



### Description of Instrument

Mortgage derivative securities are products created from pools of mortgage-backed securities. They include collateralized mortgage obligations (CMOs), Real Estate Mortgage Investment Conduits (REMICs), and stripped mortgage-back securities, such as interest-only (IO) and principal-only (PO) strips.

All institutions that file Schedule CMR must report the book value of their mortgage derivative securities in CMR351 to CMR378. In addition, some institutions are required to report the estimated economic value of their mortgage derivative securities in the base case and alternate rate scenarios in CMR921 to CMR929.<sup>1</sup> Other institutions may do so voluntarily.

### Valuation Methodology

#### *Economic Values for Institutions that Report Economic Value Estimates*

Institutions that report estimates of the economic value of their mortgage derivatives provide values for the base case and six alternate rate scenarios.

If an institution provides these estimates, the NPV Model reports them on the Exposure Report on the line Mortgage Derivative Securities Valued by the Institution. The Model does not produce its own estimates in such cases.

#### *Economic Values for Institutions that do not Report Economic Value Estimates*

For institutions that do not report economic value estimates for mortgage derivatives in CMR921 to CMR929, the Model assumes each of the categories of CMOs and REMICs reported on Schedule CMR has the same interest rate sensitivity as a selected benchmark security. The benchmark security chosen for each category is selected by reviewing existing CMO/REMIC structures to find a tranche with characteristics representative of tranches likely to be reported in that cell. The benchmarks are reviewed quarterly and if it is determined they are no longer representative, new benchmarks are chosen.

The economic values of reported CMOs are assumed to be equal to their book values in the base case interest rate scenario. To calculate the economic values in the alternate rate scenarios, the Model multiplies the base case by the percentage price change from the base case of the associated benchmark.

The quarterly Asset and Liability Pricing Tables contains a table reporting the benchmarks.

#### *Stripped Mortgage-Backed Securities*

IOs and POs are priced using the OAS methodology described in Section 5.A. The same interest rate simulation described in the fixed-rate mortgage section is used to generate 200 streams of principal-only and interest-only cash flows.

Each of the 200 unique cash flow streams for IOs and POs is discounted by the sequence of short-term rates in its path plus an option-adjusted spread for fixed-rate mortgages. The resulting present values are then averaged to obtain the NPV Model's price for the base case rate scenario.

In the alternate interest rate scenarios for IOs and POs, the initial short and long rates in the option-based simulation are shocked and the interest rate paths regenerated. Each of the 200 cash flow streams for IOs and POs changes because the shocked mortgage rates and the prepayment function result in different prepayment rates. Although the same OAS is used for discounting in the alternate rate scenarios as in the

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<sup>1</sup> These institutions include those with assets over \$1 billion and those with a portfolio of mortgage derivatives with a book value exceeding 5 percent of assets.

base case, the shocked short-term Treasury rates cause the discount rates in each path to change in the alternate rate scenarios.

The Model produces tables containing economic value estimates for IOs and POs with several different WACs and WARMS. The reported balances of IOs and POs are matched to prices from the table based on their reported WAC. The WARM for low-risk IOs and POs (CMR370 and 374) is assumed to be 60 months while that for high-risk IOs and POs (CMR369 and 373) is assumed to be 300 months.

The combined economic value of CMOs valued using the benchmark approach, and of IOs and POs valued using the method described above, is listed on the Exposure Report on the line titled Mortgage-Derivative Securities Valued by OTS.

## Section 5.O - Assets Valued Using Static Discounted Cash Flow Method

The following assets are valued using the static discounted cash flow method:

- Multifamily and Nonresidential Mortgages
- Construction and Land Loans
- Second Mortgages
- Commercial Loans
- Consumer Loans
- Zero-Coupon Securities
- Government and Agency Securities
- Term Fed Funds, Term Repos, and Interest-Earning Deposits
- "Other" Securities

The method used to value these instruments is described below. Details on how each type of loan or security is valued are discussed in Sections 5.P to 5.W.

### Cash Flows

Information on each of the five types of loans listed above is reported separately on Schedule CMR for adjustable-rate and fixed-rate balances. Adjustable-rate and fixed-rate loans are valued separately by the NPV Model.

