed in Table 9 is reached five years into the stress period. For the remainder of the stress test, the maximum haircut applies.

TABLE 9.—STRESS TEST FINAL HAIRCUTS BY CREDIT RATING CATEGORY

| Ratings Classification | Derivative Contract Counterparties | Nonderivative Contract Counterparties or Instruments |
|---|---|---|
| AAA | 2% | 5% |
| AA | 4% | 15% |
| A | 8% | 20% |
| BBB | 16% | 40% |
| Unrated/Below BBB [1] | 100% | 100% |

[1] Unrated, unsubordinated obligations issued by Government-sponsored enterprises other than the reporting Enterprise are treated as AAA. Unrated seller/servicers are treated as BBB. Other unrated counterparties and securities are subject to a 100% haircut applied in the first month of the stress test.

[185] Adjustable-rate loans and fixed-rate balloon loans exhibited improve performance, but less than fixed-rate fully amortizing loans. Therefore, different variables are used for these different loan types.

[186] In the up-rate scenario, the final rule includes no prepayments. In the down-rate scenario, the final rule applies a two percent annual prepayment rate to loans that are subject to prepayment penalty provisions and a 25 percent annual rate to loans that are not subject to these provisions or to loans after the provisions have expired.

[187] In the case of swaps, the stress test cancels a portion of ''in-the-money'' swaps based on the haircut amount.

OFHEO considered a number of alternatives to the haircuts in the final rule. NPR2 proposed a schedule of non-derivative haircuts that were approximately double those in the final rule, but were phased in over ten years rather than five.

In response to comments that those counterparty haircuts were too severe, OFHEO conducted extensive analysis of the historical data, including some updated rating agency data and studies submitted by commenters. As a result, haircuts were lowered. However, OFHEO determined that phasing the haircuts in more quickly would be more consistent with the probable impact on counterparties of stress test conditions. Also in response to comments regarding the proposed rule, OFHEO added a category that increased the haircuts on below-investment-grade and unrated counterparties. However, OFHEO decided to except unrated seller-servicers from this new category, continuing the NPR2 treatment of them as triple-B counterparties. OFHEO found this exception warranted because of (1) The seller-servicers' close and ongoing relationships with the Enterprises, (2) the types of controls available to the Enterprises under their seller-servicer contracts, and (3) factors other than lack of creditworthiness that may account for seller-servicers not having a rating, such as their small size. In the future, OFHEO will consider how Enterprise internal ratings can be used to make finer, but consistent, risk distinctions between such seller-servicers.

(xiii) New Debt

NPR2 specified that when the stress test resulted in a cash deficit requiring the issuance of new debt, all such debt would have a six-month maturity. OFHEO considered comments recommending a balance of long- and short-term debt to reflect better the rebalancing strategies that the Enterprises would be likely to follow. OFHEO agrees with the comments that a mix of long and short maturities may be more appropriate, but disagrees with those commenters who suggested that the stress test specify the issuance of primarily long-term debt as interest rates rise and short-term debt as they fall. OFHEO did not believe this approach would create a reasonable model of the reactions of the Enterprises to interest rate shocks, especially because the Enterprises do not manage their debt issuances in this manner. Moreover, it would have created interest rate hedges in both scenarios that were not appropriate. However, the Enterprises do generally manage the maturities in their debt portfolios to achieve a balance in the entire portfolio and OFHEO selected a similar approach to issuing new debt in the stress test. OFHEO constructed the stress test to add either long- or short-term debt as required to achieve and maintain a 50/50 balance of long- and short-term debt. The 50/50 balance was selected because it is more risk-neutral than the proposed approach, and because OFHEO will not try to model an Enterprise's internal predictions about whether interest rates will go up or down.

OFHEO also considered whether to change the short-term debt from a six-month maturity to a one-month maturity, as suggested by some commenters, but determined that a six-month rate is more representative of the mix of short-term maturities issued by the Enterprises. OFHEO also considered a commenter's suggestion to use a ten-year maturity for the long-term debt, but determined that a five-year callable bond was a more representative proxy for the typical mix of long-term Enterprise debt than ten-year bullet debt.

(xiv) Operating Expenses

The proposed decision rule for operating expenses was that these expenses would decline in proportion to the decline in the mortgage portfolio. Specifically, the operating expense for a given month was determined by multiplying the ratio of assets remaining at the end of each month to assets at the beginning of the stress test by one-third of the Enterprise's total operating expenses in the quarter immediately preceding the start of the stress test. No distinction was made between fixed and variable expenses. This treatment caused the expense reduction pattern for the up-rate scenario to differ from the down-rate scenario and within each scenario depending on the changes in the characteristics of an Enterprise's total mortgage portfolio.

The final rule reflects OFHEO's consideration of comments regarding the proposed rule, which linked operating expenses directly to the size of the mortgage portfolio, assumed all operating expenses were variable, did not exclude a portion of expenses associated with new business, and tied operating expenses to the previous quarter's operating expenses. The final rule modifies the proposal in only two respects. To recognize that operating expenses are partly fixed and partly variable, one third of each Enterprise's operating expenses at the start of the stress test remain fixed throughout the stress period, while the remainder declines in proportion to the decline in the mortgage portfolio. Secondly, a reduction of one third in the total of the fixed and variable components has been included to recognize that a cessation of new business would have a significant impact upon operating expenses. That reduction is phased in on a straight-line basis over the first 12 months of the stress period, because it would take an Enterprise at least that long to implement such a reduction. An impact of these changes is to reduce the differences in operating expenses between the up- and down-rate scenarios. OFHEO considered the Enterprises' recommendation that the stress test use a fixed expense ratio between 1.5 and 5.0 basis points of unpaid principal balance per year, but believed such a ratio would be unreasonably low, because, as one commenter noted, the ratio of Enterprise expenses to outstanding mortgage-backed securities and portfolio balances has averaged over 7.0 basis points for the past ten years. OFHEO also considered a commenter's recommendation to hold the level of expenses constant throughout the stress period based on the experience of financial institutions under stress. Although this argument has intuitive appeal for some types of financial institutions, adopting such an approach would have resulted in unreasonably high capital requirements relative to operating expenses in OFHEO's stress test. The approach in the final rule, which fixes only a portion of the expenses, seemed more appropriate for the Enterprises.

(xv) Distinction Between Preferred and Common Stock Dividends

The final rule adopts the proposed treatment of dividends, distinguishing between preferred stock and common stock by allowing the payment of preferred stock dividends as long as an Enterprise meets the minimum capital requirement, while terminating the payment of common stock dividends after the first year of the stress test. The payout rate (dividends as a percentage of earnings) is based on the trend in earnings. If earnings are increasing, the dividend payout rate is equal to the average of the payout rate of the preceding four quarters. If earnings are not increasing, the dividend payout is based on the preceding quarter's dollar amount of dividends per share. The final rule also modified the proposal to include repurchases of stock in the first two quarters of the stress period, based upon any such repurchases within the previous four quarters.

OFHEO considered and rejected a suggestion to lengthen the look-back

period used to determine payout ratios from one to three years. OFHEO recognizes a shorter look-back period may add volatility in the capital requirement, but determined that relating the payout to the experience of the last four quarters is more appropriate because it is more reflective of current policies, because dividends are only paid for one year in the stress test, and because market considerations generally cause companies to be cautious in making changes to dividend policies. Relating dividend payouts to recent dividend payout experience is also more consistent with the need to provide a timely early warning of potential capital deficiencies. For similar reasons, OFHEO also rejected a proposal to use a long-term industry average dividend rate of approximately 25 percent of earnings. Also, a review of the Enterprises' payout ratios over a ten-year period revealed that such payouts would frequently not have been reflective of reality for each Enterprise.

(xvi) Capital Calculation

To calculate the amount of capital that an Enterprise would need just to maintain positive capital during the stress test, the final rule discounts the monthly capital balances back to the start date of the stress period and adjusts the starting capital by the lowest of the discounted capital balances. This approach converts future surpluses or deficits into current dollars. OFHEO also considered an approach that would use a series of iterative simulations to adjust the Enterprise's balance sheet until a starting level of capital was found that was just sufficient to maintain positive capital throughout the stress period. Either approach would ensure that an Enterprise would have enough capital to survive the stress test regardless of when losses associated with management and operations risk might occur, even if that were the first day of the stress period. OFHEO adopted the discounting approach because it is much simpler to design and replicate.

OFHEO rejected a recommendation by the Enterprises to assume that the amount of capital needed was the simple result of subtracting the maximum undiscounted amount of total capital consumed during the stress period from the starting position total capital. Such an approach is easier to implement, but it does not take into account the time value of money and would not ensure that the Enterprises hold capital sufficient to survive the stress test if management and operations losses occurred at any time during the ten-year stress period. Also, OFHEO believes that a present-value approach is preferable because it requires an Enterprise to create a greater capital cushion (as compared to the Enterprises' recommendation) when credit risk and interest rate risks are relatively low, making it more likely that an Enterprise can survive subsequent, more stressful periods.

5. Analysis of Relative Costs and Benefits

The 1992 Act presumptively determined that the benefit/cost ratio favors a detailed and complete stress test and risk-based capital regulation such as that in the final rule, and OFHEO has found no reason to question that judgment. The nation faces huge potential liabilities and economic disruption if the Enterprises are allowed to operate in an undercapitalized state, and all parties agree that a clear capital standard that is also sensitive to risk is an important tool for avoiding undercapitalization.

OFHEO has balanced the cost of capital or other forms of risk mitigation against the risk of loss in the Enterprises' operations and designed a risk-based capital rule that requires adequate capital or risk mitigation for activities that pose credit or interest rate risk, while not imposing inordinate costs on any area of the Enterprises' business. That is, the stress test reflects incremental capital charges associated with the Enterprises business activities that are consistent with risk. The stress test imposes higher capital costs on new activities and unusual activities for which the Enterprises lack adequate data about risks than on activities for which sufficient data is available to model them precisely. These higher costs help to insure that there is adequate capital for the risks that may be associated with the new or unusual activities and provide appropriate incentives for the Enterprises to maintain top quality data on all activities and to pay close attention to risk management. To the extent that requiring adequate capital may prevent certain innovations from being rushed to market before their risks are fully understood, OFHEO believes that result is appropriate.

In any event, OFHEO does not believe that the regulation will impede innovation and the timely introduction of new activities. The regulation provides a flexible and responsive procedure that has been designed to develop appropriate capital treatments as the Enterprises bring products to market. Moreover, when engaging in activities in which the financial risks are not fully understood, an Enterprise should hold capital (or utilize some type of risk mitigation) sufficient to cover the risks that might be associated with them. Prudent risk management under a voluntary system would require the same, and OFHEO's rule is designed to provide a regulatory incentive for prudent risk management. Further, even in the absence of a risk-based capital rule, OFHEO's safety and soundness examinations would require similarly conservative treatments of activities that pose risks that cannot be quantified accurately.

OFHEO has not performed more detailed analyses of the relative costs of a voluntary versus a mandatory system, because the 1992 Act does not make voluntary risk-based capital an option. However, if the Enterprises were to design and run the stress test internally, OFHEO's costs might be higher than otherwise, because of the need to monitor and examine two separate systems. Therefore, OFHEO views the net difference in cost between a voluntary versus a mandatory risk-based capital system as likely to be *de minimus.*

*B. Executive Order 13132, Federalism*

Executive Order 13132 requires that Executive departments and agencies identify regulatory actions that have significant Federalism implications. ''Policies that have Federalism implications'' are defined as regulations or actions that have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities between the various levels of government. The agency certifies that this rule has no such Federalism implications.

*C. Executive Order 12988, Civil Justice Reform*

Executive Order 12988 sets forth guidelines to promote the just and efficient resolution of civil claims and to reduce the risk of litigation to the government. The rule meets the applicable standards of sections 3(a) and (b) of Executive Order 12988.

*D. Regulatory Flexibility Act*

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires that a regulation that has a significant economic impact on a substantial number of small entities must include a regulatory flexibility analysis describing the rule's impact on small entities. Such an analysis need not be undertaken if the agency head certifies that the rule will not have a significant economic impact on a substantial number of small entities. 5 U.S.C. 605(b).

OFHEO has considered the impacts of the risk-based capital regulation under the Regulatory Flexibility Act. The regulation does not have a significant effect on a substantial number of small entities since it is applicable only to the Enterprises, which are not small entities for purposes of the Regulatory Flexibility Act. Therefore, the General Counsel of OFHEO, acting under delegated authority, has certified that the regulation will not have a significant economic impact on a substantial number of small entities.

Although not expressly referencing the Regulatory Flexibility Act, a trade association representing credit unions requested that OFHEO address the regulation's impact on its members. OFHEO has determined that such an analysis is not required. The Regulatory Flexibility Act requires such an analysis only for entities the agency has direct statutory authority to regulate. In this case, OFHEO only has direct authority to regulate the Enterprises.

*E. Paperwork Reduction Act*

The risk-based capital rule contains no information collection requirements that require OMB approval under the Paperwork Reduction Act, 44 U.S.C. Chapter 35.

*F. Unfunded Mandates Reform Act*

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and tribal governments, and the private sector. This final rule would not impose any Federal mandates on any State, local, or tribal governments, or on the private sector, within the meaning of the UMRA.

**List of Subjects in 12 CFR Part 1750**

Capital classification, Mortgages, Risk-based capital.

Accordingly, for reasons set forth in the preamble, the Office of Federal Housing Enterprise Oversight amends 12 CFR part 1750 as follows:

## PART 1750—CAPITAL

1. The authority citation for part 1750 is revised to read as follows:

**Authority:** 12 U.S.C. 4513, 4514, 4611, 4612, 4614, 4615, 4618.

2. Add new subpart B to part 1750 to read as follows:

### Subpart B—Risk-Based Capital

Sec.

1750.10 General.
1750.11 Definitions.
1750.12 Procedures and timing.
1750.13 Risk-based capital level computation.
Appendix A to subpart B of part 1750—Risk-Based Capital Test Methodology and Specifications

## Subpart B—Risk-Based Capital

### § 1750.10 General.

The regulation contained in this subpart B establishes the methodology for computing the risk-based capital level for each Enterprise. The board of directors of each Enterprise is responsible for ensuring that the Enterprise maintains total capital at a level that is sufficient to ensure the continued financial viability of the Enterprise and is equal to or exceeds the risk-based capital level computed pursuant to this subpart B.

### § 1750.11 Definitions.

Except where a term is explicitly defined differently in this subpart, all terms defined at § 1750.2 of subpart A of this part shall have the same meanings for purposes of this subpart. For purposes of subpart B of this part, the following definitions shall apply:

(a) *Benchmark loss experience* means the rates of default and severity for mortgage loans that—

(1) Were originated during a period of two or more consecutive calendar years in contiguous areas that together contain at least five percent of the population of the United States, and

(2) Experienced the highest loss rate for any period of such duration in comparison with the loans originated in any other contiguous areas that together contain at least five percent of the population of the United States.

(b) *Constant maturity Treasury yield* means the constant maturity Treasury yield, published by the Board of Governors of the Federal Reserve System.

(c) *Contiguous areas* means all the areas within a state or a group of two or more states sharing common borders. ''Sharing common borders'' does not mean meeting at a single point. Colorado, for example, is contiguous with New Mexico, but not with Arizona.

(d) *Credit risk* means the risk of financial loss to an Enterprise from nonperformance by borrowers or other obligors on instruments in which an Enterprise has a financial interest, or as to which the Enterprise has a financial obligation.

(e) *Default rate* of a given group of loans means the ratio of the aggregate original principal balance of the defaulted loans in the group to the aggregate original principal balance of all loans in the group.

(f) *Defaulted loan* means a loan that, within ten years following its origination:

(1) Resulted in pre-foreclosure sale,

(2) Completed foreclosure,

(3) Resulted in the acquisition of real estate collateral, or

(4) Otherwise resulted in a credit loss to an Enterprise.

(g) *Financing costs* of property acquired through foreclosure means the product of:

(1) The number of years (including fractions) of the period from the completion of foreclosure through disposition of the property,

(2) The average of the Enterprises' short-term funding rates, and

(3) The unpaid principal balance at the time of foreclosure.

(h) *Interest rate risk* means the risk of financial loss due to the sensitivity of earnings and net worth of an Enterprise to changes in interest rates.

(i) *Loss* on a defaulted loan means:

(1) With respect to a loan in category 1, 2, or 3 of the definition of defaulted loan the difference between:

(i) The sum of the principal and interest owed when the borrower lost title to the property securing the mortgage; financing costs through the date of property disposition; and cash expenses incurred during the foreclosure process, the holding period for real estate collateral acquired as a result of default, and the property liquidation process; and

(ii) The sum of the property sales price and any other liquidation proceeds (except those resulting from private mortgage insurance proceeds or other third-party credit enhancements).

(2) With respect to defaulted loans not in categories 1, 2, or 3, the amount of the financial loss to the Enterprise.

(j) *Mortgage* means any loan secured by such classes of liens as are commonly given or are legally effective to secure advances on, or the unpaid purchase price of, real estate under the laws of the State in which the real estate is located; or a manufactured house that is personal property under the laws of the State in which the manufactured house is located, together with the credit instruments, if any, secured thereby, and includes interests in mortgages.

(k) *Seasoning* means the change over time in the ratio of the unpaid principal balance of a mortgage to the value of the property by which such mortgage loan is secured.

(l) *Severity rate* for any group of defaulted loans means the aggregate losses on all loans in that group divided by the aggregate original principal balances of those loans.

(m) *Stress period* means a hypothetical ten-year period immediately following the day for which capital is being measured, which is a period marked by the severely adverse economic circumstances defined in 12 CFR 1750.13 and Appendix A to this subpart.

(n) *Total capital* means, with respect to an Enterprise, the sum of the following:

(1) The core capital of the Enterprise;

(2) A general allowance for foreclosure losses, which—

(i) Shall include an allowance for portfolio mortgage losses, an allowance for non-reimbursable foreclosure costs on government claims, and an allowance for liabilities reflected on the balance sheet for the Enterprise for estimated foreclosure losses on mortgage-backed securities; and

(ii) Shall not include any reserves of the Enterprise made or held against specific assets.

(3) Any other amounts from sources of funds available to absorb losses incurred by the Enterprise, that the Director by regulation determines are appropriate to include in determining total capital.

(o) *Type of mortgage product* means a classification of one or more mortgage products, as established by the Director, that have similar characteristics from each set of characteristics under the paragraphs (o)(1) through (o)(7) of this section:

(1) The property securing the mortgage is—

(i) A residential property consisting of 1 to 4 dwelling units; or

(ii) A residential property consisting of more than 4 dwelling units.

(2) The interest rate on the mortgage is—-

(i) Fixed; or

(ii) Adjustable.

(3) The priority of the lien securing the mortgage is—

(i) First; or

(ii) Second or other.

(4) The term of the mortgage is—

(i) 1 to 15 years;

(ii) 16–30 years; or

(iii) More than 30 years.

(5) The owner of the property is—

(i) An owner-occupant; or

(ii) An investor.

(6) The unpaid principal balance of the mortgage—

(i) Will amortize completely over the term of the mortgage, and will not increase significantly at any time during the term of the mortgage;

(ii) Will not amortize completely over the term of the mortgage, and will not increase significantly at any time during the term of the mortgage; or

(iii) May increase significantly at some time during the term of the mortgage.

(7) Any other characteristics of the mortgage, as specified in Appendix A to this subpart.

**§ 1750.12 Procedures and timing.**

(a) Each Enterprise shall file with the Director a Risk-Based Capital Report each quarter, and at such other times as the Director may require, in his or her discretion. The report shall contain the information required by the Director in the instructions to the Risk-Based Capital Report in the format or media specified therein and such other information as may be required by the Director.

(b) The quarterly Risk-Based Capital Report shall contain information for the last day of the quarter and shall be submitted not later than 30 days after the end of the quarter. Reports required by the Director other than quarterly reports shall be submitted within such time period as the Director shall specify.

(c) When an Enterprise contemplates entering into a new activity, as that term is defined in section 3.11 of Appendix A to this subpart, the Enterprise shall notify the Director as soon as possible while the transaction or activity is under consideration, but in no event later than 5 calendar days after settlement or closing. The Enterprise shall provide to the Director such information regarding the activity as the Director may require to determine a stress test treatment. OFHEO will inform the Enterprise as soon as possible thereafter of the proposed stress test treatment of the new activity. In addition, the notice of proposed capital classification required by § 1750.21 of subpart C of this part will inform the Enterprise of the capital treatment of such new activity used in the determination of the risk-based capital requirement.

(d) If an Enterprise discovers that a Risk-Based Capital Report previously filed with OFHEO contains any errors or omissions, the Enterprise shall notify OFHEO immediately of such discovery and file an amended Risk-Based Capital Report not later than three days thereafter.

(e) Each capital classification shall be determined by OFHEO on the basis of the Risk-Based Capital Report filed by the Enterprise under paragraph (a) of this section; provided that, in the event an amended Risk-Based Capital Report is filed prior to the issuance of the final notice of capital classification, the Director has the discretion to determine the Enterprise's capital classification on the basis of the amended report.

(f) Each Risk-Based Capital Report or any amended Risk-Based Capital Report shall contain a declaration by the officer who has been designated by the Board as responsible for overseeing the capital adequacy of the Enterprise that the report is true and correct to the best of such officer's knowledge and belief.

**§ 1750.13 Risk-based capital level computation.**

(a) *Risk-Based Capital Test*—OFHEO shall compute a risk-based capital level for each Enterprise at least quarterly by applying the risk-based capital test described in Appendix A to this subpart to determine the amount of total capital required for each Enterprise to maintain positive capital during the stress period. In making this determination, the Director shall take into account any appropriate distinctions among types of mortgage products, differences in seasoning of mortgages, and other factors determined appropriate by the Director in accordance with the methodology specified in Appendix A to this subpart. The stress period has the following characteristics:

(1) *Credit risk*—With respect to mortgages owned or guaranteed by the Enterprise and other obligations of the Enterprise, losses occur throughout the United States at a rate of default and severity reasonably related, in accordance with Appendix A to this subpart, to the benchmark loss experience.

(2) *Interest rate risk*—(i) *In general*. Interest rates decrease as described in paragraph (a)(2)(ii) of this section or increase as described in paragraph (a)(2)(iii) of this section, whichever would require more capital in the stress test for the Enterprise. Appendix A to this subpart contains a description of the methodology applied to implement the interest rate scenarios described in paragraphs (a)(2)(ii) and (iii) of this section.

(ii) *Decreases*. The 10-year constant maturity Treasury yield decreases during the first year of the stress period and remains at the new level for the remainder of the stress period. The yield decreases to the lesser of-(A) 600 basis points below the average yield during the 9 months immediately preceding the stress period, or

(B) 60 percent of the average yield during the 3 years immediately preceding the stress period, but in no case to a yield less than 50 percent of the average yield during the 9 months immediately preceding the stress period.

(iii) *Increases*. The 10-year constant maturity Treasury yield increases during the first year of the stress period

and will remain at the new level for the remainder of the stress period. The yield increases to the greater of—

(A) 600 basis points above the average yield during the 9 months immediately preceding the stress period, or

(B) 160 percent of the average yield during the 3 years immediately preceding the stress period, but in no case to a yield greater than 175 percent of the average yield during the 9 months immediately preceding the stress period.

(iv) *Different terms to maturity.* Yields of Treasury instruments with terms to maturity other than 10 years will change relative to the 10-year constant maturity Treasury yield in patterns and for durations that are reasonably related to historical experience and are judged reasonable by the Director. The methodology used by the Director to adjust the yields of those other instruments is specified in Appendix A to this subpart.

(v) *Large increases in yields.* If the 10-year constant maturity Treasury yield is assumed to increase by more than 50 percent over the average yield during the 9 months immediately preceding the stress period, the Director shall adjust the losses resulting from the conditions specified in paragraph (a)(2)(iii) of this section to reflect a correspondingly higher rate of general price inflation. The method of such adjustment by the Director is specified in Appendix A to this subpart.

(3) *New business.* Any contractual commitments of the Enterprise to purchase mortgages or issue securities will be fulfilled. The characteristics of resulting mortgages purchased, securities issued, and other financing will be consistent with the contractual terms of such commitments, recent experience, and the economic characteristics of the stress period, as more fully specified in Appendix A to this subpart. No other purchases of mortgages shall be assumed.

(4) *Other activities.* Losses or gains on other activities, including interest rate and foreign exchange hedging activities, shall be determined by the Director, in accordance with Appendix A to this subpart and on the basis of available information, to be consistent with the stress period.

(5) *Consistency.* Characteristics of the stress period other than those specifically set forth in paragraph (a) of this section, such as prepayment experience and dividend policies, will be determined by the Director, in accordance with Appendix A to this subpart, on the basis of available information, to be most consistent with the stress period.

(b) *Risk-Based Capital Level.* The risk-based capital level of an Enterprise, to be used in determining the appropriate capital classification of each Enterprise, as required by section 1364 of the Federal Housing Enterprises Financial Safety and Soundness Act of 1992 (12 U.S.C. 4614), shall be equal to the sum of the following amounts:

(1) *Credit and Interest Rate Risk.* The amount of total capital determined by applying the risk-based capital test under paragraph (a) of this section to the Enterprise.

(2) *Management and Operations Risk.* To provide for management and operations risk, 30 percent of the amount of total capital determined by applying the risk-based capital test under paragraph (a) of this section to the Enterprise.

## Appendix A to Subpart B of Part 1750—Risk-Based Capital Test Methodology and Specifications


1.0 Identification of the Benchmark Loss Experience
1.1 Definitions
1.2 Data
1.3 Procedures
2.0 Identification of a New Benchmark Loss Experience
3.0 Computation of the Risk-Based Capital Requirement
3.1 Data
3.1.1 Introduction
3.1.2 Risk-Based Capital Report
3.1.2.1 Whole Loan Inputs
3.1.2.2 Mortgage Related Securities Inputs
3.1.2.3 Nonmortgage Instrument Cash Flows Inputs
3.1.2.4 Inputs for Alternative Modeling Treatment Items
3.1.2.5 Operations, Taxes, and Accounting Inputs
3.1.3 Public Data
3.1.3.1 Interest Rates
3.1.3.2 Property Valuation Inputs
3.1.4 Constant Values
3.1.4.1 Single Family Loan Performance
3.1.4.2 Multifamily Loan Performance
3.2 Commitments
3.2.1 Commitments Overview
3.2.2 Commitments Inputs
3.2.2.1 Loan Data
3.2.2.2 Interest Rate Data
3.2.3 Commitments Procedures
3.2.4 Commitments Outputs
3.3 Interest Rates
3.3.1 Interest Rates Overview
3.3.2 Interest Rates Inputs
3.3.3 Interest Rates Procedures
3.3.4 Interest Rates Outputs
3.4 Property Valuation
3.4.1 Property Valuation Overview
3.4.2 Property Valuation Inputs
3.4.3 Property Valuation Procedures for Inflation Adjustment
3.4.4 Property Valuation Outputs
3.5 Counterparty Defaults
3.5.1 Counterparty Defaults Overview
3.5.2 Counterparty Defaults Input
3.5.3 Counterparty Defaults Procedures
3.5.4 Counterparty Defaults Outputs
3.6 Whole Loan Cash Flows
3.6.1 Whole Loan Cash Flows Overview
3.6.2 Whole Loan Cash Flows Inputs
3.6.3 Whole Loan Cash Flows Procedures
3.6.3.1 Timing Conventions
3.6.3.2 Payment Allocation Conventions
3.6.3.3 Mortgage Amortization Schedule
3.6.3.4 Single Family Default and Prepayment Rates
3.6.3.5 Multifamily Default and Prepayment Rates
3.6.3.6 Calculation of Single Family and Multifamily Mortgage Losses
3.6.3.7 Stress Test Whole Loan Cash Flows
3.6.3.8 Whole Loan Accounting Flows
3.6.4 Final Whole Loan Cash Flow Outputs
3.7 Mortgage-Related Securities Cash Flows
3.7.1 Mortgage-Related Securities Overview
3.7.2 Mortgage-Related Securities Inputs
3.7.2.1 Inputs Specifying Individual Securities
3.7.2.2 Interest Rate Inputs
3.7.2.3 Mortgage Performance Inputs
3.7.2.4 Third-Party Credit Inputs
3.7.3 Mortgage-Related Securities Procedures
3.7.3.1 Single Class MBSs
3.7.3.2 REMICs and Strips
3.7.3.3 Mortgage Revenue Bonds and Miscellaneous MRS
3.7.3.4 Accounting
3.7.4 Mortgage-Related Securities Outputs
3.8 Nonmortgage Instrument Cash Flows
3.8.1 Nonmortgage Instrument Overview
3.8.2 Nonmortgage Instrument Inputs
3.8.3 Nonmortgage Instrument Procedures
3.8.3.1 Apply Specific Calculation Simplifications
3.8.3.2 Determine the Timing of Cash Flows
3.8.3.3 Obtain the Principal Factor Amount at Each Payment Date
3.8.3.4 Calculate the Coupon Factor
3.8.3.5 Project Principal Cash Flows or Changes in the Notional Amount
3.8.3.6 Project Interest and Dividend Cash Flows
3.8.3.7 Apply Call, Put, or Cancellation Features, if Applicable
3.8.3.8 Calculate Monthly Interest Accruals for the Life of the Instrument
3.8.3.9 Calulate Monthly Amotization (Accretion) of Premiums (Discounts) and Fees
3.8.3.10 Apply Counterparty Haircuts
3.8.4 Nonmortgage Instrument Outputs
3.9 Alternative Modeling Treatments
3.9.1 Alternative Modeling Treatments Overview
3.9.2 Alternative Modeling Treatments Inputs
3.9.3 Alternative Modeling Treatments Procedures
3.9.3.1 Off-Balance Sheet Items
3.9.3.2 Reconciling Items
3.9.3.3 Balance Sheet Items
3.9.4 Alternative Modeling Treatments Outputs
3.10 Operations, Taxes, and Accounting

3.10.1 Operations, Taxes, and Accounting Overview
3.10.2 Operations, Taxes, and Accounting Inputs
3.10.3 Operations, Taxes, and Accounting Procedures
3.10.3.1 New Debt and Investments
3.10.3.2 Dividends and Share Repurchases
3.10.3.3 Allowances for Loan Losses and Other Charge-Offs
3.10.3.4 Operating Expenses
3.10.3.5 Income Taxes
3.10.3.6 Accounting
3.10.4 Operations, Taxes, and Accounting Outputs
3.11 Treatment of New Enterprise Activities
3.11.1 New Enterprise Activities Overview
3.11.2 New Enterprise Activities Inputs
3.11.3 New Enterprise Activities Procedures
3.11.4 New Enterprise Activities Outputs
3.12 Calculation of the Risk-Based Capital Requirement
3.12.1 Risk-Based Capital Requirement Overview
3.12.2 Risk-Based Capital Requirement Inputs
3.12.3 Risk-Based Capital Requirement Procedures
3.12.4 Risk-Based Capital Requirement Output
4.0 Glossary

## 1.0 Identification of the Benchmark Loss Experience

OFHEO will use the definitions, data, and methodology described below to identify the Benchmark Loss Experience.

### *1.1 Definitions*

The terms defined in the Glossary to this Appendix shall apply for this Appendix.

### *1.2 Data*

[a] OFHEO identifies the Benchmark Loss Experience (BLE) using historical loan-level data required to be submitted by each of the two Enterprises. OFHEO's analysis is based entirely on the data available through 1995 on conventional, 30-year, fixed-rate loans secured by first liens on single-unit, owner-occupied, detached properties. For this purpose, detached properties are defined as single family properties excluding condominiums, planned urban developments, and cooperatives. The data includes only loans that were purchased by an Enterprise within 12 months after loan origination and loans for which the Enterprise has no recourse to the lender.

[b] OFHEO organizes the data from each Enterprise to create two substantially consistent data sets. OFHEO separately analyzes default and severity data from each Enterprise. Default rates are calculated from loan records meeting the criteria specified above. Severity rates are calculated from the subset of defaulted loans for which loss data are available.

### *1.3 Procedures*

[a] Cumulative ten-year default rates for each combination of states and origination years (state/year combination) that OFHEO examines are calculated for each Enterprise by grouping all of the Enterprise's loans originated in that combination of states and years. For origination years with less than ten-years of loss experience, cumulative-to-date default rates are used. The two Enterprise default rates are averaged, yielding an ''average default rate'' for that state/year combination.

[b] An ''average severity rate'' for each state/year combination is determined in the same manner as the average default rate. For each Enterprise, the aggregate severity rate is calculated for all loans in the relevant state/year combination and the two Enterprise severity rates are averaged.

[c] The ''loss rate'' for any state/year combination examined is calculated by multiplying the average default rate for that state/year combination by the average severity rate for that combination.

[d] The rates of default and Loss Severity of loans in the state/year combination containing at least two consecutive origination years and contiguous areas with a total population equal to or greater than five percent of the population of the United States with the highest loss rate constitutes the Benchmark Loss Experience.

## 2.0 Identification of a New Benchmark Loss Experience

OFHEO will periodically monitor available data and reevaluate the Benchmark Loss Experience using the methodology set forth in this Appendix. Using this methodology, OFHEO may identify a new Benchmark Loss Experience that has a higher rate of loss than the Benchmark Loss Experience identified at the time of the issuance of this regulation. In the event such a Benchmark Loss Experience is identified, OFHEO may incorporate the resulting higher loss rates in the Stress Test.

## 3.0 Computation of the Risk-Based Capital Requirement

### *3.1 Data*

#### 3.1.1 Introduction

[a] The Stress Test requires data on all of an Enterprise's assets, liabilities, stockholders equity, accounting entries, operations and off-balance sheet obligations, as well as economic factors that affect them: interest rates, house prices, rent growth rates, and vacancy rates. The Enterprises are responsible for compiling and aggregating data on at least a quarterly basis into a standard format called the Risk-Based Capital Report (RBC Report). Each Enterprise is required to certify that the RBC Report submission is complete and accurate. Data on economic factors, such as interest rates, are compiled from public sources. The Stress Test uses proprietary and public data directly, and also uses values derived from such data in the form of constants or default values. (See Table 3–1, Sources of Stress Test Input Data.) Data fields from each of these sources for Stress Test computations are described in the following tables and in each section of this Appendix.

[b] The RBC Report includes information for all the loans owned or guaranteed by an Enterprise, as well as securities and derivative contracts, the dollar balances of these instruments and obligations, as well as all characteristics that bear on their behavior under stress conditions. As detailed in the RBC Report, data are required for all the following categories of instruments and obligations:

- Mortgages owned by or underlying mortgage-backed securities (MBS) issued by the Enterprises (whole loans)
- Mortgage-related securities
- Nonmortgage related securities, whether issued by an Enterprise, (e.g., debt) or held as investments
- Derivative contracts
- Other off-balance sheet guarantees (e.g., guarantees of private-issue securities).

TABLE 3–1—SOURCES OF STRESS TEST INPUT DATA

| Section of this Appendix | Table | Data Source(s) R = RBC Report P = Public Data F = Fixed Values | | | |
|---|---|---|---|---|---|
| | | R | P | F | Intermediate Outputs |
| 3.1.3, Public Data | 3–19, Stress Test Single Family Quarterly House Price Growth Rates | | | F | |
| | 3–20, Multifamily Monthly Rent Growth and Vacancy Rates | | | F | |
| 3.2.2, Commitments Inputs | Characteristics of securitized single family loans originated and delivered within 6 months prior to the Start of the Stress Test | R | | | 3.3.4, Interest Rates Outputs |
| 3.2.3, Commitments Procedures | 3–25, Monthly Deliveries as a Percentage of Commitments Outstanding (MDP) | | | F | |

TABLE 3–1—SOURCES OF STRESS TEST INPUT DATA—Continued

| Section of this Appendix | Table | Data Source(s) R = RBC Report P = Public Data F = Fixed Values | | | |
|---|---|---|---|---|---|
| | | R | P | F | Intermediate Outputs |
| 3.3.2, Interest Rates Inputs | 3–18, Interest Rate and Index Inputs | | P | | |
| 3.3.3, Interest Rates Procedures | 3–26, CMT Ratios to the Ten-Year CMT | | | F | |
| 3.4.2, Property Valuation Inputs | 3–28, Property Valuation Inputs | | | | 3.1.3, Public Data<br>3.3.4, Interest Rates Outputs |
| 3.5.3, Counterparty Defaults Procedures | 3–30, Rating Agencies Mappings to OFHEO Ratings Categories | | P | | |
| | 3–31, Stress Test Maximum Haircut by Ratings Classification | | | F | |
| 3.6.3.3.2, Mortgage Amortization Schedule Inputs | 3–32, Loan Group Inputs for Mortgage Amortization Calculation | | | | 3.3.4, Interest Rates Outputs |
| 3.6.3.4.2, Single Family Default and Prepayment Inputs | 3–34, Single Family Default and Prepayment Inputs | R | | F | 3.6.3.3.4, Mortgage Amortization Schedule Outputs |
| 3.6.3.4.3.2, Prepayment and Default Rates and Performance Fractions | 3–35, Coefficients for Single Family Default and Prepayment Explanatory Variables | | | F | |
| 3.6.3.5.2, Multifamily Default and Prepayment Inputs | 3–38, Loan Group Inputs for Multifamily Default and Prepayment Calculations | R | | F | |
| 3.6.3.5.3.2, Default and Prepayment Rates and Performance Fractions | 3–39, Explanatory Variable Coefficients for Multifamily Default | | | F | 3.6.3.3.4, Mortgage Amortization Schedule Outputs |
| 3.6.3.6.2.2, Single Family Gross Loss Severity Inputs | 3–42, Loan Group Inputs for Gross Loss Severity | | | F | 3.3.4, Interest Rates Outputs<br>3.6.3.3.4, Mortgage Amortization Schedule Outputs<br>3.6.3.4.4, Single Family Default and Prepayment Outputs |
| 3.6.3.6.3.2, Multifamily Gross Loss Severity Inputs | 3–44, Loan Group Inputs for Multifamily Gross Loss Severity | | | F | 3.3.4, Interest Rates Outputs<br>3.6.3.3.4, Mortgage Amortization Schedule Outputs |
| 3.6.3.6.4.2, Mortgage Credit Enhancement Inputs | 3–10, CE Inputs for each Loan Group | R | | | 3.6.3.3.4, Mortgage Amortization Schedule Outputs<br>3.6.3.4.4, Single Family Default and Prepayment Outputs<br>3.6.3.5.4, Multifamily Default and Prepayment Outputs<br>3.6.3.6.2.4, Single Family Gross Loss Severity Outputs<br>3.6.3.6.3.4, Multifamily Gross Loss Severity Outputs |
| | 3–47, Inputs for each Distinct CE Combination (DCC) | R | | | |
| 3.6.3.7.2, Stress Test Whole Loan Cash Flow Inputs | 3–51, Inputs for Final Calculation of Stress Test Whole Loan Cash Flows | R | | | 3.3.4, Interest Rates Outputs<br>3.6.3.3.4, Mortgage Amortization Schedule Outputs<br>3.6.3.4.4, Single Family Default and Prepayment Outputs<br>3.6.3.5.4, Multifamily Default and Prepayment Outputs<br>3.6.3.6.5.2, Single Family and Multifamily Net Loss Severity Outputs |
| 3.6.3.8.2, Whole Loan Accounting Flows Inputs | 3–54, Inputs for Whole Loan Accounting Flows | R | | | 3.6.3.7.4, Stress Test Whole Loan Cash Flow Outputs |
| 3.7.2, Mortgage-Related Securities Inputs | 3–56, RBC Report Inputs for Single Class MBS Cash Flows | R | | | |
| | 3–57, RBC Report Inputs for Multi-Class and Derivative MBS Cash Flows | R | | | |
| | 3–58, RBC Report Inputs for MRBs and Derivative MBS Cash Flows | R | | | |
| 3.8.2, Nonmortgage Instrument Inputs | 3–65, Input Variables for Nonmortgage Instrument Cash flows | R | | | |

TABLE 3–1—SOURCES OF STRESS TEST INPUT DATA—Continued

| Section of this Appendix | Table | Data Source(s) R = RBC Report P = Public Data F = Fixed Values | | | |
|---|---|---|---|---|---|
| | | R | P | F | Intermediate Outputs |
| 3.9.2, Alternative Modeling Treatments Inputs | 3–69, Alternative Modeling Treatment Inputs | R | | | |
| 3.10.2, Operations, Taxes, and Accounting Inputs | 3–70, Operations, Taxes, and Accounting Inputs | R | | | 3.3.4, Interest Rates Outputs<br>3.6.3.7.4, Stress Test Whole Loan Cash Flow Outputs<br>3.7.4, Mortgage-Related Securities Outputs<br>3.8.4, Nonmortgage Instrument Outputs |
| 3.12.2, Risk-Based Capital Requirement Inputs | ..... | R | | | 3.3.4, Interest Rates Outputs<br>3.9.4, Alternative Modeling Treatments Outputs<br>3.10.4, Operations, Taxes, and Accounting Outputs |

3.1.2 Risk-Based Capital Report

The Risk-Based Capital Report is comprised of information on whole loans, mortgage-related securities, nonmortgage instruments (including liabilities and derivatives), and accounting items (including off-balance sheet guarantees). In addition to their reported data, the Enterprises may report scale factors in order to reconcile this reported data with their published financials (*see* section 3.10.2[b] of this Appendix). If so, specific data items, as indicated, are adjusted by appropriate scale factors before any calculations occur.

3.1.2.1 Whole Loan Inputs

[a] Whole loans are individual single family or multifamily mortgage loans. The Stress Test distinguishes between whole loans that the Enterprises hold in their investment portfolios (retained loans) and those that underlie mortgage-backed securities (sold loans). Consistent with Table 3–2, Whole Loan Classification Variables, each Enterprise aggregates the data for loans with similar portfolio (retained or sold), risk, and product characteristics. The characteristics of these loan groups determine rates of mortgage Default, Prepayment and Loss Severity and cash flows.

[b] The characteristics that are the basis for loan groups are called ''classification variables'' and reflect categories, e.g., fixed interest rate versus floating interest rate, or identify a value range, e.g., original loan-to-value (LTV) ratio greater than 80 percent and less than or equal to 90 percent.

[c] All loans with the same values for each of the relevant classification variables included in 3–2 (and where applicable 3–3 and 3–4) comprise a single loan group. For example, one loan group includes all loans with the following characteristics:

- Single family
- Sold portfolio
- 30-year fixed rate conventional loan
- Mortgage age greater than or equal to 36 months and less than 48 months
- Original LTV greater than 75 percent and less than or equal to 80 percent
- Current mortgage interest rate class greater than or equal to six percent and less than seven percent
- Secured by property located in the East North Central Census Division
- Relative loan size greater than or equal to 75 percent and less than 100 percent of the average for its state and origination year.

TABLE 3–2—WHOLE LOAN CLASSIFICATION VARIABLES

| Variable | Description | Range |
|---|---|---|
| Reporting Date | The last day of the quarter for the loan group activity that is being reported to OFHEO | YYYY0331<br>YYYY0630<br>YYYY0930<br>YYYY1231 |
| Enterprise | Enterprise submitting the loan group data | Fannie Mae<br>Freddie Mac |
| Business Type | Single family or multifamily | Single family<br>Multifamily |
| Portfolio Type | Retained portfolio or Sold portfolio | Retained Portfolio<br>Sold Portfolio |
| Government Flag | Conventional or Government insured loan | Conventional<br>Government |
| Original LTV | Assigned LTV classes based on the ratio, in percent, between the original loan amount and the lesser of the purchase price or appraised value | LTV<=60<br>60 <LTV<=70<br>70 <LTV<=75<br>75 <LTV<=80<br>80 <LTV<=90<br>90 <LTV<=95<br>95 <LTV<=100<br>100 <LTV |
| Current Mortgage Interest Rate | Assigned classes for the current mortgage interest rate | 0.0<=Rate<4.0<br>4.0<=Rate<5.0 |

TABLE 3–2—WHOLE LOAN CLASSIFICATION VARIABLES—Continued

| Variable | Description | Range |
|---|---|---|
| | | 5.0<=Rate<6.0<br>6.0<=Rate<7.0<br>7.0<=Rate<8.0<br>8.0<=Rate<9.0<br>9.0<=Rate<10.0<br>10.0<=Rate<11.0<br>11.0<=Rate<12.0<br>12.0<=Rate<13.0<br>13.0<=Rate<14.0<br>14.0<=Rate<15.0<br>15.0<=Rate<16.0<br>Rate=>16.0 |
| Original Mortgage Interest Rate | Assigned classes for the original mortgage interest rate | 0.0<=Rate<4.0<br>4.0<=Rate<5.0<br>5.0<=Rate<6.0<br>6.0<=Rate<7.0<br>7.0<=Rate<8.0<br>8.0<=Rate<9.0<br>9.0<=Rate<10.0<br>10.0<=Rate<11.0<br>11.0<=Rate<12.0<br>12.0<=Rate<13.0<br>13.0<=Rate<14.0<br>14.0<=Rate<15.0<br>15.0<=Rate<16.0<br>Rate=>16.0 |
| Mortgage Age | Assigned classes for the age of the loan | 0<=Age<12<br>12<=Age<24<br>24<=Age<36<br>36<=Age<48<br>48<=Age<60<br>60<=Age<72<br>72<=Age<84<br>84<=Age<96<br>96<=Age<108<br>108<=Age<120<br>120<=Age<132<br>132<=Age<144<br>144<=Age<156<br>156<=Age<168<br>168<=Age<180<br>Age>=180 |
| Rate Reset Period | Assigned classes for the number of months between rate adjustments | Period =1<br>1< Period <=4<br>4< Period <=9<br>9< Period <=15<br>15< Period <=60<br>Period >60 |
| Payment Reset Period | Assigned classes for the number of months between payment adjustments after the duration of the teaser rate | Period <=9<br>9< Period <=15<br>Period >15 |
| ARM Index | Specifies the type of index used to determine the interest rate at each adjustment | FHLB 11th District Cost of Funds.<br>1 Month Federal Agency Cost of Funds.<br>3 Month Federal Agency Cost of Funds.<br>6 Month Federal Agency Cost of Funds.<br>12 Month Federal Agency Cost of Funds.<br>24 Month Federal Agency Cost of Funds.<br>36 Month Federal Agency Cost of Funds.<br>60 Month Federal Agency Cost of Funds.<br>120 Month Federal Agency Cost of Funds.<br>360 Month Federal Agency Cost of Funds.<br>Overnight Federal Funds (Effective).<br>1 Week Federal Funds<br>6 Month Federal Funds<br>1 month LIBOR<br>3 Month LIBOR<br>6 Month LIBOR<br>12 Month LIBOR<br>Conventional Mortgage Rate.<br>15 Year Fixed Mortgage Rate.<br>7 Year Balloon Mortgage Rate.<br>Prime Rate<br>1 Month Treasury Bill<br>3 Month CMT<br>6 Month CMT<br>12 Month CMT |

TABLE 3–2—WHOLE LOAN CLASSIFICATION VARIABLES—Continued

| Variable | Description | Range |
|---|---|---|
| | | 24 Month CMT<br>36 Month CMT<br>60 Month CMT<br>120 Month CMT<br>240 Month CMT<br>360 Month CMT |
| Cap Type Flag | Indicates if a loan group is rate-capped, payment-capped or uncapped | Payment Capped<br>Rate Capped<br>No periodic rate cap |

TABLE 3–3—ADDITIONAL SINGLE FAMILY LOAN CLASSIFICATION VARIABLES

| Variable | Description | Range |
|---|---|---|
| Single Family Product Code | Identifies the mortgage product types for single family loans | Fixed Rate 30YR<br>Fixed Rate 20YR<br>Fixed Rate 15YR<br>5 Year Fixed Rate Balloon<br>7 Year Fixed Rate Balloon<br>10 Year Fixed Rate Balloon<br>15 Year Fixed Rate Balloon<br>Adjustable Rate<br>Second Lien<br>Other |
| Census Division | The Census Division in which the property resides. This variable is populated based on the property's state code | East North Central<br>East South Central<br>Middle Atlantic<br>Mountain<br>New England<br>Pacific<br>South Atlantic<br>West North Central<br>West South Central |
| Relative Loan Size | Assigned classes for the loan amount at origination divided by the simple average of the loan amount for the origination year and for the state in which the property is located. It is expressed as a percent | 0<=Size<=40%<br>40%<Size<=60%<br>60%<Size<=75%<br>75%<Size<=100%<br>100%<Size<=125%<br>125%<Size<=150%<br>Size>150% |

TABLE 3–4—ADDITIONAL MULTIFAMILY LOAN CLASSIFICATION VARIABLES

| Variable | Description | Range |
|---|---|---|
| Multifamily Product Code | Identifies the mortgage product types for multifamily loans | Fixed Rate Fully Amortizing<br>Adjustable Rate Fully Amortizing<br>5 Year Fixed Rate Balloon<br>7 Year Fixed Rate Balloon<br>10 Year Fixed Rate Balloon<br>15 Year Fixed Rate Balloon<br>Balloon ARM<br>Other |
| New Book Flag | ''New Book'' is applied to Fannie Mae loans acquired beginning in 1988 and Freddie Mac loans acquired beginning in 1993, except for loans that were refinanced to avoid a default on a loan originated or acquired earlier | New Book<br>Old Book |
| Ratio Update Flag | Indicates if the LTV and DCR were updated at origination or at Enterprise acquisition | Yes<br>No |
| Interest Only Flag | Indicates if the loan is currently paying interest only. Loans that started as I/Os and are currently amortizing should be flagged as 'N' | Yes<br>No |
| Current DCR | Assigned classes for the Debt Service Coverage Ratio based on the most recent annual operating statement | DCR <1.00<br>1.00 <=DCR<1.10<br>1.10 <=DCR<1.20<br>1.20 <=DCR<1.30<br>1.30 <=DCR<1.40<br>1.40 <=DCR<1.50<br>1.50 <=DCR<1.60<br>1.60 <=DCR<1.70<br>1.70 <=DCR<1.80 |

TABLE 3–4—ADDITIONAL MULTIFAMILY LOAN CLASSIFICATION VARIABLES—Continued

| Variable | Description | Range |
|---|---|---|
| | | 1.80 <=DCR<1.90<br>1.90 <=DCR<2.00<br>2.00 <=DCR<2.50<br>2.50 <=DCR<4.00<br>DCR >= 4.00 |

3.1.2.1.1 Loan Group Inputs

TABLE 3–5—MORTGAGE AMORTIZATION CALCULATION INPUTS

| Variable | Description |
|---|---|
| | Rate Type (Fixed or Adjustable) |
| | Product Type (30/20/15-Year FRM, ARM, Balloon, Government, etc.) |
| $UPB_{ORIG}$ | Unpaid Principal Balance at Origination (aggregate for Loan Group) |
| $UPB_0$ | Unpaid Principal Balance at start of Stress Test (aggregate for Loan Group), adjusted by UPB scale factor. |
| $MIR_0$ | Mortgage Interest Rate for the Mortgage Payment prior to the start of the Stress Test, or Initial Mortgage Interest Rate for new loans (weighted average for Loan Group) (expressed as a decimal per annum) |
| $PMT_0$ | Amount of the Mortgage Payment (Principal and Interest) prior to the start of the Stress Test, or first Payment for new loans (aggregate for Loan Group), adjusted by UPB scale factor. |
| AT | Original loan Amortizing Term in months (weighted average for Loan Group) |
| RM | Remaining term to Maturity in months (i.e., number of contractual payments due between the start of the Stress Test and the contractual maturity date of the loan) (weighted average for Loan Group) |
| $A_0$ | Age of the loan at the start of Stress Test, in months (weighted average for Loan Group) |
| Unamortized Balance Scale Factor | Factor determined by reconciling reported Unamortized Balance to published financials |
| UPB Scale Factor | Factor determined by reconciling reported UPB to published financials |
| Additional Interest Rate Inputs | |
| GFR | Guarantee Fee Rate (weighted average for Loan Group) (decimal per annum) |
| SFR | Servicing Fee Rate (weighted average for Loan Group) (decimal per annum) |
| Additional Inputs for ARMs (weighted averages for Loan Group, except for Index) | |
| $INDEX_m$ | Monthly values of the contractual Interest Rate Index |
| LB | Look-Back period, in months |
| MARGIN | Loan Margin (over index), decimal per annum |
| RRP | Rate Reset Period, in months |
| | Rate Reset Limit (up and down), decimal per annum |
| | Maximum Rate (life cap), decimal per annum |
| | Minimum Rate (life floor), decimal per annum |
| NAC | Negative Amortization Cap, decimal fraction of $UPB_{ORIG}$ |
| | Unlimited Payment Reset Period, in months |
| PRP | Payment Reset Period, in months |
| | Payment Reset Limit, as decimal fraction of prior payment |
| IRP | Initial Rate Period, in months |
| Additional Inputs for Multifamily Loans | |
| | Interest-only Flag |
| RIOP | Remaining Interest-only period, in months (weighted average for loan group) |

TABLE 3–6—ADDITIONAL INPUTS FOR SINGLE FAMILY DEFAULT AND PREPAYMENT

| Variable | Description |
|---|---|
| PROD | Mortgage Product Type |
| $A_0$ | Age *immediately prior to* start of Stress Test, in months (weighted average for Loan Group) |
| $LTV_{ORIG}$ | Loan-to-Value ratio at Origination (weighted average for Loan Group) |
| $UPB_{ORIG}$ | UPB at Origination (aggregate for Loan Group), adjusted by UPB scale factor. |
| $MIR_{ORIG}$ | Mortgage Interest Rate at origination (''Initial Rate'' for ARMs), decimal per annum (weighted average for loan group) |
| $UPB_0$ | Unpaid Principal Balance immediately prior to start of Stress Test (aggregate for Loan Group), |
| IF | Fraction (by UPB, in decimal form) of Loan Group backed by Investor-owned properties |
| $RLS_{ORIG}$ | Weighted average Relative Loan Size at Origination (Original UPB as a fraction of average UPB for the state and Origination Year of loan origination) |
| $CHPGF_0^{LG}$ | Cumulative House Price Growth Factor since Loan Origination (weighted average for Loan Group) |

TABLE 3–7—ADDITIONAL INPUTS FOR MULTIFAMILY DEFAULT AND PREPAYMENT

| Variable | Description |
|---|---|
| | Mortgage Product Type |
| $A_0$ | Age *immediately prior to* start of Stress Test, in months (weighted average for Loan Group) |
| NBF | New Book Flag |
| RUF | Ratio Update Flag |
| $LTV_{ORIG}$ | Loan-to-Value ratio at loan origination |
| $DCR_0$ | Debt Service Coverage Ratio at the start of the Stress Test |
| $PMT_0$ | Amount of the mortgage payment (principal and interest) prior to the start of the Stress Test, or first payment for new loans (aggregate for Loan Group) |
| PPEM | Prepayment Penalty End Month number in the Stress Test (weighted average for Loan Group) |
| RM | Remaining term to Maturity in months (i.e., number of contractual payments due between the start of the Stress Test and the contractual maturity date of the loan) (weighted average for Loan Group) |

TABLE 3–8—MISCELLANEOUS WHOLE LOAN CASH AND ACCOUNTING FLOW INPUTS

| Variable | Description |
|---|---|
| GF | Guarantee Fee rate (weighted average for Loan Group) (decimal per annum) |
| FDS | Float Days for Scheduled Principal and Interest |
| FDP | Float Days for Prepaid Principal |
| FREP | Fraction Repurchased (weighted average for Loan Group) (decimal) |
| RM | Remaining Term to Maturity in months |
| $UPD_0$ | Unamortized Premium (positive) or Discount (negative) (Deferred Balances) for the Loan Group at the start of the Stress Test, adjusted by Unamortized Balance scale factor |
| $SUPD_0$ | Security Unamortized Premium (positive) or Discount (negative) associated with the repurchase price of a Repurchased MBS (aggregate over all purchases of the same MBS) |

TABLE 3–9—ADDITIONAL INPUTS FOR REPURCHASED MBS

| Variable | Description |
|---|---|
| Wtd Ave Percent Repurchased | For sold loan groups, the percent of the loan group UPB that gives the actual dollar amount of loans that collateralize single class MBSs that the Enterprise holds in its own portfolio |
| Security Unamortized Balances | The aggregate sum of all unamortized discounts, premiums, fees, commissions, etc. associated with the securities modeled using the Wtd Ave Percent Repurchased |

3.1.2.1.2 Credit Enhancement Inputs

To calculate reductions in mortgage credit losses due to credit enhancements, the following data are required for any credit-enhanced loans in a loan group. For this purpose, a Loan Group is divided into Distinct Credit Enhancement Combinations, as further described in section 3.6.3.6.4,

Mortgage Credit Enhancement, of this Appendix.

TABLE 3–10—CE INPUTS FOR EACH LOAN GROUP

| Variable | Description |
|---|---|
| $UPB_{ORIG}^{LG}$ | Origination UPB. |
| $LTV_{ORIG}^{LG}$ | Original LTV. |

TABLE 3–11—INPUTS FOR EACH DISTINCT CE COMBINATION (DCC)

| Variable | Description |
|---|---|
| $P^{DCC}$ | Percent of Initial Loan Group UPB represented by individual loan(s) in a DCC |
| $R^{MI,DCC}$ or $R^{LSA,DCC}$ | Credit rating of Loan Limit CE (MI or LSA) Counterparty |
| $C^{MI,DCC}$ or $C^{LSA,DCC}$ | Weighted Average Coverage Percentage for MI or LSA Coverage (weighted by Initial UPB) |
| $AB_0^{DCC,C1}$ | DCC Available First Priority CE Balance immediately prior to start of the Stress Test |
| $AB_0^{DCC,C2}$ | DCC Available Second Priority CE Balance immediately prior to start of the Stress Test |
| $R^{DCC,C1}$ | DCC Credit Rating of First Priority CE Provider or Counterparty; or Cash/Cash Equivalent (which is not Haircutted) |
| $R^{DCC,C2}$ | DCC Credit Rating of Second Priority CE Provider or Counterparty; or Cash/Cash Equivalent (which is not Haircutted) |
| $C^{DCC,C1}$ | DCC Loan-Level Coverage Limit of First Priority Contract (If Subtype is MPI; otherwise = 1) |
| $C^{DCC,C2}$ | DCC Loan-Limit Coverage Limit of Second Priority Contract (if Subtype is MPI; otherwise = 1) |
| $ExpMo^{DCC,C1}$ | Month in the Stress Test (1...120 or after) in which the DCC First Priority Contract expires |
| $ExpMo^{DCC,C2}$ | Month in the Stress Test (1...120 or after) in which the DCC Second Priority Contract expires |
| $ELPF^{DCC,C1}$ | DCC Enterprise Loss Position Flag for First Priority Contract (Y or N) |
| $ELPF^{DCC,C2}$ | DCC Enterprise Loss Position Flag for Second Priority Contract (Y or N) |

3.1.2.1.3 Commitments Inputs

[a] The Enterprises report Commitment Loan Group categories based on specific product type characteristics of securitized single family loans originated and delivered during the six months prior to the start of the Stress Test (*see* section 3.2, Commitments, of this Appendix). For each category, the Enterprises report the same information as for Whole Loan Groups with the following exceptions:

1. Amortization term and remaining term are set to those appropriate for newly originated loans;
2. Unamortized balances are set to zero;
3. The House Price Growth Factor is set to one;
4. Age is set to zero;
5. Any credit enhancement coverage other than mortgage insurance is not reported.

3.1.2.2 Mortgage Related Securities Inputs

[a] The Enterprises hold mortgage-related securities, including single class and Derivative Mortgage-Backed Securities (certain multi-class and strip securities) issued by Fannie Mae, Freddie Mac, and Ginnie Mae; mortgage revenue bonds issued by State and local governments and their instrumentalities; and single class and Derivative Mortgage-Backed Securities issued by private entities. The Stress Test models the cash flows of these securities individually. Table 3–12, Inputs for Single Class MBS Cash Flows sets forth the data elements that the Enterprises must compile in the RBC Report regarding each MBS held in their portfolios. This information is necessary for determining associated cash flows in the Stress Test.

TABLE 3–12—INPUTS FOR SINGLE CLASS MBS CASH FLOWS

| Variable | Description |
|---|---|
| Pool Number | A unique number identifying each mortgage pool |
| CUSIP Number | A unique number assigned to publicly traded securities by the Committee on Uniform Securities Identification Procedures |
| Issuer | Issuer of the mortgage pool |
| Government Flag | Indicates Government insured collateral |
| Original UPB Amount | Original pool balance adjusted by UPB scale factor and multiplied by the Enterprise's percentage ownership |
| Current UPB Amount | Initial Pool balance (at the start of the Stress Test), adjusted by UPB scale factor and multiplied by the Enterprise's percentage ownership |
| Product Code | Mortgage product type for the pool |
| Security Rate Index | If the rate on the security adjusts over time, the index that the adjustment is based on |
| Unamortized Balance | The sum of all unamortized discounts, premiums, fees, commissions, etc. adjusted by Unamortized Balance scale factor |

TABLE 3–12—INPUTS FOR SINGLE CLASS MBS CASH FLOWS—Continued

| Variable | Description |
|---|---|
| Wt Avg Original Amortization Term | Original amortization term of the underlying loans, in months (weighted average for underlying loans) |
| Wt Avg Remaining Term of Maturity | Remaining maturity of the underlying loans at the start of the Stress Test (weighted average for underlying loans) |
| Wt Avg Age | Age of the underlying loans at the start of the Stress Test (weighted average for underlying loans) |
| Wt Avg Current Mortgage Interest rate | Mortgage Interest Rate of the underlying loans at the start of the Stress Test (weighted average for underlying loans) |
| Wt Avg Pass-Through Rate | Pass-Through Rate of the underlying loans at the start of the Stress Test (Sold loans only) (weighted average for underlying loans) |
| Wt Avg Original Mortgage Interest Rate | The current UPB weighted average mortgage interest rate in effect at origination for the loans in the pool |
| Security Rating | The most current rating issued by any Nationally Recognized Statistical Rating Organization (NRSRO) for this security, as of the reporting date |
| Wt Avg Gross Margin | Gross margin for the underlying loans (ARM MBS only) (weighted average for underlying loans) |
| Wt Avg Net Margin | Net margin (used to determine the security rate for ARM MBS) (weighted average for underlying loans) |
| Wt Avg Rate Reset Period | Rate reset period in months (ARM MBS only) (weighted average for underlying loans) |
| Wt Avg Rate Reset Limit | Rate reset limit up/down (ARM MBS only) (weighted average for underlying loans) |
| Wt Avg Life Interest Rate Ceiling | Maximum rate (lifetime cap) (ARM MBS only) (weighted average for underlying loans) |
| Wt Avg Life Interest Rate Floor | Minimum rate (lifetime floor) (ARM MBS only) (weighted average for underlying loans) |
| Wt Avg Payment Reset Period | Payment reset period in months (ARM MBS only) (weighted average for underlying loans) |
| Wt Avg Payment Reset Limit | Payment reset limit up/down (ARM MBS only) (weighted average for underlying loans) |
| Wt Avg Lockback Period | The number of months to look back from the interest rate change date to find the index value that will be used to determine the next interest rate. (weighted average for underlying loans) |
| Wt Avg Negative Amortization Cap | The maximum amount to which the balance can increase before the payment is recast to a fully amortizing amount. It is expressed as a fraction of the original UPB. (weighted average for underlying loans) |
| Wt Avg Original Mortgage Interest Rate | The current UPB weighted average original mortgage interest rate for the loans in the pool |
| Wt Avg Initial Interest Rate Period | Number of months between the loan origination date and the first rate adjustment date (weighted average for underlying loans) |
| Wt Avg Unlimited Payment Reset Period | Number of months between unlimited payment resets i.e., not limited by payment caps, starting with origination date (weighted average for underlying loans) |
| Notional Flag | Indicates if the amounts reported in Original Security Balance and Current Security Balance are notional |
| UPB Scale Factor | Factor determined by reconciling reported UPB to published financials |
| Unamortized Balance Scale Factor | Factor determined by reconciling reported Unamortized Balance to published financials |
| Whole Loan Modeling Flag | Indicates that the Current UPB Amount and Unamortized Balance associated with this repurchased MBS are included in the Wt Avg Percent Repurchased and Security Unamortized Balance fields |
| FAS 115 Classification | The financial instrument's classification according to FAS 115 |
| $HPGR_K$ | Vector of House Price Growth Rates for quarters q=1...40 of the Stress Period |

[b] Table 3–13, Information for Multi-Class and Derivative MBS Cash Flows Inputs sets forth the data elements that the Enterprises must compile regarding multi-class and Derivative MBS (e.g., REMICs and Strips). This information is necessary for determining associated cash flows in the Stress Test.

TABLE 3–13—INFORMATION FOR MULTI-CLASS AND DERIVATIVE MBS CASH FLOWS INPUTS

| Variable | Description |
|---|---|
| CUSIP Number | A unique number assigned to publicly traded securities by the Committee on Uniform Securities Identification Procedures |
| Issuer | Issuer of the security: FNMA, FHLMC, GNMA or other |
| Original Security Balance | Original principal balance of the security (notional amount for interest-only securities) at the time of issuance, adjusted by UPB scale factor, multiplied by the Enterprise's percentage ownership |

TABLE 3–13—INFORMATION FOR MULTI-CLASS AND DERIVATIVE MBS CASH FLOWS INPUTS—Continued

| Variable | Description |
|---|---|
| Current Security Balance | Initial principal balance, or notional amount, at the start of the Stress Period, adjusted by UPB scale factor, multiplied by the Enterprise's percentage ownership |
| Current Security Percentage Owned | The percentage of a security's total current balance owned by the Enterprise |
| Notional Flag | Indicates if the amounts reported in Original Security Balance and Current Security Balance are notional |
| Unamortized Balance | The sum of all unamortized discounts, premiums, fees, commissions, etc. Components of the balance that amortize as a gain (like discounts) should be positive. Components that amortize as a cost or as a loss (premiums, fees, etc.) should be negative |
| Unamortized Balance Scale Factor | Factor determined by reconciling reported Unamortized Balance to published financials |
| UPB Scale Factor | Factor determined by reconciling the reported current security balance to published financials |
| Security Rating | The most current rating issued by any Nationally Recognized Statistical Rating Organization (NRSRO) for this security, as of the reporting date |

[c] Table 3–14, Inputs for MRBs and Derivative MBS Cash Flows Inputs sets forth the data elements that the Enterprises must compile in the RBC Report regarding mortgage revenue bonds and private issue mortgage related securities (MRS). The data in this table is supplemented with public securities disclosure data. This information is necessary for determining associated cash flows in the Stress Test.

TABLE 3–14—INPUTS FOR MRBS AND DERIVATIVE MBS CASH FLOWS INPUTS

| Variable | Description |
|---|---|
| CUSIP Number | A unique number assigned to publicly traded securities by the Committee on Uniform Securities Identification Procedures |
| Original Security Balance | Original principal balance, adjusted by UPB scale factor and multiplied by the Enterprise's percentage ownership |
| Current Security Balance | Initial Principal balance (at start of Stress Period), adjusted by UPB scale factor and multiplied by the Enterprise's percentage ownership |
| Unamortized Balance | The sum of all unamortized discounts, premiums, fees, commissions, etc. adjusted by Unamortized Balance scale factor |
| Unamortized Balance Scale Factor | Factor determined by reconciling reported Unamortized Balance to published financials |
| UPB Scale Factor | Factor determined by reconciling the reported current security balance to published financials |
| Floating Rate Flag | Indicates the instrument pays interest at a floating rate |
| Issue Date | The issue date of the security |
| Maturity Date | The stated maturity date of the security |
| Security Interest Rate | The rate at which the security earns interest, as of the reporting date |
| Principal Payment Window Starting Date, Down-Rate Scenario | The month in the Stress Test that principal payment is expected to start for the security under the statutory ''down'' interest rate scenario, according to Enterprise projections |
| Principal Payment Window Ending Date, Down-Rate Scenario | The month in the Stress Test that principal payment is expected to end for the security under the statutory ''down'' interest rate scenario, according to Enterprise projections |
| Principal Payment Window Starting Date, Up-Rate Scenario | The month in the Stress Test that principal payment is expected to start for the security under the statutory ''up'' interest rate scenario, according to Enterprise projections |
| Principal Payment Window Ending Date, Up-Rate Scenario | The month in the Stress Test that principal payment is expected to end for the security under the statutory ''up'' interest rate scenario, according to Enterprise projections |
| Notional Flag | Indicates if the amounts reported in Original Security Balance and Current Security Balance are notional |
| Security Rating | The most current rating issued by any Nationally Recognized Statistical Rating Organization (NRSRO) for this security, as of the reporting date |
| Security Rate Index | If the rate on the security adjusts over time, the index on which the adjustment is based |
| Security Rate Index Coefficient | If the rate on the security adjusts over time, the coefficient is the number used to multiply by the value of the index |
| Security Rate Index Spread | If the rate on the security adjusts over time, the spread is added to the value of the index multiplied by the coefficient to determine the new rate |
| Security Rate Adjustment Frequency | The number of months between rate adjustments |

TABLE 3–14—INPUTS FOR MRBS AND DERIVATIVE MBS CASH FLOWS INPUTS—Continued

| Variable | Description |
|---|---|
| Security Interest Rate Ceiling | The maximum rate (lifetime cap) on the security |
| Security Interest Rate Floor | The minimum rate (lifetime floor) on the security |
| Life Ceiling Interest Rate | The maximum interest rate allowed throughout the life of the security |
| Life Floor Interest Rate | The minimum interest rate allowed throughout the life of security |

3.1.2.3 Nonmortgage Instrument Cash Flows Inputs

Table 3–15, Input Variables for Nonmortgage Instrument Cash flows sets forth the data elements that the Enterprises must compile in the RBC Report to identify individual securities (other than Mortgage Related Securities) that are held by the Enterprises in their portfolios. These include debt securities, preferred stock, and derivative contracts (interest rate swaps, caps, and floors). All data are instrument specific. The data in this table are supplemented by public securities disclosure data. For instruments with complex or non-standard features, the Enterprises may be required to provide additional information such as amortization schedules, interest rate coupon reset formulas, and the terms of the call options.

TABLE 3–15—INPUT VARIABLES FOR NONMORTGAGE INSTRUMENT CASH FLOWS

| Data Elements | Description |
|---|---|
| Amortization Methodology Code | Enterprise method of amortizing deferred balances (e.g., straight line) |
| Asset ID | CUSIP or Reference Pool Number identifying the asset underlying a derivative position |
| Asset Type Code | Code that identifies asset type used in the commercial information service (e.g. ABS, Fannie Mae pool, Freddie Mac pool) |
| Associated Instrument ID | Instrument ID of an instrument linked to another instrument |
| Coefficient | Indicates the extent to which the coupon is leveraged or de-leveraged |
| Compound Indicator | Indicates if interest is compounded |
| Compounding Frequency | Indicates how often interest is compounded |
| Counterparty Credit Rating | NRSRO's rating for the counterparty |
| Counterparty Credit Rating Type | An indicator identifying the counterparty's credit rating as short-term ('S') or long-term ('L') |
| Counterparty ID | Enterprise counterparty tracking ID |
| Country Code | Standard country codes in compliance with Federal Information Processing Standards Publication 10–4 |
| Credit Agency Code | Identifies NRSRO (e.g., Moody's) |
| Current Asset Face Amount | Current face amount of the asset underlying a swap adjusted by UPB scale factor |
| Current Coupon | Current coupon or dividend rate of the instrument |
| Current Unamortized Discount | Current unamortized premium or unaccreted discount of the instrument adjusted by Unamortized Balance scale factor |
| Current Unamortized Fees | Current unamortized fees associated with the instrument adjusted by Unamortized Balance scale factor |
| Current Unamortized Hedge | Current unamortized hedging gains or losses associated with the instrument adjusted by Unamortized Balance scale factor |
| Current Unamortized Other | Any other unamortized items originally associated with the instrument adjusted by Unamortized Balance scale factor |
| CUSIP__ISIN | CUSIP or ISIN Number identifying the instrument |
| Day Count | Day count convention (e.g. 30/360) |
| End Date | The last index repricing date |
| EOP Principal Balance | End of Period face, principal or notional, amount of the instrument adjusted by UPB scale factor |
| Exact Representation | Indicates that an instrument is modeled according to its contractual terms |
| Exercise Convention | Indicates option exercise convention (e.g., American Option) |
| Exercise Price | Par = 1.0; Options |
| First Coupon Date | Date first coupon is received or paid |
| Index Cap | Indicates maximum index rate |
| Index Floor | Indicates minimum index rate |
| Index Reset Frequency | Indicates how often the interest rate index resets on floating-rate instruments |
| Index Code | Indicates the interest rate index to which floating-rate instruments are tied (e.g., LIBOR) |

TABLE 3–15—INPUT VARIABLES FOR NONMORTGAGE INSTRUMENT CASH FLOWS—Continued

| Data Elements | Description |
|---|---|
| Index Term | Point on yield curve, expressed in months, upon which the index is based |
| Instrument Credit Rating | NRSRO credit rating for the instrument |
| Instrument Credit Rating Type | An indicator identifying the instruments credit rating as short-term ('S') or long-term ('L') |
| Instrument ID | An integer used internally by the Enterprise that uniquely identifies the instrument |
| Interest Currency Code | Indicates currency in which interest payments are paid or received |
| Interest Type Code | Indicates the method of interest rate payments (e.g., fixed, floating, step, discount) |
| Issue Date | Indicates the date that the instrument was issued |
| Life Cap Rate | The maximum interest rate for the instrument throughout its life |
| Life Floor Rate | The minimum interest rate for the instrument throughout its life |
| Look-Back Period | Period from the index reset date, expressed in months, that the index value is derived |
| Maturity Date | Date that the instrument contractually matures |
| Notional Indicator | Identifies whether the face amount is notional |
| Instrument Type Code | Indicates the type of instrument to be modeled (e.g., ABS, Cap, Swap) |
| Option Indicator | Indicates if instrument contains an option |
| Option Type | Indicates option type (e.g., Call option) |
| Original Asset Face Amount | Original face amount of the asset underlying a swap adjusted by UPB scale factor |
| Original Discount | Original discount or premium amount of the instrument adjusted by Unamortized Balance scale factor |
| Original Face | Original face, principal or notional, amount of the instrument adjusted by UPB scale factor |
| Original Fees | Fees associated with the instrument at inception adjusted by Unamortized Balance scale factor |
| Original Hedge | Hedging gain or loss to be amortized or accreted at inception adjusted by Unamortized Balance scale factor |
| Original Other | Any other amounts originally associated with the instrument to be amortized or accreted adjusted by Unamortized Balance scale factor |
| Parent Entity ID | Enterprise internal tracking ID for parent entity |
| Payment Amount | Interest payment amount associated with the instrument (reserved for complex instruments where interest payments are not modeled) adjusted by UPB scale factor |
| Payment Frequency | Indicates how often interest payments are made or received |
| Performance Date | ''As of'' date on which the data is submitted |
| Periodic Adjustment | The maximum amount that the interest rate for the instrument can change per reset |
| Position Code | Indicates whether the Enterprise pays or receives interest on the instrument |
| Principal Currency Code | Indicates currency in which principal payments are paid or received |
| Principal Factor Amount | EOP Principal Balance expressed as a percentage of Original Face |
| Principal Payment Date | A valid date identifying the date that principal is paid |
| Settlement Date | A valid date identifying the date the settlement occurred |
| Spread | An amount added to an index to determine an instrument's interest rate |
| Start Date | The date, spot or forward, when some feature of a financial contract becomes effective (e.g., Call Date), or when interest payments or receipts begin to be calculated |
| Strike Rate | The price or rate at which an option begins to have a settlement value at expiration, or, for interest-rate caps and floors, the rate that triggers interest payments |
| Submitting Entity | Indicates which Enterprise is submitting information |
| Trade ID | Unique code identifying the trade of an instrument |
| Transaction Code | Indicates the transaction that an Enterprise is initiating with the instrument (e.g. buy, issue reopen) |
| Transaction Date | A valid date identifying the date the transaction occurred |
| UPB Scale Factor | Factor determined by reconciling reported UPB to published financials |

TABLE 3–15—INPUT VARIABLES FOR NONMORTGAGE INSTRUMENT CASH FLOWS—Continued

| Data Elements | Description |
|---|---|
| Unamortized Balances Scale Factor | Factor determined by reconciling reported Unamortized Balances to published financials |

3.1.2.4 Inputs for Alternative Modeling Treatment Items

TABLE 3–16—INPUTS FOR ALTERNATIVE MODELING TREATMENT ITEMS

| Variable | Description |
|---|---|
| TYPE | Type of item (asset, liability or off-balance sheet item) |
| BOOK | Book Value of item (amount outstanding adjusted for deferred items) |
| FACE | Face Value or notional balance of item for off-balance sheet items |
| REMATUR | Remaining Contractual Maturity of item in whole months. Any fraction of a month equals one whole month |
| RATE | Interest Rate |
| INDEX | Index used to calculate Interest Rate |
| FAS115 | Designation that the item is recorded at fair value, according to FAS 115 |
| RATING | Instrument or counterparty rating |
| FHA | In the case of off-balance sheet guarantees, a designation indicating 100% of collateral is guaranteed by FHA |
| UABAL | Unamortized Balance (Book minus Face) |
| MARGIN | Margin over an Index |

3.1.2.5 Operations, Taxes, and Accounting Inputs

[a] Table 3–17, Operations, Taxes, and Accounting Inputs sets forth the data the Enterprises must compile in the RBC Report to permit the calculation of taxes, operating expenses, and dividends. These data include:

- Average monthly Operating Expenses (i.e., administrative expenses, salaries and benefits, professional services, property costs, equipment costs) for the quarter prior to the beginning of the Stress Test;
- Income for the current year-to-date, one year, and two years prior to the beginning of the stress test, before taxes and provision for income taxes;
- Dividend payout ratio for the four quarters prior to the beginning of the Stress Period;
- Minimum capital requirement as of the beginning of the Stress Period.

TABLE 3–17—OPERATIONS, TAXES, AND ACCOUNTING INPUTS

| Input | Description |
|---|---|
| FAS 115 and 125 fair value adjustment on retained mortgage portfolio | |
| FAS 133 fair value adjustment on retained mortgage portfolio | |
| Reserve for losses on retained mortgage portfolio | |
| FAS 115 and 125 fair value adjustments on non-mortgage investments | |
| FAS 133 fair value adjustments on non-mortgage investments | |
| Total cash | |
| Accrued interest receivable on mortgages | |
| Accrued interest receivable on non-mortgage investment securities | |
| Accrued interest receivable on non-mortgage investment securities denominated in foreign currency—hedged | |
| Accrued interest receivable on non-mortgage investment securities denominated in foreign currency—unhedged | |
| Accrued interest receivable on mortgage-linked derivatives, gross | |
| Accrued interest receivable on investment-linked derivatives, gross | |
| Accrued interest receivable on debt-linked derivatives, gross | |
| Other accrued interest receivable | |
| Accrued interest receivable on hedged debt-linked foreign currency swaps | Underlying instrument is GSE issued debt |
| Accrued interest receivable on unhedged debt-linked foreign currency swaps | |

TABLE 3–17—OPERATIONS, TAXES, AND ACCOUNTING INPUTS—Continued

| Input | Description |
|---|---|
| Accrued interest receivable on hedged asset-linked foreign currency swaps | Underlying instrument is an asset |
| Accrued interest receivable on unhedged asset-linked foreign currency swaps | |
| Currency transaction adjustments—hedged assets | Cumulative gain or loss due to changes in foreign exchange rates relative to on-balance sheet assets originally denominated in foreign currency |
| Currency transaction adjustments—unhedged assets | Cumulative gain or loss due to changes in foreign exchange rates relative to unhedged assets and off-balance sheet items originally denominated in foreign currency |
| Federal income tax refundable | |
| Accounts receivable | |
| Fees receivable | |
| Low income housing tax credit investments | |
| Fixed assets, net | |
| Clearing accounts | Net book value of all clearing accounts |
| Other assets | |
| Foreclosed property, net | Real estate owned including property acquired through foreclosure proceedings |
| FAS 133 fair value adjustment on debt securities | |
| Accrued interest payable on existing fixed-rate debt securities | |
| Accrued interest payable on existing floating-rate debt securities | |
| Accrued interest payable on existing debt issued in foreign currency—hedged | |
| Accrued interest payable on existing debt issued in foreign currency—unhedged | |
| Accrued interest payable on mortgage-linked derivatives, gross | |
| Accrued interest payable on investment-linked derivatives, gross | |
| Accrued interest payable on debt-linked derivatives, gross | |
| Other accrued interest payable | |
| Accrued interest payable debt-linked foreign currency swaps—hedged | |
| Accrued interest payable debt-linked foreign currency swaps—unhedged | |
| Accrued interest payable asset-linked foreign currency swaps—hedged | |
| Accrued interest payable asset-linked foreign currency swaps—unhedged | |
| Principal and interest due to mortgage security investors | Cash received on sold mortgages for onward submission to mortgage security investors |
| Currency transaction adjustments—hedged debt | Cumulative gain or loss due to changes in foreign exchange rates relative to on-balance sheet debt originally denominated in foreign currency |
| Currency transaction adjustments—unhedged debt | Cumulative gain or loss due to changes in foreign exchange rates relative to unhedged liabilities and off-balance sheet items originally denominated in foreign currency |
| Escrow deposits | Cash balances held in relation to servicing of multi-family loans |
| Federal income taxes payable | |
| Preferred dividends payable | |
| Accounts payable | |
| Other liabilities | |
| Common dividends payable | |
| Reserve for losses on sold mortgages | |
| Common stock | |
| Preferred stock, non-cumulative | |
| Additional paid-in capital | |

TABLE 3–17—OPERATIONS, TAXES, AND ACCOUNTING INPUTS—Continued

| Input | Description |
|---|---|
| Retained earnings | |
| Treasury stock | |
| Unrealized gains and losses on available-for-sale securities, net of tax, in accordance with FAS 115 and 125 | |
| Unrealized gains and losses due to mark to market adjustments, FAS 115 and 125 | |
| Unrealized gains and losses due to deferred balances related to pre-FAS 115 and 125 adjustments | |
| Unrealized gains and losses due to other realized gains, FAS 115 | |
| Other comprehensive income, net of tax, in accordance with FAS 133 | |
| OCI due to mark to market adjustments, FAS 133 | |
| OCI due to deferred balances related to pre-FAS 133 adjustments | |
| OCI due to other realized gains, FAS 133 | |
| Operating expenses | Average of prior three months |
| Common dividend payout ratio (average of prior 4 quarters) | Sum dollar amount of common dividends paid over prior 4 quarters and divided by the sum of total of after tax income less preferred dividends paid over prior 4 quarters |
| Common dividends per share paid 1 quarter prior to the beginning of the stress period | |
| Common shares outstanding | |
| Common Share Market Price | |
| Dividends paid on common stock 1 quarter prior to the beginning of the stress period | |
| Share Repurchases (average of prior 4 quarters) | Sum dollar amount of repurchased shares, net of newly issued shares, over prior 4 quarters and divided by 4 |
| Off-balance-sheet Guarantees | Guaranteed instruments not reported on the balance sheet, such as whole loan REMICs and multifamily credit enhancements, and not 100% guaranteed by the FHA |
| Other Off-Balance Sheet Guarantees | All other off-balance sheet guaranteed instruments not included in another category, and not 100% guaranteed by the FHA |
| YTD provision for income taxes | Provision for income taxes for the period beginning January 1 and ending as of the report date |
| Tax loss carryforward | Net losses available to write off against future years' net income |
| Tax liability for the year prior to the beginning of the Stress Test | |
| Tax liability for the year 2 years prior to the beginning of the Stress Test (net of carrybacks) | |
| Taxable income for the year prior to the beginning of the Stress Test | |
| Taxable income for the year 2 years prior to the beginning of the Stress Test (net of carrybacks) | |
| Net after tax income for the quarter preceding the start of the stress test | |
| YTD taxable income | Total amount of taxable income for the period beginning January 1 and ending as of the report date |
| Minimum capital requirement at the beginning of the Stress Period | |
| Specific allowance for loan losses | Loss allowances calculated in accordance with FAS 114 |
| Zero coupon swap receivable | |
| Unamortized discount on zero coupon swap receivable | |

3.1.3 Public Data

3.1.3.1 Interest Rates

[a] The Interest Rates component of the Stress Test projects Treasury yields as well as other interest rate indexes that are needed to calculate cash flows, to simulate the performance of mortgages and other financial instruments, and to calculate capital for each of the 120 months in the Stress Period. Table 3–18, Interest Rate and Index Inputs, sets forth the interest rate indexes used in the Stress Test

[b] The starting values for all of the Interest Rates are the monthly average of daily rates for the month preceding the start of the stress test.

[c] For the 10-year CMT, monthly values are required for the three years prior to the start of the Stress Test (m = −35, −34...0). For all other indexes, monthly values for the prior two years are required (m = −23, −22...0).

TABLE 3–18—INTEREST RATE AND INDEX INPUTS

| Interest Rate Index | Description | Source |
|---|---|---|
| 1 MO Treasury Bill | One-month Treasury bill yield, monthly simple average of daily rate, quoted as actual/360 | Bloomberg Generic 1 Month U.S. Treasury bill, Ticker: GB1M (index) |
| 3 MO CMT | Three-month constant maturity Treasury yield, monthly simple average of daily rate, quoted as bond equivalent yield | Federal Reserve H.15 Release |
| 6 MO CMT | Six-month constant maturity Treasury yield, monthly simple average of daily rate, quoted as bond equivalent yield | Federal Reserve H.15 Release |
| 1 YR CMT | One-year constant maturity Treasury yield, monthly simple average of daily rate, quoted as bond equivalent yield | Federal Reserve H.15 Release |
| 2 YR CMT | Two-year constant maturity Treasury yield, monthly simple average of daily rate, quoted as bond equivalent yield | Federal Reserve H.15 Release |
| 3 YR CMT | Three-year constant maturity Treasury yield, monthly simple average of daily rate, quoted as bond equivalent yield | Federal Reserve H.15 Release |
| 5 YR CMT | Five-year constant maturity Treasury yield, monthly simple average of daily rate, quoted as bond equivalent yield | Federal Reserve H.15 Release |
| 10 YR CMT | Ten-year constant maturity Treasury yield, monthly simple average of daily rate, quoted as bond equivalent yield | Federal Reserve H.15 Release |
| 20 YR CMT | Twenty-year constant maturity Treasury yield, monthly simple average of daily rate, quoted as bond equivalent yield | Federal Reserve H.15 Release |
| 30 YR CMT | Thirty-year constant maturity Treasury yield, monthly simple average of daily rate, quoted as bond equivalent yield | Federal Reserve H.15 Release |
| Overnight Fed Funds (Effective) | Overnight effective Federal Funds rate, monthly simple average of daily rate | Federal Reserve H.15 Release |
| 1 Week Federal Funds | 1 week Federal Funds rate, monthly simple average of daily rates | Bloomberg Term Fed Funds U.S. Domestic, Ticker: FFTD01W (index) |
| 6 Month Fed Funds | 6 month Federal Funds rate, monthly simple average of daily rates | Bloomberg Term Fed Funds U.S. Domestic, Ticker: FFTD06M (index) |
| Conventional Mortgage Rate | FHLMC (Freddie Mac) contract interest rates for 30 YR fixed-rate mortgage commitments, monthly average of weekly rates | Federal Reserve H.15 Release |
| FHLB 11th District COF | 11th District (San Francisco) weighted average cost of funds for savings and loans, monthly | Bloomberg Cost of Funds for the 11th District Ticker: COF11 (index) |
| 1 MO LIBOR | One-month London Interbank Offered Rate, average of bid and asked, monthly simple average of daily rates, quoted as actual/360 | British Bankers Association Bloomberg Ticker: US0001M (index) |
| 3 MO LIBOR | Three-month London Interbank Offered Rate, average of bid and asked, monthly simple average of daily rates, quoted as actual/360 | British Bankers Association Bloomberg Ticker: US0003M (index) |
| 6 MO LIBOR | Six-month London Interbank Offered Rate, average of bid and asked, monthly simple average of daily rates, quoted as actual/360 | British Bankers Association Bloomberg Ticker: US0006M (index) |
| 12 MO LIBOR | One-year London Interbank Offered Rate, average of bid and asked, monthly simple average of daily rates, quoted as actual/360 | British Bankers Association Bloomberg Ticker: US0012M (index) |
| Prime Rate | Prevailing rate as quoted, monthly average of daily rates | Federal Reserve H.15 Release |
| 1 MO Federal Agency COF | One-month Federal Agency Cost of Funds, monthly simple average of daily rates, quoted as actual/360 | Bloomberg Generic 1 Month Agency Discount Note Yield Ticker: AGDN030Y (index) |
| 3 MO Federal Agency COF | Three-month Federal Agency Cost of Funds, monthly simple average of daily rates, quoted as actual/360 | Bloomberg Generic 3 Month Agency Discount Note Yield Ticker: AGDN090Y (index) |
| 6 MO Federal Agency COF | Six-month Federal Agency Cost of Funds, monthly simple average of daily rates, quoted as actual/360 | Bloomberg Generic 6 Month Agency Discount Note Yield Ticker: AGDN180Y (index) |

TABLE 3–18—INTEREST RATE AND INDEX INPUTS—Continued

| Interest Rate Index | Description | Source |
|---|---|---|
| 1 YR Federal Agency COF | One-year Federal Agency Cost of Funds, monthly simple average of daily rates, quoted as actual/360 | Bloomberg Generic 12 Month Agency Discount Note Yield Ticker: AGDN360Y (index) |
| 2 YR Federal Agency COF | Two-year Federal Agency Fair Market Yield, monthly simple average of daily rates | Bloomberg Generic 2 Year Agency Fair Market Yield Ticker: AGAC02 (index) |
| 3 YR Federal Agency COF | Three-year Federal Agency Fair Market Yield, monthly simple average of daily rates | Bloomberg Generic 3 Year Agency Fair Market Yield Ticker: AGAC03 (index) |
| 5 YR Federal Agency COF | Five-year Federal Agency Fair Market Yield, monthly simple average of daily rates | Bloomberg Generic 5 Year Agency Fair Market Yield Ticker: AGAC05 (index) |
| 10 YR Federal Agency COF | Ten-year Federal Agency Fair Market Yield, monthly simple average of daily rates | Bloomberg Generic 10 Year Agency Fair Market Yield Ticker: AGAC10 (index) |
| 30 YR Federal Agency COF | Thirty-year Federal Agency Fair Market Yield, monthly simple average of daily rates | Bloomberg Generic 30 Year Agency Fair Market Yield Ticker: AGAC30 (index) |
| 15 YR fixed-rate mortgage | FHLMC (Freddie Mac) contract interest rates for 15 YR fixed-rate mortgage commitments, monthly average of FHLMC (Freddie Mac) contract interest rates for 15 YR | Bloomberg FHLMC 15 YR, 10 day commitment rate Ticker: FHCR1510 (index) |
| 7-year balloon mortgage rate | Seven-year balloon mortgage, equal to the Conventional Mortgage Rate less 50 basis points | Computed |

3.1.3.2 Property Valuation Inputs

Table 3–19, Stress Test Single Family Quarterly House Price Growth Rates and Table 3–21, HPI Dispersion Parameters, set forth inputs which are used to project single family mortgage performance. Table 3–20, Multifamily Monthly Rent Growth and Vacancy Rates, sets forth inputs which are used to project multifamily mortgage performance.