Schedule CMR collects most of the information the Model needs to estimate the economic value of fixed-rate balances. Because of space constraints, some items that are needed to project the cash flows of adjustable-rate loans are not collected, however, and must be estimated. The estimation of these values is described below.

### Adjustable-Rate Loans: Estimation of Next Coupon Reset and Current Coupon

The number of **months until the next coupon reset** is assumed to be equal to one-half the reset frequency reported on Schedule CMR. For example, if the reset frequency were 12 months, the Model would assume the next coupon reset would occur in 6 months.

The **current coupon** is calculated as the estimated value of the index at the last reset plus the reported margin. To estimate the value of the index at the last reset, the Model averages historical month-end values of the index over a number of months equal to the reported reset frequency.

#### **Example: Estimating the Current Coupon of Adjustable-Rate Loans**

*Suppose an institution reports on the December 31 Schedule CMR that it holds a second mortgage loan whose coupon resets every 12 months, is tied to the 1-year Constant Maturity Treasury yield, and has a margin of 300 basis points. The Model would average the historical values of the 1-year CMT yield over the previous twelve months, from the previous December to November of the current year, and add 300 basis points to obtain the estimated current coupon.*

### Adjustable-Rate Loans: Projecting the Coupon

The Model projects the coupon of adjustable-rate loans after the initial reset by projecting the index to which the loan is tied, and adding the reported margin. Appendix A of the Schedule CMR instructions lists 31 types of in-

terest rate index codes representing indices to which adjustable-rate loans may be tied.<sup>1</sup> Using that list, institutions report the code for the index to which the largest portion of their balances of a given type (e.g., second mortgages) are tied. All balances of that type are evaluated as though they were tied to that index.<sup>2</sup>

Future index rates for adjustable-rate loans are projected based on the implied forward par rates of that index. In cases where implied forward rates cannot be calculated (e.g., the prime rate), the future values of the index are projected using implied forward Treasury rates and a statistical relationship between the index and the Treasury forwards. (See Chapter 8.)

Projected values for a few of the index types listed in Appendix A are not calculated by the Model. These include index codes 812 (the lender's own cost of funds), 820 (the Federal Cost-of-Funds Index), 910 (rate adjusted at lender's discretion), and 911 (any other index). For all four codes, the 11th District COF Index is used as a proxy for the index. For codes 812 and 820, the reported margin is added to the 11th District COF to derive the coupon in each future month. For codes 910 and 911, instead of using the reported margin, the Model uses the median margin of all institutions with loans in that category (e.g., all second mortgages) tied to the 11th District COF (see second example below).<sup>3</sup>

### **Example: How Coupons of Adjustable-rate Loans are Projected**

*Suppose an institution reports that its adjustable-rate multifamily and nonresidential balloon mortgages are tied to 3-month LIBOR (index code 403) with a margin of 335 basis points. The Model would project the future coupons for Multifamily and Nonresidential balloon mortgages by calculating the 3-month LIBOR implied forward rate in each future month, and adding 335 basis points. Chapter 8 describes how the implied forward rates are calculated.*

*Suppose a different institution reports adjustable-rate construction and land loans with a rate index code of 910, "Rate adjusted at lender's discretion." The coupon for these loans would be approximated as the projected value of the 11th District COF Index plus the median margin of all reported construction and land loans tied to the 11th District COFI.*

### Scheduled Payments and Prepayments

All loans described in this chapter are assumed to generate monthly cash flows. The following types of loans are assumed to generate both principal and interest payments.

- Multifamily and nonresidential mortgages
- Second mortgages
- Consumer loans

These other assets are assumed to generate monthly interest payments and pay all principal at maturity:

<sup>1</sup> For example, the index code for loans tied to the 3-month Treasury rate is 303 while that for loans tied to the prime rate is 830.

<sup>2</sup> For example, suppose 70 percent of an institution's balances of adjustable-rate construction loans were tied to the prime rate with the remaining 30 percent tied to the 1-year Treasury rate. The institution would report the code for the prime rate, 830, in the Schedule CMR cell for the rate index code. The Model would treat all of that institution's adjustable-rate construction loans as though they were indexed to the prime rate.