TABLE 3–19—STRESS TEST SINGLE FAMILY QUARTERLY HOUSE PRICE GROWTH RATES [1]

| Stress Test Months | Historical Months | House Price Growth Rate | Stress Test Months | Historical Months | House Price Growth Rate |
|---|---|---|---|---|---|
| 1–3 | Jan–Mar 1984 | –0.005048 | 61–63 | Jan–Mar 1989 | 0.006292 |
| 4–6 | Apr–Jun 1984 | 0.001146 | 64–66 | Apr–Jun 1989 | 0.010523 |
| 7–9 | Jul–Sep 1984 | 0.001708 | 67–69 | Jul–Sep 1989 | 0.017893 |
| 10–12 | Oct–Dec 1984 | –0.007835 | 70–72 | Oct–Dec 1989 | –0.004881 |
| 13–15 | Jan–Mar 1985 | –0.006975 | 73–75 | Jan–Mar 1990 | –0.000227 |
| 16–18 | Apr–Jun 1985 | 0.004178 | 76–78 | Apr–Jun 1990 | 0.008804 |
| 19–21 | Jul–Sep 1985 | –0.005937 | 79–81 | Jul–Sep 1990 | 0.003441 |
| 22–24 | Oct–Dec 1985 | –0.019422 | 82–84 | Oct–Dec 1990 | –0.003777 |
| 25–27 | Jan–Mar 1986 | 0.026231 | 85–87 | Jan–Mar 1991 | 0.009952 |
| 28–30 | Apr–Jun 1986 | 0.022851 | 88–90 | Apr–Jun 1991 | 0.012616 |
| 31–33 | Jul–Sep 1986 | –0.021402 | 91–93 | Jul–Sep 1991 | 0.002267 |
| 34–36 | Oct–Dec 1986 | –0.018507 | 94–96 | Oct–Dec 1991 | 0.012522 |
| 37–39 | Jan–Mar 1987 | 0.004558 | 97–99 | Jan–Mar 1992 | 0.013378 |
| 40–42 | Apr–Jun 1987 | –0.039306 | 100–102 | Apr–Jun 1992 | –0.000519 |
| 43–45 | Jul–Sep 1987 | –0.024382 | 103–105 | Jul–Sep 1992 | 0.016035 |
| 46–48 | Oct–Dec 1987 | –0.026761 | 106–108 | Oct–Dec 1992 | 0.005691 |
| 49–51 | Jan–Mar 1988 | –0.003182 | 109–111 | Jan–Mar 1993 | 0.005723 |
| 52–54 | Apr–Jun 1988 | 0.011854 | 112–114 | Apr–Jun 1993 | 0.010614 |
| 55–57 | Jul–Sep 1988 | –0.020488 | 115–117 | Jul–Sep 1993 | 0.013919 |
| 58–60 | Oct–Dec 1988 | –0.007260 | 118–120 | Oct–Dec 1993 | 0.011267 |

[1] Source: OFHEO House Price Report, 1996:3.

TABLE 3–20—MULTIFAMILY MONTHLY RENT GROWTH [1] AND VACANCY RATES [2]

| Stress Test Month | Historical Month | Rent Growth Rate | Vacancy Rate | Stress Test Month | Historical Month | Rent Growth Rate | Vacancy Rate |
|---|---|---|---|---|---|---|---|
| 1 | Jan 1984 | 0.001367 | 0.136 | 61 | Jan 1989 | 0.000052 | 0.135 |
| 2 | Feb 1984 | 0.001186 | 0.136 | 62 | Feb 1989 | 0.000284 | 0.135 |
| 3 | Mar 1984 | 0.001422 | 0.136 | 63 | Mar 1989 | 0.000404 | 0.135 |
| 4 | Apr 1984 | 0.001723 | 0.136 | 64 | Apr 1989 | 0.000150 | 0.135 |
| 5 | May 1984 | 0.001537 | 0.136 | 65 | May 1989 | 0.000331 | 0.135 |
| 6 | Jun 1984 | 0.001354 | 0.136 | 66 | Jun 1989 | 0.001483 | 0.135 |
| 7 | Jul 1984 | 0.000961 | 0.136 | 67 | Jul 1989 | 0.000759 | 0.135 |
| 8 | Aug 1984 | 0.000601 | 0.136 | 68 | Aug 1989 | 0.001502 | 0.135 |
| 9 | Sep 1984 | 0.001106 | 0.136 | 69 | Sep 1989 | 0.002254 | 0.135 |
| 10 | Oct 1984 | 0.001623 | 0.136 | 70 | Oct 1989 | 0.002768 | 0.135 |
| 11 | Nov 1984 | 0.001395 | 0.136 | 71 | Nov 1989 | 0.002220 | 0.135 |
| 12 | Dec 1984 | 0.001170 | 0.136 | 72 | Dec 1989 | 0.002040 | 0.135 |
| 13 | Jan 1985 | 0.001014 | 0.150 | 73 | Jan 1990 | 0.002180 | 0.120 |
| 14 | Feb 1985 | 0.000857 | 0.150 | 74 | Feb 1990 | 0.002772 | 0.120 |
| 15 | Mar 1985 | 0.000315 | 0.150 | 75 | Mar 1990 | 0.002867 | 0.120 |
| 16 | Apr 1985 | –0.000225 | 0.150 | 76 | Apr 1990 | 0.003243 | 0.120 |
| 17 | May 1985 | 0.000154 | 0.150 | 77 | May 1990 | 0.002963 | 0.120 |
| 18 | Jun 1985 | 0.000534 | 0.150 | 78 | Jun 1990 | 0.003588 | 0.120 |
| 19 | Jul 1985 | 0.001115 | 0.150 | 79 | Jul 1990 | 0.004885 | 0.120 |
| 20 | Aug 1985 | 0.001702 | 0.150 | 80 | Aug 1990 | 0.004564 | 0.120 |
| 21 | Sep 1985 | 0.001576 | 0.150 | 81 | Sep 1990 | 0.005491 | 0.120 |
| 22 | Oct 1985 | 0.001450 | 0.150 | 82 | Oct 1990 | 0.005475 | 0.120 |
| 23 | Nov 1985 | 0.001357 | 0.150 | 83 | Nov 1990 | 0.005763 | 0.120 |
| 24 | Dec 1985 | 0.001266 | 0.150 | 84 | Dec 1990 | 0.005817 | 0.120 |
| 25 | Jan 1986 | 0.001823 | 0.168 | 85 | Jan 1991 | 0.005261 | 0.108 |
| 26 | Feb 1986 | 0.002392 | 0.168 | 86 | Feb 1991 | 0.005456 | 0.108 |
| 27 | Mar 1986 | 0.002665 | 0.168 | 87 | Mar 1991 | 0.005637 | 0.108 |
| 28 | Apr 1986 | 0.002942 | 0.168 | 88 | Apr 1991 | 0.005843 | 0.108 |
| 29 | May 1986 | 0.002517 | 0.168 | 89 | May 1991 | 0.005970 | 0.108 |
| 30 | Jun 1986 | 0.002105 | 0.168 | 90 | Jun 1991 | 0.005719 | 0.108 |
| 31 | Jul 1986 | 0.001372 | 0.168 | 91 | Jul 1991 | 0.005533 | 0.108 |
| 32 | Aug 1986 | 0.000652 | 0.168 | 92 | Aug 1991 | 0.004512 | 0.108 |
| 33 | Sep 1986 | 0.000110 | 0.168 | 93 | Sep 1991 | 0.003916 | 0.108 |
| 34 | Oct 1986 | –0.000431 | 0.168 | 94 | Oct 1991 | 0.003779 | 0.108 |
| 35 | Nov 1986 | –0.000201 | 0.168 | 95 | Nov 1991 | 0.004226 | 0.108 |
| 36 | Dec 1986 | 0.000030 | 0.168 | 96 | Dec 1991 | 0.004791 | 0.108 |
| 37 | Jan 1987 | –0.001448 | 0.175 | 97 | Jan 1992 | 0.005361 | 0.098 |
| 38 | Feb 1987 | –0.002162 | 0.175 | 98 | Feb 1992 | 0.004085 | 0.098 |
| 39 | Mar 1987 | –0.001202 | 0.175 | 99 | Mar 1992 | 0.003885 | 0.098 |
| 40 | Apr 1987 | –0.001136 | 0.175 | 100 | Apr 1992 | 0.002992 | 0.098 |
| 41 | May 1987 | –0.001466 | 0.175 | 101 | May 1992 | 0.002941 | 0.098 |

TABLE 3–20—MULTIFAMILY MONTHLY RENT GROWTH [1] AND VACANCY RATES [2]—Continued

| Stress Test Month | Historical Month | Rent Growth Rate | Vacancy Rate | Stress Test Month | Historical Month | Rent Growth Rate | Vacancy Rate |
|---|---|---|---|---|---|---|---|
| 42 | Jun 1987 | –0.002809 | 0.175 | 102 | Jun 1992 | 0.002851 | 0.098 |
| 43 | Jul 1987 | –0.002069 | 0.175 | 103 | Jul 1992 | 0.002346 | 0.098 |
| 44 | Aug 1987 | –0.002530 | 0.175 | 104 | Aug 1992 | 0.003850 | 0.098 |
| 45 | Sep 1987 | –0.001033 | 0.175 | 105 | Sep 1992 | 0.003245 | 0.098 |
| 46 | Oct 1987 | –0.001148 | 0.175 | 106 | Oct 1992 | 0.003194 | 0.098 |
| 47 | Nov 1987 | –0.001617 | 0.175 | 107 | Nov 1992 | 0.001931 | 0.098 |
| 48 | Dec 1987 | –0.002064 | 0.175 | 108 | Dec 1992 | 0.001494 | 0.098 |
| 49 | Jan 1988 | –0.001372 | 0.158 | 109 | Jan 1993 | 0.001527 | 0.104 |
| 50 | Feb 1988 | –0.001524 | 0.158 | 110 | Feb 1993 | 0.002317 | 0.104 |
| 51 | Mar 1988 | –0.001972 | 0.158 | 111 | Mar 1993 | 0.001904 | 0.104 |
| 52 | Apr 1988 | –0.001363 | 0.158 | 112 | Apr 1993 | 0.002545 | 0.104 |
| 53 | May 1988 | –0.001143 | 0.158 | 113 | May 1993 | 0.002570 | 0.104 |
| 54 | Jun 1988 | –0.001194 | 0.158 | 114 | Jun 1993 | 0.002449 | 0.104 |
| 55 | Jul 1988 | –0.001429 | 0.158 | 115 | Jul 1993 | 0.002161 | 0.104 |
| 56 | Aug 1988 | –0.001315 | 0.158 | 116 | Aug 1993 | 0.001857 | 0.104 |
| 57 | Sep 1988 | –0.002581 | 0.158 | 117 | Sep 1993 | 0.001664 | 0.104 |
| 58 | Oct 1988 | –0.002337 | 0.158 | 118 | Oct 1993 | 0.002184 | 0.104 |
| 59 | Nov 1988 | –0.001218 | 0.158 | 119 | Nov 1993 | 0.002932 | 0.104 |
| 60 | Dec 1988 | –0.000203 | 0.158 | 120 | Dec 1993 | 0.002776 | 0.104 |

[1] Source: U.S. Department of Labor, Bureau of Labor Statistics, Rent of Primary Residence component of the Consumer Price Index—All Urban Consumers.
[2] Source: U.S. Census Bureau, Housing Vacancy Survey—Annual 1999.

TABLE 3–21—HPI DISPERSION PARAMETERS [1]

| | Linear ($\alpha$) | Quadratic ($\beta$) |
|---|---|---|
| Dispersion Parameter | 0.002977 | –0.000024322 |

[1] Source: OFHEO House Price Report, 1996:3.

3.1.4 Constant Values

Certain values are numerical constants that are parameters of the cash flow simulation. These values are established by OFHEO on the basis of analysis of Benchmark and other historical data.

3.1.4.1 Single Family Loan Performance

TABLE 3–22—LOAN GROUP INPUTS FOR SINGLE FAMILY GROSS LOSS SEVERITY

| Variable | Description | Value | Source |
|---|---|---|---|
| MQ | Months Delinquent: time during which Enterprise pays delinquent loan interest to MBS holders | 4 for sold loans<br>0 otherwise | |
| MF | Months to Foreclosure: number of missed payments through completion of foreclosure | 13 months | Average value of BLE data |
| MR | Months in REO | 7 months | Average value of BLE data |
| F | Foreclosure Costs as a decimal fraction of Defaulted UPB | 0.037 | Average of historical data from Enterprise loans, 1979–1999 |
| R | REO Expenses as a decimal fraction of Defaulted UPB | 0.163 | Average of historical data from Enterprise loans, 1979–1999 |

TABLE 3–22—LOAN GROUP INPUTS FOR SINGLE FAMILY GROSS LOSS SEVERITY—Continued

| Variable | Description | Value | Source |
|---|---|---|---|
| RR | Recovery Rate for Defaulted loans in the BLE, as a percent of predicted house price using HPI (decimal) | 0.61 | Average value of BLE data |

*See also* Table 3–35, Coefficients for Single Family Default and Prepayment Explanatory Variables.

3.1.4.2 Multifamily Loan Performance

TABLE 3–23—LOAN GROUP INPUTS FOR MULTIFAMILY DEFAULT AND PREPAYMENT

| Variable | Description | Value | Source |
|---|---|---|---|
| OE | Operating expenses as a share of gross potential rents | 0.472 | Average ratio of operating expenses to gross rents, 1970–1992 Institute for Real Estate Management annual surveys of apartments. |
| $RVR_o$ | Initial rental vacancy rate | 0.0623 | National average vacancy rate, 1970–1995, from census surveys. |

TABLE 3–24—LOAN GROUP INPUTS FOR MULTIFAMILY GROSS LOSS SEVERITY

| Variable | Description | Value | Source |
|---|---|---|---|
| MQ | Time during which delinquent loan interest is passed-through to MBS holders | 4 for sold loans<br>0 otherwise | |
| RHC | Net REO holding costs as a decimal fraction of Defaulted UPB | 0.1333 | UPB-weighted average, Freddie Mac ''old book'' REO through 1995. |
| MF | Time from Default to completion of foreclosure (REO acquisition) | 18 months | UPB-weighted average, Freddie Mac ''old book'' REO through 1995. |
| MR | Months from REO acquisition to REO disposition | 13 months | UPB-weighted average, Freddie Mac ''old book'' REO through 1995. |
| RP | REO proceeds as a decimal fraction of Defaulted UPB | 0.5888 | UPB-weighted average, Freddie Mac ''old book'' REO through 1995. |

*See also* Table 3–39, Explanatory Variable Coefficients for Multifamily Default.

*3.2 Commitments*

3.2.1 Commitments Overview

The Enterprises make contractual commitments to purchase or securitize mortgages. The Stress Test provides for deliveries of mortgages into the commitments that exist at the start of the Stress Period. These mortgages are grouped into ''Commitment Loan Groups'' that reflect the characteristics of the mortgages that were originated in the six months preceding the start of the Stress Period and securitized by the Enterprise, except that they are assigned coupon rates consistent with the projected delivery month in each interest rate scenario. These Commitment Loan Groups are added to the Enterprise's sold portfolio and the Stress Test projects their performance during the Stress Period. In the down-rate scenario, the Stress Test provides that 100 percent of the mortgages specified in the commitments are delivered within the first three months. In the up-rate scenario, 75 percent are delivered within the first six months.

3.2.2 Commitments Inputs

The Stress Test uses two sources of data to determine the characteristics of the mortgages delivered under commitments:

- Information from the Enterprises on the characteristics of loans originated and delivered to the Enterprises in the six months preceding the start of the Stress Period, broken out into four categories, scaled by the dollar value of commitments outstanding at the start of the Stress Period;
- Interest Rate series generated by the Interest Rates component of the Stress Test.

3.2.2.1 Loan Data

[a] The Enterprises report Commitment Loan Group categories based on the following product type characteristics of securitized single family loans originated and delivered during the six months prior to the start of the Stress Test:

- 30-year fixed-rate
- 15-year fixed-rate
- One-year CMT ARM
- Seven-year balloon

[b] For each Commitment Loan Group category, the Enterprises report the same information as in section 3.6 for Whole Loan groups with the following exceptions:

- Amortization term and remaining term are set to those appropriate for newly originated loans
- Unamortized balances are set to zero
- The House Price Growth Factor is set to one
- Age is set to zero
- Any credit enhancement coverage other than mortgage insurance is not reported.

[c] For each Commitment Loan Group category, the Enterprises report the Starting UPB defined as follows:

$$\text{Starting UPB} = \left[\begin{array}{c}\text{Total dollar amount}\\ \text{of Commitments}\\ \text{Outstanding}\end{array}\right] \times \left[\frac{\text{Starting UPB for the Commitment Loan Group Category}}{\text{Total Starting UPB for all Commitment Loan Group Categories}}\right]$$

3.2.2.2 Interest Rate Data

The Stress Test uses the following Interest Rate series, generated from section 3.3, Interest Rates, of this Appendix, for the first 12 months of the Stress Period:

- One-year Constant Maturity Treasury yield (CMT)
- Conventional mortgage rate (30-year fixed rate)
- 15-year fixed-rate mortgage rate
- Seven-year balloon mortgage rate.

3.2.3 Commitments Procedures

[a] Determine Commitment Loan Groups from the Commitment Loan Group categories as follows:

1. Divide each category into one subcategory for each delivery month. Three subcategories are created in the down-rate scenario and six in the up-rate scenario.

2. Calculate the total starting UPB for each subcategory as follows:

$$\text{Subcategory Starting UPB} = \begin{bmatrix} \text{Starting UPB for} \\ \text{Commitment Loan} \\ \text{Group Category} \end{bmatrix} \times \text{MDP}$$

Where: MDP is taken from Table 3–25.

TABLE 3–25—MONTHLY DELIVERIES AS A PERCENTAGE OF COMMITMENTS OUTSTANDING (MDP)

| Delivery Month (DM) | Up-Rate Scenario MDP | Down-Rate Scenario MDP |
|---|---|---|
| 1 | 18.75% | 62.50% |
| 2 | 18.75% | 25.00% |
| 3 | 12.50% | 12.50% |
| 4 | 12.50% | 0.00% |
| 5 | 6.25% | 0.00% |
| 6 | 6.25% | 0.00% |
| Total | 75% | 100% |

3. Set the Initial Mortgage Interest Rate for each subcategory using the interest rate series consistent with the commitment product type. For fixed rate loans, this rate = $\text{INDEX}_{DM}$. For ARM loans, the Initial Mortgage Interest Rate and the Mortgage Interest Rate at Origination are equal and set to $\text{INDEX}_{DM-LB-1}$ +MARGIN, where LB (Lookback Period) and MARGIN for ARM commitment loan groups come from the RBC Report. Calculate the mortgage payment amount consistent with the Initial rate and amortizing term.

[b] Cash flows for the commitment loan groups, broken down by subcategory corresponding to assumed month of delivery to the Enterprises, are to be generated using the same procedures as contained in section 3.6, Whole Loan Cash Flows, of this Appendix, except as follows:

1. For purposes of generating cash flows, treat each commitment loan subcategory as if the loans were newly originated and delivered just prior to the start of the Stress Test (that is, treat them as if mortgage age at time zero, $A_0$, were zero).
2. Wherever section 3.6, Whole Loan Cash Flows, of this Appendix, refers to interest rate or discount rate adjustments, add Delivery Month (DM) to the Interest Rate or discount rate monthly counter, where constant DM ∈ [1,2,3,4,5,6] refers to the number of months into the Stress Test that the commitment subcategory is assumed to be delivered to the Enterprise. For example,
   a. Section 3.6.3.3.3[a]1.b.3) of this Appendix, if m is a rate reset month, then:

$$\text{MIR}_m = \text{INDEX}_{m-1-LB+DM} + \text{MARGIN}$$

   b. Section 3.6.3.4.3.1[a]3.a., of this Appendix,

$$B_q = 1 \text{ if } \text{MCON}_{m+DM} + 0.02 \le \text{MIR}_m$$

   c. Section 3.6.3.4.3.1[a]4., of this Appendix,

$$\text{RS}_q = avg\left(\frac{\text{MIR}_{ORIG} - \text{MCON}_{m+DM}}{\text{MIR}_{ORIG}}\right)$$

   d. Section 3.6.3.4.3.1[a]5., of this Appendix,

$$\text{YCS}_q = avg\left(\frac{\text{T120Y}_{m+DM}}{\text{T12Y}_{m+DM}}\right)$$

   e. Section 3.6.3.6.5.1, of this Appendix. Throughout this section replace $DR_m$ with $DR_{m+DM}$ wherever it appears.
   f. Section 3.6.3.7.3[a]9.b., of this Appendix. The formula for float income received should replace $FER_m$ with $FER_{m+DM}$
3. For purpose of computing $LTV_q$ as defined in section 3.6.3.4.3.1[a]2.a., of this Appendix, adjust the quarterly index for the vector of house price growth rates by adding DQ=2 if the loans are delivered in the Stress Test month 6, DQ = 1 if the loans are delivered in Stress Test months 3, 4 or 5, and 0 otherwise. That is, in the $LTV_q$ formula:

$$Exp\left(\sum_{k=1}^{q} \text{HPGR}_{k+DQ}\right)$$

Where:

$$\text{DQ} = int\left(\frac{\text{DM}}{3}\right)$$

4. The note at the end of section 3.6.3.4.3.2[a]5., of this Appendix, should be adjusted to read: for m > 120 − DM, use $MPR_{120-DM}$ and $MDR_{120-DM}$.
5. Adjust the final outputs for each commitment subcategory by adding DM to each monthly counter, m. That is, the outputs in Table 3–52 and 3–55 should be revised to replace each value's monthly counter of m with the new counter of m + DM, which will modify the description of each to read ''in month m = 1 + DM, ... RM+DM''. (Note that for one variable, $PUPB_m$, the revised counter will range from DM to RM + DM). The revised monthly counters will now correspond to the months of the Stress Test. For values of m under the revised description which are less than or equal to DM, each variable (except Performing UPB) in these two tables should equal zero. For Performing UPB in month DM, the variable will equal the Original UPB for month DM and will equal zero for months less than DM.

3.2.4 Commitments Outputs

[a] The outputs of the Commitment component of the Stress Test include Commitment Loan Groups specified in the same way as loan groups in the RBC Report (*See* section 3.6, Whole Loan Cash Flows, of this Appendix) with two exceptions: mortgage insurance is the only available credit enhancement coverage; and delivery month is added to indicate the month in which these loan groups are added to the sold portfolio. The data for these loan groups allow the Stress Test to project the Default, Prepayment and loss rates and cash flows for loans purchased under commitments for the ten-year Stress Period.

[b] The Commitment outputs also include cash flows analagous to those specified for Whole Loans in section 3.6.4, Final Whole Loan Cash Flow Outputs, of this Appendix, which are produced for each Commitment Loan Group.

*3.3 Interest Rates*

3.3.1 Interest Rates Overview

[a] The Interest Rates component of the Stress Test projects Constant Maturity Treasury yields as well as other interest rates and indexes (collectively, ''Interest Rates'') that are needed to project mortgage performance and calculate cash flows for mortgages and other financial instruments for each of the 120 months in the Stress Period.

[b] The process for determining interest rates is as follows: first, identify values for the necessary Interest Rates at time zero; second, project the ten-year CMT for each month of the Stress Period as specified in the 1992 Act; third, project the 1-month Treasury yield, the 3-month, 6-month, 1-, 2-, 3-, 5-, 20- and 30-year CMTs; and fourth, project non-Treasury Interest Rates, including the Federal Agency Cost of funds.

[c] In cases where the Stress Test would require interest rates for maturities other than those specifically projected in Table 3–18 of section 3.1.3, Public Data, of this Appendix, the Interest Rates component performs a monthly linear interpolation. In cases where the Stress Test would require an Interest Rate for a maturity greater than the longest maturity specifically projected for that index, the Stress Test would use the longest maturity for that index.

3.3.2 Interest Rates Inputs

The Interest Rates that are input to the Stress Test are set forth in Table 3–18 of section 3.1.3, Public Data, of this Appendix.

3.3.3 Interest Rates Procedures

[a] Produce Interest Rates for use in the Stress Test using the following three steps:

1. Project the Ten-Year CMT as specified in the 1992 Act:
   a. *Down-Rate Scenario.* In the Stress Test, the ten-year CMT changes from its starting level to its new level in equal increments over the first twelve months of the Stress Period, and remains constant at the new level for the remaining 108 months of the Stress Period. The new level of the ten-year CMT in the last 108 months of the down-rate scenario equals the lesser of:
      1) The average of the ten-year CMT for the nine months prior to the start of the Stress Test, minus 600 basis points; or
      2) The average yield of the ten-year CMT for the 36 months prior to the start of the Stress Test, multiplied by 60 percent;

but in no case less than 50 percent of the average for the nine months preceding the start of the Stress Period.

   b. *Up-Rate Scenario.* In the Stress Test, the ten-year CMT changes from its starting level to its new level in equal increments

over the first twelve months of the Stress Period, and remains at the new level for the remaining 108 months of the Stress Period. The new level of the ten-year CMT in the last 108 months of the up-rate scenario is the greater of:

1) The average of the ten-year CMT for the nine months prior to the start of the Stress Test, plus 600 basis points; or
2) The average of the ten-year CMT for the 36 months prior to the start of the Stress Test, multiplied by 160 percent;

but in no case greater than 175 percent of the average of the ten-year CMT for the nine months preceding the start of the Stress Period.

2. Project the 1-month Treasury and other CMT yields:

a. *Down-Rate Scenario.* For the down-rate scenario, the new value of each of the other Treasury and CMT yields for the last 108 months of the Stress Test is calculated by multiplying the ten-year CMT by the appropriate ratio from Table 3–26. For the first 12 months of the Stress Period, the other rates are computed in the same way as the ten-year CMT, i.e. from their time zero levels. Each of the other CMTs changes in equal steps in each of the first twelve months of the Stress Period until it reaches the new level for the remaining 108 months of the Stress Test.

TABLE 3–26—CMT RATIOS TO THE TEN-YEAR CMT [1]

| | |
|---|---|
| 1 MO / 10 YR | 0.68271 |
| 3 MO / 10 YR | 0.73700 |
| 6 MO / 10 YR | 0.76697 |
| 1 YR / 10 YR | 0.79995 |
| 2 YR / 10 YR | 0.86591 |
| 3 YR / 10 YR | 0.89856 |
| 5 YR / 10 YR | 0.94646 |
| 20 YR / 10 YR | 1.06246 |
| 30 YR / 10 YR | 1.03432 |

[1] Source: calculated over the period from May, 1986, through April, 1995.

b. *Up-Rate Scenario.* In the up-rate scenario, all other Treasury and CMT yields are equal to the ten-year CMT in the last 108 months of the Stress Test. Each of the other yields changes in equal increments over the first twelve months of the Stress Test until it equals the ten-year CMT.

3. Project Non-Treasury Interest Rates:

a. *Non-Treasury Rates.* For each of the non-Treasury interest rates with the exception of mortgage rates, rates during the Stress Test are computed as a proportional spread to the nearest maturity Treasury yield as given in Table 3–27. The proportional spread is the average over the two years prior to the start of the Stress Test, of the difference between the non-Treasury rate and the comparable maturity Treasury yield divided by that Treasury yield. For example, the three month LIBOR proportional spread would be calculated as the two year average of the ratio:

$$\frac{\left(\begin{array}{c}\text{3-month LIBOR minus}\\ \text{3-month Treasury}\end{array}\right)}{\text{3-month Treasury}}$$

During the Stress Test, the 3-month LIBOR rate is projected by multiplying the 3-month Treasury yield by 1 plus this average proportional spread.

b. *Mortgage Rates.* Mortgage interest rates are projected as described in this section for other non-Treasury interest rates, except that an average of the additive, not proportional, spread to the appropriate Treasury interest rate is used. For example, the 30-year Conventional Mortgage Rate spread is projected as the average, over the two years preceding the start of the Stress Test, of: (Conventional Mortgage Rate minus the ten-year CMT). This spread is then added to the ten-year CMT for the 120 months of the Stress Test to obtain the projected Conventional Mortgage Rate.

TABLE 3–27—NON-TREASURY INTEREST RATES

| Mortgage Rates | Spread Based on |
|---|---|
| 15-year Fixed-rate Mortgage Rate | 10-year CMT |
| 30-year Conventional Mortgage Rate | 10-year CMT |
| 7-year Balloon Mortgage Rate | (computed from Conventional Mortgage Rate) |
| Other Non-Treasury Interest Rates | |
| Overnight Fed Funds | 1-month Treasury Yield |
| 7-day Fed Funds | 1-month Treasury Yield |
| 1-month LIBOR | 1-month Treasury Yield |
| 1-month Federal Agency Cost of Funds | 1-month Treasury Yield |
| 3-month LIBOR | 3-month CMT |
| 3-month Federal Agency Cost of Funds | 3-month CMT |
| PRIME | 3-month CMT |
| 6-month LIBOR | 6-month CMT |
| 6-month Federal Agency Cost of Funds | 6-month CMT |
| 6-month Fed Funds | 6-month CMT |
| FHLB 11th District Cost of Funds | 1-year CMT |
| 12-month LIBOR | 1-year CMT |
| 1-year Federal Agency Cost of Funds | 1-year CMT |
| 2-year Federal Agency Cost of Funds | 2-year CMT |
| 3-year Federal Agency Cost of Funds | 3-year CMT |
| 5-year Federal Agency Cost of Funds | 5-year CMT |
| 10-year Federal Agency Cost of Funds | 10-year CMT |

TABLE 3–27—NON-TREASURY INTEREST RATES—Continued

| Mortgage Rates | Spread Based on |
|---|---|
| 30-year Federal Agency Cost of Funds | 30-year CMT |

c. *Enterprise Borrowing Rates.* In the Stress Test, the Federal Agency Cost of Funds Index is also called the Enterprise Cost of Funds during the Stress Period.

3.3.4 Interest Rates Outputs

Interest Rate outputs are monthly values for: the projected ten points on the Treasury yield curve (1-month, 3-month, 6-month, 1-year, 2-year, 3-year, 5-year, 10-year, 20-year and 30-year); the 21 non-Treasury rates contained in Table 3–27; and the nine points on the Enterprise Cost of Funds curve.

*3.4 Property Valuation*

3.4.1 Property Valuation Overview

[a] The Property Valuation component applies inflation adjustments to the single family house price growth rates and multifamily rent growth rates that are used to determine single family property values and multifamily current debt-service coverage ratios during the up-rate scenario, as required by the 1992 Act.

[b] Single family house price growth rates during the 120 months of the Stress Test are calculated from the HPI series for the West South Central Census Division for the years 1984–1993, as derived from OFHEO's Third Quarter, 1996 HPI Report. The West South Central Census Division includes Texas and all of the Benchmark states except Mississippi. This series is applied to single family loans nationwide during the Stress Test because the 1992 Act applies a regional loss experience (the BLE) to the entire nation. In contrast, house prices are brought forward to the start of the Stress Test based on local Census Division HPI values available at the start of the Stress Test.

[c] Multifamily rent growth rates during the 120 months of the Stress Test are computed using a population-weighted average of the monthly growth of the Rent of Primary Residence component of the Consumer Price Index-Urban, which is generated by the U.S. Department of Labor Bureau of Labor Statistics. The metropolitan areas used for this computation are the Dallas/Ft. Worth CMSA, the Houston/Galveston/Brazoria CMSA, and the New Orleans MSA.

[d] Multifamily rental vacancy rates during the 120 months of the Stress Test are computed using a population-weighted average of annual rental vacancy rates from the U.S. Department of Commerce, Bureau of the Census' Housing Vacancy Survey. The metropolitan areas used for this computation are the Dallas, Houston and Fort Worth PMSAs and the San Antonio, New Orleans and Oklahoma City MSAs.

[e] *Inflation adjustment.* In the up-rate scenario, if the ten-year CMT rises more than 50 percent above the average yield during the nine months preceding the Stress Period, rent and house price growth rates are adjusted to account for inflation as required by the 1992 Act. The single family House Price Growth Rates and the multifamily Rent Growth Rates are increased by the amount by which the ten-year CMT exceeds 50 percent of its annualized monthly yield averaged over the nine months preceding the Stress Test. The inflation adjustment is applied only in the last 60 months of the Stress Period.

3.4.2 Property Valuation Inputs

The inputs required for the Property Valuation component are set forth in Table 3–28.

TABLE 3–28—PROPERTY VALUATION INPUTS

| Variable | Description | Source |
|---|---|---|
| $CMT10_m$ | 10-year CMT yield for months m = 1...20 of the Stress Test | section 3.3, Interest Rates |
| $ACMT_0$ | Unweighted nine-month average of the ten-year CMT yield for the nine months immediately preceding the Stress Test. (Monthly rates are unweighted monthly averages of daily rates, bond equivalent yield) | section 3.3, Interest Rates |
| $HHPGR_q^{HSP}$ | Quarterly single family historical house price growth rates computed from the HPI series for the Benchmark region and time period, unadjusted for inflation. The specific series is the West South Central Census Division for the years 1984–1993, as reported in OFHEO's Third Quarter, 1996 HPI Report. | Table 3–19 of section 3.1.3, Public Data. |
| $RG_m^{HSP}$ | Multifamily Rent Growth Rates for months m = 1...120 of the Benchmark region and time period, unadjusted for inflation | Table 3–20 of section 3.1.3, Public Data. |
| $RVR_m^{HSP}$ | Multifamily Rental Vacancy Rates for months m = 1...120 of the Benchmark region and time period | Table 3–20 of section 3.1.3, Public Data. |

3.4.3 Property Valuation Procedures for Inflation Adjustment

[a] Calculate inflation-adjusted House Price Growth Rates and Rent Growth Rates using the following six steps:

1. Calculate the Inflation-Adjustment (IA) for the up-rate stress test, as follows:

$$IA = max\begin{bmatrix} CMT10^{MAX} \\ -(1.50 \times ACMT_0), 0 \end{bmatrix}$$

Where:

$CMT10^{MAX}$ is the value of the ten-year CMT during the last 108 months of the up-rate Stress Test.

2. The Inflation Adjustment (IA) is compounded annually over 9 years and 2 months (110 months) to obtain the Cumulative Inflation Adjustment (CIA) according to the following equation:

$$CIA = (1 + IA)^{\frac{110}{12}}$$

3. For single family house prices, convert the CIA to continuously compounded quarterly factors, the Quarterly House Price Growth Adjustments ($QHGA_q$), which take on positive values only in the last twenty quarters of the Stress Test, using:

$$QHGA_q = \frac{ln(CIA)}{20} \text{ for } q = 21\ldots40 \text{ in the up-rate Stress Test}$$

$$QHGA_q = 0, \text{ otherwise}$$

4. For Multifamily rent growth, the CIA is converted to discrete monthly factors or Monthly Rent Growth Adjustments ($MRGA_m$), and is applied only in the last 60 months of the Stress Test in the up-rate scenario, as follows:

$$MRGA_m = \left[ (CIA)^{\frac{1}{60}} - 1 \right] \text{ for } m = 61...120 \text{ in the up-rate Stress Test}$$

$$MRGA_m = 0, \text{ otherwise}$$

5. Calculate the inflation-adjusted House Price Growth Rates ($HPGR_q$), used in updating single family house prices during the Stress Test:

$$HPGR_q = HHPGR_q^{HSP} + QHGA_q$$

6. Calculate inflation-adjusted Rent Growth Rates ($RGR_m$), used in updating Multifamily debt-service coverage ratios during the Stress Test:

$$RGR_m = RG_m^{HSP} + MRGA_m$$

3.4.4 Property Valuation Outputs

[a] The outputs of the Property Valuation component of the Stress Test are set forth in Table 3–29.

TABLE 3–29—PROPERTY VALUATION OUTPUTS

| Variable | Description |
|---|---|
| $HPGR_q$ | House price growth rates for quarters 1...40 of the Stress Test, adjusted for inflation, if applicable. |
| $RGR_m$ | Multifamily Rent Growth Rates for months m = 1...120 of the Stress Test, adjusted for inflation, if applicable. |
| $RVR_m$ | Multifamily Rental Vacancy Rates for months m = 1...120 of the Stress Test. |

[b] Inflation-adjusted House Price Growth Rates ($HPGR_q$) are inputs to the Single Family Default and Prepayment component of the Stress Test (*see* section 3.6.3.4, of this Appendix). Inflation-adjusted Rent Growth Rates ($RGR_m$) and Rental Vacancy Rates ($RVR_m$) are inputs to the Multifamily Default and Prepayment component (*see* section 3.6.3.5, of this Appendix).

*3.5 Counterparty Defaults*

3.5.1 Counterparty Defaults Overview

The Counterparty Defaults component of the Stress Test accounts for the risk of default by credit enhancement and derivative contract counterparties, corporate securities, municipal securities, and mortgage-related securities. The Stress Test recognizes five rating categories (''AAA'', ''AA'', ''A'', ''BBB'', and ''Below BBB and Unrated'') and establishes appropriate credit loss factors that are applied during the Stress Period. Securities rated below BBB are treated as unrated securities, unless OFHEO determines to specify a different treatment upon a showing by an Enterprise that a different treatment is warranted.

3.5.2 Counterparty Defaults Input

For counterparties and securities, information on counterparty type and the lowest public rating of the counterparty is required. The Stress Test uses credit ratings issued by Nationally Recognized Statistical Rating Organizations (''NRSROs'') to assign rating categories to counterparties and securities. If a counterparty or security has different ratings from different rating agencies, i.e., a ''split rating,'' or has a long-term rating and a short-term rating, then the lower rating is used.

3.5.3 Counterparty Defaults Procedures

[a] Apply the following three steps to determine maximum haircuts:

1. *Identifying Counterparties.* The Stress Test divides all sources of credit risk other than mortgage default into two categories—(1) derivative contract counterparties and (2) non-derivative contract counterparties and instruments. Non-derivative contract counterparties and instruments include mortgage insurance (MI) counterparties, seller-servicers, mortgage-related securities such as mortgage revenue bonds (MRBs) and private label REMICS, and nonmortgage investments such as corporate and municipal bonds and asset-backed securities (ABSs).
2. *Classify Rating Categories.*
   a. Stress Test rating categories are defined as set forth in Table 3–30. Organizations frequently apply modifiers (numerical, plus, minus) to the generic rating classifications. In order to determine the correct mapping, ignore these modifiers except as noted in Table 3–30.

TABLE 3–30—RATING AGENCIES MAPPINGS TO OFHEO RATINGS CATEGORIES

| OFHEO Ratings Category | AAA | AA | A | BBB | Below BBB and Unrated |
|---|---|---|---|---|---|
| Standard & Poor's Long-Term | AAA | AA | A | BBB | Below BBB and Unrated |
| Fitch Long-Term | AAA | AA | A | BBB | Below BBB and Unrated |
| Moody's Long-Term | Aaa | Aa | A | Baa | Below Baa and Unrated |
| Standard & Poor's Short-Term | A–1+ | A–1 | A–2 | A–3 | Below A–3 and Unrated |
| Fitch Short-Term | F–1+ | F–1 | F–2 | F–3 | Below F–3 and Unrated |
| Moody's Short-Term [1] | P–1 | P–1 | P–2 | P–3 | Below P–3 and Unrated |
| Fitch Bank Ratings | A | B | C | D | E |

[1] Any short-term rating that appears in more than one OFHEO category column is assigned the lower OFHEO rating category.

   b. The Stress Test also includes a ratings classification called cash. This includes cash equivalents as defined in FAS 95, Government securities, and securities of the reporting Enterprise.
   c. Unrated, unsubordinated obligations issued by Government Sponsored Enterprises other than the reporting Enterprise are treated as AAA. Unrated seller-servicers are treated as BBB.
3. *Determine Maximum Haircuts.* The Stress Test specifies the Maximum Haircut (i.e., the maximum reduction applied to cash flows during the Stress Test to reflect the default of counterparties or securities) by rating category and counterparty type as shown in Table 3–31. Haircuts for the Below BBB and Unrated category are applied fully starting in the first month of the Stress Test. For nonmortgage instruments, Haircuts for the Below BBB and Unrated category are applied to 100 percent of the principal balance and interest due on the date of the first cash flow. For other categories, Haircuts are phased in linearly over the first 60 months of the Stress Test. The Maximum Haircut is applied in months 60 through 120 of the Stress Period.

TABLE 3–31—STRESS TEST MAXIMUM HAIRCUT BY RATINGS CLASSIFICATION

| Ratings Classification | Derivative Contract Counterparties | Non-Derivative Contract Counterparties or Instruments | Number of Phase-in Months |
|---|---|---|---|
| Cash | 0% | 0% | N/A |
| AAA | 2% | 5% | 60 |
| AA | 4% | 15% | 60 |
| A | 8% | 20% | 60 |
| BBB | 16% | 40% | 60 |
| Below BBB and Unrated | 100% | 100% | 1 |

3.5.4 Counterparty Defaults Outputs

The Maximum Haircut for a given Counterparty Type and Rating Classification is used in section 3.6, Whole Loan Cash Flows, section 3.7, Mortgage-Related Securities Cash Flows, and section 3.8, Nonmortgage Instrument Cash Flows, of this Appendix.

*3.6 Whole Loan Cash Flows*

3.6.1 Whole Loan Cash Flows Overview

[a] *Loan Aggregation.* In the Stress Test calculations (except as described in section 3.6.3.6.4, Mortgage Credit Enhancement, of this Appendix), individual loans having similar characteristics are aggregated into Loan Groups as described in section 3.1.2.1, Whole Loan Inputs, of this Appendix (RBC Report). All individual loans within a Loan Group are considered to be identical for computational purposes. In the discussions in this section, quantities described as ''loan level'' will actually be computed at the Loan Group level.

[b] *Loan Participations.* In some cases, an Enterprise may hold only a *pari passu* fractional ownership interest in a loan. This interest is referred to as a participation, and is specified by the ownership percentage held by the Enterprise (the participation percentage). In such cases, the Unpaid Principal Balance (UPB) and Mortgage Payment reported in the RBC Report will be only the Enterprise's participation percentage of the loan's actual UPB and Mortgage Payment. The actual UPB is not explicitly used in the calculations described in this section 3.6 but it is used in the creation of the RBC Report.

[c] *Retained Loans vs. Sold Loans.* The Stress Test models cash flows from single family and multifamily mortgage loans that are held in portfolio (Retained Loans) and loans that are pooled into Mortgage-Backed Securities (MBSs) that are sold to investors and guaranteed by the Enterprises (Sold Loans). Together, Retained Loans and Sold Loans are referred to as ''Whole Loans.'' The treatment of cash flows for loans not guaranteed by the Enterprises, e.g., loans backing GNMA Certificates and private label MBSs and REMICs, is discussed in section 3.7, Mortgage-Related Securities Cash Flows, of this Appendix.

[d] *Repurchased MBSs.* From time to time an Enterprise may repurchase all or part of one of its own previously issued single-class MBSs for its own securities portfolio. At an Enterprise's option, these ''Repurchased MBSs'' may be reported with the underlying Whole Loans for computation in this section 3.6 rather than in section 3.7, Mortgage-Related Securities Cash Flows, of this Appendix. In such cases, the Enterprise will report the underlying Whole Loans as sold loans, along with the appropriate Fraction Repurchased and any security unamortized balances associated with the purchase of the MBS (not with the original sale of the underlying loans, which unamortized balances are reported separately).

[e] *Sources of Enterprise Whole Loan Cash Flows.* For Retained Loans, the Enterprises receive all principal and interest payments on the loans, except for a portion of the interest payment retained by the servicer as compensation (the Servicing Fee). For Sold Loans, the Enterprises receive Guarantee Fees and Float Income. Float Income is the earnings on the investment of loan principal and interest payments (net of the Servicing Fee and Guarantee Fee) from the time these payments are received from the servicer until they are remitted to security holders. The length of this period depends on the security payment cycle (the remittance cycle). For both retained and sold loans, the Enterprises retain 100 percent of their credit losses and experience amortization of discounts as income and amortization of premiums as expense. For Repurchased MBSs, the Enterprise receives the Fraction Repurchased of the cash flows it remits to investors, and retains 100 percent of the Credit Losses, the Guarantee Fee and the Float Income. *See* section 3.6.3.7, Stress Test Whole Loan Cash Flows and section 3.6.3.8, Whole Loan Accounting Flows, of this Appendix.

[f] *Required Inputs.* The calculation of Whole Loan cash flows requires mortgage Amortization Schedules, mortgage Prepayment, Default and Loss Severity rates, and Credit Enhancement information. The four mortgage performance components of the Stress Test are single family Default and Prepayment, single family Loss Severity, multifamily Default and Prepayment, and multifamily Loss Severity. Mortgage Amortization Schedules are computed from input data in the RBC Report. (For ARMs, selected interest rate indexes from section 3.3, Interest Rates, of this Appendix, are also used.) Prepayment and Default Rates are computed by combining explanatory variables and weighting coefficients according to a set of logistic equations. The explanatory variables are computed from the mortgage Amortization Schedule and external economic variables such as Interest Rates (section 3.3, Interest Rates, of this Appendix), historical house-price indexes (HPIs) or rental-price indexes (RPIs), and Stress Period HPI growth rate, RPI and Vacancy Rate (RVR) series from section 3.4, Property Valuation, of this Appendix. The weighting coefficients determine the relative importance of the different explanatory variables, and are estimated from a statistical analysis of data from the Benchmark Loss region and time period as described in section 1, Identification of the Benchmark Loss Experience, of this Appendix. Mortgage Amortization information is also combined with HPI, RPI and VR series to determine Gross Loss Severity rates, which are offset by Credit Enhancements. Finally, the Amortization Schedules, Default and Prepayment rates and Net Loss Severity rates are combined to produce Stress Test Whole Loan Cash Flows to the Enterprises for each Loan Group, as well as amortization of any discounts, premiums and fees.

[g] *Specification of Mortgage Prepayment.* Mortgages are assumed to prepay in full. The model makes no specific provision for partial Prepayments of principal (curtailments).

[h] *Specification of Mortgage Default and Loss.* Mortgage Defaults are modeled as follows: Defaulting loans enter foreclosure after a number of missed payments (MQ, Months in Delinquency), and are foreclosed upon several months later. Months in Foreclosure (MF) is the total number of missed payments through foreclosure. Upon completion of foreclosure, the loan as such ceases to exist and the property becomes Real Estate Owned by the lender (REO). Foreclosure expenses are paid and MI proceeds received when foreclosure is completed. After several more months (MR, Months in REO), the property is sold, REO expenses are paid, and sales proceeds and other credit enhancements are received. These timing differences are not modeled explicitly in the cash flows, but their economic effect is taken into account by calculating the present value of the Default-related cash flows back to the initial month of Default.

[i] *Combining Cash Flows from Scheduled Payments, Prepayments and Defaults.* Aggregate Whole Loan Cash Flows, adjusted for the effects of mortgage performance, are based on the following conceptual equation,

which is made more explicit in the calculations in the sections specified in section 3.6.2 of this Appendix:

$$\begin{bmatrix}\text{Aggregate Cash Flows from}\\ \text{Whole Loans that Default}\\ \text{and Prepay at Rates that}\\ \text{vary in each month m}\end{bmatrix} = \begin{bmatrix}\begin{pmatrix}\text{scheduled Mortgage}\\ \text{Payment}\end{pmatrix}\times \begin{pmatrix}\text{fraction of loans that remain}\\ \text{on original schedule}\end{pmatrix}\\ \text{plus}\\ \begin{pmatrix}\text{entire loan UPB plus}\\ \text{final interest payment}\end{pmatrix}\times \begin{pmatrix}\text{fraction of loans that}\\ \text{Prepay in month m}\end{pmatrix}\\ \text{plus}\\ \begin{pmatrix}\text{present value of Default-related}\\ \text{receipts minus expenses}\end{pmatrix}\times \begin{pmatrix}\text{fraction of loans that}\\ \text{Default in month m}\end{pmatrix}\end{bmatrix}$$

3.6.2 Whole Loan Cash Flows Inputs

Inputs for each stage of the Whole Loan Cash Flows calculation are found in the following sections:

- Section 3.6.3.3.2, Mortgage Amortization Schedule Inputs
- Section 3.6.3.4.2, Single Family Default and Prepayment Inputs
- Section 3.6.3.5.2, Multifamily Default and Prepayment Inputs
- Section 3.6.3.6.2.2, Single Family Gross Loss Severity Inputs
- Section 3.6.3.6.3.2, Multifamily Gross Loss Severity Inputs
- Section 3.6.3.6.4.2, Mortgage Credit Enhancement Inputs
- Section 3.6.3.7.2, Stress Test Whole Loan Cash Flow Inputs
- Section 3.6.3.8.2, Whole Loan Accounting Flows Inputs, of this Appendix

3.6.3 Whole Loan Cash Flows Procedures

3.6.3.1 Timing Conventions

[a] *Calculations are monthly.* The Stress Test operates monthly, with all events of a given type assumed to take place on the same day of the month. For mortgages, unless otherwise specified, all payments and other mortgage-related cash flows that are due on the first day of the month are received on the fifteenth. Biweekly loans are mapped into their closest term-equivalent monthly counterpart.

[b] *''Time Zero'' for Calculations.* Time Zero refers to the beginning of the Stress Test. For example, if the 2Q2000 Stress Test uses Enterprise Data as of June 30, ''month zero'' represents conditions as of June 30, the Stress Period begins July 1, and July 2000 is month one of the Stress Test. In this document, $UPB_0$ is the Unpaid Principal Balance of a loan immediately prior to (as of) the start of the Stress Test, i.e. as reported by the Enterprise in the RBC Report. Origination refers to the beginning of the life of the loan, which will be prior to the start of the Stress Test for all loans except those delivered later under Commitments, for which Origination refers to the delivery month (*See* section 3.2, Commitments, of this Appendix).

[c] *Definition of Mortgage Age.* The Mortgage Age at a given time is the number of scheduled mortgage payment dates that have occurred prior to that time, whether or not the borrower has actually made the payments. Prior to the first payment date, the Mortgage Age would be zero. From the first payment date until (but not including) the second loan payment date, the Mortgage Age would be one. The Mortgage Age at Time Zero ($A_0$) is thus the number of scheduled loan payment dates that have occurred prior to the start of the Stress Test. The scheduled payment date for all loans is assumed to be the first day of each month; therefore, the Mortgage Age will be $A_1$ on the first day of the Stress Test (except for Commitments that are delivered after the start of the Stress Test).

[d] *Interest Rate Setting Procedure.* Mortgage interest is due in arrears, i.e., on the first day following the month in which it is accrued. Thus, a payment due on the first day of month m is for interest accrued during the *prior* month. For example, for Adjustable Rate Mortgages (ARMs) the Mortgage Interest Rate ($MIR_m$) applicable to the July reset is set on the first day of June, and is generally based on the May or April value of the underlying Index, as specified in the loan terms. This Lookback Period (LB) is specified in the Stress Test as a period of one or two months, respectively. Thus, $PMT_m$ will be based on $MIR_m$, which is based on $INDEX_{m-1-LB}$.

[e] *Prepayment Interest Shortfall.* In some remittance cycles, the period between an Enterprise's receipt of Prepayments and transmittal to investors exceeds a full month. In those cases, the Enterprise must remit an additional month's interest (at the Pass-Through Rate) to MBS investors. *See* section 3.6.3.7.3, Stress Test Whole Loan Cash Flow Procedures, of this Appendix.

[f] *Certain Calculations Extend Beyond the End of the Stress Test.* Even though the Stress Test calculates capital only through the ten year Stress Period, certain calculations (for example, the level yield amortization of discounts, premiums and fees, as described in section 3.10, Operations, Taxes, and Accounting, of this Appendix) require cash flows throughout the life of the instrument. For such calculations in the Stress Test, the conditions of month 120 are held constant throughout the remaining life of the instrument: specifically, Interest Rates (which are already held constant for months 13 through 120), Prepayment and Default rates for months m > 120 are taken to be equal to their respective values in month 120.

3.6.3.2 Payment Allocation Conventions

3.6.3.2.1 Allocation of Mortgage Interest

[a] *Components of Mortgage Interest.* The interest portion of the Mortgage Payment is allocated among several components. For all Whole Loans, a Servicing Fee is retained by the servicer. For Sold Loans, the Enterprise retains a Guarantee Fee. An additional amount of interest (Spread) [1] may be deposited into a Spread Account to reimburse potential future credit losses on loans covered by this form of Credit Enhancement, as described further in section 3.6.3.6.4, Mortgage Credit Enhancement, of this Appendix. The remaining interest amount is either retained by the Enterprise (Net Yield on Retained Loans) or passed through to MBS investors (Pass-Through Interest on Sold Loans).

[b] *Effect of Negative Amortization.* If the Mortgage Payment is contractually limited to an amount less than the full amount accrued (as may be the case with loans that permit Negative Amortization), then the Servicing Fee, the Guarantee Fee and the spread are paid in full, and the shortfall is borne entirely by the recipient of the Net Yield or Pass-Through Interest.

[c] *Effect of Variable Rates.* For ARMs, the Servicing Fee, Guarantee Fee and Spread rates are taken to be constant over time, as they are for Fixed Rate Loans. Thus in the Stress Test the Mortgage Interest Rate and the Net Yield or Pass-through Rate will change simultaneously by equal amounts. All other details of the rate and payment reset mechanisms are modeled in accordance with the contractual terms using the inputs specified in section 3.6.3.3.2, Mortgage Amortization Schedule Inputs, of this Appendix.

3.6.3.2.2 Allocation of Mortgage Principal

[a] Scheduled Principal is that amount of the mortgage payment that amortizes principal. For calculational purposes, when a loan prepays in full the amount specified in the Amortization Schedule is counted as Scheduled Principal, and the rest is Prepayment Principal. For a Balloon Loan, the final Balloon Payment includes the remaining UPB, all of which is counted as Scheduled Principal.

[b] Mortgages that prepay are assumed to prepay in full. Partial Prepayments (curtailments) are not modeled.

[c] Any loan that does not prepay or Default remains on its original Amortization Schedule.

3.6.3.3 Mortgage Amortization Schedule

3.6.3.3.1 Mortgage Amortization Schedule Overview

[a] The Stress Test requires an Amortization Schedule for each Loan Group. A mortgage is paid down, or amortized over time, to the extent that the contractual mortgage payment exceeds the amount required to cover interest due.

[b] *Definitions.*

1. *Fully Amortizing Loans.* The Amortization Schedule for a mortgage with age $A_0$ at the beginning of the Stress Test is generated using the starting UPB ($UPB_0$), the Remaining Term to Maturity (RM), the remaining Amortization Term ($AT - A_0$), the remaining Mortgage

[1] The spread may or may not be embedded in the recorded Servicing Fee.

Payments ($PMT_m$ for m = 1...RM) and Mortgage Interest Rates ($MIR_m$ for m = 1...RM). The Amortization Schedule is generated by repeating the following three steps iteratively until the UPB is zero:

a. Interest Due = UPB × Mortgage Interest Rate
b. Principal Amortization = Payment − Interest Due
c. Next period's UPB = UPB − Principal Amortization

2. *Balloon Loans.* A Balloon Loan matures prior to its Amortizing Term, i.e. before the UPB is fully amortized to zero. Computationally, $AT - A_0 > RM$, usually by at least 180 months. In order that $UPB_{RM} = 0$, the principal component of the resulting lump sum final payment (the Balloon Payment, equal to $UPB_{RM-1}$) is counted as Scheduled Principal, not as a Prepayment.

[c] *Special Cases.* In general the UPB of a mortgage decreases monotonically over time, i.e. $UPB_m > UPB_{m+1}$, reaching zero at maturity except for Balloon Loans as described in [b]2. in this section. However, in practice certain exceptions must be handled.

1. *Interest-Only Loans.* Certain loans are interest-only for all or part of their term. The monthly payment covers only the interest due, and the UPB stays constant until maturity (in some cases), in which case a Balloon Payment is due or a changeover date (in other cases) at which time the payment is recast so that the loan begins to amortize over its remaining term. If the loan does not amortize fully over its remaining term, a Balloon Payment will be due at maturity.
2. *Negative Amortization.* For some loans, the UPB may increase for a period of time if the mortgage payment is contractually limited to an amount that is less than the amount of interest due, and the remainder is added to the UPB. At some point, however, the payment must exceed the interest due or else the loan balance will never be reduced to zero. In the calculation, this is permitted to occur only for payment-capped ARMs that contractually specify negative amortization. Certain types of FRMs, notably Graduated Payment Mortgages (GPMs) and Tiered Payment Mortgages (TPMs), also have variable payment schedules that result in negative amortization, but in the Stress Test all such loans are assumed to have passed their negative amortization periods.
3. *Early Amortization.*
   a. If a borrower has made additional principal payments (curtailments or partial prepayments) on a FRM prior to the start of the Stress Test, the contractual mortgage payment will amortize the loan prior to its final maturity, i.e. $UPB_m = 0$ for some m < RM. *This is an acceptable outcome in the Stress Test. Note:* for ARMs, the mortgage payment is recalculated, and thus the amortization schedule is recast to end exactly at m = RM, on each rate or payment reset date.
   b. When this calculation is performed for a fully amortizing FRM using weighted average values to represent a Loan Group, the final scheduled payment may exceed the amount required to reduce the UPB to zero, or the UPB may reach zero prior to month RM. This is because the mortgage payment calculation is nonlinear, and as a result the average mortgage payment is not mathematically guaranteed to amortize the average UPB using the average MIR. This is an acceptable outcome in the Stress Test.
4. *Late Amortization.* According to its contractual terms, the UPB of a mortgage loan must reach zero at its scheduled maturity. The borrower receives a disclosure schedule that explicitly sets forth such an Amortization Schedule. If the characteristics of a mortgage loan representing a Loan Group in the RBC Report do not result in $UPB_{RM} = 0$, it must be for one of three reasons: a data error, an averaging artifact, or an extension of the Amortization Schedule related to a delinquency prior to the start of the Stress Test. In any such case, the Stress Test does not recognize cash flows beyond the scheduled maturity date and models the performing portion of $UPB_{RM}$ in month RM as a credit loss.

[d] *Biweekly Loans.* Biweekly loans are mapped into the FRM category that most closely approximates their final maturity.

[e] *Step-Rate (or ''Two-Step'') Loans.* Certain loans have an initial interest rate for an extended period of time (typically several years) and then ''step'' to a final fixed rate for the remaining life of the loan. This final fixed rate may be either a predetermined number or a margin over an index. Such loans can be exactly represented as ARMs with the appropriate Initial Mortgage Interest Rate and Initial Rate Period, Index and Margin (if applicable). If the final rate is a predetermined rate (e.g., 8 percent per annum) then the ARM's Maximum and Minimum Rate should be set to that number. The Rate and Payment Reset Periods should be set equal to the final rate period after the step.

3.6.3.3.2 Mortgage Amortization Schedule Inputs

The inputs needed to calculate the amortization schedule are set forth in Table 3–32:

TABLE 3–32—LOAN GROUP INPUTS FOR MORTGAGE AMORTIZATION CALCULATION

| Variable* | Description | Source |
|---|---|---|
| | Rate Type (Fixed or Adjustable) | RBC Report |
| | Product Type (30/20/15-Year FRM, ARM, Balloon, Government, etc.) | RBC Report |
| $UPB_{ORIG}$ | Unpaid Principal Balance at Origination (aggregate for Loan Group) | RBC Report |
| $UPB_0$ | Unpaid Principal Balance at start of Stress Test (aggregate for Loan Group) | RBC Report |
| $MIR_0$ | Mortgage Interest Rate for the Mortgage Payment prior to the start of the Stress Test, or Initial Mortgage Interest Rate for new loans (weighted average for Loan Group) (expressed as a decimal per annum) | RBC Report |
| $PMT_0$ | Amount of the Mortgage Payment (Principal and Interest) prior to the start of the Stress Test, or first payment for new loans (aggregate for Loan Group) | RBC Report |
| AT | Original loan Amortizing Term in months (weighted average for Loan Group) | RBC Report |
| RM | Remaining term to Maturity in months (i.e., number of contractual payments due between the start of the Stress Test and the contractual maturity date of the loan) (weighted average for Loan Group) | RBC Report |
| $A_0$ | Age *immediately prior to* the start of the Stress Test, in months (weighted average for Loan Group) | RBC Report |
| Additional Interest Rate Inputs | | |
| GFR | Guarantee Fee Rate (weighted average for Loan Group) (decimal per annum) | RBC Report |
| SFR | Servicing Fee Rate (weighted average for Loan Group) (decimal per annum) | RBC Report |
| Additional Inputs for ARMs (weighted averages for Loan Group, except for Index) | | |

TABLE 3–32—LOAN GROUP INPUTS FOR MORTGAGE AMORTIZATION CALCULATION—Continued

| Variable* | Description | Source |
|---|---|---|
| $INDEX_M$ | Monthly values of the contractual Interest Rate Index | section 3.3, Interest Rates |
| LB | Look-Back period, in months | RBC Report |
| MARGIN | Loan Margin (over index), decimal per annum | RBC Report |
| RRP | Rate Reset Period, in months | RBC Report |
| | Rate Reset Limit (up and down), decimal per annum | RBC Report |
| | Maximum Rate (life cap), decimal per annum | RBC Report |
| | Minimum Rate (life floor), decimal per annum | RBC Report |
| NAC | Negative Amortization Cap, decimal fraction of $UPB_{ORIG}$ | RBC Report |
| | Unlimited Payment Reset Period, in months | RBC Report |
| PRP | Payment Reset Period, in months | RBC Report |
| | Payment Reset Limit, as decimal fraction of prior payment | RBC Report |
| IRP | Initial Rate Period, in months | RBC Report |
| Additional Inputs for Multifamily Loans | | |
| | Interest-only Flag | RBC Report |
| RIOP | Remaining Interest-only period, in months (weighted average for loan group) | RBC Report |

*Variable name is given when used in an equation

3.6.3.3.3 Mortgage Amortization Schedule Procedures

[a] For each Loan Group, calculate a mortgage Amortization Schedule using the inputs in Table 3–32 and the following ten steps. *Note:* Do not round dollar amounts to the nearest penny.)

For months m = 1...RM, calculate quantities for month m based on values from month m − 1 as follows:

1. Calculate current month's Mortgage Interest Rate ($MIR_m$).
   a. For FRMs: $MIR_m = MIR_0$ for all m = 1 to RM
   b. For ARMs, use the following procedure:
   1) If RRP = PRP then month m is a rate reset month if:

$$\left[A_0 + m - (IRP + 1)\right] \textit{mod}\ RRP = 0$$

$$\text{and} \quad A_0 + m - 1 \geq IRP$$

   2) If RRP ≠ PRP then month m is a rate reset month if either:
   a) $A_0 + m - (IRP + 1) = 0$, or
   b) $[A_0 + m - 1]$ *mod* RRP = 0 and $A_0 + m - 1 \geq IRP$
   3) If m is a rate reset month, then:

$$MIR_m = INDEX_{m-1-LB} + MARGIN,$$

   *but not greater than* $MIR_{m-1}$ + Rate Reset Limit
   *nor less than* $MIR_{m-1}$ − Rate Reset Limit
   *and in no case greater than* Maximum Rate
   *and in no case less than* Minimum Rate
   4) If month m is not a rate reset month, then $MIR_m = MIR_{m-1}$.
   c. In all cases, $MIR_m = MIR_{120}$ for m > 120, and $MIR_m = 0$ for m > RM.
2. Calculate current month's Payment ($PMT_m$).
   a. For FRMs:
   1) For Interest-Only Loans, if m = RIOP + 1 then month m is a reset month; recompute $PMT_m$ as described for ARMs in step b.4)b), of this section without applying any payment limit.
   2) $PMT_m = PMT_0$ for all m = 1 to RM
   b. For ARMs, use the following procedure:
   1) For Interest Only Loans, if m = RIOP + 1 then month m is a payment reset month.
   2) If PRP = RRP, then month m is a payment reset month if m is also a rate reset month.
   3) If PRP ≠ RRP then month m is a payment reset month if:

$$\left[A_0 + m - 1\right] \textit{mod}\ PRP = 0$$

   4) If month m is a payment reset month, then:
   a) For loans in an Interest-only Period,

$$PMT_m = UPB_{m-1} \times \frac{MIR_m}{12}$$

   b) Otherwise, $PMT_m$ = the amount that will fully amortize the Loan over its remaining Amortizing Term (i.e. $AT - A_o - m + 1$ months) with a *fixed* Mortgage Interest Rate equal to $MIR_m$ as determined in Step 1 of this section
   *but not greater than* $PMT_{m-1} \times (1 +$ Payment Reset Limit Up)
   *nor less than* $PMT_{m-1} \times (1 -$ Payment Reset Limit Down)
   *unless* month m is the month following the end of an Unlimited Payment Reset Period, in which case $PMT_m$ is not subject to any reset limitations.
   5) If month m is not a payment reset month, then $PMT_m = PMT_{m-1}$
   6) If, in any month,

$$UPB_{m-1} \times \left(1 + \frac{MIR_m}{12}\right) - PMT_m > UPB_{ORIG} \times NAC,$$

   then recalculate $PMT_m$ without applying any Payment Reset Limit.
   c. For Balloon Loans, or for loans that have RIOP = RM, if m = RM then:

$$PMT_m = UPB_{m-1} \times \left(1 + \frac{MIR_m}{12}\right)$$

   d. In all cases, $PMT_m$ should amortize the loan within the Remaining Maturity:

$$PMT_m = 0 \text{ for } m > RM \text{ or after } UPB_m = 0$$

3. Determine Net Yield Rate ($NYR_m$) and, for sold loans, Pass-Through Rate ($PTR_m$) applicable to the $m^{th}$ payment:

$$NYR_m = MIR_m - SFR$$

$$PTR_m = NYR_m - GFR$$

4. Calculate Scheduled Interest Accrued (during month m − 1) on account of the $m^{th}$ payment ($SIA_m$)

$$SIA_m = UPB_{m-1} \times \frac{MIR_m}{12}$$

5. Calculate the Scheduled Interest component of the $m^{th}$ payment ($SI_m$)

$$SI_m = \textit{min}\left(SIA_m,\ PMT_m\right)$$

6. Calculate Scheduled Principal for the $m^{th}$ payment ($SP_m$):

$$SP_m = \textit{min}\left(PMT_m - SIA_m,\ UPB_{m-1}\right)$$

*Note:* Scheduled Principal should not be greater than the remaining UPB. SPM can be

negative if the Scheduled Payment is less than Scheduled Interest Accrued.

7. Calculate Loan Unpaid Principal Balance after taking into account the $m^{th}$ monthly payment ($UPB_m$):

$$UPB_m = max\left(UPB_{m-1} - SP_m,\ 0\right)$$

8. In the month when $UPB_m$ is reduced to zero, reset

$$PMT_m = UPB_{m-1} \times \left(1 + \frac{MIR_m}{12}\right)$$

9. Repeat all steps for m = 1...RM or until $UPB_m = 0$.

*Note:* If $UPB_{RM}$ is greater than zero, the performing portion is included in Credit Losses (section 3.6.3.7.3, Stress Test Whole Loan Cash Flow Procedures, of this Appendix).

10. Determine Net Yield Rate ($NYR_o$) and, for sold loans, Pass-Through Rate ($PTR_o$) for month 0:

$$NYR_0 = MIR_0 - SFR$$

$$PTR_0 = NYR_0 - GFR$$

3.6.3.3.4 Mortgage Amortization Schedule Outputs

The Mortgage Amortization Schedule Outputs set forth in Table 3–33 are used in section 3.6.3.4, Single Family Default and Prepayment Rates, section 3.6.3.5, Multifamily Default and Prepayment Rates, section 3.6.3.6, Calculation of Single Family and Multifamily Mortgage Losses, section 3.6.3.7, Stress Test Whole Loan Cash Flows, and section 3.6.3.8, Whole Loan Accounting Flows, of this Appendix.

TABLE 3–33—MORTGAGE AMORTIZATION SCHEDULE OUTPUTS

| Variable | Description |
|---|---|
| $UPB_m$ | Unpaid Principal Balance for months m=1...RM |
| $MIR_m$ | Mortgage Interest Rate for months m=1...RM |
| $NYR_m$ | Net Yield Rate for months m=1...RM |
| $PTR_m$ | Passthrough Rate for months m=1...RM |
| $SP_m$ | Scheduled Principal (Amortization) for months m=1...RM |
| $SI_m$ | Scheduled Interest for months m=1...RM |
| $PMT_m$ | Scheduled Mortgage Payment for months m=1...RM |

3.6.3.4 Single Family Default and Prepayment Rates

3.6.3.4.1 Single Family Default and Prepayment Overview

[a] The Stress Test projects conditional Default and Prepayment rates for each single family Loan Group for each month of the Stress Period. The conditional rate is the percentage (by principal balance) of the remaining loans in a Loan Group that defaults or prepays during a given period of time. Computing Default and Prepayment rates for a Loan Group requires information on the Loan Group characteristics at the beginning of the Stress Test, historical and projected interest rates from section 3.3, Interest Rates, and house price growth rates and volatility measures from section 3.4, Property Valuation, of this Appendix.

[b] *Explanatory Variables.* Several explanatory variables are used in the equations to determine Default and Prepayment rates for single family loans: Mortgage Age, Original Loan-to-Value (LTV) ratio, Probability of Negative Equity, Burnout, the percentage of Investor-owned Loans, Relative Interest Rate Spread, Payment Shock (for ARMs only), Initial Rate Effect (for ARMs only), Yield Curve Slope, Relative Loan Size, and Mortgage Product Type. Regression coefficients (weights) are associated with each variable. All of this information is used to compute conditional quarterly Default and Prepayment rates throughout the Stress Test. The quarterly rates are then converted to monthly conditional Default and Prepayment rates, which are used to calculate Stress Test Whole Loan cash flows and Default losses. *See* section 3.6.3.7, Stress Test Whole Loan Cash Flows, of this Appendix.

[c] The regression coefficients for each Loan Group will come from one of three models. The choice of model will be determined by the values of the single family product code and Government Flag in the RBC Report. *See* section 3.6.3.4.3.2, Prepayment and Default Rates and Performance Fractions, of this Appendix.

[d] *Special Provision for Accounting Calculations.* For accounting calculations that require cash flows over the entire remaining life of the instrument, Default and Prepayment rates for months beyond the end of the Stress Test are held constant at their values for month 120.

3.6.3.4.2 Single Family Default and Prepayment Inputs

The information in Table 3–34 is required for each single family Loan Group:

TABLE 3–34—SINGLE FAMILY DEFAULT AND PREPAYMENT INPUTS

| Variable | Description | Source |
|---|---|---|
| PROD | Mortgage Product Type | RBC Report |
| $A_0$ | Age *immediately prior to* start of Stress Test, in months (weighted average for Loan Group) | RBC Report |
| $LTV_{ORIG}$ | Loan-to-Value ratio at Origination (weighted average for Loan Group) | RBC Report |
| $UPB_{ORIG}$ | UPB at Origination (aggregate for Loan Group) | RBC Report |
| $MIR_{ORIG}$ | Mortgage Interest Rate at Origination (''Initial Rate'' for ARMs), decimal per annum (weighted average for loan group) | RBC Report |
| $UPB_0$ | Unpaid Principal Balance immediately prior to start of Stress Test (aggregate for Loan Group) | RBC Report |
| $UPB_m$ | Unpaid Principal Balance in months m = 1...RM | section 3.6.3.3.4, Mortgage Amortization Schedule Outputs |

TABLE 3–34—SINGLE FAMILY DEFAULT AND PREPAYMENT INPUTS—Continued

| Variable | Description | Source |
|---|---|---|
| $MIR_m$ | Mortgage Interest Rate in months m = 1...RM (weighted average for Loan Group) | section 3.6.3.3.4, Mortgage Amortization Schedule Outputs |
| $MCON_m$ | Conventional (30 Year Fixed-Rate) Mortgage Rate series projected for months 1...RM and for the 24 months prior to the start of the Stress Test | section 3.3.2, Interest Rates Inputs, and section 3.3.4, Interest Rates Outputs |
| $T12Y_m$ | 1-year CMT series projected for months 1...120 of the Benchmark region and time period | section 3.3.4, Interest Rates Outputs |
| $T120Y_m$ | 10-year CMT series projected for months 1...120 of the Benchmark region and time period | section 3.3.4, Interest Rates Outputs |
| $HPGR_q$ | Vector of House Price Growth Rates for quarters q = 1...40 of the Stress Period | section 3.4.4, Property Valuation Outputs |
| $CHPGF_0^{LG}$ | Cumulative House Price Growth Factor since Loan Origination (weighted average for Loan Group) | RBC Report |
| α, β | HPI Dispersion Parameters for the Stress Period (Benchmark Census Division, currently West South Central Census Division, as published in the OFHEO House Price Report for 1996:3) | α = 0.002977<br>β = −0.000024322 |
| IF | Fraction (by UPB, in decimal form) of Loan Group backed by Investor-owned properties | RBC Report |
| $RLS_{ORIG}$ | Weighted average Relative Loan Size at Origination (Original UPB as a fraction of average UPB for the state and Origination Year of loan origination) | RBC Report |

3.6.3.4.3 Single Family Default and Prepayment Procedures

3.6.3.4.3.1 Single Family Default and Prepayment Explanatory Variables

[a] Compute the explanatory variables for single family Default and Prepayment in the seven steps as follows:

1. Calculate $A_q$, the loan Age in quarters, for quarter q:

$$A_q = int\left(\frac{A_0}{3}\right) + q,$$

Where:

*int* means to round to the lower integer if the argument is not an integer.

2. Calculate $PNEQ_q$, the Probability of Negative Equity in quarter q:

$$PNEQ_q = N\left(\frac{ln LTV_q}{s_q}\right),$$

Where:

N designates the cumulative normal distribution function.

a. $LTV_q$ is evaluated for a quarter q as:

$$LTV_q = LTV_{ORIG} \times \frac{\begin{pmatrix}\text{Ratio of current}\\ \text{Loan Group UPB}\\ \text{to Original UPB}\end{pmatrix}}{\begin{pmatrix}\text{Ratio of current property}\\ \text{value (based on HPI in}\\ \text{quarter q) to original}\\ \text{property value (based on}\\ \text{HPI at Origination)}\end{pmatrix}}$$

The HPI at Origination is updated to the beginning of the Stress Test using actual historical experience as measured by the OFHEO HPI; and then updated within the Stress Test using House Price Growth Factors from the Benchmark region and time period:

$$LTV_q = LTV_{ORIG} \times \frac{\left(\frac{UPB_{m=3q-3}}{UPB_{ORIG}}\right)}{\left[CHPGF_0^{LG} \times exp\left(\sum_{k=1}^{q} HPGR_k\right)\right]}$$

Where:

$UPB_{m=3q-3}$ = UPB for the month at the end of the quarter prior to quarter q

b. Calculate the Dispersion of House Prices for loans in quarter q of the Stress Test ($\sigma_q$) as follows:

$$\sigma_q = \sqrt{\alpha A'_q + \beta A'^2_q}$$

Where:

α and β are obtained from Table 3–34 and

$$A'_q = min\left(A_q, -\frac{\alpha}{2\beta}\right)$$

3. Calculate $B_q$, the Burnout factor in quarter q. A loan's Prepayment incentive is ''burned out'' (i.e., reduced) if, during at least two of the previous eight full quarters, the borrower had, but did not take advantage of, an opportunity to reduce his or her mortgage interest rate by at least two percentage points. For this purpose, the mortgage interest rate is compared with values of the Conventional Mortgage Rate (MCON) Index.

a. Compare mortgage rates for each quarter of the Stress Test and for the eight quarters prior to the start of the stress test (q = −7, −6, ...0, 1, ...30):

$$b_q = 1 \text{ if } MCON_m + 0.02 \le MIR_m \text{ for all three months in quarter q (i.e., } m = 3q-2,\ 3q-1,\ 3q),$$

$$b_q = 0 \text{ otherwise}$$

*Note:* For this purpose, $MCON_m$ is required for the 24 months (eight quarters) prior to the start of the Stress Test. Also, $MIR_m = MIR_o$ for m <0.

b. Determine whether the loan is ''burned out'' in quarter q (Burnout Flag, $B_q^f$):

$$B_q^f = 1 \text{ if } b_{q'} = 1 \text{ for two or more quarters } q' \text{ between q-8 and q-1 inclusive, or since Origination if } 2 < A_q < 8 \text{ (Note: by definition, } B_q = 0 \text{ if } A_q < 3);$$

$$B_q^f = 0 \text{ otherwise}$$

Where:

q′ = index variable for prior 8 quarters

c. Adjust for recently originated loans as follows:

$$\begin{aligned} B_q &= 0.25 \times B_q^f \text{ if } A_q = 3 \text{ or } 4 \\ &= 0.50 \times B_q^f \text{ if } A_q = 5 \text{ or } 6 \\ &= 0.75 \times B_q^f \text{ if } A_q = 7 \text{ or } 8 \\ &= B_q^f \text{ otherwise} \end{aligned}$$

4. Calculate $RS_q$, the Relative Spread in quarter q, as the average value of the monthly Relative Spread of the Original mortgage interest rate to the Conventional (30-Year Fixed Rate) Mortgage Rate series for the three months in the quarter.

*Note:* Use the Current MIR for Fixed Rate Loans and the Original MIR for Adjustable Rate Loans.

$$RS_q = avg\left(\frac{MIR - MCON_m}{MIR}\right)$$

over all three months m in quarter q

If MIR = 0, then $RS_q = -0.20$ for all q.

5. Calculate $YCS_q$, the Yield Curve Slope in quarter q, as the average of the monthly ratio of the 10-Year CMT to the One-Year CMT for the three months in the quarter:

$$YCS_q = avg\left(\frac{T120Y_m}{T12Y_m}\right)$$

for all three months in quarter q

6. Evaluate the Payment Shock Indicator ($PS_q$) for ARMs only:

$$PS_q = RS_q \text{ if } PROD = ARM$$

7. Evaluate the Initial Rate Effect Flag ($IREF_q$) for ARMS only:

$$IREF_q = 1 \text{ if } A_q \le 12 \text{ and } PROD = ARM$$
$$= 0 \text{ otherwise}$$

3.6.3.4.3.2 Prepayment and Default Rates and Performance Fractions

[a] Calculate Prepayment and Default Rates and Performance Fractions using the following five steps:

1. Compute the logits for Default and Prepayment using the formulas for simultaneous processes using inputs from Table 3–34 and explanatory variable coefficients in Table 3–35.

*Note:* $\beta_{BCal_{LTV}}$ is the LTV-specific constant used to calibrate the Default rates to the BLE.

$$X\beta_q = \beta_{A_q} + \beta_{LTV_{ORIG}} + \beta_{PNEQ_q} + \beta_{B_q}B_q + \beta_{IF}IF + \beta_{PS_q} + \beta_{IREF} \times IREF_q + \beta_{Prod} + \beta_{BCal_{LTV}} + \beta_0$$

$$X\gamma_q = \gamma_{A_q} + \gamma_{LTV_{ORIG}} + \gamma_{PNEQ_q} + \gamma_{B_q}B_q + \gamma_{IF}IF + \gamma_{RS_q} + \gamma_{PS_q} + \gamma_{YCS_q} + \gamma_{IREF} \times IREF_q + \gamma_{RLS_{ORIG}} + \gamma_{Prod} + \gamma_0$$

TABLE 3–35—COEFFICIENTS FOR SINGLE FAMILY DEFAULT AND PREPAYMENT EXPLANATORY VARIABLE

| Explanatory Variable (V) | 30-Year Fixed-Rate Loans | | Adjustable-Rate Loans (ARMs) | | Other Fixed-Rate Loans | |
|---|---|---|---|---|---|---|
| | Default Weight ($\beta_v$) | Pre-payment Weight ($\gamma_v$) | Default Weight ($\beta_v$) | Pre-payment Weight ($\gamma_v$) | Default Weight ($\beta_v$) | Pre-payment Weight ($\gamma_v$) |
| $A_q$ | | | | | | |
| $0 \le A_q \le 4$ | −0.6276 | −0.6122 | −0.7046 | −0.5033 | −0.7721 | −0.6400 |
| $5 \le A_q \le 8$ | −0.1676 | 0.1972 | −0.2259 | 0.1798 | −0.2738 | 0.1721 |
| $9 \le A_q \le 12$ | −0.05872 | 0.2668 | 0.01504 | 0.2744 | −0.09809 | 0.2317 |
| $13 \le A_q \le 16$ | 0.07447 | 0.2151 | 0.2253 | 0.2473 | 0.1311 | 0.1884 |
| $17 \le A_q \le 20$ | 0.2395 | 0.1723 | 0.3522 | 0.1421 | 0.3229 | 0.1900 |
| $21 \le A_q \le 24$ | 0.2773 | 0.2340 | 0.4369 | 0.1276 | 0.3203 | 0.2356 |
| $25 \le A_q \le 36$ | 0.2740 | 0.1646 | 0.2954 | 0.1098 | 0.3005 | 0.1493 |
| $37 \le A_q \le 48$ | 0.1908 | −0.2318 | 0.06902 | −0.1462 | 0.2306 | −0.2357 |
| $49 \le A_q$ | −0.2022 | −0.4059 | −0.4634 | −0.4314 | −0.1614 | −0.2914 |
| $LTV_{ORIG}$ | | | | | | |
| $LTV_{ORIG} \le 60$ | −1.150 | 0.04787 | −1.303 | 0.08871 | −1.280 | 0.02309 |
| $60 < LTV_{ORIG} \le 70$ | −0.1035 | −0.03131 | −0.1275 | −0.005619 | −0.06929 | −0.02668 |
| $70 < LTV_{ORIG} \le 75$ | 0.5969 | −0.09885 | 0.4853 | −0.09852 | 0.6013 | −0.05446 |
| $75 < LTV_{ORIG} \le 80$ | 0.2237 | −0.04071 | 0.1343 | −0.03099 | 0.2375 | −0.03835 |
| $80 < LTV_{ORIG} \le 90$ | 0.2000 | −0.004698 | 0.2576 | 0.004226 | 0.2421 | −0.01433 |
| $90 < LTV_{ORIG}$ | 0.2329 | 0.1277 | 0.5528 | 0.04220 | 0.2680 | 0.1107 |
| $PNEQ_Q$ | | | | | | |
| $0 < PNEQ_q \le 0.05$ | −1.603 | 0.5910 | −1.1961 | 0.4607 | −1.620 | 0.5483 |
| $0.05 < PNEQ_q \le 0.1$ | −0.5241 | 0.3696 | −0.3816 | 0.2325 | −0.5055 | 0.3515 |
| $0.1 < PNEQ_q \le 0.15$ | −0.1805 | 0.2286 | −0.1431 | 0.1276 | −0.1249 | 0.2178 |
| $0.15 < PNEQ_q \le 0.2$ | 0.07961 | −0.02000 | −0.04819 | 0.03003 | 0.07964 | −0.02137 |
| $0.2 < PNEQ_q \le 0.25$ | 0.2553 | −0.1658 | 0.2320 | −0.1037 | 0.2851 | −0.1540 |
| $0.25 < PNEQ_q \le 0.3$ | 0.5154 | −0.2459 | 0.2630 | −0.1829 | 0.4953 | −0.2723 |

TABLE 3–35—COEFFICIENTS FOR SINGLE FAMILY DEFAULT AND PREPAYMENT EXPLANATORY VARIABLE—Continued

| Explanatory Variable (V) | 30-Year Fixed-Rate Loans | | Adjustable-Rate Loans (ARMs) | | Other Fixed-Rate Loans | |
|---|---|---|---|---|---|---|
| | Default Weight ($\beta_v$) | Pre-payment Weight ($\gamma_v$) | Default Weight ($\beta_v$) | Pre-payment Weight ($\gamma_v$) | Default Weight ($\beta_v$) | Pre-payment Weight ($\gamma_v$) |
| $0.3 < PNEQ_q \leq 0.35$ | 0.6518 | −0.2938 | 0.5372 | −0.2075 | 0.5979 | −0.2714 |
| $0.35 < PNEQ_q$ | 0.8058 | −0.4636 | 0.7368 | −0.3567 | 0.7923 | −0.3986 |
| $B_q$ | 1.303 | −0.3331 | 0.8835 | −0.2083 | 1.253 | −0.3244 |
| RLS<br>$0 < RLS_{ORIG} \leq 0.4$ | ..... | −0.5130 | ..... | −0.4765 | ..... | −0.4344 |
| $0.4 < RLS_{ORIG} \leq 0.6$ | ..... | −0.3264 | ..... | −0.2970 | ..... | −0.2852 |
| $0.6 < RLS_{ORIG} \leq 0.75$ | ..... | −0.1378 | ..... | −0.1216 | ..... | −0.1348 |
| $0.75 < RLS_{ORIG} \leq 1.0$ | ..... | 0.03495 | ..... | 0.04045 | ..... | 0.01686 |
| $1.0 < RLS_{ORIG} \leq 1.25$ | ..... | 0.1888 | ..... | 0.1742 | ..... | 0.1597 |
| $1.25 < RLS_{ORIG} \leq 1.5$ | ..... | 0.3136 | ..... | 0.2755 | ..... | 0.2733 |
| $1.5 < RLS_{ORIG}$ | ..... | 0.4399 | ..... | 0.4049 | ..... | 0.4045 |
| IF | 0.4133 | −0.3084 | 0.6419 | −0.3261 | 0.4259 | −0.3035 |
| $RS_q$<br>$RS_q \leq -0.20$ | ..... | −1.368 | ..... | −0.5463 | ..... | −1.195 |
| $-0.20 < RS_q \leq -0.10$ | ..... | −1.023 | ..... | −0.4560 | ..... | −0.9741 |
| $-0.10 < RS_q \leq 0$ | ..... | −0.8078 | ..... | −0.4566 | ..... | −0.7679 |
| $0.10 < RS_q \leq 0.10$ | ..... | −0.3296 | ..... | −0.3024 | ..... | −0.2783 |
| $0 < RS_q \leq 0.20$ | ..... | 0.8045 | ..... | 0.3631 | ..... | 0.7270 |
| $0.20 < RS_q \leq 0.30$ | ..... | 1.346 | ..... | 0.7158 | ..... | 1.229 |
| $0.30 < RS_q$ | ..... | 1.377 | ..... | 0.6824 | ..... | 1.259 |
| $PS_q$<br>$PS_q \leq -0.20$ | ..... | ..... | 0.08490 | 0.6613 | ..... | ..... |
| $-0.20 < PS_q \leq -0.10$ | ..... | ..... | 0.3736 | 0.4370 | ..... | ..... |
| $-0.10 < PS_q \leq 0$ | ..... | ..... | 0.2816 | 0.2476 | ..... | ..... |
| $0 < PS_q \leq 0.10$ | ..... | ..... | 0.1381 | 0.1073 | ..... | ..... |
| $0.10 < PS_q \leq 0.20$ | ..... | ..... | −0.1433 | −0.3516 | ..... | ..... |
| $0.20 < PS_q \leq 0.30$ | ..... | ..... | −0.2869 | −0.5649 | ..... | ..... |
| $0.30 < PS_q$ | ..... | ..... | −0.4481 | −0.5366 | ..... | ..... |
| $YCS_q$<br>$YCS_q < 1.0$ | ..... | −0.2582 | ..... | −0.2947 | ..... | −0.2917 |
| $1.0 \leq YCS_q < 1.2$ | ..... | −0.02735 | ..... | −0.1996 | ..... | −0.01395 |
| $1.2 \leq YCS_q < 1.5$ | ..... | −0.04099 | ..... | 0.03356 | ..... | −0.03796 |
| $1.5 \leq YCS_q$ | ..... | 0.3265 | ..... | 0.4608 | ..... | 0.3436 |
| $IREF_q$ | ..... | ..... | 0.1084 | −0.01382 | ..... | ..... |
| PROD<br>ARMS | ..... | ..... | 0.8151 | 0.2453 | ..... | ..... |
| Balloons Loans | ..... | ..... | ..... | ..... | 1.253 | 0.9483 |
| 15-Year FRMs | ..... | ..... | ..... | ..... | −1.104 | 0.07990 |
| 20-Year FRMs | ..... | ..... | ..... | ..... | −0.5834 | 0.06780 |
| Government Loans | ..... | ..... | ..... | ..... | 0.9125 | −0.5660 |

TABLE 3–35—COEFFICIENTS FOR SINGLE FAMILY DEFAULT AND PREPAYMENT EXPLANATORY VARIABLE—Continued

| Explanatory Variable (V) | 30-Year Fixed-Rate Loans | | Adjustable-Rate Loans (ARMs) | | Other Fixed-Rate Loans | |
|---|---|---|---|---|---|---|
| | Default Weight ($\beta_v$) | Pre-payment Weight ($\gamma_v$) | Default Weight ($\beta_v$) | Pre-payment Weight ($\gamma_v$) | Default Weight ($\beta_v$) | Pre-payment Weight ($\gamma_v$) |
| $BCal_{LTV}$ | | | | | | |
| $LTV_{ORIG} \leq 60$ | 2.045 | ..... | 2.045 | ..... | 2.045 | ..... |
| $60 < LTV_{ORIG} \leq 70$ | 0.3051 | ..... | 0.3051 | ..... | 0.3051 | ..... |
| $70 < LTV_{ORIG} \leq 75$ | −0.07900 | ..... | −0.07900 | ..... | −0.07900 | ..... |
| $75 < LTV_{ORIG} \leq 80$ | −0.05519 | ..... | −0.05519 | ..... | −0.05519 | ..... |
| $80 < LTV_{ORIG} \leq 90$ | −0.1838 | ..... | −0.1838 | ..... | −0.1838 | ..... |
| $90 < LTV_{ORIG}$ | 0.2913 | ..... | 0.2913 | ..... | 0.2913 | ..... |
| Intercept ($\beta_0$, $\gamma_0$) | −6.516 | −4.033 | −6.602 | −3.965 | −6.513 | −3.949 |

2. The choice of coefficients from Table 3–35 will be governed by the single family product code and Government Flag, according to Table 3–36.