<sup>3</sup> As described in Sections 5.P to 5.R, for loans tied to index codes 910 and 911, the Model uses the same discount factor that it uses for loans tied to the 11th District COF. Because the index, margin, and discount factor for these loans are all based on the 11th District COF, the result is that most of these loans will have a base case economic value equal to their outstanding balance, and an interest rate sensitivity approximately equal to that of a typical 11th District COF loan of that type.

- Construction and land loans
- Commercial loans
- Term fed funds, term repos, and interest-earning deposits

The following assets are assumed to generate semi-annual interest payments and pay all principal at maturity:

- Government and agency securities
- "Other" securities

Finally,

- Zero-coupon securities
- generate a single cash flow at maturity.

Equations Used by the Static Discounted Cash Flow Method

*Calculation of Cash Flows*

The following equations illustrate the calculation of monthly cash flows for an asset valued with the static discounted cash flow method. The interest payment,  $I_t$ , in any month,  $t$ , is calculated for nonamortizing assets as follows.  $B_t$  is the outstanding balance and the coupon,  $c$ , is an annual decimal rate.

**Equation 5.O.1 - Interest Payment for Nonamortizing Assets**

$$I_t = B_t \cdot \frac{C_t}{12}$$

For amortizing assets, the principal and interest payment is calculated as follows, where  $T$  is the remaining maturity of the loan.

**Equation 5.O.2 - Scheduled Payment for Amortizing Assets**

$$\text{Scheduled Payment}_t = \frac{B_t \left( \frac{C_t}{12} \right)}{\left[ 1 - \left( 1 + \frac{C_t}{12} \right)^{-T} \right]}$$

An assumed **servicing cost** is deducted from the cash flows of all loans. The variable "cost" in Equation O.3 below is an annual cost.

Some loans are assumed to exhibit prepayments. For those loans, the total monthly payment equals the P&I payment as above, plus an additional term for prepaid principal where  $p$  is the fraction of the outstanding balance expected to prepay in each month.<sup>4</sup>

<sup>4</sup> In Sections 5.P to 5.U, the prepayment rate is given for each type of loan as an annual rate. The annual rate is transformed to a monthly rate,  $p$ , using the following equation where the constant prepayment rate (CPR) is the annual rate in decimal form.

Incorporating both the servicing cost and prepayments, the cash flow in any month  $t$  is as follows,

**Equation 5.O.3 - Monthly Cash Flow**

$$CF_t = \text{ScheduledPayment}_t + (p_t \cdot B_t) - \left( \frac{\text{cost}}{12} \right) \cdot B_t$$

*Discounting the Cash Flows*

After the monthly cash flows have been calculated, each is multiplied by a discount factor,  $df_t$ . The sum of the discounted monthly payments is the asset's estimated economic value, or present value (PV).

**Equation 5.O.4 - Present Value of an Asset**

$$PV = (CF_1 \cdot df_1) + (CF_2 \cdot df_2) + \dots + (CF_T \cdot df_T)$$

The discount factor is calculated as follows where  $f$  is the implied forward one-month Treasury rate and  $s$  is a constant spread (both are in monthly decimal form).<sup>5</sup>

**Equation 5.O.5 - Discount Factor for Assets**

$$df_t = \frac{1}{(1 + f_1 + s)(1 + f_2 + s) \dots (1 + f_t + s)}$$

The spread is the amount that must be added to the forward rates in the equation above to discount the cash flows to the current price of the asset.

Separate spreads are calculated for each of the categories of assets described in this chapter (e.g., a different spread is used for term fed funds than for investment securities). For each category, separate spreads are calculated for fixed-rate and adjustable-rate loans.<sup>6</sup>

To calculate the spread, the Model assumes that the discount factors of a newly issued loan would discount its cash flows to its face value. Cash flows of the newly issued loan are projected, given assumptions concerning its coupon, servicing cost, amortization and prepayment characteristics, and in the case of adjustable-rate loans, the type of index, the margin, and number of months until the coupon resets.