TABLE 3–36—SINGLE FAMILY PRODUCT CODE COEFFICIENT MAPPING

| Single Family Product Code | Model Coefficient Applied |
|---|---|
| Non-Government Loans | |
| Fixed Rate 30YR | 30-Year FRMs |
| Fixed Rate 20YR | 20-Year FRMs |
| Fixed Rate 15YR | 15-Year FRMs |
| 5-Year Fixed Rate Balloon | Balloon Loans |
| 7-Year Fixed Rate Balloon | Balloon Loans |
| 10-Year Fixed Rate Balloon | Balloon Loans |
| 15-Year Fixed Rate Balloon | Balloon Loans |
| Adjustable Rate | ARMs |
| Second Lien | Balloon Loans |
| Other | Balloon Loans |
| Government Loans | |
| Government Flag | Model Coefficient Applied |
| All government loans except for ARMs | Government Loans |
| Government ARMs | ARMs |

3. Compute Quarterly Prepayment and Default Rates (QPR, QDR) from the logistic expressions as follows:

$$QDR_q = \frac{exp\{X\beta_q\}}{1 + exp\{X\beta_q\} + exp\{X\gamma_q\}}$$

$$QPR_q = \frac{exp\{X\gamma_q\}}{1 + exp\{X\beta_q\} + exp\{X\gamma_q\}}$$

4. Convert quarterly rates to monthly rates using the following formulas for simultaneous processes. The quarterly rate for q = 1 gives the monthly rate for months m = 1,2,3, and so on through q = 40:

$$MDR_m = \frac{QDR_q}{QDR_q + QPR_q} \times \left[1 - \left(1 - QDR_q - QPR_q\right)^{\frac{1}{3}}\right]$$

$$MPR_m = \frac{QPR_q}{QDR_q + QPR_q} \times \left[1 - \left(1 - QDR_q - QPR_q\right)^{\frac{1}{3}}\right]$$

5. Calculate Defaulting Fraction (DEF), Prepaying Fraction (PRE), and Performing Fraction (PERF) of the Initial Loan Group. Initially (at the beginning of the Stress Test), all loans are assumed to be performing, i.e. $PERF_0 = 1.0$. For each month m = 1...RM, calculate the following quantities. *Note:* For m > 120, use and $MPR_{120}$ and $MDR_{120}$:

$$PRE_m = PERF_{m-1} \times MPR_m$$

$$DEF_m = PERF_{m-1} \times MDR_m$$

$$PERF_m = PERF_{m-1} - PRE_m - DEF_m$$

3.6.3.4.4 Single Family Default and Prepayment Outputs

Single family Default and Prepayment outputs are set forth in Table 3–37. Prepayment, Default and Performing Fractions for single family loans for months m = 1...RM are used in section 3.6.3.6, Calculation of Single Family and Multifamily Mortgage Losses; and section 3.6.3.7, Stress Test Whole Loan Cash Flows, of this Appendix. Quarterly LTV ratios are used in section 3.6.3.6.2.3, Single Family Gross Loss Severity Procedures, of this Appendix.

TABLE 3–37—SINGLE FAMILY DEFAULT AND PREPAYMENT OUTPUTS

| Variable | Description |
|---|---|
| $LTV_q$ | Current Loan-to-Value ratio in quarter q = 1...40 |
| $PRE_m^{SF}$ | Prepaying Fraction of Initial Loan Group in month m = 1...RM (single family Loans) |
| $DEF_m^{SF}$ | Defaulting Fraction of Initial Loan Group in month m = 1...RM (single family Loans) |
| $PERF_m^{SF}$ | Performing Fraction of Initial original Loan Group in month m = 1...RM (single family loans) |

3.6.3.5 Multifamily Default and Prepayment Rates

3.6.3.5.1 Multifamily Default and Prepayment Rates Overview

[a] The Stress Test projects conditional Default and Prepayment rates for each multifamily Loan Group for each month of the Stress Period. Computing Default rates for a Loan Group requires information on the Loan Group characteristics at the beginning of the Stress Test and the economic conditions of the Stress Period—interest rates (section 3.3 of this Appendix), vacancy rates and rent growth rates (section 3.4 of this Appendix). These input data are used to create values for the explanatory variables in the Multifamily Default component.

[b] *Explanatory Variables for Default Rates.* Ten explanatory variables are used as specified in the equations section 3.6.3.5.3.1, of this Appendix, to determine Default rates for multifamily loans: Mortgage Age, Mortgage Age Squared, New Book indicator, New Book—ARM interaction, New Book—Balloon Loan interaction, Ratio Update Flag, current Debt-Service Coverage Ratio, Underwater Current Debt-Service Coverage indicator, Loan-To-Value Ratio at origination/acquisition, and a Balloon Maturity indicator. Regression coefficients (weights) are associated with each variable. All of this information is used to compute conditional annual Default rates throughout the Stress Test. The annualized Default rates are converted to monthly conditional Default rates and are used together with monthly conditional Prepayment rates to calculate Stress Test Whole Loan Cash Flows. (*See* section 3.6.3.7, Stress Test Whole Loan Cash Flows, of this appendix).

[c] *Specification of Multifamily Prepayment Rates.* Multifamily Prepayment rates are not generated by a statistical model but follow a set of Prepayment rules that capture the effect of yield maintenance, Prepayment penalties and other mechanisms that effectively curtail or eliminate multifamily Prepayments for a specified period of time.

[d] *Special Provision for Accounting Calculations.* For accounting calculations, which require cash flows over the entire remaining life of the instrument, Default and Prepayment rates for months beyond the end of the Stress Test are held constant at their values for month 120.

3.6.3.5.2 Multifamily Default and Prepayment Inputs

The information in Table 3–38 is required for each multifamily Loan Group:

TABLE 3–38—LOAN GROUP INPUTS FOR MULTIFAMILY DEFAULT AND PREPAYMENT CALCULATIONS

| Variable | Description | Source |
|---|---|---|
| | Mortgage Product Type | RBC Report |
| $A_0$ | Age immediately prior to start of Stress Test, in months (weighted average for Loan Group) | RBC Report |
| NBF | New Book Flag | RBC Report |
| RUF | Ratio Update Flag | RBC Report |
| $LTV_{ORIG}$ | Loan-to-Value ratio at loan Origination | RBC Report |
| $DCR_0$ | Debt Service Coverage Ratio at the start of the Stress Test | RBC Report |
| $PMT_0$ | Amount of the mortgage Payment (principal and interest) prior to the start of the Stress Test, or first Payment for new loans (aggregate for Loan Group) | RBC Report |
| PPEM | Prepayment Penalty End Month number in the Stress Test (weighted average for Loan Group) | RBC Report |
| RM | Remaining term to Maturity in months (i.e., number of contractual payments due between the start of the Stress Test and the contractual maturity date of the loan) (weighted average for Loan Group) | RBC Report |
| $RGR_m$ | Benchmark Rent Growth for months m = 1...120 of the Stress Test | section 3.4.4, Property Valuation Outputs |
| $RVR_m$ | Benchmark Vacancy Rates for months m = 1...120 of the Stress Test | section 3.4.4, Property Valuation Outputs |
| $PMT_m$ | Scheduled Payment for months m = 1...RM | section 3.6.3.3.4, Mortgage Amortization Schedule Outputs |
| OE | Operating expenses as a share of gross potential rents (0.472) | fixed decimal from Benchmark region and time period |

TABLE 3–38—LOAN GROUP INPUTS FOR MULTIFAMILY DEFAULT AND PREPAYMENT CALCULATIONS—Continued

| Variable | Description | Source |
|---|---|---|
| $RVR_o$ | Initial rental vacancy rate | 0.0623 |

3.6.3.5.3 Multifamily Default and Prepayment Procedures

3.6.3.5.3.1 Explanatory Variables

[a] Compute the explanatory variables for multifamily Default and Prepayment in five steps as follows:

1. Calculate Loan Age in Years for months m = 0...120 of the Stress Test ($AY_m$):

$$AY_m = \frac{A_0 + m}{12}$$

Where:

$A_0$ + m is Loan Age in months at the beginning of month m of the Stress Test.

*Note:* $AY_m$ is calculated for each month m, whereas the corresponding Age variable for single family Loans $A_q$ is calculated only quarterly.

2. Assign Product and Ratio Update Flags (NBF, NAF, NBLF, RUF). *Note:* these values do not change over time for a given Loan Group.

a. New Book Flag (NBF):

NBF = 1 for Fannie Mae loans acquired after 1987 and Freddie Mac loans acquired after 1992, *except* for loans that were refinanced to avoid a Default on a loan originated or acquired earlier.

NBF = 0 otherwise.

b. New ARM Flag (NAF):

$$NAF = ARMF \times NBF$$

Where:

ARMF = 1 for ARMs (including Balloon ARMs)

ARMF = 0 otherwise

c. New Balloon Flag (NBLF):

$$NBLF = BALF \times NBF$$

Where:

BALF = 1 for Fixed Rate Balloon Loans

BALF = 0 otherwise

d. Ratio Update Flag (RUF):

RUF = 1 for loans whose LTV and DCR were updated at origination or Enterprise acquisition

RUF = 0 otherwise.

3. Calculate Debt Service Coverage Ratio in month m ($DCR_m$):

The standard definition of Debt Service Coverage Ratio is current net operating income divided by current mortgage payment. However, for the Stress Test, update $DCR_m$ each month from the prior month's value using Rent Growth Rates ($RGR_m$) and Rental Vacancy Rates ($RVR_m$) starting with $DCR_m$ from Table 3–38, as follows:

$$DCR_m = DCR_{m-1} \times \left[ \frac{(1 + RGR_m)\left(\frac{1 - OE - RVR_m}{1 - OE - RVR_{m-1}}\right)}{\frac{PMT_m}{PMT_{m-1}}} \right]$$

4. Assign Underwater Debt-Service Coverage Flag ($UWDCRF_m$):

$UWDCRF_m$ = 1 if $DCR_m$ <1 in month m

$UWDCRF_m$ = 0 otherwise.

5. Assign Balloon Maturity Flag ($BMF_m$) for any Balloon Loan that is within twelve months of its maturity date:

$$BMF_m = 1 \text{ if } RM - m < 12$$

$$BMF_m = 0 \text{ otherwise.}$$

3.6.3.5.3.2 Default and Prepayment Rates and Performance Fractions

[a] Compute Default and Prepayment Rates and Performance Fractions for multifamily loans in the following four steps:

1. Compute the logits for multifamily Default using inputs from Table 3–38 and coefficients from Table 3–39. For indexing purposes, the Default rate for a period m is the likelihood of missing the $m^{th}$ payment; calculate its corresponding logit ($X\delta_m$) based on Loan Group characteristics as of the period *prior* to m, i.e. *prior* to making the $m^{th}$ payment.

$$\begin{aligned} X\delta_m = {} & \delta_{AY} AY_{m-1} + \delta_{AY^2} AY_{m-1}^2 \\ & + \delta_{NBF} NBF + \delta_{NAF} NAF \\ & + \delta_{NBLF} NBLF + \delta_{RUF} RUF \\ & + \delta_{DCR} ln(DCR_{m-1}) \\ & + \delta_{UWDCRF} UWDCRF_{m-1} \\ & + \delta_{LTV} ln(LTV_{ORIG}) \\ & + \delta_{BMF} BMF_{m-1} + \delta_0 \end{aligned}$$

TABLE 3–39—EXPLANATORY VARIABLE COEFFICIENTS FOR MULTIFAMILY DEFAULT

| Explanatory variable (V) | Default weight ($\delta_v$) |
|---|---|
| AY | 0.5171 |
| $AY^2$ | −0.02788 |
| NBF | −2.041 |
| NAF | 1.694 |
| NBLF | 0.8191 |

TABLE 3–39—EXPLANATORY VARIABLE COEFFICIENTS FOR MULTIFAMILY DEFAULT—Continued

| Explanatory variable (V) | Default weight ($\delta_v$) |
|---|---|
| RUF | −0.5929 |
| DCR | −2.495 |
| UWDCRF | 1.488 |
| LTV | 0.8585 |
| BMF | 1.541 |
| Intercept ($\delta_0$) | −4.452 |

2. Compute Annual Prepayment Rate (APR) and Annual Default Rate (ADR) as follows:

$$ADR_m = \frac{exp\{X\delta_m\} \times (1 - APR_m)}{1 + exp\{X\delta_m\}}$$

$APR_m$ is a constant, determined as follows:

a. For the up-rate scenario, $APR_m$ = 0 for all months m

b. For the down-rate scenario,

$APR_m$ = 2 percent during the Prepayment penalty period (i.e., when m ≤ PPEM)

$APR_m$ = 25 percent after the Prepayment penalty period (i.e., when m > PPEM)

3. Convert annual Prepayment and Default rates to monthly rates (MPR and MDR) using the following formulas for simultaneous processes:

$$MPR_m = \frac{APR_m}{ADR_m + APR_m} \times \left[ 1 - (1 - ADR_m - APR_m)^{\frac{1}{12}} \right]$$

$$MDR_m = \frac{ADR_m}{ADR_m + APR_m} \times \left[ 1 - (1 - ADR_m - APR_m)^{\frac{1}{12}} \right]$$

4. Calculate Defaulting Fraction ($DEF_m$), Prepaying Fraction ($PRE_m$), and Performing Fraction ($PERF_m$) of the Initial Loan Group for each month m = 1...RM. Initially (immediately prior to the beginning of the Stress Test), all loans are assumed to be performing, i.e. $PERF_0$ = 1.0. *Note:* For m> 120, use $MPR_{120}$ and $MDR_{120}$.

$$PRE_m = PERF_{m-1} \times MPR_m$$

$$DEF_m = PERF_{m-1} \times MDR_m$$

$$PERF_m = PERF_{m-1} - PRE_m - DEF_m$$

3.6.3.5.4 Multifamily Default and Prepayment Outputs

[a] Multifamily Default and Prepayment Outputs are set forth in Table 3–40.

TABLE 3–40—MULTIFAMILY DEFAULT AND PREPAYMENT OUTPUTS

| Variable | Description |
|---|---|
| $PRE_m^{MF}$ | Prepaying Fraction of initial Loan Group in month m=1...RM (multifamily Loans) |
| $DEF_m^{MF}$ | Defaulting Fraction of initial Loan Group in month m=1...RM (multifamily Loans) |
| $PERF_m^{MF}$ | Performing Fraction of initial Loan Group in month m=1...RM (multifamily Loans) |

[b] Multifamily monthly Prepayment Fractions ($PERF_m^{MF}$) and monthly Default Fractions ($DEF_m^{MF}$) for months m=1...RM are used in section 3.6.3.6, Calculation of Single Family and Multifamily Mortgage Losses; section 3.6.3.7, Stress Test Whole Loan Cash Flows, and section 3.6.3.8, Whole Loan Accounting Flows, of this Appendix.

3.6.3.6 Calculation of Single Family and Multifamily Mortgage Losses

3.6.3.6.1 Calculation of Single Family and Multifamily Mortgage Losses Overview

[a] *Definition.* Loss Severity is the net cost to an Enterprise of a loan Default. Though losses may be associated with delinquency, loan restructuring and/or modification and other loss mitigation efforts, foreclosures are the only loss events modeled during the Stress Test.

[b] *Calculation.* The Loss Severity rate is expressed as a fraction of the Unpaid Principal Balance (UPB) at the time of Default. The Stress Test calculates Loss Severity rates for each Loan Group for each month of the Stress Period. Funding costs (and offsetting revenues) of defaulted loans are captured by discounting the Loss Severity elements using a cost-of-funds interest rate that varies during the Stress Period. Table 3–41 specifies the Stress Test Loss Severity timeline. Loss Severity rates also depend upon the application of Credit Enhancements and the credit ratings of enhancement providers.

TABLE 3–41—LOSS SEVERITY EVENT TIMING

| Month | Event |
|---|---|
| 1 | First missed payment |
| 4 ( = MQ) | Loan is repurchased from securitized pool and UPB is passed through to MBS investors (Sold Loans only) |
| 13 ( = $MF^{SF}$) | Single family foreclosure |
| 18 ( = $MF^{MF}$) | Multifamily foreclosure |
| 20 ( = $MF^{SF}$+ $MR^{SF}$) | Single family property disposition |
| 31 ( = $MF^{MF}$+$MR^{MF}$) | Multifamily property disposition |

[c] *Timing of the Default Process.* Mortgage Defaults are modeled as follows: defaulting loans enter foreclosure after a number of months (MQ, Months in Delinquency) and are foreclosed upon several months later. MF (Months in Foreclosure) is the total number of missed payments. Upon completion of foreclosure, the loan as such ceases to exist and the property becomes Real Estate Owned by the lender (REO). After several more months (MR, Months in REO), the property is sold. Foreclosure expenses are paid and MI proceeds (and, for multifamily loans, loss sharing proceeds) are received when foreclosure is completed. REO expenses are paid, and sales proceeds and other Credit Enhancements are received, when the property is sold. These timing differences are not modeled explicitly in the cash flows, but their economic effect is taken into account by present-valuing the default-related cash flows to the month of Default.

[d] *Gross Loss Severity, Credit Enhancement, and Net Loss Severity.* The calculation of mortgage losses is divided into three parts. First, Gross Loss Severity is determined by expressing the principal loss plus unpaid interest plus expenses as a percentage of the loan UPB at the time of Default (section 3.6.3.6.2, Single Family Gross Loss Severity, and section 3.6.3.6.3, Multifamily Gross Loss Severity, of this Appendix). Second, Credit Enhancements (CEs) are applied according to their terms to offset losses on loans that are covered by one or more CE arrangements (section 3.6.3.6.4, Mortgage Credit Enhancement, of this Appendix). Finally, to account for the timing of these different cash flows, net losses are discounted back to the month in which the Default initially occurred (section 3.6.3.6.5, Single Family and Multifamily Net Loss Severity, of this Appendix).

3.6.3.6.2 Single Family Gross Loss Severity

3.6.3.6.2.1 Single Family Gross Loss Severity Overview

The Loss Severity calculation adds the discounted present value of various costs and offsetting revenues associated with the foreclosure of single family properties, expressed as a fraction of UPB on the date of Default. The loss elements are:

[a] *Unpaid Principal Balance.* Because all Loss Severity elements are expressed as a fraction of Default date UPB, the outstanding loan balance is represented as 1.

[b] *Unpaid Interest.* Unpaid interest at the Mortgage Interest Rate is included in the MI claim amount. Unpaid interest at the Pass-Through Rate must be paid to MBS holders until the Defaulted loan is repurchased from the MBS pool.

[c] *Foreclosure Expenses and REO Expenses.* Foreclosure expenses are reimbursed by MI. REO expenses are incurred in connection with the maintenance and sale of a property after foreclosure is completed. Stress Test values for these quantities are derived from historical Enterprise REO experience.

[d] *Net Recovery Proceeds from REO sale (RP).* This amount is less than the sale price for ordinary properties as predicted by the HPI, because of the distressed nature of the sale.

3.6.3.6.2.2 Single Family Gross Loss Severity Inputs

The inputs in Table 3–42 are used to compute Gross Loss Severity for single family loans:

TABLE 3–42—LOAN GROUP INPUTS FOR GROSS LOSS SEVERITY

| Variable | Description | Definition or Source |
|---|---|---|
| | Government Flag | RBC Report |
| MQ | Months Delinquent: time during which Enterprise pays delinquent loan interest to MBS holders | 4 for sold loans<br>0 otherwise |
| MF | Months to Foreclosure: number of missed payments through completion of foreclosure | 13 months |
| MR | Months from REO acquisition to REO disposition | 7 months |
| F | Foreclosure Costs as a decimal fraction of Defaulted UPB | 0.037 |
| R | REO Expenses as a decimal fraction of Defaulted UPB | 0.163 |

TABLE 3–42—LOAN GROUP INPUTS FOR GROSS LOSS SEVERITY—Continued

| Variable | Description | Definition or Source |
|---|---|---|
| $DR_m$ | Discount Rate in month m (decimal per annum) | 6-month Enterprise Cost of Funds from section 3.3, Interest Rates |
| $LTV_q$ | Current LTV in quarter q = 1...40 | section 3.6.3.4.4, Single Family Default and Prepayment Outputs |
| $MIR_m$ | Mortgage Interest Rate in month m (decimal per annum) | section 3.6.3.3.4, Mortgage Amortization Schedule Outputs |
| $PTR_m$ | Pass-Through Rate applicable to payment due in month m (decimal per annum) | section 3.6.3.3.4, Mortgage Amortization Schedule Outputs |
| RR | Recovery Rate for Defaulted loans in the BLE, as a percent of predicted house price using HPI (decimal) | 0.61 |

3.6.3.6.2.3 Single Family Gross Loss Severity Procedures

[a] Calculate single family gross Loss Severity using the following three steps:

1. Compute REO Proceeds in month m ($RP_m$) as a fraction of Defaulted UPB:

$$RP_m = \frac{RR}{LTV_q}$$

2. Compute MI Claim Amount on loans that Defaulted in month m ($CLM_m^{MI}$) as a fraction of Defaulted UPB:

$$CLM_m^{MI} = 1 + \left(\frac{MF}{12} \times MIR_m\right) + F \text{ for all loans other than Government Loans}$$

$$= 1 + \left(0.75 \times \frac{MF}{12} \times MIR_m\right) + (0.67 \times F) \text{ for Government Loans}$$

Where:

0.67 = FHA reimbursement rate on foreclosure-related expenses

0.75 = adjustment to reflect that FHA reimbursement on unpaid interest is at a government debenture rate, not MIR.

3. Compute Gross Loss Severity of loans that Defaulted in month m ($GL_m$) as a fraction of Defaulted UPB:

$$GLS_m = 1 + \left(\frac{MQ}{12} \times PTR_m\right) + F + R - RP_m \text{ but not} < 0$$

3.6.3.6.2.4 Single Family Gross Loss Severity Outputs

The single family Gross Loss Severity outputs in Table 3–43 are used in the Credit Enhancement calculations in section 3.6.3.6.4 of this Appendix.

TABLE 3–43—SINGLE FAMILY GROSS LOSS SEVERITY OUTPUTS

| Variable | Description |
|---|---|
| $GLS_m$ | Gross Loss Severity for loans that defaulted in month m = 1...120 |
| $CLM_m^{MI}$ | MI claim on account of loans that defaulted in month m = 1...120 |
| $RP_m$ | REO Proceeds on account of loans that defaulted in month m = 1...120 |

3.6.3.6.3 Multifamily Gross Loss Severity

3.6.3.6.3.1 Multifamily Gross Loss Severity Overview

The multifamily Loss Severity calculation adds the discounted present value of various costs and offsetting revenues associated with the foreclosure of multifamily properties, expressed as a fraction of Defaulted UPB. The loss elements are:

[a] *Unpaid Principal Balance (UPB).* Because all Loss Severity elements are expressed as a fraction of Default date UPB, the outstanding loan balance is represented as 1.

[b] *Unpaid Interest.* Unpaid interest at the Net Yield Rate is included in the Loss Sharing Claim amount. Unpaid interest at the Pass-Through Rate must be paid to MBS holders until the defaulted loan is repurchased from the MBS pool.

[c] *Net REO Holding Costs (RHC).* Foreclosure costs, including attorneys fees and other liquidation expenses are incurred between the date of Default and the date of foreclosure completion (REO acquisition). Operating and capitalized expenses are incurred and rental and other income are received between REO acquisition and REO disposition. As a result, half of the Net REO Holding Costs (RHC) are expensed at REO acquisition and the remainder are expensed at REO disposition.

[d] *Net Proceeds from REO sale (RP).* The gross sale price of the REO less all costs associated with the disposition of the REO asset are discounted from the date of REO sale.

3.6.3.6.3.2 Multifamily Gross Loss Severity Inputs

The inputs in Table 3–44 are used to compute Gross Loss Severity for multifamily Loans:

TABLE 3–44—LOAN GROUP INPUTS FOR MULTIFAMILY GROSS LOSS SEVERITY

| Variable | Description | Value or Source |
|---|---|---|
| | Government Flag | RBC Report |
| $DR_m$ | Discount Rate in month m (decimal per annum) | 6-month Enterprise Cost of Funds from Section 3.3, Interest Rates |
| MQ | Time during which delinquent loan interest is passed-through to MBS holders | 4 for sold loans<br>0 otherwise |

TABLE 3–44—LOAN GROUP INPUTS FOR MULTIFAMILY GROSS LOSS SEVERITY—Continued

| Variable | Description | Value or Source |
|---|---|---|
| $PTR_m$ | Pass Through Rate applicable to payment due in month m (decimal per annum) | section 3.6.3.3.4, Mortgage Amortization Schedule Outputs |
| $NYR_m$ | Net Yield Rate applicable to payment due in month m (decimal per annum) | section 3.6.3.3.4, Mortgage Amortization Schedule Outputs |
| RHC | Net REO holding costs as a decimal fraction of Defaulted UPB | 0.1333 |
| MF | Time from Default to completion of foreclosure (REO acquisition) | 18 months |
| MR | Months from REO acquisition to REO disposition | 13 months |
| RP | REO proceeds as a decimal fraction of Defaulted UPB | 0.5888 |

3.6.3.6.3.3 Multifamily Gross Loss Severity Procedures

[a] Calculate multifamily gross loss severity in the following two steps:

1. For Conventional Loans, compute the Loss Sharing Claim Amount ($CLM_m^{LSA}$) and Gross Loss ($GL_m$) on loans that Defaulted in month m, as a fraction of Defaulted UPB:

$$CLM_m^{LSA} = 1.75 + \left(\frac{MF}{12} \times NYR_m\right) + RHC - RP$$

$$GL_m = 1 + \frac{MQ}{12} \times PTR_m + RHC - RP$$

2. For FHA-insured (i.e., government) multifamily Loans, separate Gross Loss Severity and Credit Enhancement calculations are not necessary. Net Loss Severity is determined explicitly in section 3.6.3.6.5, Single Family and Multifamily Net Loss Severity, of this Appendix).

3.6.3.6.3.4 Multifamily Gross Loss Severity Outputs

Multifamily Gross Loss Severity Outputs in Table 3–45 are used in the Credit Enhancements Calculations section 3.6.3.6.4, of this Appendix.

TABLE 3–45—MULTIFAMILY GROSS LOSS SEVERITY OUTPUTS FOR USE IN CREDIT ENHANCEMENT CALCULATIONS

| Variable | Description |
|---|---|
| $GLS_m$ | Gross Loss Severity for loans that Defaulted in month m = 1...120 |
| $CLM_m^{LSA}$ | Loss Sharing Claim on account of loans that Defaulted in month m = 1...120 |

3.6.3.6.4 Mortgage Credit Enhancement

3.6.3.6.4.1 Mortgage Credit Enhancement Overview

[a] *Types of Mortgage Credit Enhancements.* Credit Enhancements (CE) reimburse losses on individual loans. The CE most often utilized by the Enterprises at the present time is primary Mortgage Insurance (MI) including both private and government MI or loan guarantees (e.g. FHA, VA), which pays claims up to a given limit on each loan. Most other types of CE do not limit the amount payable on each loan individually, but do limit the aggregate amount available under a given CE arrangement or Contract. These two types of CE must be computed differently. To denote this distinction, this Appendix will refer to ''Loan Limit'' and ''Aggregate Limit'' CE types. Loan Limit CE includes Mortgage Insurance for single family loans and Loss-Sharing Arrangements (LSA) for multifamily loans. Aggregate Limit CE includes Pool Insurance, Spread Accounts, Letters of Credit, Cash or Collateral Accounts, and Subordination Agreements. For operational convenience in the Stress Test, the Aggregate Limit classification also includes Unlimited Recourse, which has neither loan-level nor aggregate-level coverage limits, and Modified Pool Insurance, Limited Recourse, Limited Indemnification and FHA risk-sharing, which may have both loan-level and aggregate-level coverage limits.

[b] *Loan Limit Credit Enhancements.* Loan Limit Credit Enhancements are applied to every covered loan individually, without regard to how much has been paid on any other covered loan. For example, an MI policy covers losses on an individual loan up to a specified limit. If every loan with MI were to Default, every claim would be payable regardless of the total outlay on the part of the MI provider. Loss Sharing Arrangements on multifamily loans operate the same way.

[c] *Aggregate Limit Credit Enhancements.* Aggregate Limit Credit Enhancements cover a group of loans on an aggregate basis. In most such arrangements, the coverage for any individual loan is unlimited, except that the total outlay by the provider cannot exceed a certain aggregate limit. Thus, the amount of Aggregate Limit coverage available to an individual loan depends, in practice, on how much has been paid on all previous claims under the specified Contract.

[d] *Credit Enhancement Counterparty Defaults.* CE payments from a rated counterparty are subject to Haircuts to simulate counterparty failures during the Stress Test. These Haircuts are based on the rating of the counterparty or guarantor immediately prior to the Stress Test, and are applied each month as described in section 3.5, Counterparty Defaults, of this Appendix.

[e] *Stress Test Application of Credit Enhancement.* The Stress Test calculates mortgage cash flows for aggregated Loan Groups, within which individual loans are assumed to have identical characteristics, and therefore are not differentiated in the computations. However, a single Loan Group may include loans with Loan Limit CE and/or one or more types of Aggregate Limit CE. Additionally, this coverage may come from a rated provider or from cash or cash-equivalent collateral. Therefore, for computational purposes it is necessary to distinguish among the different possible CE combinations that each loan or subset of loans in a Loan Group may have. In the Stress Test, this is accomplished by creating Distinct Credit Enhancement Combinations (DCCs).

1. *Distinct Credit Enhancement Combinations.* When aggregating individual loans into Loan Groups for the RBC Report, the applicable CE arrangements will have been identified for each loan:
   a. Loan Group (LG) Number
   b. Initial UPB of individual loan
   c. Rating of MI or LSA Counterparty
   d. Loan-Limit Coverage Percentage for MI or LSA
   e. Contract Number for Aggregate Limit CE, First Priority
   f. Contract Number for Aggregate Limit CE, Second Priority
   g. Contract Number for Aggregate Limit CE, Third Priority
   h. Contract Number for Aggregate Limit CE, Fourth Priority
2. Individual loans for which all of the entries in step 1) of this section (except UPB and Loan-Limit Coverage Percent) are identical, are aggregated into a DCCs. For example, all loans in a given Loan Group with MI from a AAA-rated provider and no other CE would comprise one DCC whose balance is the aggregate of the included loans and whose MI Coverage Percent is the weighted average of that of the included loans. In each month, within each Loan Group, for each DCC, each applicable form of CE is applied in priority order to reduce Gross Loss Severity as much as possible to zero. The total CE payment for each DCC, as a percentage of Defaulted UPB is converted to a total CE

payment for each Loan Group and then factored into the calculation of Net Loss Severity in section 3.6.3.6.5, Single Family and Multifamily Net Loss Severity, of this Appendix.

3. *DCC First and Second Priority Available Aggregate CE Balance.* In the Stress Test, First and Second Priority Available Aggregate CE Balances are allocated to the DCCs that are parties to each Contract on a pro-rata basis. Third and Fourth Priority Aggregate Limit Contracts are not modeled because they are extremely rare. In each month of the Stress Test these CE Balances, adjusted by appropriate Haircuts, are reduced by the losses incurred by each DCC that is a party to each Contract. Spread Account deposits, if applicable, are included in the First and Second Priority DCC Available Aggregate CE Balances.

a. Spread Accounts may take one of two forms: Balance-Limited, or Deposit-Limited. A Balance-Limited Spread Account receives monthly spread payments based on the UPB of the covered loans until a required balance is achieved and maintained. Any amounts paid to cover losses must be replenished by future spread payments from the covered loans that are still performing. Thus, there is no known limit to the amount of spread deposits that may be made over the life of the covered loans. In contrast, for a Deposit-Limited Spread Account the limit is similar to a customary coverage limit. The total amount of spread deposits made into the account is limited to a maximum amount specified in the Contract.

b. In the Stress Test, the Available Contract Balance of a Spread Account is adjusted prior to the calculation of the DCC Available Balance as reported in the RBC Report. For each Spread Account contract, the Enterprises report the Remaining Limit Amount, which represents the maximum dollar amount of additional spread deposits that could be required under the Contract. For Deposit-Limited Spread Accounts, this amount is the maximum remaining dollar amount of spread deposits required under the Contract. For Balance-Limited Spread Accounts, this amount is defined as one-twelfth of the annualized spread rate times the UPB of the covered loans at the start of the Stress Test times the weighted average Remaining term to Maturity of those loans. However, the maximum amount of spread deposits that could be received will generally be higher than the amount reasonably expected to be received during the Stress Test, because the UPB of the covered loans, which is the basis for determining the amounts of future spread deposits, declines over the term of the Contract due to Amortization, Defaults, and Prepayments. Therefore, the Enterprises report an adjusted Available Contract Balance for both types of Spread Accounts before reporting the DCC Available Balance by adding the lesser of the Remaining Limit Amount or one-twelfth of the spread rate times the UPB of the covered loans at the start of the stress test times 60 months.

c. Modified Pool Insurance, Limited Recourse, Limited Indemnification and FHA risk-sharing contracts may have both loan-level and aggregate-level coverage limits. To account for this aspect of these types of Aggregate Limit CE, the Enterprises report a DCC Loan Level Coverage Limit Amount, which represents the share of each loss after deductibles (such as MI or First Priority Contract payments) covered by a given MPI Contract. (The Loan Level Coverage Limit Amount takes the value of one if the Contract is not of this type, representing that 100 percent of losses are covered by other types of Contracts).

d. In practice, Unlimited Recourse Contracts have neither loan-level nor aggregate-level coverage limits. However, the Enterprises report the Available Aggregate CE Balance of Unlimited Recourse Contracts as the summation of the Original UPB of all covered loans.

e. The Available Aggregate CE Balances of Collateral Account Contracts funded with anything other than Cash or Cash-equivalents are discounted by thirty percent to account for market risk in securities that are not cash equivalents.

f. Enterprise Loss Positions are treated as Aggregate Limit CE in terms of reducing remaining losses eligible to be covered by a next-priority Contract. However, since Enterprise Loss Positions are typically a deductible for other forms of supplementary coverage, payments from such accounts do not reduce loss severity.

[f] *Multiple Layers of Credit Enhancement.* For loans with more than one type of Credit Enhancement, MI or Loss Sharing is applied first, and then other types of CE (if available) are applied in priority order to the remaining losses. MI and Loss Sharing claims are payable regardless of whether (and to what extent) a loan is also covered by other forms of CE. MI is unique in that the MI payment is based on a percentage of a Claim Amount equal to the entire Defaulted UPB plus expenses, not the actual loss incurred upon liquidation. Therefore, an Enterprise can receive MI payments on a defaulted loan in excess of the actual realized loss on that loan. However, it is frequently the case that MI payments are insufficient to cover the entire loss amount. In such cases, one or more types of Aggregate Limit CE may be available to make up the deficiency. Unlike MI claims, however, the Claim Amounts for Loss Sharing and for all Aggregate Limit CE types do depend on the actual losses incurred; and unlike Loss Sharing and MI, Claim Amounts payable under other forms of CE are net of payments received on account of other forms of CE. When a single loan is covered by multiple forms of CE, the order in which they are to be applied (First Priority, Second Priority, etc.) must be specified. To avoid double-counting, a higher-numbered priority CE only covers losses that were not covered by a lower-numbered priority CE.

3.6.3.6.4.2 Mortgage Credit Enhancement Inputs

[a] For each Loan Group, the inputs in Table 3–46 are required:

TABLE 3–46—CE INPUTS FOR EACH LOAN GROUP

| Variable | Description | Source |
|---|---|---|
| $UPB_{ORIG}^{LG}$ | Origination UPB | RBC Report |
| $UPB_0^{LG}$ and $UPB_m^{LG}$ | Initial UPB and UPB in month m = 0,1...120 | section 3.6.3.3.4, Mortgage Amortization Schedule Outputs |
| $LTV_{ORIG}^{LG}$ | Original LTV | RBC Report |
| $DEF_m^{LG}$ and $PERF_m^{LG}$ | Defaulting and Performing Fractions of Initial Loan Group UPB in month m = 1...120 | section 3.6.3.4.4, Single Family Default and Prepayment Outputs and section 3.6.3.5.4, Multifamily Default and Prepayment Outputs |
| $CLM_m^{MI,LG}$ $CLM_m^{LSA,LG}$ | MI Claim Amount and LSA Claim Amount | section 3.6.3.6.2, Single Family Gross Loss Severity and section 3.6.3.6.3, Multifamily Gross Loss Severity |
| $GLS_m^{LG}$ | Gross Loss Severity | section 3.6.3.6.2, Single Family Gross Loss Severity and section 3.6.3.6.3, Multifamily Gross Loss Severity |

[b] For each DCC covering loans in the Loan Group, the inputs in Table 3–47 are required:

TABLE 3–47—INPUTS FOR EACH DISTINCT CE COMBINATION (DCC)

| Variable | Description | Source |
|---|---|---|
| $P^{DCC}$ | Percent of Initial Loan Group UPB represented by individual loan(s) in a DCC | RBC Report |
| $R^{MI,DCC}$ or $R^{LSA,DCC}$ | Credit rating of Loan Limit CE (MI or LSA) Counterparty | RBC Report |
| $C^{MI,DCC}$ or $C^{LSA,DCC}$ | Weighted Average Coverage Percentage for MI or LSA Coverage (weighted by Initial UPB) | RBC Report |
| $AB_0^{DCC,C1}$ | DCC Available First Priority CE Balance immediately prior to start of the Stress Test | RBC Report |
| $AB_0^{DCC,C2}$ | DCC Available Second Priority CE Balance immediately prior to start of the Stress Test | RBC Report |
| $R^{DCC,C1}$ | DCC Credit Rating of First Priority CE Provider or Counterparty; or Cash/Cash Equivalent (which is not Haircutted) | RBC Report |
| $R^{DCC,C2}$ | DCC Credit Rating of Second Priority CE Provider or Counterparty; or Cash/Cash Equivalent (which is not Haircutted) | RBC Report |
| $C^{DCC,C1}$ | DCC Loan-Level Coverage Limit of First Priority Contract (If Subtype is MPI; otherwise = 1) | RBC Report |
| $C^{DCC,C2}$ | DCC Loan-Limit Coverage Limit of Second Priority Contract (if Subtype is MPI; otherwise = 1) | RBC Report |
| $ExpMo^{DCC,C1}$ | Month in the Stress Test (1...120 or after) in which the DCC First Priority Contract expires | RBC Report |
| $ExpMo^{DCC,C2}$ | Month in the Stress Test (1...120 or after) in which the DCC Second Priority Contract expires | RBC Report |
| $ELPF^{DCC,C1}$ | DCC Enterprise Loss Position Flag for First Priority Contract (Y or N) | RBC Report |
| $ELPF^{DCC,C2}$ | DCC Enterprise Loss Position Flag for Second Priority Contract (Y or N) | RBC Report |

[c] In the RBC Report, Aggregate Limit CE Subtypes are grouped as illustrated in Table 3–48.

TABLE 3–48—AGGREGATE LIMIT CE SUBTYPE GROUPING

| Symbol | Subtype | Also Includes |
|---|---|---|
| REC | Unlimited Recourse | Unlimited Indemnification |
| PI | Pool Insurance | Pool Insurance |
| | | Letter of Credit |
| | | Subordination Arrangements |
| MPI | Modified Pool Insurance | Modified Pool Insurance |
| | | Limited Recourse |
| | | Limited Indemnification |
| | | FHA Risk-sharing Agreements |
| CASH | Cash Account | Cash Account |
| COLL | Collateral Account | Collateral |
| ELP | Enterprise Loss Position | GSE Loss Position (ledger item) |
| SA | Spread Account | Spread Account |

3.6.3.6.4.3 Mortgage Credit Enhancement Procedures

[a] For each month m of the Stress Test, for each Loan Group (LG), carry out the following six steps [a] 1–6 for each DCC. *Note:* Process the Loan Groups and DCCs using the numerical order assigned to them in the RBC Report.

1. Determine Mortgage Insurance Payment ($MI_m$) for single family loans in the DCC, or Loss Sharing Payment ($LSA_m$) for multifamily loans in the DCC, as a percentage of Defaulted UPB, applying appropriate counterparty Haircuts from section 3.5, of this Appendix:

$$MI_m^{DCC} = \left(1 - MIExp_m^{LG}\right) \times C^{MI,DCC} \times CLM_m^{MI,LG} \times \left[1 - \frac{m'}{60} \times MaxHct\left(R^{MI,DCC}\right)\right]$$

$$LSA_m^{DCC} = C^{LSA,DCC} \times CLM_m^{LSA,LG} \times \left[1 - \frac{m'}{60} \times MaxHct\left(R^{LSA,DCC}\right)\right]$$

Where:

m′ = *min* (m, 60). For counterparties rated below BBB, m′ = 60

$$\mathrm{MIExp}_m^{LG} = 1 \text{ if } \left( \mathrm{LTV}_{ORIG} \times \frac{\mathrm{UPB}_m^{LG}}{\mathrm{UPB}_{ORIG}^{LG}} \right) < 0.78$$

$$\mathrm{MIExp}_m^{LG} = 0 \text{ otherwise}$$

0.78 (78%) = the LTV at which MI is cancelled if payments are current

2. Determine Remaining Loss in Dollars (RLD) after application of MI or LSA and prior to application of other Aggregate Limit CE:

$$\mathrm{RLD}_m^{DCC,(MI-LSA)} = max\left[\left(\mathrm{GLS}_m^{LG} - \mathrm{MI}_m^{DCC}\right), 0\right] \times \mathrm{P}^{DCC} \times \mathrm{UPB}_{m-1}^{LG} \times \mathrm{DEF}_m^{LG}$$

3. Determine the contractual CE Payment in Dollars under the First Priority Contract C1. Determine Payment after Haircut. Update Remaining Loss Dollars and DCC Available Balance.

a. Determine CE Payment as the minimum of the Remaining Loss Dollars after MI or LSA (if applicable) times the DCC Loan-Level Coverage Limit (=1 if not MPI Contract) or the previous month's ending DCC Available Balance:

$$\mathrm{PD}_m^{DCC,C1} = min\left(\mathrm{RLD}_m^{DCC,(MI-LSA)} \times \mathrm{C}^{DCC,C1}, \mathrm{AB}_{m-1}^{DCC,C1}\right)$$

b. Determine CE Payment in Dollars after application of Haircuts:

$$\mathrm{PD}_m^{DCC,C1,H} = \mathrm{PD}_m^{DCC,C1} \times \left[1 - \frac{m'}{60} \times \mathrm{MaxHct}\left(\mathrm{R}^{DCC,C1}\right)\right]$$

Where:

$m'$ = *min* (m, 60). For counterparties rated below BBB, $m'$ = 60.

c. Update DCC Remaining Loss Dollars and DCC Available Balance under the First Priority Contract C1:

$$\mathrm{RLD}_m^{DCC,C1} = max\left(\mathrm{RLD}_m^{DCC,(MI-LSA)} - \mathrm{PD}_m^{DCC,C1,H}, 0\right)$$

$$\mathrm{AB}_m^{DCC,C1} = max\left(\left[\mathrm{AB}_{m-1}^{DCC,C1} - \mathrm{PD}_m^{DCC,C1}\right] \times \left(1 - \mathrm{Exp}_m^{DCC,C1}\right), 0\right)$$

Where:

$\mathrm{Exp}_m^C$ = 1 if the Contract has expired, i.e. if the calendar month corresponding to the $m^{th}$ month of the Stress Test is on or after the expiration month ($\mathrm{ExpMo}^C$)

$\mathrm{Exp}_m^C$ = 0 otherwise

4. Determine the contractual CE Payment in Dollars under the Second Priority Contract C2. Determine Payment after Haircut. Update Remaining Loss Dollars and DCC Available Balance.

a. Determine CE Payment as the minimum of the Remaining Loss Dollars after C1 Payment (if applicable) times a DCC Loan-Level Coverage Limit (=1 if not MPI Contract) or the previous month's ending DCC Available Balance:

$$\mathrm{PD}_m^{DCC,C2} = min\left(\mathrm{RLD}_m^{DCC,C1} \times \mathrm{C}^{DCC,C2}, \mathrm{AB}_{m-1}^{DCC,C2}\right)$$

b. Determine CE Payment in Dollars after application of Haircuts:

$$\mathrm{PD}_m^{DCC,C2,H} = \mathrm{PD}_m^{DCC,C2} \times \left[1 - \frac{m'}{60} \times \mathrm{MaxHct}\left(\mathrm{R}^{DCC,C2}\right)\right]$$

Where:

$m'$ = *min* (m, 60). For counterparties rated below BBB, $m'$ = 60.

c. Update DCC Remaining Loss Dollars and DCC Available Balance under the Second Priority Contract C2:

$$\mathrm{RLD}_m^{DCC,C2} = max\left(\mathrm{RLD}_m^{DCC,C1} - \mathrm{PD}_m^{DCC,C2,H}, 0\right)$$

$$\mathrm{AB}_m^{DCC,C2} = max\left(\left[\mathrm{AB}_{m-1}^{DCC,C2} - \mathrm{PD}_m^{DCC,C2}\right] \times \left(1 - \mathrm{Exp}_m^{DCC,C2}\right), 0\right)$$

Where:

$\mathrm{Exp}_m^C$ = 1 if the Contract has expired, i.e. if the calendar month corresponding to the $m^{th}$ month of the Stress Test is on or after the expiration month ($\mathrm{ExpMo}^C$)

$\mathrm{Exp}_m^C$ = 0 otherwise

5. Convert Aggregate Limit First and Second Priority Contract receipts in Dollars for each DCC in month m to a percentage of DCC Defaulted UPB:

$$ALPD_m^{DCC} = \frac{\left(PD_m^{DCC,C1,H} \times ELPI^{DCC,C1}\right) + \left(PD_m^{DCC,C2,H} \times ELPI^{DCC,C2}\right)}{DEF_m \times UPB_{m-1}^{LG} \times P^{DCC}}$$

Where:

$ELPI^{DCC,C1} = 0$ if $ELPF^{DCC,C1} = Y$ (Yes, indicating that C1 is an Enterprise Loss Position)

$ELPI^{DCC,C2} = 1$ otherwise

6. Add the Loan Limit CE (MI and LSA) and Aggregate Limit CE (ALPD), each expressed as a share of DCC Defaulted UPB, separately for each DCC to increment the respective Loan Group totals:

$$MI_m^{LG} = MI_m^{LG} + \left(P^{DCC} \times MI_m^{DCC}\right) \text{ for single family Loans; or}$$

$$LSA_m^{LG} = LSA_m^{LG} + \left(P^{DCC} \times LSA_m^{DCC}\right) \text{ for multifamily Loans; and}$$

$$ALCE_m^{LG} = ALCE_m^{LG} + \left(P^{DCC} \times ALPD_m^{DCC}\right) \text{ for both single family and multifamily Loans}$$

3.6.3.6.4.4 Mortgage Credit Enhancement Outputs

[a] Mortgage Credit Enhancement Outputs are set forth in Table 3–49.

TABLE 3–49—SINGLE FAMILY AND MULTIFAMILY CREDIT ENHANCEMENT OUTPUTS

| Variable | Description |
|---|---|
| $MI_m$ | MI payments applied to reduce single family Gross Loss Severity in month m of the Stress Test (as a fraction of Defaulted UPB in month m) |
| $LSA_m$ | LSA payments applied to reduce multifamily Gross Loss Severity in month m of the Street Test (as a fraction of Defaulted UPB in month m) |
| $ALCE_m$ | Aggregate receipts from all forms of Aggregate Limit Limit Credit Enhancement applied to reduce single- and multifamily Gross Loss Severity in month m of the Stress Test (as a fraction of Defaulted UPB in month m) |

[b] $MI_m^{LG}$ or $LSA_m^{LG}$ and $ALCE_m^{LG}$ for months m = 1...120 of the Stress Test are used in section 3.6.3.6.5, Single Family and Multifamily Net Loss Severity, of this Appendix.

3.6.3.6.5 Single Family and Multifamily Net Loss Severity

3.6.3.6.5.1 Single Family and Multifamily Net Loss Severity Procedures

Combine inputs and outputs from Gross Loss Severity and Credit Enhancements (Table 3–42 through Table 3–49) in the following formulas for each Loan Group in month m:

[a] For Conventional single family Loan Groups:

$$LS_m^{SF} = \frac{1}{\left(1 + \frac{DR_m}{2}\right)^{\frac{MQ}{6}}} + \frac{\left(\frac{MQ}{12} \times PTR_m\right) + F - MI_m}{\left(1 + \frac{DR_m}{2}\right)^{\frac{MF}{6}}} + \frac{R - RP_m - ALCE_m}{\left(1 + \frac{DR_m}{2}\right)^{\frac{MF+MR}{6}}}$$

[b] For Government single family Loan Groups, complete the following three steps:

1. Compute a Loss Severity value for FHA-insured loans using the Conventional formula for all government loans. FHA reimbursement rates will be reflected in the value of $MI_m$, as computed in section 3.6.3.6.4.3, Mortgage Credit Enhancement Procedures, of this Appendix.
2. Compute a Loss Severity value for VA-insured loans as follows for all government loans:

$$LS_m^{VA} = \frac{1 + F + \left(\frac{MQ}{12} \times PTR_m\right) + \left(R - RP_m\right) - 0.30}{\left(1 + \frac{DR_m}{2}\right)^{\frac{MF}{6}}}$$

Where:

0.30 is a fixed percentage representing the VA guarantee coverage percentage. (The VA coverage rate is a function of the initial loan size.)

3. Compute Net Loss Severity by combining FHA-insured and VA-insured Loss Severity values as follows:

$$LS_m^{SF,GVT} = \left(\frac{2}{3} \times LS_m^{SF}\right) + \left(\frac{1}{3} \times LS_m^{VA}\right)$$

[c] For multifamily Loan Groups other than FHA-Insured:

$$LS_m^{MF} = \frac{1+\left(\frac{MQ}{12}\times PTR_m\right)}{\left(1+\frac{DR_m}{2}\right)^{\frac{MQ}{6}}} + \frac{\frac{RHC}{2}-LSA_m}{\left(1+\frac{DR_m}{2}\right)^{\frac{MF}{6}}} + \frac{\frac{RHC}{2}-RP-ALCE_m}{\left(1+\frac{DR_m}{2}\right)^{\frac{MF+MR}{6}}}$$

[d] For FHA-Insured multifamily Loan Groups:

$$LS_m^{MF} = 0.03 \text{ (3 percent) for all months}$$

3.6.3.6.5.2 Single Family and Multifamily Net Loss Severity Outputs

Net Loss Severity outputs are set forth in Table 3–50:

TABLE 3–50—SINGLE FAMILY AND MULTIFAMILY LOSS SEVERITY OUTPUTS

| Variable | Description |
|---|---|
| $LS_m^{SF}$ | Loss Severity (as a fraction of Defaulted UPB) for single family loans in month m |
| $LS_m^{MF}$ | Loss Severity (as a fraction of Defaulted UPB) for multifamily loans in month m |

Single family and multifamily Loss Severities for months 1...120 of the Stress Test are used in section 3.6.3.7, Stress Test Whole Loan Cash Flows, of this Appendix.

3.6.3.7 Stress Test Whole Loan Cash Flows

3.6.3.7.1 Stress Test Whole Loan Cash Flow Overview

This section combines the mortgage Amortization Schedules with Default, Prepayment and Net Loss Severity Rates to produce performance-adjusted cash flows for Enterprise Whole Loans in the Stress Test.

3.6.3.7.2 Stress Test Whole Loan Cash Flow Inputs

The inputs required to compute Stress Test Whole Loan Cash Flows for each Loan Group are listed in Table 3–51.

TABLE 3–51—INPUTS FOR FINAL CALCULATION OF STRESS TEST WHOLE LOAN CASH FLOWS

| Variable | Description | Source |
|---|---|---|
| $UPB_m$ | Aggregate Unpaid Principal Balance in month m = 0...RM | section 3.6.3.3.4, Mortgage Amortization Schedule Outputs |
| $NYR_m$ | Net Yield Rate in month m = 1...RM | section 3.6.3.3.4, Mortgage Amortization Schedule Outputs |
| GF | Guarantee Fee rate (weighted average for Loan Group) (decimal per annum) | RBC Report |
| $PTR_m$ | Pass-Through Rate in month m = 1...RM | section 3.6.3.3.4, Mortgage Amortization Schedule Outputs |
| $SP_m$ | Aggregate Scheduled Principal (Amortization) in month m = 1...RM | section 3.6.3.3.4, Mortgage Amortization Schedule Outputs |
| $PRE_m^{SF}$<br>$PRE_m^{MF}$ | Prepaying Fraction of original Loan Group in month m = 1...RM | section 3.6.3.4.4, Single Family Default and Prepayment Outputs and,<br>section 3.6.3.5.4, Multifamily Default and Prepayment Outputs |
| $DEF_m^{SF}$<br>$DEF_m^{MF}$ | Defaulting Fraction of original Loan Group in month m = 1...RM | section 3.6.3.4.4, Single Family Default and Prepayment Outputs and,<br>section 3.6.3.5.4, Multifamily Default and Prepayment Outputs |
| $PERF_m^{SF}$<br>$PERF_m^{MF}$ | Performing Fraction of original Loan Group in month m = 1...RM | section 3.6.3.4.4, Single Family Default and Prepayment Outputs and,<br>section 3.6.3.5.4, Multifamily Default and Prepayment Outputs |
| FDS | Float Days for Scheduled Principal and Interest | RBC Report |
| FDP | Float Days for Prepaid Principal | RBC Report |
| $FER_m$ | Float Earnings Rate in month m = 1...RM | 1 week Fed Funds Rate; section 3.3, Interest Rates |
| $LS_m^{SF}$ | Loss Severity Rate in month m = 1...RM | section 3.6.3.6.5.2, Single Family and Multifamily Net Loss Severity Outputs |
| FREP | Fraction Repurchased (weighted average for Loan Group) (decimal) | RBC Report |

3.6.3.7.3 Stress Test Whole Loan Cash Flow Procedures

[a] Calculate Stress Test whole loan cash flows using the following nine steps:

1. Calculate Scheduled Principal Received (SPR) in month m:

$$SPR_m = max\left(SP_m, 0\right) \times \left(PERF_m + PRE_m\right)$$

*Note:* Scheduled Principal Received is zero, not negative, when amortization is negative.

2. Calculate Net Interest Received (NIR) in month m. Any interest shortfall due to Negative Amortization reduces Net Yield directly. *Note:* NIR includes loans that default in month m, because lost interest is included in Credit Losses in step 6) of this section. (*See* section 3.6.3.6, Calculation of Single Family and Multifamily Mortgage Losses, of this Appendix.)

$$NIR_m = \left[\left(UPB_{m-1} \times \frac{NYR_m}{12}\right) + min\left(SP_m, 0\right)\right] \times PERF_{m-1}$$

3. Calculate Prepaid Principal Received (PPR) in month m:

$$PPR_m = UPB_m \times PRE_m$$

4. Calculate newly Defaulted Principal (DP) in month m:

$$DP_m = UPB_{m-1} \times DEF_m$$

5. Calculate Recovery Principal Received (RPR) on account of loans that Defaulted in month m:

$$RPR_m = UPB_{m-1} \times DEF_m \times \left(1 - LS_m\right)$$

6. Calculate Credit Losses (CL) on account of loans that Defaulted in month m:

$$CL_m = UPB_{m-1} \times DEF_m \times LS_m$$

In addition, if m = RM and $UPB_{RM} > 0$ then,

$$CL_{RM} = \left(UPB_{RM} \times PERF_{RM}\right) + \left(UPB_{RM-1} \times DEF_{RM} \times LS_{RM}\right),$$

and

$$PUPB_{RM} = 0$$

7. Calculate Performing Loan Group UPB in month m ($PUPB_m$), including $PUPB_0$.

*Note:* All loans are assumed to be performing in month 0; therefore $PUPB_0 = UPB_0$.

$$PUPB_m = UPB_m \times PERF_m$$

8. Calculate Total Principal Received (TPR) and Total Interest Received (TIR) in month m:

$$TPR_m = SPR_m + PPR_m + RPR_m$$

$$TIR_m = NIR_m$$

9. For Sold Loans, calculate the following cash flow components:

a. Guarantee Fee (GF) received in month m:

$$GF_m = UPB_{m-1} \times \frac{GFR}{12} \times \left(PERF_m + PRE_m\right)$$

b. Float Income (FI) received in month m:

$$FI_m = \left[\left(\left(SPR_m + NIR_m - GF_m\right) \times \frac{FDS}{365}\right) + \left(PPR_m \times \frac{FDP}{365}\right)\right] \times FER_m - PIS_m$$

Where:

Prepayment Interest Shortfall (PIS) in month m is:

$$PIS_m = UPB_{m-1} \times PRE_m \times \frac{PTR_m}{12} \quad \text{if } FDP \geq 30$$

$$PIS_m = UPB_{m-1} \times PRE_m \times \frac{PTR_m}{24} \quad \text{if } 15 \leq FDP < 30$$

3.6.3.7.4 Stress Test Whole Loan Cash Flow Outputs

The Whole Loan Cash Flows in Table 3–52 are used to prepare pro forma balance sheets and income statements for each month of the Stress Period (*see* section 3.10 Operations, Taxes and Accounting, of this Appendix). For Retained Loan groups, cash flows consist of Scheduled Principal, Prepaid Principal, Defaulted Principal, Credit Losses, and Interest. For Sold Loan groups, cash flow consists of Credit Losses, Guarantee Fees and Float Income. For Repurchased MBSs, cash flows are allocated according to the Fraction Repurchased. Table 3–52 covers all cases; for Retained Loans FREP = 1.0.

TABLE 3–52—OUTPUTS FOR WHOLE LOAN CASH FLOWS

| Variable | Description |
|---|---|
| $SPR_m$ | Scheduled Principal Received in month m = 1...RM |
| $PPR_m$ | Prepaid Principal Received in month m = 1...RM |
| $DP_m$ | Defaulted Principal in month m = 1...RM |
| $CL_m$ | Credit Losses in month m = 1...RM |
| $PUPB_m$ | Performing Loan Group UPB in month m = 0...RM |
| $TPR_m$ | Total Principal Received in month m = 1...RM |
| $TIR_m$ | Total Interest Received in month m = 1...RM |
| $GF_m$ | Guarantee Fees received in month m = 1...RM |
| $FI_m$ | Float Income received in month m = 1...RM |

TABLE 3–53—ADDITIONAL OUTPUTS FOR REPURCHASED MBSS

| Variable | Quantity | Description |
|---|---|---|
| $STPR_m$ | FREP × ($SPR_m$ + $PPR_m$+ $DP_m$) | Enterprise's portion of Total Principal Received in months m = 1...RM, reflecting its fractional ownership of the MBS |
| $STIR_m$ | FREP × ($TIR_m - GF_m$) | Enterprise's portion of Total Interest Received (at the Pass-Through Rate) in months m = 1...RM, reflecting its fractional ownership of the MBS |

TABLE 3–53—ADDITIONAL OUTPUTS FOR REPURCHASED MBSS—Continued

| Variable | Quantity | Description |
|---|---|---|
| $SPUPB_m$ | $FREP \times PUPB_m$ | Enterprise's portion of the Performing UPB of the repurchased MBS in months m = 0...RM, reflecting its fractional ownership of the MBS |

3.6.3.8 Whole Loan Accounting Flows

3.6.3.8.1 Whole Loan Accounting Flows Overview

[a] For accounting purposes, cash flows are adjusted to reflect (1) the value over time of discounts, premiums and fees paid or received (Deferred Balances) when an asset was acquired; and (2) the fact that mortgage interest is paid in arrears, i.e. it is received in the month after it is earned. In the Stress Test calculations, payments are indexed by the month in which they are received. Therefore, interest received in month m was earned in month m − 1. However, principal is accounted for in the month received.

[b] Deferred Balances are amortized over the remaining life of the asset. Therefore, these calculations go beyond the end of the Stress Test if the Remaining Maturity (RM) is greater than the 120 months of the Stress Test. The projection of cash flows beyond the end of the Stress Test is discussed in the individual sections where the cash flows are first calculated. In general, for interest rate indexes, monthly Prepayment rates and monthly Default rates, the value for m = 120 is used for all months $120 < m \leq RM$, but LS = 0 for m > 120.

3.6.3.8.2 Whole Loan Accounting Flows Inputs

The inputs in Table 3–54 are required to compute Accounting Flows:

TABLE 3–54—INPUTS FOR WHOLE LOAN ACCOUNTING FLOWS

| Variable | Description | Source |
|---|---|---|
| RM | Remaining Term to Maturity in months | RBC Report |
| $UPD_0$ | Unamortized Premium (positive) or Discount (negative) (Deferred Balances) for the Loan Group at the start of the Stress Test | RBC Report |
| $NYR_0$ | Net Yield Rate at time zero | section 3.6.3.3.4, Mortgage Amortization Schedule Outputs |
| $PUPB_m$ | Performing Loan Group UPB in months m = 0...RM | section 3.6.3.7.4, Stress Test Whole Loan Cash Flow Outputs |
| $PTR_0$ | Pass-Through Rate at time zero | section 3.6.3.3.4, Mortgage Amortization Schedule Outputs |
| $SPUPB_m$ | Security Performing UPB in months m = 0...RM | section 3.6.3.7.4, Stress Test Whole Loan Cash Flow Outputs |
| $SUPD_0$ | Security Unamortized Premium (positive) or Discount (negative) associated with the repurchase price of a Repurchased MBS (aggregate over all purchases of the same MBS) | RBC Report |

3.6.3.8.3 Whole Loan Accounting Flows Procedures

3.6.3.8.3.1 Accounting for Retained and Sold Whole Loans

[a] Complete the following three steps to account for Retained and Sold loans:

1. Compute Allocated Interest in month m ($AI^m$) as follows:

$$AI_m = PUPB_{m-1} \times \frac{NYR_0}{12}$$

*Note:* Allocated Interest is used only to determine the allocation of Amortization Expense over time, not to generate actual cash flows)

2. Calculate the monthly Internal Rate of Return (IRR) that equates the adjusted cash flows (actual principal plus Allocated Interest) to the Initial Book Value ($BV_0$) of the Loan Group. A single IRR is used for all months m. Solve for IRR such that:

$$BV_0 = \sum_{m=1}^{RM} \frac{ACF_m}{(1+IRR)^m}$$

Where:

$$BV_0 = PUPB_0 + UPD_0$$

$$ACF_m = AI_m - PUPB_m + PUPB_{m-1}$$

3. Calculate the monthly Amortization Expense for each month m:
   a. If $BV_0 < 0$, or if $12 \times IRR > 1.0$ (100%), or if

$$BV_0 > \sum_{m=1}^{RM} ACF_m$$

then the full amount of $UPD_0$ is realized in the first month ($AE_1 = -UPD_0$)

   b. Otherwise:

$$AE_m = (BV_{m-1} \times IRR) - AI_m \quad \text{if } PUPB_m > 0$$

$$AE_m = -UPD_{m-1} \text{ if } PUPB_m = 0$$

$$UPD_m = UPD_{m-1} + AE_m$$

$$BV_m = PUPB_m + UPD_m$$

3.6.3.8.3.2 Additional Accounting for Repurchased MBSs

[a] Complete the following three steps to account for Repurchased MBSs:

1. Compute Security Allocated Interest in month m ($SAI_m$) as follows:

$$SAI_m = SPUPB_{m-1} \times \frac{PTR_0}{12}$$

*Note:* Security Allocated Interest is used only to determine the allocation of Security Amortization Expense over time, not to generate actual cash flows.

2. Calculate the monthly Internal Rate of Return (IRR) that equates the adjusted cash flows (actual principal plus Allocated Interest) to the Initial Book Value ($SBV_0$) of the Loan Group. A single IRR is used for all months m. Solve for IRR such that:

$$SBV_0 = \sum_{m=1}^{RM} \frac{SACF_m}{(1+IRR)^m}$$

Where:

$SBV_0 = SPUPB_0 + SUPD_0$

$SACF_m = SAI_m - SPUPB_m + SPUPB_{m-1}$

3. Calculate the monthly Security Amortization Expense for each month m:
   a. If $SBV_0 < 0$, or if $12 \times IRR > 1.0$ (100%), or if

$$SBV_0 > \sum_{m=1}^{RM} SACF_m$$

then the full amount of $SUPD_0$ is realized in the first month ($SAE_1 = -SUPD_0$).

b. Otherwise:

$$SAE_m = (SBV_{m-1} \times IRR) - SAI_m \quad \text{if } SPUPB_m > 0$$

$$SAE_m = -SUPD_{m-1} \text{ if } SPUPB_m = 0$$

$$SUPD_m = SUPD_{m-1} + SAE_m$$

$$SBV_m = SPUPB_m + SUPD_m$$

3.6.3.8.4 Whole Loan Accounting Flows Outputs

Whole loan accounting flows outputs are set forth in Table 3–55. Amortization Expense for months m = 1...RM are used in section 3.10, Operations, Taxes, and Accounting, of this Appendix.

TABLE 3–55—OUTPUTS FOR WHOLE LOAN ACCOUNTING FLOWS

| Variable | Description |
|---|---|
| $AE_m$ | Amortization Expense for months m = 1...RM |
| $SAE_m$ | Security Amortization Expense for months m = 1...RM |

3.6.4 Final Whole Loan Cash Flow Outputs

The final outputs for section 3.6, Whole Loan Cash Flows, of this Appendix are as specified in Table 3–52, and Table 3–55.

*3.7 Mortgage-Related Securities Cash Flows*

3.7.1 Mortgage-Related Securities Overview

[a] Mortgage-Related Securities (MRSs) include Single Class MBSs, Multi-class MBSs (REMICs or Collateralized Mortgage Obligations (CMOs)), Mortgage Revenue Bonds (MRBs), and Derivative Mortgage Securities such as Interest-Only and Principal-Only Stripped MBSs. MBSs and Derivative Mortgage Securities are issued by the Enterprises, Ginnie Mae and private issuers. MRBs are issued by State and local governments or their instrumentalities. For computational purposes, certain Asset-Backed Securities (ABS) backed by mortgages (Mortgage ABSs backed by manufactured housing loans, second mortgages or home equity loans) are treated as REMICs in the Stress Test.

[b] Cash flows from Single Class MBSs represent the pass-through of all principal and interest payments, net of servicing and guarantee fees, on the underlying pools of mortgages. Cash flows from Multi-Class MBSs and Derivative Mortgage Securities represent a specified portion of the cash flows produced by an underlying pool of mortgages and/or Mortgage-Related Securities, determined according to rules set forth in offering documents for the securities. MRBs may have specific maturity schedules and call provisions, whereas MBSs have only expected maturities and, in most cases, no issuer call provision (other than ''cleanup calls'' if the pool balance becomes quite small). However, the timing of principal payments for MRBs is still closely related to that of their underlying mortgage collateral. The Stress Test treats most MRBs in a manner similar to single class MBSs. Finally, a small number of Enterprise and private label REMIC securities for which modeling information is not readily available and which are not modeled by a commercial information service (referred to as ''miscellaneous MRS'') are treated separately.

[c] In addition to reflecting the defaults of mortgage borrowers during the Stress Period, the Stress Test considers the possibility of issuer Default on Mortgage-Related Securities. Credit impairments throughout the Stress Period are based on the rating of these securities, and are modeled by reducing contractual interest payments and ''writing down'' principal. No Credit Losses are assumed for the Enterprise's own securities and Ginnie Mae securities (*see* section 3.5.3, Counterparty Defaults Procedures, of this Appendix).

[d] The calculation of cash flows for Mortgage-Related Securities requires information from the Enterprises identifying their holdings, publicly available information characterizing the securities, and information on the interest rate, mortgage performance and credit rating (for rated securities).

[e] Cash and accounting flows—monthly principal and interest payments and amortization expense—are produced for each month of the Stress Period for each security. (Principal- and interest-only securities pay principal or interest respectively.) These cash flows are input to the Operations, Taxes, and Accounting component of the Stress Test.

3.7.2 Mortgage-Related Securities Inputs

3.7.2.1 Inputs Specifying Individual Securities

3.7.2.1.1 Single Class MBSs

The information in Table 3–56 is required for single class MBSs held by an Enterprise at the start of the Stress Test. This information identifies the Enterprise's holdings and describes the MBS and the underlying mortgage loans.

TABLE 3–56—RBC REPORT INPUTS FOR SINGLE CLASS MBS CASH FLOWS

| Variable | Description |
|---|---|
| Pool Number | A unique number identifying each mortgage pool |
| CUSIP Number | A unique number assigned to publicly traded securities by the Committee on Uniform Securities Identification Procedures |
| Issuer | Issuer of the mortgage pool |
| Original UPB Amount | Original pool balance multiplied by the Enterprise's percentage ownership. |
| Current UPB Amount | Initial Pool balance (at the start of the Stress Test), multiplied by the Enterprise's percentage ownership |
| Product Code | Mortgage product type for the pool |
| Security Rate Index | If the rate on the security adjusts over time, the index that the adjustment is based on |
| Unamortized Balance | The sum of all unamortized discounts, premiums, fees, commissions, etc. Components of the balance that amortize as a gain (like discounts) should be positive. Components that amortize as a cost or as a loss (premiums, fees, etc.) should be negative. |
| Wt Avg Original Amortization Term | Original amortization term of the underlying loans, in months (weighted average for underlying loans) |
| Wt Avg Remaining Term of Maturity | Remaining Maturity of the underlying loans at the start of the Stress Test (weighted average for underlying loans) |
| Wt Avg Age | Age of the underlying loans at the start of the Stress Test (weighted average for underlying loans) |
| Wt Avg Current Mortgage Interest rate | Mortgage Interest Rate of the underlying loans at the start of the Stress Test (weighted average for underlying loans) |
| Wt Avg Pass-Through Rate | Pass-Through Rate of the underlying loans at the start of the Stress Test (weighted average for underlying loans) |
| Wt Avg Original Mortgage Interest Rate | The current UPB weighted average Mortgage Interest Rate in effect at Origination for the loans in the pool |

TABLE 3–56—RBC REPORT INPUTS FOR SINGLE CLASS MBS CASH FLOWS—Continued

| Variable | Description |
|---|---|
| Security Rating | The most current rating issued by any Nationally Recognized Statistical Rating Organization (NRSRO) for this security, as of the reporting date. In the case of a ''split'' rating, the lowest rating should be given. |
| Wt Avg Gross Margin | Gross margin for the underlying loans (ARM MBS only) (weighted average for underlying loans) |
| Wt Avg Net Margin | Net margin (used to determine the security rate for ARM MBS) (weighted average for underlying loans) |
| Wt Avg Rate Reset Period | Rate reset period in months (ARM MBS only) (weighted average for underlying loans) |
| Wt Avg Rate Reset Limit | Rate reset limit up/down (ARM MBS only) (weighted average for underlying loans) |
| Wt Avg Life Interest Rate Ceiling | Maximum rate (lifetime cap) (ARM MBS only) (weighted average for underlying loans) |
| Wt Avg Life Interest Rate Floor | Minimum rate (lifetime floor) (ARM MBS only) (weighted average for underlying loans) |
| Wt Avg Payment Reset Period | Payment reset period in months (ARM MBS only) (weighted average for underlying loans). |
| Wt Avg Payment Reset Limit | Payment reset limit up/down (ARM MBS only) (weighted average for underlying loans) |
| Wt Avg Lookback Period | The number of months to look back from the interest rate change date to find the index value that will be used to determine the next interest rate (ARM MBS only) (weighted average for underlying loans) |
| Wt Avg Negative Amortization Cap | The maximum amount to which the balance can increase before the payment is recast to a fully amortizing amount. It is expressed as a fraction of the original UPB. (ARM MBS only) (weighted average for underlying loans) |
| Wt Avg Initial Interest Rate Period | Number of months between the loan origination date and the first rate adjustment date (ARM MBS only) (weighted average for underlying loans) |
| Wt Avg Unlimited Payment Reset Period | Number of months between unlimited payment resets i.e., not limited by payment caps, starting with Origination date (ARM MBS only) (weighted average for underlying loans) |
| Notional Flag | Indicates that amounts reported in Original UPB Amount and Current UPB Amount are notional |
| UPB Scale Factor | Factor applied to the current UPB that offsets any timing adjustments between the security level data and the Enterprise's published financials |
| Whole Loan Modeling Flag | Indicates that the Current UPB Amount and Unamortized Balance associated with this Repurchased MBS are included in the Wt Avg Percent Repurchased and Security Unamortized Balance fields |
| FAS 115 Classification | The financial instrument's classification according to FAS 115 |
| $HPGR_K$ | Vector of House Price Growth Rates for quarters q=1...40 of the Stress Period. |

3.7.2.1.2 Multi-Class MBSs and Derivative Mortgage Securities

[a] The information in Table 3–57 is required for Multi-Class MBSs and Derivative Mortgage Securities held by an Enterprise at the start of the Stress Test. This information identifies the MBS and an Enterprise's holdings.

TABLE 3–57—RBC REPORT INPUTS FOR MULTI-CLASS AND DERIVATIVE MBS CASH FLOWS

| Variable | Description |
|---|---|
| CUSIP Number | A unique number assigned to publicly traded securities by the Committee on Uniform Securities Identification Procedures |
| Issuer | Issuer of the security: FNMA, FHLMC, GNMA or other |
| Original Security Balance | Original principal balance of the security (notional amount for Interest-Only securities) at the time of issuance, multiplied by the Enterprise's percentage ownership |
| Current Security Balance | Initial principal balance, or notional amount, at the start of the Stress Period multiplied by the Enterprise's percentage ownership |
| Current Security Percentage Owned | The percentage of a security's total current balance owned by the Enterprise |
| Unamortized Balance | The sum of all unamortized discounts, premiums, fees, commissions, etc. Components of the balance that amortize as a gain (like discounts) should be positive. Components that amortize as a cost or as a loss (premiums, fees, etc.) should be negative. |

[b] The Stress Test requires sufficient information about the cash flow allocation rules among the different classes of a Multi-Class MBS to determine the cash flows for the individual class(es) owned by an Enterprise, including descriptions of the component classes of the security, the underlying collateral, and the rules directing cash flows to the component classes. This information is obtained from offering documents or securities data services. In the Stress Test, this information is used either as an input to a commercial modeling service or, for securities that are not so modeled, to derive an approximate modeling treatment as described more fully in this section.

[c] If a Derivative Mortgage Security is itself backed by one or more underlying

securities, sufficient information is required for each underlying security as described in the preceding paragraph.

3.7.2.1.3 Mortgage Revenue Bonds and Miscellaneous MRSs

[a] The Stress Test requires two types of information for Mortgage Revenue Bonds and miscellaneous MRS held by an Enterprise at the start of the Stress Test: information identifying the Enterprise's holdings and the contractual terms of the securities. The inputs required for these instruments are set forth in Table 3–58.

TABLE 3–58—RBC REPORT INPUTS FOR MRBS AND DERIVATIVE MBS CASH FLOWS

| Variable | Description |
|---|---|
| CUSIP Number | A unique number assigned to publicly traded securities by the Committee on Uniform Securities Identification Procedures |
| Original Security Balance | Original principal balance, multiplied by the Enterprise's percentage ownership |
| Current Security Balance | Initial principal balance (at start of Stress Period), multiplied by the Enterprise's percentage ownership |
| Unamortized Balance | The sum of all unamortized discounts, premiums, fees, commissions, etc. Components of the balance that amortize as a gain (like discounts) should be positive. Components that amortize as a cost or as a loss (premiums, fees, etc.) should be negative. |
| Issue Date | The Issue Date of the security |
| Maturity Date | The stated Maturity Date of the security |
| Security Interest Rate | The rate at which the security earns interest, as of the reporting date |
| Principal Payment Window Starting Date, Down-Rate Scenario | The month in the Stress Test that principal payment is expected to start for the security under the statutory ''down'' interest rate scenario, according to Enterprise projections |
| Principal Payment Window Ending Date, Down-Rate Scenario | The month in the Stress Test that principal payment is expected to end for the security under the statutory ''down'' interest rate scenario, according to Enterprise projections |
| Principal Payment Window Starting Date, Up-Rate Scenario | The month in the Stress Test that principal payment is expected to start for the security under the statutory ''up'' interest rate scenario, according to Enterprise projections |
| Principal Payment Window Ending Date, Up-Rate Scenario | The month in the Stress Test that principal payment is expected to end for the security under the statutory ''up'' interest rate scenario, according to Enterprise projections |
| Security Rating | The most current rating issued by any Nationally Recognized Statistical Rating Organization (NRSRO) for this security, as of the reporting date. In the case of a ''split'' rating, the lowest rating should be given. |
| Security Rate Index | If the rate on the security adjusts over time, the index on which the adjustment is based |
| Security Rate Index Coefficient | If the rate on the security adjusts over time, the coefficient is the number used to multiply by the value of the index |
| Security Rate Index Spread | If the rate on the security adjusts over time, the spread is added to the value of the index multiplied by the coefficient to determine the new rate |
| Security Rate Adjustment Frequency | The number of months between rate adjustments |
| Security Interest Rate Ceiling | The maximum rate (lifetime cap) on the security |
| Security Interest Rate Floor | The minimum rate (lifetime floor) on the security |

[b] The Payment Window Starting and Ending Dates are projected by the Enterprise on the basis of prospectus information or simulations from a dealer in the securities or other qualified source, such as the structured finance division of an accounting firm, for the two statutory scenarios.

3.7.2.2 Interest Rate Inputs

Interest rates projected for each month of the Stress Period are used to calculate principal amortization and interest payments for ARM MBSs and MRBs, and for Derivative Mortgage Securities with indexed coupon rates. This information is produced in section 3.3, Interest Rates, of this Appendix.

3.7.2.3 Mortgage Performance Inputs

Default and Prepayment rates for the loans underlying a single- or multiclass MBS are computed according to the characteristics of the loans as specified in this section 3.7.2, Mortgage-Related Securities Inputs. LTV and Census Region are not uniquely specified for the loans underlying a given security; instead, the Prepayment and Default rates are averaged over all LTV categories, weighted according to the distribution of LTVs given in Table 3–59. (This weighting applies to Time Zero, i.e., the start of the Stress Test; the weightings will change over time as individual LTV groups pay down at different rates. *See* section 3.7.3, Mortgage-Related Securities Procedures, of this Appendix.) Instead of Census Division, the national average HPI is used for all calculations in this section.

TABLE 3–59—AGGREGATE ENTERPRISE AMORTIZED ORIGINAL LTV ($AOLTV_0$) DISTRIBUTION [1]

| Original LTV | UPB Distribution | Wt Avg AOLTV for Range |
|---|---|---|
| 00<LTV<=60 | 17.00% | 48.35% |
| 60<LTV<=70 | 14.15% | 66.35% |
| 70<LTV<=75 | 14.99% | 73.81% |
| 75<LTV<=80 | 26.84% | 79.30% |
| 80<LTV<=90 | 14.78% | 88.31% |
| 90<LTV<=95 | 10.89% | 94.67% |
| 95<LTV<=100 | 1.35% | 97.51% |
| 100<LTV | 0.00% | 100.02% |

[1] Source: Combined Enterprise Portfolios as of the second quarter, 2000.

*Note:* Amortized Original LTV (also known as the ''current-loan-to-original-value'' ratio) is the Original LTV adjusted for the change in UPB but not for changes in property value. Because of its small size the LTV>100 group is not used in the calculation.

3.7.2.4 Third-Party Credit Inputs

For securities not issued by the Enterprise or Ginnie Mae, issuer Default risk is reflected by haircutting the instrument cash flows based on the rating of the security, as described in section 3.5, Counterparty Defaults, of this Appendix.

3.7.3 Mortgage-Related Securities Procedures

The following sections describe the calculations for (1) single class MBSs, (2) Multi-Class MBSs and derivative mortgage securities, and (3) MRBs and miscellaneous MRS.

3.7.3.1 Single Class MBSs

[a] The calculation of cash flows for single class MBSs is based on the procedures outlined earlier in section 3.6, Whole Loan Cash Flows, of this Appendix. The collateral (i.e., the mortgage pool) underlying each MBS is treated as one single family Loan Group with characteristics equal to the weighted average characteristics of the underlying loans.

[b] For each MBS, compute the scheduled cash flows specified in Table 3–33, as directed in section 3.6.3.3.3, Mortgage Amortization Schedule Procedures of this Appendix, with the following exceptions and clarifications:

1. The Net Yield Rate (NYR) is not used in the MBS calculation. Instead, the Pass-Through Rate (for Fixed-Rate MBSs) and INDEX + Net Margin (for Adjustable-Rate MBSs) are used.
2. PMT is not a direct input for MBSs. (That is, it is not specified in the RBC Report.) Instead, compute PMT from UPB, MIR and remaining amortizing term $AT - A_0$, using the standard mortgage payment formula (and update it as appropriate for ARMs, as described in the Whole Loan calculation).
3. For ARM MBS, interest rate and monthly payment adjustments for the underlying loans are calculated in the same manner as they are for ARM Loan Groups.
4. MBSs backed by Biweekly mortgages, GPMs, TPMs, GEMs, and Step mortgages are mapped into mortgage types as described in section 3.6, Whole Loan Cash Flows, of this Appendix.

[c] Use the Loan Group characteristics to generate Default and Prepayment rates as described in section 3.6.3.4.3, Single Family Default and Prepayment Procedures, of this Appendix. For the following explanatory variables that are not specified for MBSs, proceed as follows:

1. For fixed rate Ginnie Mae certificates and the small number of multifamily MBS held by the Enterprises, use the model coefficients for Government Loans. For loans underlying Ginnie Mae ARM certificates, use the conventional ARM model coefficients.
2. Set Investor Fraction (IF) = 7.56%
3. Set Relative Loan Size (RLS) = 1.0. For Ginnie Mae certificates, use RLS = 0.75.
4. For $LTV_{ORIG}$ of the underlying loans: Divide the MBS's single weighted average Loan Group into several otherwise identical Loan Groups (''LTV subgroups''), one for each Original LTV range specified in Table 3–59. $UPB_0$ for each of these LTV subgroups is the specified percentage of the aggregate $UPB_0$. $AOLTV_0$ for each subgroup is also specified in Table 3–59. For Ginnie Mae certificates, use only the $95 < LTV \leq 100$ LTV category and its associated weighted average LTV.
5. For each LTV subgroup, compute $LTV_0$ as follows:

$$LTV_0 = AOLTV_0 \times \left( \frac{HPI_{ORIG}}{HPI_{AQ'_0}} \right)^{\frac{AQ_0}{AQ'_0}}$$

Where:

HPI = the national average HPI figures in Table 3–60 (updated as necessary from subsequent releases of the OFHEO HPI).

$A_0$ = weighted average age in months of the underlying loans immediately prior to the start of the Stress Test.

$AQ_0$ = weighted average age in quarters of the underlying loans immediately prior to the start of the Stress Test. $AQ_0 = int\ (A_0/3)$.

$AQ'_0 = AQ_0$ minus the number of whole quarters between the most recently available HPI at the start of the Stress Test and time zero.

If $AQ'_0 \leq 0$, then $LTV_0 = AOLTV_0$.

TABLE 3–60—HISTORICAL NATIONAL AVERAGE HPI [1]

| Quarter [2] | HPI | Quarter | HPI | Quarter | HPI |
|---|---|---|---|---|---|
| 1975Q1 | 62.45 | 1983Q4 | 116.63 | 1992Q3 | 177.94 |
| 1975Q2 | 63.50 | 1984Q1 | 118.31 | 1992Q4 | 178.71 |
| 1975Q3 | 62.85 | 1984Q2 | 120.40 | 1993Q1 | 178.48 |
| 1975Q4 | 63.92 | 1984Q3 | 121.68 | 1993Q2 | 179.89 |
| 1976Q1 | 65.45 | 1984Q4 | 122.94 | 1993Q3 | 180.98 |
| 1976Q2 | 66.73 | 1985Q1 | 124.81 | 1993Q4 | 182.38 |
| 1976Q3 | 67.73 | 1985Q2 | 126.91 | 1994Q1 | 183.35 |
| 1976Q4 | 68.75 | 1985Q3 | 129.38 | 1994Q2 | 183.95 |
| 1977Q1 | 70.70 | 1985Q4 | 131.20 | 1994Q3 | 184.43 |
| 1977Q2 | 73.34 | 1986Q1 | 133.77 | 1994Q4 | 184.08 |
| 1977Q3 | 75.35 | 1986Q2 | 136.72 | 1995Q1 | 184.85 |
| 1977Q4 | 77.71 | 1986Q3 | 139.37 | 1995Q2 | 187.98 |
| 1978Q1 | 79.96 | 1986Q4 | 141.99 | 1995Q3 | 190.81 |
| 1978Q2 | 82.75 | 1987Q1 | 145.07 | 1995Q4 | 192.42 |
| 1978Q3 | 85.39 | 1987Q2 | 147.88 | 1996Q1 | 194.80 |
| 1978Q4 | 87.88 | 1987Q3 | 150.21 | 1996Q2 | 195.00 |
| 1979Q1 | 91.65 | 1987Q4 | 151.57 | 1996Q3 | 195.78 |
| 1979Q2 | 94.26 | 1988Q1 | 154.26 | 1996Q4 | 197.48 |
| 1979Q3 | 96.24 | 1988Q2 | 157.60 | 1997Q1 | 199.39 |

TABLE 3–60—HISTORICAL NATIONAL AVERAGE HPI [1]—Continued

| Quarter [2] | HPI | Quarter | HPI | Quarter | HPI |
|---|---|---|---|---|---|
| 1979Q4 | 98.20 | 1988Q3 | 159.25 | 1997Q2 | 201.00 |
| 1980Q1 | 100.00 | 1988Q4 | 160.96 | 1997Q3 | 203.94 |
| 1980Q2 | 100.86 | 1989Q1 | 163.10 | 1997Q4 | 206.97 |
| 1980Q3 | 104.27 | 1989Q2 | 165.33 | 1998Q1 | 210.09 |
| 1980Q4 | 104.90 | 1989Q3 | 169.09 | 1998Q2 | 212.37 |
| 1981Q1 | 105.69 | 1989Q4 | 170.74 | 1998Q3 | 215.53 |
| 1981Q2 | 107.85 | 1990Q1 | 171.42 | 1998Q4 | 218.09 |
| 1981Q3 | 109.21 | 1990Q2 | 171.31 | 1999Q1 | 220.80 |
| 1981Q4 | 109.38 | 1990Q3 | 171.85 | 1999Q2 | 224.32 |
| 1982Q1 | 111.02 | 1990Q4 | 171.03 | 1999Q3 | 228.46 |
| 1982Q2 | 111.45 | 1991Q1 | 172.41 | 1999Q4 | 232.41 |
| 1982Q3 | 110.91 | 1991Q2 | 173.14 | 2000Q1 | 235.91 |
| 1982Q4 | 111.96 | 1991Q3 | 173.14 | 2000Q2 | 240.81 |
| 1983Q1 | 114.12 | 1991Q4 | 175.46 | 2000Q3 | 245.15 |
| 1983Q2 | 115.33 | 1992Q1 | 176.62 | | |
| 1983Q3 | 116.15 | 1992Q2 | 176.26 | | |

[1] These numbers are updated as necessary from subsequent releases of the HPI after 2000Q3.
[2] *Note:* If the underlying loans were originated before 1975, use the HPI from 1975Q1 as $HPI_{ORIG}$.

6. For each quarter q of the Stress Test, use $UPB_q$ and the house price growth rates from the Benchmark regional time period:

$$LTV_q = LTV_0 \times \frac{\left(\frac{UPB_{m=3q-3}}{UPB_0}\right)}{exp\sum_{k=1}^{q} HPGR_K}$$

7. Generate Default, Prepayment and Performance vectors $PRE_m$, $DEF_m$ and $PERF_m$ for each LTV subgroup. When $LTV_{ORIG}$ is used as a categorical variable, use the corresponding range defined for each LTV subgroup in Table 3–59. For LTV subgroup 95 < LTV < 100, use 90 < $LTV_{ORIG}$ in Table 3–35.

[d] For each LTV subgroup, do not compute any Loss Severity or Credit Enhancement amounts. MBS investors receive the full UPB of defaulted loans.

[e] Compute Total Principal Received (TPR), Total Interest Received (TIR), and Amortization Expense (AE) for each LTV subgroup as directed in section 3.6.3.7.3, Stress Test Whole Loan Cash Flow Procedures and section 3.6.3.8.3, Whole Loan Accounting Flows Procedures, of this Appendix, with the following exception:

1. For Net Interest Received (NIR), do not use the Net Yield Rate ($NYR_m$). Instead, use the Pass-Through Rate ($PTR_m$) for Fixed Rate Loans, and $INDEX_{m-1-LB}$ + Wt Avg Net Margin, subject to rate resets as described in section 3.6.3.3.3, Mortgage Amortization Schedule Procedures, [a]1.b.3) of this Appendix, for ARMs.
2. Calculate Recovery Principal Received using a Loss Severity rate of zero (LS = 0).

[f] Sum over the LTV subgroups to obtain the original MBS's TPR, TIR and AE for m = 1...RM.

[g] Apply counterparty Haircuts in each month m as follows:

1. Compute:

$$HctFac_m = \frac{m'}{60} \times MaxHct(R)$$

Where:

m′ = *min* (m, 60)
R = MBS credit rating

2. Compute:

$$HctAmt_m = (TPR_m + TIR_m) + HctFac_m$$

[h] The resulting values, for each MBS, of TPR, TIR, AE, and HctAmt for months m = 1...RM are used in the section 3.10, Operations, Taxes, and Accounting, of this Appendix.

3.7.3.2 REMICs and Strips

[a] Cash flows for REMICs and Strips are generated according to standard securities industry procedures, as follows:

1. From the CUSIP number of the security, identify the characteristics of the underlying collateral. This is facilitated by using a securities data service.
2. Calculate the cash flows for the underlying collateral in the manner described for whole loans and MBS, based on Stress Test interest, Default, and Prepayment rates appropriate for the collateral.
3. Calculate cash flows for the Multiclass MBS using the allocation rules specified in the offering materials.
4. Determine the cash flows attributable to the specific securities held by an Enterprise, applying the Enterprise's ownership percentage.
5. For securities not issued by the Enterprise or Ginnie Mae, reduce cash flows by applying the Haircuts specified in section 3.5, Counterparty Defaults, of this Appendix.

[b] If a commercial information service is used for steps [a] 1 through 4 of this section, the information service may model mortgage product types beyond those described for Whole Loans in section 3.6, Whole Loan Cash Flows, and ARM indexes in addition to those listed in section 3.3, Interest Rates, of this Appendix. In such cases, the cash flows used are generated from the actual data used by the information service for the underlying security.

3.7.3.3 Mortgage Revenue Bonds and Miscellaneous MRS

[a] Cash flows for mortgage revenue bonds and miscellaneous MRS are computed as follows:

1. From the start of the Stress Test until the first principal payment date at the start of the Principal Payment Window, the security pays coupon interest at the Security Interest Rate, adjusted as necessary according to the Security Rate Index and Adjustment information in Table 3–58, but pays no principal.
2. During the Principal Payment Window, the security pays principal and interest equal to the aggregate cash flow from a level pay mortgage whose term is equal to the length of the Principal Payment Window and whose interest rate is the Security Interest Rate. If the Security Interest Rate is zero (as in the case of

zero-coupon MRBs), then the security pays principal only in level monthly payment amounts equal to the Current Security Balance divided by the length of the Principal Payment Window.

3. For securities not issued by the Enterprise or Ginnie Mae, reduce cash flows by applying the Haircuts specified in section 3.5, Counterparty Defaults, of this Appendix.

3.7.3.4 Accounting

Deferred balances are amortized as described in section 3.6.3.8, Whole Loan Accounting Flows, of this Appendix, using the Pass-Through Rate (or Security Interest Rate for MRBs) rather than the Net Yield Rate. For principal-only strips and zero-coupon MRBs, assume Allocated Interest is zero. If the conditions in section 3.6.3.8.3.1[a]3.a. of this Appendix, apply, do not realize the full amount in the first month. Instead, amortize the deferred balances using a straight line method over a period from the start of the Stress Test through the latest month with a non-zero cash flow.

3.7.4 Mortgage-Related Securities Outputs

[a] The outputs for MBS and MRS Cash Flows, found in Table 3–55, are analogous to those specified for Whole Loans in section 3.6.4, Final Whole Loan Cash Flow Outputs, of this Appendix, which are produced for each security for each month.

TABLE 3–61—OUTPUTS FOR MORTGAGE-RELATED SECURITIES

| Variable | Description |
|---|---|
| $TPR_m$ | Total Principal Received in month m = 1...RM |
| $TIR_m$ | Total Interest Received in month m = 1...RM |
| $HctAmt_m$ | Total Haircut amount in month m = 1...RM |
| $AE_m$ | Amortization Expense for months m = 1...RM |

[b] These outputs are used as inputs to the Operations, Taxes, and Accounting component of the Stress Test, which prepares pro forma financial statements. *See* section 3.10, Operations, Taxes, and Accounting, of this Appendix.

*3.8 Nonmortgage Instrument Cash Flows*

3.8.1 Nonmortgage Instrument Overview

[a] The Nonmortgage Instrument Cash Flows component of the Stress Test produces instrument level cash flows and accounting flows (accruals and amortization) for the 120 months of the Stress Test for:

1. Debt
2. Nonmortgage investments
3. Guaranteed Investment Contracts (GICs)
4. Preferred stock
5. Derivative contracts
   a. Debt-linked derivative contracts
   b. Investment-linked derivative contracts
   c. Mortgage-linked derivative contracts
   d. Derivative contracts that hedge forecasted transactions
   e. Non-linked derivative contracts

[b] Although mortgage-linked derivative contracts are usually linked to mortgage assets rather than nonmortgage instruments, they are treated similarly to debt-linked and investment-linked derivative contracts and, therefore, are covered in this section.

[c] Debt, nonmortgage investments, and preferred stock cash flows include interest (or dividends for preferred stock) and principal payments or receipts, while debt-linked, investment-linked, and mortgage-linked derivative contract cash flows are composed of interest payments and receipts only. Debt, nonmortgage investments, and preferred stock are categorized in one of six classes [2] as shown in Table 3–62.

TABLE 3–62—DEBT, NON-MORTGAGE INVESTMENTS, AND PREFERRED STOCK CLASSIFICATIONS

| Classification | Description |
|---|---|
| Fixed-Rate Bonds or Preferred Stock | Fixed-rate securities that pay periodic interest or dividends |
| Floating-Rate Bonds or Preferred Stock | Floating-rate securities that pay periodic interest or dividends |
| Fixed-Rate Asset-Backed Securities | Fixed-rate securities collateralized by nonmortgage assets |
| Floating-Rate Asset-Backed Securities | Floating-rate securities collateralized by nonmortgage assets |
| Short-Term Instruments | Fixed-rate, short-term securities that are not issued at a discount and which pay principal and interest only at maturity |
| Discount Instruments | Securities issued below face value that pay a contractually fixed amount at maturity |

[d] Derivative contracts consist of interest rate caps, floors, and swaps. The primary difference between financial instruments and derivative contracts, in terms of calculating cash flows, is that interest payments on financial instruments are based on principal amounts that are eventually repaid to creditors, whereas interest payments on derivative contracts are based on notional amounts that never change hands. Debt- and investment-linked derivative contracts are categorized in one of seven classes [3] as shown in Table 3–63:

TABLE 3–63—DEBT- AND INVESTMENT-LINKED DERIVATIVE CONTRACT CLASSIFICATION

| Classification | Description of Contract |
|---|---|
| Basis Swap | Floating-rate interest payments are exchanged based on different interest rate indexes |
| Fixed-Pay Swap | Enterprise pays a fixed interest rate and receives a floating interest rate |
| Floating-Pay Swap | Enterprise pays a floating interest rate and receives a fixed interest rate |
| Long Cap | Enterprise receives a floating interest rate when the interest rate to which it is indexed exceeds a specified level (strike rate) |
| Short Cap | Enterprise pays a floating interest rate when the interest rate to which it is indexed exceeds the strike rate |
| Long Floor | Enterprise receives a floating interest rate when the interest rate to which it is indexed falls below the strike rate |
| Short Floor | Enterprise pays a floating interest rate when the interest rate to which it is indexed falls below the strike rate |

[2] In addition to the items listed here, there are instruments that do not fit into these categories. Additional input information and calculation methodologies may be required for these instruments.

[3] *Ibid.*

[e] Mortgage-linked swaps are similar to debt-linked swaps except that the notional amount of a mortgage-linked swap amortizes based on the performance of certain MBS pools. Mortgage-linked derivative contracts are divided into two classes [4] as shown in Table 3–64:

TABLE 3–64—MORTGAGE-LINKED DERIVATIVE CONTRACT CLASSIFICATION

| Classification | Description of Contract |
|---|---|
| Fixed-Pay Amortizing Swaps | Enterprise pays a fixed interest rate and receives a floating interest rate, both of which are based on a declining notional balance |
| Floating-Pay Amortizing Swaps | Enterprise pays a floating interest rate and receives a fixed interest rate, both of which are based on a declining notional balance |

3.8.2 Nonmortgage Instrument Inputs

[a] The Nonmortgage Instrument Cash Flows component of the Stress Test requires numerous inputs. Instrument level inputs provided by the Enterprises in the RBC Report are listed in Table 3–65. Many instrument classes require simulated Interest Rates because their interest payments adjust periodically based on rates tied to various indexes. These rates are generated as described in section 3.3, Interest Rates, of this Appendix.

TABLE 3–65—INPUT VARIABLES FOR NONMORTGAGE INSTRUMENT CASH FLOWS

| Data Elements | Description |
|---|---|
| Amortization Methodology Code | Enterprise method of amortizing deferred balances (e.g., straight line) |
| Asset ID | CUSIP or Reference Pool Number identifying the asset underlying a derivative position |
| Asset Type Code | Code that identifies asset type used in the commercial information service (e.g. ABS, Fannie Mae pool, Freddie Mac pool) |
| Associated Instrument ID | Instrument ID of an instrument linked to another instrument |
| Coefficient | Indicates the extent to which the coupon is leveraged or de-leveraged |
| Compound Indicator | Indicates if interest is compounded |
| Compounding Frequency | Indicates how often interest is compounded |
| Counterparty Credit Rating | NRSRO's rating for the counterparty |
| Counterparty Credit Rating Type | An indicator identifying the counterparty's credit rating as short-term ('S') or long-term ('L') |
| Counterparty ID | Enterprise counterparty tracking ID |
| Country Code | Standard country codes in compliance with Federal Information Processing Standards Publication 10–4 |
| Credit Agency Code | Identifies NRSRO (e.g., Moody's) |
| Current Asset Face Amount | Current face amount of the asset underlying a swap |
| Current Coupon | Current coupon or dividend rate of the instrument |
| Current Unamortized Discount | Current unamortized premium or unaccreted discount of the instrument |
| Current Unamortized Fees | Current unamortized fees associated with the instrument |
| Current Unamortized Hedge | Current unamortized hedging gains or losses associated with the instrument |
| Current Unamortized Other | Any other unamortized items originally associated with the instrument |
| CUSIP__ISIN | CUSIP or ISIN Number identifying the instrument |
| Day Count | Day count convention (e.g. 30/360) |
| End Date | The last index repricing date |
| EOP Principal Balance | End of Period face, principal or notional, amount of the instrument |
| Exact Representation | Indicates that an instrument is modeled according to its contractual terms |
| Exercise Convention | Indicates option exercise convention (e.g., American Option) |
| Exercise Price | Par = 1.0; Options |
| First Coupon Date | Date first coupon is received or paid |
| Index Cap | Indicates maximum index rate |
| Index Floor | Indicates minimum index rate |
| Index Reset Frequency | Indicates how often the interest rate index resets on floating-rate instruments |

[4] *Ibid.*

TABLE 3–65—INPUT VARIABLES FOR NONMORTGAGE INSTRUMENT CASH FLOWS—Continued

| Data Elements | Description |
|---|---|
| Index Code | Indicates the interest rate index to which floating-rate instruments are tied (e.g., LIBOR) |
| Index Term | Point on yield curve, expressed in months, upon which the index is based |
| Instrument Credit Rating | NRSRO credit rating for the instrument |
| Instrument Credit Rating Type | An indicator identifying the instruments credit rating as short-term ('S') or long-term ('L'). |
| Instrument ID | An integer used internally by the Enterprise that uniquely identifies the instrument |
| Interest Currency Code | Indicates currency in which interest payments are paid or received |
| Interest Type Code | Indicates the method of interest rate payments (e.g., fixed, floating, step, discount) |
| Issue Date | Indicates the date that the instrument was issued |
| Life Cap Rate | The maximum interest rate for the instrument throughout its life |
| Life Floor Rate | The minimum interest rate for the instrument throughout its life |
| Look-Back Period | Period from the index reset date, expressed in months, that the index value is derived |
| Maturity Date | Date that the instrument contractually matures |
| Notional Indicator | Identifies whether the face amount is notional |
| Instrument Type Code | Indicates the type of instrument to be modeled (e.g., ABS, Cap, Swap) |
| Option Indicator | Indicates if instrument contains an option |
| Option Type | Indicates option type (e.g., Call option) |
| Original Asset Face Amount | Original face amount of the asset underlying a swap |
| Original Discount | Original discount or premium amount of the instrument |
| Original Face | Original face, principal or notional, amount of the instrument |
| Original Fees | Fees associated with the instrument at inception |
| Original Hedge | Hedging gain or loss to be amortized or accreted at inception |
| Original Other | Any other amounts originally associated with the instrument to be amortized or accreted |
| Parent Entity ID | Enterprise internal tracking ID for parent entity |
| Payment Amount | Interest payment amount associated with the instrument (reserved for complex instruments where interest payments are not modeled) |
| Payment Frequency | Indicates how often interest payments are made or received |
| Performance Date | ''As of'' date on which the data is submitted |
| Periodic Adjustment | The maximum amount that the interest rate for the instrument can change per reset |
| Position Code | Indicates whether the Enterprise pays or receives interest on the instrument |
| Principal Currency Code | Indicates currency in which principal payments are paid or received |
| Principal Factor Amount | EOP Principal Balance expressed as a percentage of Original Face |
| Principal Payment Date | A valid date identifying the date that principal is paid |
| Settlement Date | A valid date identifying the date the settlement occurred |
| Spread | An amount added to an index to determine an instrument's interest rate |
| Start Date | The date, spot or forward, when some feature of a financial contract becomes effective (e.g., Call Date), or when interest payments or receipts begin to be calculated |
| Strike Rate | The price or rate at which an option begins to have a settlement value at expiration, or, for interest-rate caps and floors, the rate that triggers interest payments |
| Submitting Entity | Indicates which Enterprise is submitting information |
| Trade ID | Unique code identifying the trade of an instrument |
| Transaction Code | Indicates the transaction that an Enterprise is initiating with the instrument (e.g. buy, issue reopen) |
| Transaction Date | A valid date identifying the date the transaction occurred |
| UPB Scale Factor | Factor applied to UPB to adjust for timing differences |

TABLE 3–65—INPUT VARIABLES FOR NONMORTGAGE INSTRUMENT CASH FLOWS—Continued

| Data Elements | Description |
|---|---|
| Unamortized Balances Scale Factor | Factor applied to Unamortized Balances to adjust for timing differences |

[b] In addition to the inputs in Table 3–65, other inputs may be required depending on the characteristics of the instrument modeled. For example, the mortgage-linked derivative contract cash flows require inputs describing the performance of the mortgage assets to which they are linked, including Single Family Default and Prepayment rates (*See* section 3.6.3.4, Single Family Default and Prepayment Rates, of this Appendix). Mortgage-linked derivative contract identification numbers (Asset IDs) are used to link the derivative contract to the required pool information that will be used to calculate the cash flows of the corresponding swap.

3.8.3 Nonmortgage Instrument Procedures

In general, non mortgage instruments are modeled according to their terms. The general methodology for calculating cash flows for principal and interest payments is described in this section and is not intended to serve as definitive text for calculating all possible present and future complex instruments. As mentioned in section 3.8.2, Nonmortgage Instrument Inputs, of this Appendix, there are some instruments that may require additional input information and calculation methodologies. Simplifying assumptions are made for some instrument terms until they can be modeled more precisely.

3.8.3.1 Apply Specific Calculation Simplifications

[a] In order to produce cash flows, accruals, or amortization of deferred balances, the following simplifications are used for all instruments to which they apply. Should the language in any other portion of section 3.8, Nonmortgage Instrument Cash Flows, of this Appendix, seem to conflict with a statement in this section, the language in section 3.8.3.1 takes precedence.

1. For day count methodology, use one of three methodologies 30/360, Actual/360, and Actual/365. All special day counts (i.e. Actual/366 B, Actual/366 S, Actual/366 E, and Actual/Actual) are treated as Actual/365.
2. Set the first index reset date to the First Coupon Date. If the Issue Date is later than the start of the Stress Test, use the Current Coupon Rate to determine the interest paid from Issue Date to First Coupon Date. When a calculation requires a rate that occurs before the start of the Stress Test, use the Current Coupon Rate. This applies to interest accrued but not paid for the start of the Stress test and to rate indexes where applying a Look Back Period requires data prior to the start of the Stress Test.
   a. If periodic caps are zero, change them to 999.99; If periodic floors are greater than 1, change them to zero.
   b. For instruments which have principal balance changes other than those caused by compounding interest, perform calculations as if the principal changes occur only on coupon dates (coupon dates on the fixed-rate leg for swaps) on or later than the first principal change date.
   c. When using a rate index for a specified term in an option exercise rule or as an index, assume that rate is appropriate for the calculation. Do not convert from bond equivalent yield to another yield form for a discount, monthly pay, quarterly pay, semi-annual pay or annual pay instrument.
3. When applying the option exercise rule:
   a. For zero coupon and discount securities, and zero coupon swaps, evaluate option exercise only on dates listed in the instrument's option exercise schedule. For all other instruments, evaluate option exercise only on coupon dates (coupon dates on the fixed-rate leg for swaps) later than the first option exercise date.
   b. Assume all call/put premiums/discounts are zero except for zero coupon instruments (including zero coupon swaps and discount notes). For these exceptions, when calculating a rate to compare with the Enterprise Cost of Funds, use the yield to maturity calculated by equating the face or notional amount plus the unamortized discount at the start of the Stress Test to the present value of the face or notional amount at maturity.
   c. Assume basis swaps and floating rate securities have no cancel, put, or call options.
   d. Haircuts are not applied to forward starting swaps.

3.8.3.2 Determine the Timing of Cash Flows

Project payment dates from the payment date immediately prior to the start of the stress test according to the Payment Frequency, First Coupon Date, and Maturity Date.

3.8.3.3 Obtain the Principal Factor Amount at Each Payment Date

[a] Where there is no amortization or prepayment of principal, the Principal Factor Amount is 1.0 for each payment date until the stated Maturity Date, when it becomes zero.

[b] For debt and debt-linked derivative contracts that amortize, either a principal or a notional amortization schedule must be provided. If amortization information is unavailable, then the Principal Factor Amount is 1.0 for each payment date until the stated Maturity Date, when it becomes zero.

[c] Monthly prepayment rates are 3.5 percent for fixed-rate and 2.0 percent for floating-rate asset-backed securities. Furthermore, asset-backed securities are modeled through a commercial information service where possible. Instruments that cannot be modeled through the commercial information service are treated in accordance with section 3.9, Alternative Modeling Treatments, of this Appendix.

[d] In the case of mortgage-linked derivative contracts, notional amounts are amortized based on the characteristics of the underlying pool in the manner described for principal balances of mortgage-backed securities held by an Enterprise in section 3.7, Mortgage-Related Securities Cash Flows, of this Appendix.

3.8.3.4 Calculate the Coupon Factor

The Coupon Factor applicable to a given period, which applies to dividends also, depends on day count conventions used to calculate the interest payments for the instrument. For example, the Coupon Factor for a bond that pays interest quarterly based on a non-compounded 30/360 convention would be 3 (representing the number of months in a quarter) times 30 days divided by 360 days, or 0.25. Table 3–66 lists the most common day count conventions.

TABLE 3–66—DAY COUNT CONVENTIONS

| Convention | Coupon Factor Calculation |
|---|---|
| 30/360 | Number of days between two payment dates assuming 30 days per month/360 |
| Actual/360 | Number of days between two payment dates/360 |
| Actual/365 | Number of days between two payment dates/365 |
| Actual/Actual | Number of days between two payment dates/Number of days in the year |

3.8.3.5 Project Principal Cash Flows or Changes in the Notional Amount

For all financial instruments, principal outstanding for the current period is determined by multiplying the Original Face by the Principal Factor Amount for the current period. The principal payment equals the amount of principal outstanding at the end of the previous period less the principal outstanding at the end of the current period, or zero if the instrument has a notional amount.

3.8.3.6 Project Interest and Dividend Cash Flows

3.8.3.6.1 Non-Complex Financial Instruments

[a] *Fixed-Rate Instruments.* The current period principal outstanding is multiplied by the product of the Current Coupon and current period Coupon Factor and rounded to even 100ths of a dollar.

[b] *Zero-Coupon Bonds.* Interest payments equal zero.

[c] *Discount Notes.* Interest payments equal zero.

[d] *Floating-Rate Instruments.* Interest payments are calculated as principal outstanding multiplied by the coupon for the current period. The current period coupon is calculated by adding a spread to the appropriate interest rate index and multiplying by the Coupon Factor. The coupon for the current period is set to this amount as long as the rate lies between the periodic and lifetime maximum and minimum rates. Otherwise the coupon is set to the maximum or minimum rate.

[e] *Interest Rate Caps and Floors.* These derivative instruments pay or receive interest only if the underlying index is above a Strike Rate (for caps) or below it (for floors). Interest payments are based on notional amounts instead of principal amounts.

1. The interest payment on a long cap is the Original Face multiplied by the amount, if any, by which the index exceeds the Strike Rate, as defined by the equation in Table 3–67. The interest payment on a long floor is the Original Face multiplied by the amount, if any, by which the index is below the Strike Rate. Otherwise interest payments are zero for caps and floors. Interest payments are either paid or received depending on whether the Enterprise is in a long or short position in a cap or a floor.
2. Monthly cash flows for long caps and floors are calculated as illustrated in Table 3–67:

TABLE 3–67—CALCULATION OF MONTHLY CASH FLOWS FOR CAPS

| Instrument | Interest Receipts | Interest Payments |
|---|---|---|
| Long Cap | $(I - K) \times N \times D$ if $I > K$; 0 if $I \leq K$ | 0 |
| Long Floor | 0 | $(K - I) \times N \times D$ if $I < K$; 0 if $I \geq K$ |

Where:

N = Original Face
K = Strike Rate
I = interest rate index
D = Coupon Factor

[f] *Swaps.* A derivative contract in which counterparties exchange periodic interest payments. Each swap leg (pay side or receive side) is modeled as a separate instrument, with interest payments based on the same notional amount but different interest rates.

1. For debt- and investment-linked swaps, each leg's interest payment is determined in the same manner as payments for fixed-rate, floating-rate or zero coupon instruments as described in paragraph [a], [b] and [d] of this section.
2. For mortgage-linked swaps, calculate the reduction in the notional amount due to scheduled monthly principal payments (taking into account both lifetime and reset period caps and floors), Prepayments, and Defaults of the reference MBS or index pool. Reduce the notional amount of the swap for the previous period by this amount to determine the notional amount for the current period. Calculate interest payments or receipts for a given period as the product of the notional amount of the swap in that period, the coupon, and the Coupon Factor applicable for that period.

3.8.3.6.2 Complex Financial Instruments

[a] Some instruments have more complex or non-standard features than those described in section 3.8.3.6.1, Non-Complex Financial Instruments, of this Appendix. These complexities can include more sophisticated variants of characteristics such as principal or notional amortization schedules, interest accrual methodologies, coupon reset formulas, and option features. In these instances, additional information may be required to completely specify the contractual cash flows or a proxy treatment for these instruments.

[b] An example of an instrument with complex features is an indexed amortizing swap. This instrument is non-standard because its notional amount declines in a way that is related to the level of interest rates. Its amortization table contains a notional amount reduction factor for a given range of interest rates. To compute cash flows for this instrument, reduce the notional amount on each payment date as specified in the amortization table. (The notional amount at the beginning of the Stress Period is given as an input to the calculation.)

[c] Special treatment is also required for foreign-currency-linked notes, the redemption value of which is tied to a specific foreign exchange rate. These require special treatment because the Stress Test does not forecast foreign currency rates. If these instruments are currency-hedged, then the note plus the hedge comprise a synthetic debt instrument for which only the pay side of the swap is modeled. If these instruments are not currency-hedged, the following treatment applies:

1. In the up-rate scenario, the U.S. dollar per unit of foreign currency ratio is increased in proportion to the increase in the ten-year CMT; therefore, the amount of an interest or principal payment is increased accordingly. For example, if the ten-year CMT shifts up by 50 percent, then the U.S. dollar per unit of foreign currency ratio shifts up by 50 percent. In the Stress Test, the payment would be multiplied by 1.5.
2. In the down-rate scenario, the foreign currency per U.S. dollar ratio is decreased in proportion to the decrease in the ten-year CMT.

[d] If a financial instrument's inputs are described in section 3.1, Data, of this Appendix, then model the instrument according to its terms; however, the Director reserves the authority to determine a more appropriate treatment if modeling the instrument according to its terms does not capture the instrument's impact on Enterprise risk. If the financial instrument's inputs are not described in section 3.1, then treat it as described in section 3.9, Alternative Modeling Treatments, of this Appendix.

3.8.3.7 Apply Call, Put, or Cancellation Features, if Applicable

[a] In some cases, principal and interest cash flows may be altered due to options imbedded in individual financial instruments. Securities can be called or put and contracts can be cancelled at the option of the Enterprise or the counterparty. The Option Type, Exercise Convention Type, and the Start Date determine when an option may be exercised. There are three standard Exercise Convention Types, all of which are accommodated in the Stress Test:

- American—Exercise can occur at any time after the Start Date of the option.
- European—Exercise can occur only on the Start Date of the option.
- Bermudan—Exercise can occur only on specified dates, usually on coupon payment dates between the Start Date of the option and maturity.

[b] The options are treated in the following manner for each date on which the option can be exercised:

1. Project cash flows for the instrument with the imbedded option assuming that the option is not exercised. If the instrument is tied to an index, assume that the index remains constant at its value on that date.
2. Determine the discount rate that equates the outstanding balance of the security plus option premium and accrued interest to the sum of the discounted values of the projected cash flows. This discount rate is called the yield-to-maturity.
3. Convert the yield-to-maturity to a bond-equivalent yield and compare the bond-equivalent yield with the projected Enterprise Cost of Funds for debt with an equivalent maturity. Interpolate linearly if the maturity is not equal to one of the maturities specified in section 3.3, Interest Rates, of this Appendix.
4. If the equivalent-maturity Enterprise Cost of Funds is lower (higher) than 50 basis points below (above) the bond-equivalent yield of the callable (putable) instrument, then the option is exercised. Otherwise, the option is not exercised, and it is evaluated at the next period when the option can be exercised.

[c] Some swap derivative contracts have cancellation features that allow either counterparty to terminate the contracts on certain dates. The cancellation feature is evaluated by comparing the fixed-rate leg of the swap to the Enterprise Cost of Funds. If either leg of the swap is cancelled, then the other leg is cancelled concurrently. Cancellable swaps are treated in the following manner:

1. For each period when an option can be exercised, compare the swap's fixed-leg coupon rate to the Enterprise Cost of Funds with a maturity equivalent to the maturity date of the swap.
2. If the option is a Call, it is deemed to be exercisable at the discretion of the Enterprise. If the option is a Put, it is deemed to be exercisable at the discretion of the Counterparty. If the option is a PutCall, it is deemed to be exercisable at the discretion of either party to the swap. Exercise the option when the swap is out of the money for the party who holds the option. A swap is considered out of the money when the rate on its fixed leg is at least 50 basis point higher or lower, depending upon whether the fixed rate is paid or received, than the like-maturity Enterprise Cost of Funds. For zero coupon swaps in all option exercise periods, use the yield to maturity calculated by equating the notional amount plus the unamortized discount at the start of the Stress Test to the present value of the notional amount at maturity.
   a. For example, if the Enterprise holds a call option for a fixed-pay swap and the coupon rate on the fixed-pay leg is at least 50 basis points above the Enterprise cost of funds for a maturity equivalent to that of the swap, then cancel the swap. Otherwise, the swap is not cancelled and it is evaluated the next time that the swap can be cancelled.

3.8.3.8 Calculate Monthly Interest Accruals for the Life of the Instrument

[a] Monthly interest accruals are calculated by prorating the interest cash flows on an actual-day basis. In this section, the term ''from'' means from and including, ''to'' means up to and not including, and ''through'' means up to and including. As an example, from the first to the third of a month is two days from the first through the third is three days. This convention is used to facilitate the day count and does not imply on which day's payments or accruals are actually made. Use one of the three following methodologies with the exception that interest cash flow dates occurring on or after the 30th of a month are considered as occurring on the last day of the month:

1. If the final interest cash flow occurs within the month, the interest accrual for that month is calculated by multiplying the final interest cash flow amount (as calculated in section 3.8.3.6 of this Appendix) times the number of days from the beginning of the month through the final maturity date divided by the number of days from the previous interest cash flow date to the maturity date.
2. If an interest cash flow other than the final interest cash flow occurs within a month, the interest accrual for that month is determined by multiplying the interest cash flow amount for the current month times the number of days from the beginning of the month through the interest cash flow date, divided by the number of days from the previous interest cash flow date (or issue date) to this interest cash flow date. To this add the interest cash flow amount for the next interest cash flow date times the number of days from the current month's interest cash flow date to the end of the month, divided by the number of days from the current month's interest cash flow date to the following next interest cash flow date.
3. If no interest cash flows occur during a month other than the issue month, the monthly interest accrual is calculated by multiplying the next interest cash flow amount times the number of days in the month divided by the number of days from the previous interest cash flow date to the next interest cash flow date.
4. If the issue month occurs after the start of the Stress Test, the monthly interest accrual is calculated by multiplying the next interest cash flow amount by the number of days in the month minus the day of issue, divided by the number of days from the issue date to the next interest cash flow date.

3.8.3.9 Calculate Monthly Amortization (Accretion) of Premiums (Discounts) and Fees

[a] Adjust monthly interest accruals (*see* section 3.10.3.6.1[a]3., of this Appendix) to reflect the value over time of discounts, premiums, fees and hedging gains and losses incurred (Deferred Balances). Amortize Deferred Balances that exist at the beginning of the Stress Test until the instrument's Maturity Date. If there are any put, call, or cancel options that are executed, amortize any remaining Deferred Balances in the execution month.

TABLE 3–68—INPUTS FOR NONMORTGAGE INSTRUMENT ACCOUNTING FLOWS

| Variable | Description | Source |
|---|---|---|
| MD | Maturity Date | Table 3–65, Input Variables for Nonmortgage Instrument Cash Flows |
| $UDB_0$ | The sum of Current Unamortized Discount, Current Unamortized Hedge, and Current Unamortized Other (Deferred Balances) for the instrument at the start of the Stress Test | Table 3–65, Input Variables for Nonmortgage Instrument Cash Flows |
| $MACRU_m$ | Monthly Interest Accruals | section 3.8.3.8, Calculate Monthly Interest Accruals for the Life of the Instrument |
| $EOMPBAO_m$ | Principal Balance at the end of the month for months m = 0...RM after modeling all options execution | section 3.8.3.6, Project Interest and Dividend Cash Flows |
| $EOMPB_m$ | Principal Balance at the end of the month for months m = 0...RM before modeling any options execution | section 3.8.3.6, Project Interest and Dividend Cash Flows |

1. Compute Remaining Term (RM) as follows:

$$RM = 12 \times (\text{year}(MD) - \text{year}(STDT)) + \text{month}(MD) - \text{month}(STDT) + 1$$

Where:

STDT is the Starting Date of the Stress Test

2. For nonmortgage instruments with notional principal, calculate the monthly Amortization Amount ($AA_m$) for each month m = 1...RM:

$$AA_m = -\frac{UDB_0}{RM} \text{ if } EOMPBAO_m > 0$$

$$AA_m = -UDB_{m-1} \text{ if } EOMPBAO_m = 0$$

$$UDB_m = UDB_{m-1} + AA_m$$

3. For nonmortgage instruments with principal and interest payments,
   a. Compute Allocated Interest for all months m ($AI_m$) as follows:

$$AI_m = \left[\frac{EOMPB_{m-1}}{\sum_{k=0}^{RM} EOMPB_k}\right] \times \sum_{k=1}^{RM} MACRU_k$$

   b. Calculate the monthly Internal Rate of Return (IRR) that equates the adjusted cash flows (actual principal plus allocated interest) to the Initial Book Value ($BV_0$) of the instrument. Solve for IRR such that:

$$BV_0 = \sum_{m=1}^{RM} \frac{ACF_m}{(1+IRR)^m}$$

Where:

$BV_0 = EOMPB_0 + UPD_0$

$ACF_m = EOMPB_{m-1} - EOMPB_m + AI_m$

c. Calculate the monthly Amortization Amount ($AA_m$) for each month m = 1...RM:

$$AA_m = (BV_{m-1} \times IRR) - AI_m \quad \text{if } EOMPBAO_m > 0$$

$$AA_m = -UDB_{m-1} \text{ if } EOMPBAO_m = 0$$

$$UDB_m = UDB_{m-1} + AA_m$$

$$BV_m = EOMPBAO_m + UDB_m$$

4. For discount notes,

a. Calculate Remaining Maturity in Actual Days (RMD):

$$RMD = MD - STDT + 1$$

b. Calculate the month Amortization Amount ($AA_m$) for each month m = 1...RM:

$$AA_m = -UDB_0 \times \frac{ADAYS_m}{RDM} \quad \text{if } EOMPBAO_m > 0$$

$$AA_m = -UDB_{m-1} \text{ if } EOMPBAO_m = 0$$

$$UDB_m = UDB_{m-1} + AA_m$$

Where:

$ADAYS_m$ = actual number of days in month m (days from the first of the month through maturity in month RM)

5. For zero coupon bonds,

a. Calculate Remaining Maturity in Actual Days (RMD):

$$RMD = MD - STDT + 1$$

b. Calculate Yield Factor (YF):

$$YF = \left(\frac{EOMPB_0}{EOMPB_0 + UDB_0}\right)^{\frac{1}{RMD}}$$

c. Calculate the monthly Amortization Factor ($AF_m$) for each month m = 1...RM:

$$AF_m = 1 \text{ if } m = 0$$

$$AF_m = AF_{m-1} \times YF^{ADAYS_m}$$

Where:

$ADAYS_m$ = actual number of days in month m (days from the first of the month through maturity in month RM):

d. Calculate the monthly Amortization Amount ($AA_m$) for each month m = 1...RM

$$AA_m = (EOMPB_0 + UDB_0) \times (AF_m - AF_{m-1}) \quad \text{if } EOMPBAO_m > 0$$

$$AA_m = -UDB_{m-1} \text{ if } EOMPBAO_m = 0$$

$$UDB_m = UDB_{m-1} + AA_m$$

3.8.3.10 Apply Counterparty Haircuts

[a] Finally, the interest and principal cash flows received by the Enterprises for non-mortgage instruments other than swaps and foreign currency-related instruments are Haircut (i.e., reduced) by a percentage to account for the risk of counterparty insolvency. The amount of the Haircut is calculated based on the public rating of the counterparty and time during the stress period in which the cash flow occurs, as specified in section 3.5, Counterparty Defaults, of this Appendix.

[b] An Enterprise may issue debt denominated in, or indexed to, foreign currencies, and eliminate the resulting foreign currency exposure by entering into currency swap agreements. The combination of the debt and the swap creates synthetic debt with principal and interest payments denominated in U.S. dollars. Because the Stress Test does not forecast foreign exchange rates, the counterparty (foreign-denominated) payments are not computed explicitly, and therefore cannot be Haircut explicitly in the calculation. No Haircut percentage is applied to the Enterprise's payments.

[c] Haircuts for swaps that are not foreign currency related are applied to the Monthly Interest Accruals (as calculated in section 3.8.3.8, of this Appendix) on the receive leg minus the Monthly Interest Accruals on the pay leg when this difference is positive.

3.8.4 Nonmortgage Instrument Outputs

[a] Outputs consist of cash flows and accounting information for debt, nonmortgage investments, preferred stock, and derivative contracts. Cash flows and accounting information outputs are inputs to section 3.10, Operations, Taxes, and Accounting, of this Appendix.

[b] Cash flows include the following monthly amounts:

1. Interest and principal payments for debt and nonmortgage investments,
2. Dividends and redemptions for preferred stock, and
3. Interest payments for debt-linked, investment-linked, and mortgage-linked derivative contracts.

[c] Accounting information includes the following monthly amounts:

1. Accrued interest and
2. Amortization of discounts, premiums, fees and other deferred items.

*3.9 Alternative Modeling Treatments*

3.9.1 Alternative Modeling Treatments Overview

[a] This section provides treatment for items that cannot be modeled in one of the ways specified in paragraph [b] of this section, but must be included in order to run the Stress Test. Because the rule provides treatments for a wide variety of instruments and activities that can be applied to accommodate unusual instruments, OFHEO expects few items to fall into this category.

[b] An Alternative Modeling Treatment (AMT) applies to any on- or off-balance-sheet item that is missing data elements required to calculate appropriate cash flows, or any instrument with unusual features for which this Appendix does *not*:

1. Provide an explicit computational procedure and set of inputs (i.e., the Appendix specifies exact data inputs and procedures for a class of instruments to which the item belongs); or,
2. Provide an implicit procedure (used for a general class of instruments), and explicit inputs that allow the item to be fully characterized for computational purposes (i.e., the Appendix specifies procedures and data inputs for a class of instruments to which the item does not belong that can be applied to the item to accurately compute its cash flows); or
3. Provide an implicit procedure by exact substitution, i.e., by representing the item as a computationally equivalent combination of other items that are specified in paragraphs (1) or (2) in this section (i.e., the Appendix specifies treatments for two or more instruments, which, in combination, exactly produce the item's cash flows); or
4. Permit the approximation of one or more computational characteristics by other similar values that are explicitly specified in this Appendix, or in the RBC Report instructions (i.e., the Appendix specifies a treatment, or combination of treatments, that can be used as a reasonable proxy for the computational characteristics of the item). Such proxy treatments must be approved by OFHEO. OFHEO may, in its discretion, approve a proposed proxy treatment, adopt a different proxy treatment, or treat items for which a proxy treatment has been proposed by the Enterprises according to the remaining provisions of section 3.9, Alternative Modeling Treatments, of this Appendix.

[c] For a given on- or off-balance sheet item, the appropriate AMT is determined according to the categories specified in section 3.9.3, Alternative Modeling Treatments Procedures, of this Appendix, based on the information available for that item. The output for each such item is a set of cash and accounting flows, or specific amounts to be applied in section 3.12, Calculation of the Risk-Based Capital Requirement, of this Appendix.

3.9.2 Alternative Modeling Treatments Inputs

Table 3–69 identifies the minimal inputs that are used to determine an AMT. (*See also* section 3.1, Data, of this Appendix)

TABLE 3–69—ALTERNATIVE MODELING TREATMENT INPUTS

| Variable | Description |
|---|---|
| TYPE | Type of item (asset, liability or off-balance sheet item) |
| BOOK | Book Value of item (amount outstanding adjusted for deferred items) |
| FACE | Face Value or notional balance of item for off-balance sheet items |
| REMATUR | Remaining Contractual Maturity of item in whole months. Any fraction of a month equals one whole month. |
| RATE | Interest Rate |
| INDEX | Index used to calculate Interest Rate |
| FAS115 | Designation that the item is recorded at fair value, according to FAS 115 |
| RATING | Instrument or counterparty rating |
| FHA | In the case of off-balance sheet guarantees, a designation indicating 100% of collateral is guaranteed by FHA |
| UABAL | Unamortized Balance (Book minus Face) |
| MARGIN | Margin over an Index |

3.9.3 Alternative Modeling Treatments Procedures

For each item, one of the following alternatives will be applied:

3.9.3.1 Off-Balance Sheet Items

[a] If the item is a guarantee of a tax-exempt multifamily housing bond, or a single family or multifamily whole-loan REMIC class rated triple-A, or other similar transaction guaranteed by the Enterprises, multiply the face value of the guaranteed instruments by 0.45 percent. This amount is added to the amount of capital required to maintain positive total capital throughout the ten-year Stress Period. Any instruments or obligations with 100 percent of collateral guaranteed by the Federal Housing Administration (FHA) are excluded from this calculation.

[b] Otherwise, add to the amount of capital required to maintain positive total capital throughout the ten-year Stress Period an amount equal to the face or notional value of the item at the beginning of the Stress Period times three percent.

3.9.3.2 Reconciling Items

Reconciling items falling into this category will be treated according to the specifications in section 3.10, Operations, Taxes, and Accounting, of this Appendix.

3.9.3.3 Balance Sheet Items

[a] If the item is a trading security recorded at fair value according to FAS 115, then the book value (the face value adjusted for deferred balances) will be converted to cash in the first month of the Stress Test.

[b] Otherwise, if the item is an earning asset, then it is treated as a held-to-maturity asset, based on book value, as follows:

1. In the up-rate scenario, it will be treated as a held-to-maturity bond paying compound interest on a 30/360 basis at maturity, with the item's contractual maturity and rate. The item will be Haircut according to its rating. If no maturity is provided, maturity will be set at 120 months. If no rate is provided, a rate will be assigned at the Initial Enterprise Cost of Funds whose term is equal to the remaining maturity, less 200 basis points (but not less than zero). If no rating is provided, the asset will be classified as unrated.
2. In the down-rate scenario, it will be treated as a held-to-maturity bond paying compound interest on a 30/360 basis at maturity, with the item's contractual maturity and rate. The item will be Haircut according to its rating. If no maturity is provided, maturity will be set at 120 months. If no rate is provided, a rate will be assigned at the floating one-month Enterprise Cost of Funds less 200 basis points (but not less than zero). If no rating is provided, the asset will be classified as unrated.

[c] If the item is a non-earning asset it will remain on the books and earn no interest throughout the Stress Period.

[d] Otherwise, if the item is a liability, then it is treated as follows, based on book value:

1. In the up-rate scenario, it will be treated as non-callable and monthly coupon-paying to maturity on a 30/360 basis. If the coupon rate is not specified, the liability will be given a floating rate at the one-month Enterprise Cost of Funds plus 200 basis points. If no maturity is provided, maturity will be set at 120 months.
2. In the down-rate scenario, it will be treated as non-callable and monthly coupon paying to maturity. If no coupon is provided, the liability will be given a fixed rate at the Initial Enterprise Cost of Funds plus 200 basis points. If no maturity is provided, maturity will be set at ten years.

[e] Unamortized Balances should be amortized on a straight-line basis over the designated remaining maturity of the instrument.

[f] All items in this section are treated as if they had no options or cancellation features. The face value will be held constant until maturity. If an item has an adjustable rate, it is assumed that the interest rate will adjust monthly with no caps and a lifetime floor of zero percent.

3.9.4 Alternative Modeling Treatments Outputs

For each AMT item, the output is a set of cash and accounting flows appropriate to its respective treatment as specified in section 3.9.3, Alternative Modeling Treatments Procedures, or specific amounts to be applied in section 3.12, Calculation of the Risk-Based Capital Requirement, of this Appendix.

*3.10 Operations, Taxes, and Accounting*

3.10.1 Operations, Taxes, and Accounting Overview

This section describes the procedures for determining new debt issuance and investments, computing capital distributions, calculating operating expenses and taxes, and creating pro forma balance sheets and income statements. Input data include an Enterprise's balance sheet at the beginning of the Stress Period, interest rates from the Interest Rates component of the Stress Test, and the outputs from cash flow components of the Stress Test. The outputs of the procedures discussed in this section—monthly pro forma balance sheets, cash flow and income statements for each month of the Stress Test—are the basis for the capital calculation described in section 3.12, Calculation of the Risk-Based Capital Requirement, of this Appendix.

3.10.2 Operations, Taxes, and Accounting Inputs

[a] Data described in section 3.1, Data, section 3.3.4, Interest Rates Outputs, section 3.6.4, Final Whole Loan Cash Flow Outputs, section 3.7.4, Mortgage-Related Securities Outputs, and section 3.8.4, Nonmortgage Instrument Outputs, of this Appendix, is used to produce monthly pro forma balance sheets and income statements for the Enterprises. In addition to the starting position data, described in the cash flow components, the Enterprises provide the starting position dollar values for the items in Table 3–70.

TABLE 3–70—OPERATIONS, TAXES, AND ACCOUNTING INPUTS

| Input | Description |
|---|---|
| FAS 115 and 125 fair value adjustment on retained mortgage portfolio | |
| FAS 133 fair value adjustment on retained mortgage portfolio | |
| Reserve for losses on retained mortgage portfolio | |
| FAS 115 and 125 fair value adjustments on non-mortgage investments | |
| FAS 133 fair value adjustments on non-mortgage investments | |
| Total cash | |
| Accrued interest receivable on mortgages | |
| Accrued interest receivable on non-mortgage investment securities | |
| Accrued interest receivable on non-mortgage investment securities denominated in foreign currency—hedged | |
| Accrued interest receivable on non-mortgage investment securities denominated in foreign currency—unhedged | |
| Accrued interest receivable on mortgage-linked derivatives, gross | |
| Accrued interest receivable on investment-linked derivatives, gross | |
| Accrued interest receivable on debt-linked derivatives, gross | |
| Other accrued interest receivable | |
| Accrued interest receivable on hedged debt-linked foreign currency swaps | Underlying instrument is GSE issued debt |
| Accrued interest receivable on unhedged debt-linked foreign currency swaps | |
| Accrued interest receivable on hedged asset-linked foreign currency swaps | Underlying instrument is an asset |
| Accrued interest receivable on unhedged asset-linked foreign currency swaps | |
| Currency transaction adjustments—hedged assets | Cumulative gain or loss due to changes in foreign exchange rates relative to on-balance sheet assets originally denominated in foreign currency |
| Currency transaction adjustments—unhedged assets | Cumulative gain or loss due to changes in foreign exchange rates relative to unhedged assets and off-balance sheet items originally denominated in foreign currency |
| Federal income tax refundable | |
| Accounts receivable | |
| Fees receivable | |
| Low income housing tax credit investments | |
| Fixed assets, net | |
| Clearing accounts | Net book value of all clearing accounts |
| Other assets | |
| Foreclosed property, net | Real estate owned including property acquired through foreclosure proceedings |
| FAS 133 fair value adjustment on debt securities | |
| Accrued interest payable on existing fixed-rate debt securities | |
| Accrued interest payable on existing floating-rate debt securities | |
| Accrued interest payable on existing debt issued in foreign currency—hedged | |
| Accrued interest payable on existing debt issued in foreign currency—unhedged | |
| Accrued interest payable on mortgage-linked derivatives, gross | |
| Accrued interest payable on investment-linked derivatives, gross | |
| Accrued interest payable on debt-linked derivatives, gross | |
| Other accrued interest payable | |
| Accrued interest payable debt-linked foreign currency swaps—hedged | |
| Accrued interest payable debt-linked foreign currency swaps—unhedged | |

TABLE 3–70—OPERATIONS, TAXES, AND ACCOUNTING INPUTS—Continued

| Input | Description |
|---|---|
| Accrued interest payable asset-linked foreign currency swaps—hedged | |
| Accrued interest payable asset-linked foreign currency swaps—unhedged | |
| Principal and interest due to mortgage security investors | Cash received on sold mortgages for onward submission to mortgage security investors |
| Currency transaction adjustments—hedged debt | Cumulative gain or loss due to changes in foreign exchange rates relative to on-balance sheet debt originally denominated in foreign currency |
| Currency transaction adjustments—unhedged debt | Cumulative gain or loss due to changes in foreign exchange rates relative to unhedged liabilities and off-balance sheet items originally denominated in foreign currency |
| Escrow deposits | Cash balances held in relation to servicing of multifamily loans |
| Federal income taxes payable | |
| Preferred dividends payable | |
| Accounts payable | |
| Other liabilities | |
| Common dividends payable | |
| Reserve for losses on sold mortgages | |
| Common stock | |
| Preferred stock, non-cumulative | |
| Additional paid-in capital | |
| Retained earnings | |
| Treasury stock | |
| Unrealized gains and losses on available-for-sale securities, net of tax, in accordance with FAS 115 and 125 | |
| Unrealized gains and losses due to mark to market adjustments, FAS 115 and 125 | |
| Unrealized gains and losses due to deferred balances related to pre-FAS 115 and 125 adjustments | |
| Unrealized gains and losses due to other realized gains, FAS 115 | |
| Other comprehensive income, net of tax, in accordance with FAS 133 | |
| OCI due to mark to market adjustments, FAS 133 | |
| OCI due to deferred balances related to pre-FAS 133 adjustments | |
| OCI due to other realized gains, FAS 133 | |
| Operating expenses | Average of prior three months |
| Common dividend payout ratio (average of prior 4 quarters) | Sum dollar amount of common dividends paid over prior 4 quarters and divided by the sum of total of after tax income less preferred dividends paid over prior 4 quarters |
| Common dividends per share paid 1 quarter prior to the beginning of the stress period | |
| Common shares outstanding | |
| Common Share Market Price | |
| Dividends paid on common stock 1 quarter prior to the beginning of the stress period | |
| Share Repurchases (average of prior 4 quarters) | Sum dollar amount of repurchased shares, net of newly issued shares, over prior 4 quarters and divided by 4 |
| Off-balance-sheet Guarantees | Guaranteed instruments not reported on the balance sheet, such as whole loan REMICs and multifamily credit enhancements, and not 100% guaranteed by the FHA |
| Other Off-Balance Sheet Guarantees | All other off-balance sheet guaranteed instruments not included in another category, and not 100% guaranteed by the FHA |

TABLE 3–70—OPERATIONS, TAXES, AND ACCOUNTING INPUTS—Continued

| Input | Description |
|---|---|
| YTD provision for income taxes | Provision for income taxes for the period beginning January 1 and ending as of the report date |
| Tax loss carryforward | Net losses available to write off against future years' net income |
| Tax liability for the year prior to the beginning of the Stress Test | |
| Tax liability for the year 2 years prior to the beginning of the Stress Test (net of carrybacks) | |
| Taxable income for the year prior to the beginning of the Stress Test | |
| Taxable income for the year 2 years prior to the beginning of the Stress Test (net of carrybacks) | |
| Net after tax income for the quarter preceding the start of the stress test | |
| YTD taxable income | Total amount of taxable income for the period beginning January 1 and ending as of the report date |
| Minimum capital requirement at the beginning of the Stress Period | |
| Specific allowance for loan losses | Loss allowances calculated in accordance with FAS 114 |
| Zero coupon swap receivable | |
| Unamortized discount on zero coupon receivable | |

[b] Amounts required to reconcile starting position balances from cash flow components of the Stress Test with an Enterprise's balance sheet will be reported in the RBC Report with the related instrument. The corresponding balance for the related instrument will be adjusted accordingly.

3.10.3 Operations, Taxes, and Accounting Procedures

The Stress Test calculates new debt and investments, dividends, allowances for loan losses, operating expenses, and income taxes. These calculations are determined by, and also affect, the pro forma balance sheets and income statements during the Stress Period.

3.10.3.1 New Debt and Investments

[a] For each month of the Stress Test, cash deficits and surpluses are eliminated by issuing new debt or purchasing new investments. The Stress Test calculates cash received and cash disbursed each month in order to determine the net availability of cash. Depending on the calculated net cash position at month end, new short term investments are purchased at mid-month or a mix of long and short term debt is issued at mid-month so that the recalculated net cash position at month end is zero.

[b] For each month of the Stress Test, the following calculations are performed to determine the amount and type of new debt and investments. The short-term investments and appropriate mix of long-term and short-term debt are reflected in the pro forma balance sheets. Interest income or interest expense for the new investments or debt are reflected in the pro forma income statements.

1. In any month in which the cash position is positive at the end of the month, the Stress Test invests the Enterprise's excess cash on the 15th day of that month in one-month Treasury bills that yield the six-month Treasury rate for that month as specified in section 3.3, Interest Rates, of this Appendix.
2. In any month in which the cash position is negative at the end of the month, the Stress Test issues a mix of new short-term and long-term debt on the 15th day of that month. New short-term debt issued is six-month discount notes with a discount rate at the six-month Enterprise Cost of Funds as specified in section 3.3, Interest Rates, of this Appendix, with interest accruing on a 30/360 basis. New long-term debt issued is five-year bonds not callable for the first year (''five-year-no call-one'') with an American call at par after the end of the first year, semiannual coupons on a 30/360 basis with principal paid at maturity or call, and a coupon rate set at the five year Enterprise Cost of Funds as specified in section 3.3, Interest Rates, of this Appendix, plus a 50 basis point premium for the call option. An issuance cost of 2.5 basis points is assessed on new short-term debt at issue and an issuance cost of 20 basis points is assessed on new long-term debt at issue. New short-term debt is issued in a manner so that the existing short-term debt plus the newly issued short-term debt does not exceed fifty percent of the sum of all existing debt and total new debt issued. Issuance fees for new debt are amortized on a straight line basis to the maturity of the appropriate instrument.
3. Given the Net Cash Deficit ($NCD_m$) in month m, use the following method to calculate the amount of short-term and long-term debt to issue in month m:

a. Calculate Discount Rate Factor ($DRF_m$):

$$DRF_m = \left(1 + \frac{CF_m}{12}\right)^6$$

Where:

$CF_m$ = six month Enterprise Cost of Funds for month m

b. Calculate the Adjustment Factor for Short-Term Debt Issuance Fees ($AFSIF_m$):

$$AFSIF_m = 1 - 0.00025 \times DRF_m$$

c. Calculate the Maximum Short-Term Issuance ($MSTI_m$):

$$MSTI_m = DRF_m \times \frac{NCD_m}{AFSIF_m}$$

d. Calculate New Short-Term Debt Outstanding ($NSDO_m$):

$$NSDO_m = SDO_m - PS_m + RS_m$$

Where:

$SDO_m$ = remaining principal balance of all debt maturing or repricing within the next twelve months;

$PS_m$ = remaining notional balances of the receive side of swaps maturing or repricing within the next twelve months;

$RS_m$ = remaining notional balances of the pay side of swaps maturing or repricing within the next twelve months.

e. Calculate Face Amount of Short-Term Debt to be issued this month ($FASD_m$):

$$FASD_m = min\left(MSTI_m,\ max\left(0,\ DRF_m \times \frac{\left(0.998 \times TDO_m - 1.996 \times NSDO_m + NCD_m\right)}{\left(0.998 \times DRF_m\right) + AFSIF_m}\right)\right)$$

Where:

$TDO_m$ = remaining principal balance of all debt outstanding at the end of this month

f. Calculate Face Amount of Long-Term Debt to be issued ($FALD_m$):

$$FALD_m = \frac{1}{0.998} \times max\left(0,\ NCD_m - \frac{FASD_m \times AFSIF_m}{DRF_m}\right)$$

3.10.3.2 Dividends and Share Repurchases

[a] The Stress Test determines quarterly whether to pay dividends and make share repurchases. Dividends are decided upon and paid during the first month after the end of the quarter for which they are declared. If any dividends are paid, the dividend payout cannot exceed an amount equal to core capital less the estimated minimum capital requirement at the end of the quarter. Share repurchases are made during the middle month of the quarter.

1. *Preferred Stock.* An Enterprise will pay dividends on preferred stock as long as that Enterprise meets the estimated minimum capital requirement before and after the payment of these dividends. Preferred stock dividends are based on the coupon rates of the issues outstanding. The coupon rates for any issues of variable rate preferred stock are calculated using projections of the appropriate index rate. Preferred stock dividends may not exceed core capital less the estimated minimum capital requirement at the end of the preceding quarter.
2. *Common Stock.* In the first year of the Stress Test, dividends are paid on common stock in each of the four quarters after preferred dividends, if any, are paid unless the Enterprise's capital is, or after the payment, would be, below the estimated minimum capital requirement.
   a. *First Quarter.* In the first quarter, the dividend is the dividend per share ratio for common stock from the quarter preceding the Stress Test (adjusted by the ratio of Enterprise retained earnings and retained earnings after adjustments are made that revert investment securities and derivatives to amortized cost) times the current number of shares of common stock outstanding.
   b. *Subsequent Quarters.*
   1) In the three subsequent quarters, if the preceding quarter's after tax income is greater than after tax income in the quarter preceding the Stress Test, pay the larger of (1) the dividend per share ratio for common stock from the quarter preceding the Stress Test (adjusted by the ratio of Enterprise retained earnings and retained earnings after adjustments are made that revert investment securities and derivatives to amortized cost) times the current number of shares of common stock outstanding or (2) the average dividend payout ratio for common stock for the four quarters preceding the start of the Stress Test times the preceding quarter's after tax income (adjusted by the ratio of Enterprise retained earnings and retained earnings after adjustments are made that revert investment securities and derivatives to amortized cost) less preferred dividends paid in the current quarter. In no case may the dividend payment exceed an amount equal to core capital less the estimated minimum capital requirement at the end of the preceding quarter.
   2) If the previous quarter's after tax income is less than or equal to after tax income in the quarter preceding the Stress Test (adjusted by the ratio of Enterprise retained earnings and retained earnings after adjustments are made that revert investment securities and derivatives to amortized cost), pay the lesser of (1) the dividend per share ratio for common stock for the quarter preceding the Stress Test times the current number of shares of common stock outstanding or (2) an amount equal to core capital less the estimated minimum capital requirement at the end of the preceding quarter, but not less than zero.
3. *Share Repurchases.* In the first two quarters of the Stress Test, the capital of the Enterprises will be reduced to reflect the repurchase of shares. The amount of the capital reduction in each of those two quarters will be equal to the average net stock repurchases by the Enterprise during the four quarters preceding the start of the Stress Period. Net stock repurchases equal repurchases less receipts from new stock issued, but not less than zero. Repurchases in each of the first two quarters may occur only up to the point that the amount of core capital exceeds the estimated minimum capital requirement at the end of the first month of the quarter.
4. *Minimum Capital Requirements.* For the purposes of the Stress Test, the Enterprise's minimum capital requirement is computed by applying leverage ratios to all assets (2.50 percent) and off-balance sheet obligations (0.45 percent), and summing the results. Repurchases of an Enterprise's own previously-issued MBSs are excluded from the minimum capital calculation used in section 3.10.3.2, Dividends and Share Repurchases, of this Appendix.

3.10.3.3 Allowances for Loan Losses and Other Charge-Offs

[a] The Stress Test calculates a tentative allowance for loan losses monthly by multiplying current-month Credit Losses (CL in Table 3–52) by twelve, thus annualizing current month Credit Losses. This is a proxy for a loss contingency where it is probable that a loss has been incurred and the amount can be reasonably estimated. For both the retained and sold portfolios, these credit losses include lost principal (net of recoveries from credit enhancements and disposition of the real estate collateral), and foreclosure, holding, and disposition costs. If the tentative allowance for loan losses for the current period is greater than the balance from the prior month less charge-offs (i.e., credit losses) for the current month, a provision (i.e., expense) is recorded. Otherwise, no provision is made and the allowance for loan losses is equal to the prior period amount less current month charge-offs.

[b] Other charge-offs result from Haircuts related to mortgage revenue bonds, private-issue MBS, and non mortgage investments, described in their respective cash flow components.

1. In the case of Enterprise investments in securities, these Haircuts result in the receipt of less principal and interest than is contractually due. Lost principal is recorded as Other Losses when due and not received, while lost interest is recorded as a reduction of Interest Income.
2. In the case of interest rate derivative instruments, these Haircuts result in the receipt of less net interest than is contractually due from, or the payment of more interest than is contractually due to, an Enterprise counterparty. For those swaps that are linked to Enterprise investments, the increase or decrease of net swap interest due is recorded as an adjustment of Interest Income. For those swaps that are linked to Enterprise debt obligations, the increase or decrease of net swap interest due is recorded as an adjustment of Interest Expense.

3.10.3.4 Operating Expenses

[a] The Stress Test calculates operating expenses, which include non-interest costs such as those related to an Enterprise's salaries and benefits, professional services, property, equipment and office space. Over the Stress Period, operating expenses are equal to the sum of two components. The first component in each month is equal to one-third (⅓) of the average monthly operating expenses of the Enterprise in the quarter immediately preceding the start of the Stress Test. The second component changes in proportion to the change in the

size of the Enterprise's mortgage portfolio (i.e., the sum of outstanding principal balances of its retained and sold mortgage portfolios). The Stress Test calculates the Enterprise's mortgage portfolio at the end of each month of the Stress Period as a percentage of the portfolio at the start of the Stress Test, and then multiplies the percentage of assets remaining by two-thirds (⅔) of the average monthly operating expenses of the Enterprise in the quarter immediately preceding the start of the Stress Test.

[b] The sum of the two components in paragraph [a], of this section, is multiplied by a factor which equals

$$\left(1-\frac{m}{36}\right)$$

for the first 12 months of the Stress Test and then equals two-thirds for months 13 and beyond. This product is the Enterprise's operating expense for a given month in the Stress Period.

3.10.3.5 Income Taxes

[a] Both Enterprises are subject to Federal income taxes, but neither is subject to state or local income taxes.

[b] The Stress Test applies an effective Federal income tax rate of 30 percent when calculating the monthly provision for income taxes (e.g., income tax expense). OFHEO may change the 30 percent income tax rate if there are significant changes in Enterprise experience or changes in the statutory income tax.

[c] The Stress Test sets income tax expense for tax purposes equal to the provision for income taxes. The effects of timing differences between taxable income and Generally Accepted Accounting Principles (GAAP) income before income taxes are ignored. Income before taxes is adjusted by the ratio of Enterprise retained earnings and retained earnings after adjustments are made that revert investment securities and derivatives to amortized cost. Therefore, Net Operating Loss (NOL) occurs only when the net income, before the provision for income taxes, is negative.

[d] Payments for estimated income taxes are made quarterly, in the month after the end of the quarter. At the end of each year, the annual estimated tax amount is compared to the annual actual tax amount. In March of the next year, a payment of remaining taxes is made or a refund for overpayment of income taxes is received.

[e] The NOL for the current year is ''carried back'' to offset taxes in any or all of the preceding two calendar years. (The Enterprises' tax year is the same as the calendar year.) This offset of the prior years' taxes results in a negative provision for income taxes (e.g., income) for the current year. Use of a carry back reduces available carry backs in subsequent years. Any NOL remaining after carry backs are exhausted becomes a carry forward.

[f] Carry forwards represent NOLs that cannot be carried back to offset previous years' taxes, but can be used to offset taxes in any or all of the subsequent 20 years. Carry forwards accumulate until used, or until they expire 20 years after they are generated.

[g] A valuation adjustment is used to eliminate any deferred tax asset.

3.10.3.6 Accounting

[a] The 1992 Act specifies that total capital includes core capital and a general allowance for foreclosure losses. For the Enterprises, this general allowance is represented by general allowances for loan losses on their retained and sold mortgage portfolios. As defined at 12 CFR 1750.2, core capital includes the sum of the following components of equity:

1. The par or stated value of outstanding common stock,
2. The par or stated value of outstanding perpetual, noncumulative preferred stock,
3. Paid-in capital, and
4. Retained earnings.

[b] In order to determine the amount of total capital an Enterprise must hold to maintain positive total capital throughout the ten-year Stress Period, the Stress Test projects the four components of equity listed in paragraph [a] of this section plus general loss allowances as part of the monthly pro forma balance sheets.

[c] Details of an Enterprise's actual balance sheet at the beginning of the Stress Test are recorded from a combination of starting position balances for all instruments for which other components of the Stress Test calculate cash flows and other starting position balances for assets, liabilities, and equity accounts needed to complete an Enterprise's balance sheet.

[d] After recording an Enterprise's balance sheet at the beginning of the Stress Period, the Stress Test creates monthly pro forma balance sheets and income statements by recording output from the cash flow components of the Stress Test; recording new debt and investments (and related interest), dividends, loss allowances, operating expenses, and taxes; and applying accounting rules pertaining to pro forma balance sheets and income statements.

3.10.3.6.1 Accounting for Cash Flows and Accounting Flows

[a] Balances at the beginning of the Stress Test are obtained from the RBC Report. Subsequent changes to related pro forma balance sheet and income statement accounts are obtained from data generated by cash flow components of the Stress Test as follows:

1. *Retained Loans.* For Retained Loans, interest cash flows in the first month of the Stress Period reduce accrued interest receivable at the beginning of the Stress Test. Subsequent months interest cash flows are recorded as accrued interest receivable and interest income in the month prior to receipt. When the interest cash flows are received, accrued interest receivable is reduced. Monthly principal cash flows (including Prepayments and defaulted principal) are recorded as reductions in the outstanding balance of the loan group. Net losses on Defaults are charged off against the allowance for loan losses. Amortization of deferred discounts increases interest income; amortization of deferred premiums decreases interest income.
2. *Mortgage Revenue Bonds.* For mortgage revenue bonds, interest cash flows in the first month of the Stress Period reduce accrued interest receivable at the beginning of the Stress Test. Subsequent months' interest cash flows are recorded as accrued interest receivable and interest income in the month prior to receipt. When the interest cash flows are received, accrued interest receivable is reduced. Monthly principal cash flows (including Prepayments) are recorded in the month received as a reduction in the outstanding balance of mortgage assets. Defaulted principal is charged off when due and is not received. Amortization of deferred discounts increases interest income; amortization of deferred premiums decreases interest income.
3. *Nonmortgage Instruments.* Principal repayments of nonmortgage instruments reduce the nonmortgage instrument and increases or decreases cash. When the interest cash flows are received or paid, accrued interest receivable or payable is reduced. Accrued interest includes both amounts at the beginning of the Stress Period and subsequent monthly accruals (also recorded as interest income or interest expense). Amortization of deferred discounts and premiums increases or decreases interest income or interest expense. Defaulted principal is charged off when due and not received.
4. *Sold Portfolio.* Sold portfolio cash flows include monthly guarantee fees, float, and principal and interest due MBS investors. Guarantee fees are recorded as income in the month received. Principal and interest due mortgage security investors does not affect the balance sheet; however, interest earned on these amounts (float) is recorded as income in the month the underlying principal and interest payments are received. Principal payments received and defaulted loan balances reduce the outstanding balance of the sold portfolio. Losses (net of recoveries) are charged off against the allowance for losses on the sold portfolio (a liability on the pro forma balance sheets) and reduce cash. Amortization of deferred premiums and discounts increases or decreases guarantee fees.

3.10.3.6.2 Accounting for Non-Cash Items

[a] Changes in the pro forma balances for other parts of the Enterprise's balance sheet not resulting from cash flows are recorded as described in the following nine steps:

1. *Unrealized Gains and Losses.*
   a. Recorded amounts in Other Comprehensive Income (OCI) that correspond to investments in available-for-sale securities will be reversed against related investment balances so as to revert recorded investment balances to amortized cost at the start of the Stress Test. Deferred amounts associated with these securities are amortized as described in previous sections of this document corresponding to the particular instrument type.
   b. The recorded value of derivative instruments (less unamortized amounts that, prior to the adoption of FAS 133, would have been amortized) that were

designated as Cash Flow Hedges will be reversed against OCI at the start of the Stress Test. The carrying value of derivative instruments and related hedged items (less unamortized amounts that, prior to the adoption of FAS 133, would have been amortized) that were designated Fair Value Hedges will be reversed as an increase or decrease in Retained Earnings at the start of the Stress Test.

c. Recorded amounts in OCI that correspond to derivative transactions terminated prior to the start of the Stress Test will be amortized in a manner that is consistent with the amortization of other, deferred amounts associated with the hedged instrument.

d. Any treatments in section 3.10.3.6.2[a]1. of this Appendix, are not applied to instruments that are modeled under AMT (*see* section 3.9, Alternative Modeling Treatments, of this Appendix).

2. *Low Income Housing Tax Credit Investments.* Low income housing tax credit investments at the beginning of the Stress Test are converted to cash on a straight line basis over the first six months of the Stress Period.

3. *Other Assets.* The following other assets at the beginning of the Stress Test are converted to cash as follows:

a. Clearing accounts and other miscellaneous receivables (e.g., fees receivable, accounts receivable, and other miscellaneous assets) in the first month of the Stress Test.

b. Earning assets (*see* section 3.9, Alternative Modeling Treatments, of this Appendix)

c. Items not covered by a. and b. of this section on a straight-line basis over the first five-years of the Stress Test.

4. *Real Estate Owned (REO).* Real estate owned at the beginning of the Stress Test is converted to cash on a straight-line basis over the first six months of the Stress Test.

5. *Fixed Assets.* Fixed assets (net of accumulated depreciation) as of the beginning of the Stress Test remain constant over the Stress Test. However, depreciation is included in the base on which operating expenses are calculated for each month during the Stress Period.

6. *Principal and Interest Payable.* Principal and interest payable to an Enterprise's mortgage security investors at the beginning of the Stress Test are paid during the first two months of the Stress Test (one-half in month one and one-half in month two).

7. *Other Liabilities.* The following liabilities at the beginning of the Stress Test are paid in the first month of the Stress Test, reducing cash:

a. Escrow deposits

b. Other miscellaneous liabilities

8. *Commitments.* No gains or losses are recorded when commitments are added to the Enterprise's sold portfolio. *See* section 3.2.1, of this Appendix.

9. *Fully-Hedged Foreign Currency-Denominated Liabilities.* Amounts that relate to currency swaps and foreign currency-denominated liabilities will be treated as follows:

a. Recorded balances that correspond to converted foreign currency-denominated liabilities will be amortized in a manner that is consistent with scheduled pay leg exchanges of notional amounts as set forth in corresponding currency swaps. The unamortized premiums, discounts and/or fees that are associated with these liabilities will be amortized as described in section 3.8, of this Appendix, as if they were associated with the pay legs of the corresponding currency swap. Any differences will be reflected as an increase or decrease in Retained Earnings.

b. Interest payable amounts associated with currency swaps will be settled in a manner that is consistent with the contractual terms for these instruments.

c. Receivable amounts associated with currency swaps and interest payable amounts associated with foreign currency-denominated debt will be reversed against Retained Earnings.

d. The adjustments in a., b. and c., of this section, will take place at the start of the Stress Test. These treatments are not applied to instruments that are modeled under AMT (*see* section 3.9, Alternative Modeling Treatments, of this Appendix) or foreign currency-denominated instruments that are not fully hedged.

3.10.3.6.3 Other Accounting Principles

The following additional accounting principles apply to the pro forma balance sheets and income statements:

1. All investment securities are treated as held to maturity. As such, they are recorded as assets at amortized cost, not at fair value.

2. All non-securitized mortgage loans will be classified as ''held-to-maturity'' and will be accounted for on an amortized cost basis.

3. Effective control over the collateral for collateral financings is with the party that originally delivered such collateral.

4. Enterprise Real Estate Investment Trust (REIT) subsidiaries are consolidated. Specifically, REIT assets are treated as Enterprise assets. Preferred stock of the REIT is reflected as Enterprise debt. Dividends paid on the preferred stock are reported as interest expense.

5. Treasury stock is reflected as a reduction in retained earnings.

3.10.4 Operations, Taxes, and Accounting Outputs

For each month of the Stress Period, the Stress Test produces a pro forma balance sheet and income statement. The Operations, Taxes and Accounting component outputs 121 monthly and 11 annual balance sheets, 120 monthly and 10 annual income statements, and 120 monthly and 10 annual cash flow statements, including part-year statements for the first and last calendar years of the Stress Test when necessary. These pro forma financial statements are the inputs for calculation of the risk-based capital requirement (*see* section 3.12, Calculation of the Risk-Based Capital Requirement, of this Appendix).

*3.11 Treatment of New Enterprise Activities*

3.11.1 New Enterprise Activities Overview

[a] Given rapid innovation in the financial services industry, OFHEO anticipates the Enterprises will become involved with new mortgage products, investments, debt and derivative instruments, and business activities, which must be accommodated in the Stress Test in order to capture all of the risk in the Enterprises' businesses. New accounting entries resulting from these innovations and changes in accounting must also be accommodated. The regulation is sufficiently flexible and complete to address new Enterprise activities as they emerge, using the procedures outlined in this section. However, OFHEO will monitor the Enterprises' activities and, when appropriate, propose amendments to this regulation addressing the treatment of new instruments, activities, or accounting treatments.

[b] For the purpose of this section of the Appendix, the term New Activity means any type of asset, liability, off-balance-sheet item, accounting entry, or activity to which a Stress Test treatment has not previously been applied. In addition, the Director has the discretion to treat as a New Activity: (1) any activity or instrument with characteristics or unusual features that create risks or hedges for the Enterprise that are not reflected adequately in the specified treatments for similar activities or instruments; and (2) any activity or instrument for which the specified treatment no longer adequately reflects the risk/benefit to the Enterprise, either because of increased volume or because new information concerning those risks/hedges has become available.

3.11.2 New Enterprise Activities Inputs

[a] Complete data and full explanations of the operation of the New Activity sufficient to understand the risk profile of the New Activity must be provided by the Enterprise. The Enterprises are required to notify OFHEO, pursuant to § 1750.2(c), of proposals related to New Activities as soon as possible, but in any event no later than five calendar days after the date on which the transaction closes or is settled. The Enterprises are encouraged to suggest an appropriate capital treatment that will fully capture the credit and interest rate risk in the New Activity. Information on New Activities must also be submitted and appropriately identified as such in the RBC Report.

[b] The Stress Test will not give an Enterprise the capital benefit associated with a New Activity where OFHEO determines that the impact of that activity on the risk-based capital level of the Enterprise is not commensurate with the economic benefit to the Enterprise.

3.11.3 New Enterprise Activities Procedures

[a] OFHEO will analyze the risk characteristics and determine whether an existing approach specified in the Appendix appropriately captures the risk of the New Activity or whether some combination or adaptation of existing approaches specified in the Appendix is appropriate. For example, the Stress Test might employ its mortgage performance components and adapt its cash flow components to simulate accurately the

loss mitigating effects and counterparty credit risk of credit derivatives.

[b] Where there is no reasonable approach using existing combinations or adaptations of treatments specified in this Appendix that could be applied within the timeframe for computing a quarterly capital calculation, the Stress Test will employ an appropriately conservative treatment, consistent with OFHEO's role as a safety and soundness regulator. Such treatment may include an alternative modeling treatment specified in section 3.9, Alternative Modeling Treatments, of this Appendix, or some other conservative treatment that OFHEO deems more appropriate.

[c] OFHEO will provide the Enterprise with its estimate of the capital treatment as soon as possible after receiving notice of the New Activity. In any event, the Enterprise will be notified of the capital treatment in accordance with the notice of proposed capital classification provided for in §1750.21.

[d] After a treatment has been incorporated into a final capital classification, OFHEO will provide notice of such treatment to the public, including the other Enterprise. OFHEO will consider any comments it receives from the public regarding the treatment during subsequent quarters. OFHEO may change the treatment as a result of such input or otherwise, if OFHEO determines that the risks of the New Activity are not appropriately reflected in a treatment previously adopted.

3.11.4 New Enterprise Activities Outputs

The Stress Test will generate a set of cash and/or accounting flows reflecting the treatment applied to the New Activity.

*3.12 Calculation of the Risk-Based Capital Requirement*

3.12.1 Risk-Based Capital Requirement Overview

The risk-based capital requirement is the sum of (1) the minimum amount of total capital that an Enterprise must hold at the start of the Stress Test in order to maintain positive total capital throughout the ten-year Stress Period, for all financial instruments explicitly modeled in the Stress Test (Stress Test capital subtotal) and (2) certain additional amounts relating to off-balance-sheet items addressed in section 3.9, Alternative Modeling Treatments, of this Appendix, and (3) 30 percent of that sum for management and operations risk. The Stress Test capital subtotal is determined based on monthly total capital figures from the pro forma financial statements, the additional amounts related to off-balance-sheet items, and Enterprise short term borrowing and investment rates.

3.12.2 Risk-Based Capital Requirement Inputs

[a] Inputs to the capital calculation are outputs from section 3.3, Interest Rates, section 3.9, Alternative Modeling Treatments, and section 3.10, Operations, Taxes, and Accounting, of this Appendix.

[b] For each month of the Stress Test, the following inputs are from, or used in the creation of, pro forma financial statements projected in section 3.10, Operations, Taxes, and Accounting, of this Appendix:

1. Total capital
   a. The par or stated value of outstanding common stock,
   b. The par or stated value of outstanding perpetual, noncumulative preferred stock,
   c. Paid-in capital,
   d. retained earnings, and
   e. allowance for losses on retained and sold mortgages less specific losses calculated in accordance with FAS 114,
2. Provision for income taxes (income tax expense),
3. Valuation adjustment that reduces benefits recorded from net operating losses when no net operating loss tax carrybacks are available, and
4. An Enterprise's cash position prior to the decision to issue new debt or purchase new investments to balance the balance sheet (*see* section 3.10.3.1, New Debt and Investments, of this Appendix).

[c] For present-value calculations, the Stress Test uses the six-month Enterprise Cost of Funds or the six-month CMT yield as described in section 3.3, Interest Rates, of this Appendix.

[d] The amount for off-balance-sheet items that are not explicitly modeled is obtained from section 3.9.3.1, Off-Balance Sheet Items, of this Appendix.

3.12.3 Risk-Based Capital Requirement Procedures

[a] The following eight steps are used to determine the Stress Test capital subtotal and the risk-based capital requirement for an Enterprise:

1. Determine the effective tax rate in each month. If the provision for income taxes is positive (reflecting taxes owed) or negative (reflecting tax refunds to be received), then the effective tax rate is 30 percent. If the provision for income taxes is zero after applying any valuation adjustments (*see* section 3.10.3.6, Accounting, of this Appendix), then the effective tax rate applied in step 3. of this section is zero.
2. Determine whether an Enterprise is an investor or a borrower in each month of the Stress Period. In months where an Enterprise has outstanding six-month discount notes that were issued during the stress test, then the Enterprise is a borrower. Otherwise, the Enterprise is an investor.
3. Determine the appropriate monthly discount factor for each month of the Stress Period:
   a. In months where an Enterprise is an investor, the monthly discount factor is based on the yield of short-term assets:

$$\text{Monthly Discount Factor} = \left[1 + \frac{(1 - \text{Effective Tax Rate}) \times \text{6-month CMT yield}}{2}\right]^{1/6}$$

   b. In months where an Enterprise is a borrower, the monthly discount factor is based on the cost of the Enterprise's short-term debt:

$$\text{Monthly Discount Factor} = \left[\frac{1 + \left[(1 - \text{Effective Tax Rate}) \times \left(\frac{\text{6-month Enterprise Cost of Funds}}{2}\right)\right]}{1 - \left[(1 - \text{Effective Tax Rate}) \times 0.00025\right]}\right]^{1/6}$$

Where:

0.00025 is the factor that incorporates the issuance and administrative costs for an Enterprise's new discount notes.

4. Compute the appropriate cumulative discount for each month of the Stress Period. The cumulative discount factor for a given month is the monthly discount factor for that month multiplied by the cumulative discount factor for the preceding month. (The cumulative discount factor for the first month of the Stress Period is the monthly discount factor for that month.) Thus, the cumulative discount factor for any month incorporates all of the previous monthly discount factors.
5. Discount total capital for each month of the Stress Period to the start of the Stress Period for both interest rate scenarios. Divide the total capital for a given month by the cumulative discount factor for that month.
6. Identify the Stress Test capital subtotal, which is the lowest discounted total capital amount from among the 240 monthly discounted total capital amounts.
7. From the Stress Test capital subtotal, subtract the capital required for off-balance sheet items not explicitly modeled in the Stress Test, as calculated

in section 3.9.3.1, Off-Balance Sheet Items, of this Appendix. Then subtract the resulting difference from the Enterprise's total capital at the start of the Stress Period. The resulting number is the amount of total capital that an Enterprise must hold at the start of the Stress Test in order to maintain positive total capital throughout the ten-year Stress Period.

8. Multiply the minimum total capital amount by 1.3 for management and operations risk.

3.12.4 Risk-Based Capital Requirement Output

The output of the calculations in this section is the risk-based capital requirement for an Enterprise at the start date of the Stress Test.

**4.0 Glossary**

This glossary is intended to define terms in the Regulatory Appendix that are used in a computationally specific sense that require a precise quantitative definition.

*A*

*Accounting Flows:* one or more series of numbers tracking various components of the accounting computations over time, analogous to ''Cash Flows.''

*Age:* of a Mortgage Loan, for computational purpose: the number of scheduled payment dates that have occurred prior to the time at which the Age is determined. The Age of a newly originated Mortgage is zero prior to its first payment date.

*Amortization Expense:* used in the accounting sense of the monthly allocation of a one-time amount (positive or negative) over time, not to describe amortization of principal in a mortgage.

*Amortization Schedule:* for a Mortgage Loan, a series of numbers specifying the (1) principal and (2) interest components of each Mortgage Payment, and (3) the Unpaid Principal Balance after each such payment is made.

*Allocated Interest:* in certain accounting calculations, the amount of interest deemed to be received on a certain date according to an allocation formula, whether or not equal to the amount actually received on that date (*see,* e.g., section 3.6.3.8.3, Whole Loan Accounting Flows Procedures, of this Appendix).

*Aggregate Limit: see* section 3.6.3.6.4.1, Mortgage Credit Enhancement Overview, of this Appendix.

*B*

*Balance Limit: see* section 3.6.3.6.4.1, Mortgage Credit Enhancement Overview, of this Appendix.

*Balloon Payment:* the final payment of a Balloon Loan, the principal component of which is the entire Unpaid Principal Balance of said loan at the time the Balloon Payment is contractually due.

*Balloon Loan:* a Mortgage Loan that matures before the Unpaid Principal Balance is fully amortized to zero, thus requiring a large final Balloon Payment.

*Balloon Date:* the maturity date of a Balloon Loan.

*Benchmark:* used as an adjective to refer to the economic environment (including interest rates, house prices, and vacancy and rental rates) that prevailed in the region and time period of the Benchmark Loss Experience.

*Benchmark Census Division:* the Census Division, designated by OFHEO, that is used to determine house prices and vacancy and rental rates of the Stress Period.

*Benchmark Loss Experience (BLE):* the rates of default and loss severity of loans in the state/year combination (containing at least two consecutive origination years and contiguous areas with a total population equal to or greater than five percent of the population of the United States) with the highest loss rate.

*Burnout:* in describing Mortgage Prepayments, the reduced rates of Prepayment observed with Mortgage Loans that were not prepaid during earlier periods when it would have been advantageous to do so.

*C*

*Cash Flow Hedges:* cash flow hedges as defined by FAS 133.

*Census Division:* any one of the nine geographic areas of the United States so designated by the Bureau of the Census. The OFHEO House Price Index determined at the Census Division level is used in the Stress Test.

*Claim Amount:* the amount of Credit Enhancement that an Enterprise is eligible to receive as a reimbursement on mortgage loan losses, which is often but not always equal to the total amount of the loss.

*Commitment Loan Groups:* hypothetical groups of Mortgage Loans assumed to be originated during the months immediately after the start of the Stress Test pursuant to Commitments made but not yet fulfilled by the Enterprises prior to the start of the Stress Test to purchase or securitize loans.

*Contract:* a Mortgage Credit Enhancement contract covering a distinct set of loans with a distinct set of contractual terms.

*Constant Maturity Treasury (CMT) Rate: see* table 3–18, Interest Rate and Index Inputs.

*Counterparty Type:* classification used to specify the appropriate Haircut level in section 3.5, Counterparty Defaults, of this Appendix.

*Credit Enhancement:* for the GSEs, agreements with lenders or third-parties put in place to reduce or limit mortgage credit (default) losses for an individual loan. *See* section 3.1.2.1.1, Loan Group Inputs, of this Appendix.

*D*

*Debt Service Coverage Ratio: see* section 3.6.3.5.3.1, Explanatory Variables, of this Appendix.

*Default:* for purposes of computing rates of mortgage default and losses, *see* the specific process specified in section 3.6.1, Whole Loan Cash Flows Overview, of this Appendix.

*Defaulting Fraction:* in any month, for any group of loans, the proportion of loans newly defaulted in that month expressed as a fraction of the *initial* loans (by number or by balance, depending on how Prepayment and Default Rates are measured) in the loan group; *see*, e.g., section 3.6.3.4.3.2, Prepayment and Default Rates and Performance Fractions, of this Appendix.

*Defaulted UPB:* the Unpaid Principal Balance (UPB) of a loan in the month that it Defaults.

*Deferred Balances: see* section 3.6.3.8.1, Whole Loan Accounting Flows Overview, of this Appendix.

*Derivative Mortgage Security:* generally refers to securities that receive cash flow with significantly different characteristics than the aggregate cash flow from the underlying mortgage loans, such as Interest-Only or Principal-Only Stripped MBSs or REMIC Residual Interests. *See* section 3.7.1, Mortgage-Related Securities Overview, of this Appendix.

*Deposit Limit: see* section 3.6.3.6.4.1, Mortgage Credit Enhancement Overview, of this Appendix.

*Distinct Credit Combination (DCC): see* section 3.6.3.6.4.1, Mortgage Credit Enhancement Overview, of this Appendix.

*E*

*Enterprise Cost of Funds:* for any maturity, the Federal Agency Cost of Funds (*see* section 3.3, Interest Rates, of this Appendix).

*Enterprise Loss Position: see* section 3.6.3.6.4.1, Mortgage Credit Enhancement Overview, of this Appendix.

*F*

*Fair Value Hedges:* fair value hedges as described in FAS 133.

*Float Income:* the earnings on the investment of loan principal and interest payments (net of the Servicing Fee and Guarantee Fee) from the time these payments are received from the servicer until they are remitted to security holders. *See* section 3.6.1, Whole Loan Cash Flows Overview, of this Appendix.

*G*

*Gross Loss Severity:* Loss Severity including the excess, if any, of Defaulted UPB over gross sale price of an REO property, fees, expenses and certain unpaid interest amounts, before giving effect to Credit Enhancement or any other amounts received on account of a defaulted loan (all such amounts expressed as a fraction of Defaulted UPB); *see* section 3.6.3.6.2, Single Family Gross Loss Severity, and section 3.6.3.6.3, Multifamily Gross Loss Severity, of this Appendix.

*Guarantee Fee:* the amount received by an Enterprise as payment for guaranteeing a mortgage loan; *see*, e.g., section 3.6.3.2, Payment Allocation Conventions, of this Appendix.

*H*

*Haircut:* the amount by which payments from a counterparty are reduced to account for a given probability of counterparty failure.

*I*

*Initial:* used as an adjective to specify conditions at the start of the Stress Test, except in defined terms; *see also* Time Zero.

*Initial Rate Period:* for an Adjustable Rate Mortgage, the number of months before the

mortgage interest rate changes for the first time. Also known as ''teaser period.''

*Interest-only Period:* for interest-only loans, the period of time for which the monthly payment covers only the interest due. (During the interest-only period, the UPB of the loan stays constant until maturity or a changeover date. For loans that mature, a Balloon Payment in the amount of the UPB is due at maturity. In other cases, the loan payment is recast at the changeover date and the loan begins to amortize over its remaining term.) *See* section 3.6.3.3.1, Mortgage Amortization Schedule Overview, of this Appendix.

*Interest Rates:* the Constant Maturity Treasury yields and other interest rates and indexes used in the Stress Test.

*Investor-owned:* a property that is not owner-occupied.

*L*

*Loan Limit:* used to describe a type of Credit Enhancement; *see* section 3.6.3.6.4.1, Mortgage Credit Enhancement Overview, of this Appendix.

*Loan Group:* a group of one or more mortgage loans with similar characteristics, that are treated identically for computational purposes in the Risk-Based Capital calculations.

*Loss Severity:* the amount of a mortgage loss divided by the Defaulted UPB.

*Loss Sharing Arrangements (LSA): see* section 3.6.3.6.4.1, Mortgage Credit Enhancement Overview, of this Appendix.

*M*

*Maximum Haircut:* as defined in section 3.5, Counterparty Defaults, of this Appendix.

*Modified Pool Insurance:* a form of Single Family Mortgage Credit Enhancement described in section 3.6.3.6.4.1, Mortgage Credit Enhancement Overview, of this Appendix.

*Mortgage Insurance (Primary Mortgage Insurance):* a type of credit enhancement that pays claims up to a given limit on each loan. *See* section 3.6.3.6.4.1, Mortgage Credit Enhancement Overview, of this Appendix.

*Mortgage Related Security:* a collective reference for (1) securities directly backed by mortgage loans, such as Single Class MBSs, Multi-Class MBSs (REMICs or Collaterilized Mortgage Obligations (CMOs)); (2) Derivative Mortgage-Backed Securities (certain multi-class and strip securities) issued by Fannie Mae, Freddie Mac, and Ginnie Mae; (3) Mortgage Revenue Bonds issued by State and local governments and their instrumentalities; or (4) single class and Derivative Mortgage-Backed Securities issued by private entities. *See* section 3.1.2.2, Mortgage-Related Securities Inputs, of this Appendix.

*N*

*Negative Amortization:* as defined in section 3.6.3.2.1, Allocation of Mortgage Interest, of this Appendix.

*Net Loss Severity:* Gross Loss Severity reduced by Credit Enhancements and any other amounts received on account of a defaulted loan (all such amounts expressed as a fraction of Defaulted UPB).

*Net Yield Rate:* the Mortgage Interest Rate minus the Servicing Fee Rate.

*New Activity:* as defined in section 3.11, Treatment of New Enterprise Activities, of this Appendix.

*Notional Amount:* the amount analogous to a principal balance which is used to calculate interest payments in certain swap transactions or derivative securities.

*O*

*Original:* used as an adjective to specify values in effect at Loan Origination.

*Origination:* for a Mortgage Loan with monthly payments, the date one month prior to the first contractual payment date.

*Owner-Occupied:* a property, or a Mortgage Loan backed by a property, that is a single family residence which is the primary residence of the owner.

*P*

*Pass-Through Rate:* the Mortgage Interest Rate minus the Servicing Fee and the Guarantee Fee.

*Performing Fraction:* in any month, for any group of loans, the proportion of loans that have not either prepaid or defaulted in that month or any prior month, expressed as a fraction of the loans at the start of the Stress Test (by number or by balance, depending on how Prepayment and Default rates are measured) in a loan group; *see* e.g., section 3.6.3.4.3.2, Prepayment and Default Rates and Performance Fractions, of this Appendix.

*Prepaying Fraction:* in any month, for any group of loans, the proportion of loans that prepay in full in that month expressed as a fraction of the loans at the start of the Stress Test (by number or by balance, depending on how Prepayment and Default rates are measured) in the loan group; *see* e.g., section 3.6.3.4.3.2, Prepayment and Default Rates and Performance Fractions, of this Appendix.

*Prepayment:* the prepayment in full of a loan before its contractual maturity date

*Prepayment Interest Shortfall:* as defined in section 3.6.3.1, Timing Conventions, of this Appendix.

*R*

*Risk-Based Capital (RBC) Report:* The form in which Enterprise data is to be submitted for purposes of calculating the risk-based capital requirement, as described in section 3.1, Data, of this Appendix.

*Relative Spread:* as defined in section 3.6.3.4.3.1, Single Family Default and Prepayment Explanatory Variables, of this Appendix.

*Retained Loans:* as described in section 3.6.1, Whole Loan Cash Flows Overview, of this Appendix.

*S*

*Scheduled Principal:* the amount of principal reduction that occurs in a given month according to the Amortization Schedule of a mortgage loan; *see* section 3.6.3.3, Mortgage Amortization Schedule, of this Appendix.

*Servicing Fee:* portion of mortgage interest payment retained by servicer.

*Sold Loans:* as described in section 3.6.1, Whole Loan Cash Flows Overview, of this Appendix.

*Spread Accounts:* a form of Credit Enhancement; section 3.6.3.6.4, Mortgage Credit Enhancement, of this Appendix.

*Stress Period:* the 10-year period covered by the Stress Test simulation.

*Stress Test:* the calculation, which applies specified economic assumptions to Enterprise portfolios, described in this Appendix.

*Strike Rate:* the interest rate above/below which interest is received for caps/floors.

*Subordination Agreements:* a form of Credit Enhancement in which the cash flows allocable to a portion of a mortgage pool are used to cover losses on loans allocable to another portion of the mortgage pool; *see* section 3.6.3.6.4, Mortgage Credit Enhancement, of this Appendix.

*T*

*Time Zero:* used to designate the conditions in effect at the start of the Stress Test, as defined in section 3.6.3.1, Timing Conventions, of this Appendix.

*U*

*Unpaid Principal Balance (UPB):* the Unpaid Principal Balance of a loan or loan group based solely on its Amortization Schedule, without giving effect to any missed or otherwise unscheduled payments.

*W*

*Whole Loan:* a mortgage loan.

Dated: July 19, 2001.

**Armando Falcon, Jr.,**

*Director, Office of Federal Housing Enterprise Oversight.*

[FR Doc. 01–18459 Filed 9–12–01; 8:45 am]

BILLING CODE 4220–01–U