The NPV Model uses an iterative method to solve Equation O.6 below for the monthly spread,  $s$ , where the CF's are the projected monthly cash flows, resulting from \$100 of outstanding balance. Where sufficient information exists to formulate appropriate assumptions concerning characteristics of the newly issued loan, separate spreads are calculated for adjustable-rate loans tied to several different indices.<sup>7</sup>

**Equation 5.O.6 - Equation Used to Solve for Monthly Spread**

$$p = 1 - \left( 1 - \text{CPR} \right)^{\frac{1}{12}}$$

<sup>5</sup> The derivation of the implied forward rates is described in Chapter 8.

<sup>6</sup> An exception is consumer loans. For consumer loans, the same spreads are used for fixed-rate and adjustable-rate loans. See Section 5.T for more information.

<sup>7</sup> For adjustable-rate loans tied to indices for which sufficient information is not available, the Model uses a proxy for the spread. For example, for second mortgages, the Model calculates a unique spread for loans tied to the 1-year CMT yield, but uses a proxy for the spread for loans tied to the 2-year, 3-year, and 5-year CMT yields. Sections 5.P to 5.S describe for which index types a spread is calculated, and for which types a proxy is used.

$$\$100 = CF_1 \left[ \frac{1}{(1 + f_1 + s)} \right] + CF_2 \cdot \left[ \frac{1}{(1 + f_1 + s)(1 + f_2 + s)} \right] + \dots + CF_T \left[ \frac{1}{(1 + f_1 + s) \dots (1 + f_T + s)} \right]$$

**Example: Calculation of a Spread**

To calculate the spread for the category of assets called Term Fed Funds, Term Repos, and Interest-Earning Deposits, the Model solves Equation 5.O.6 assuming receipt of monthly interest cash flows over a term of 3 months, and principal at maturity. The rate used to calculate cash flows is the 3-month commercial paper rate, 4 percent in this example.

The Model calculates the interest payments for this asset as follows:

$$I_t = \$100 \cdot \frac{.04}{12} = \$.33$$

Assume the implied forward 1-month Treasury rates are .0016, .0025, and .0033 in months 1 through 3. The spread is the value that solves Equation 5.O.6:

$$100 + .33 \left[ \frac{1}{1 + .0016 + S} \right] + .33 \cdot \left[ \frac{1}{(1 + .0016 + S)(1 + .0025 + S)} \right] + 100.23 \cdot \left[ \frac{1}{(+.0016 + S)(1 + .0033 + S)} \right]$$

The Model solves for the spread through a trial and error process. In this example the solution for the monthly spread is .00083.

Alternate Interest Rate Scenarios

*Fixed-Rate Loans*

Cash flows of fixed-rate assets discussed in this chapter remain constant in all rate scenarios since the coupon does not change, and although some assets are assumed to prepay, the prepayment rate for these assets does not vary by interest rate scenario.

*Adjustable-Rate Loans*

Coupons of adjustable-rate loans change by varying amounts in the alternate rate scenarios, depending on the index to which they are tied. Coupons based on a Treasury rate, LIBOR, or an FHLB advance rate will adjust by the full amount of the shock on their next reset date (subject to any interest rate caps in the case of Multifamily and Nonresidential Mortgages). Coupons based on a cost-of-funds index or the prime rate adjust with a lag as indicated by the equations described in Chapter 8.

*Discount Factors*

Discount factors for both adjustable-rate and fixed-rate assets are adjusted in the alternate rate scenarios by replacing the base case forward rates with forward rates derived from the zero-coupon curve after it has been shocked by the amount appropriate for that scenario (see Chapter 8).

**Section 5.P - Multifamily and Nonresidential Mortgages**

Schedule CMR Line Numbers

The lines used to report information on these mortgages on Schedule CMR are displayed below.

<b>ASSETS</b>				
MULTIFAMILY & NONRESIDENTIAL MORTGAGE LOANS & SECURITIES				
	Balloons		Fully Amortizing	
<b>Adjustable-Rate:</b>				
Balances	261	\$	262	\$
WARM	263	months	264	months
Remaining Term to Full Amortization	265	months		
Rate Index Code	267		268	
Margin	269	bp	270	bp
Reset Frequency	271	months	272	months
MEMO: ARMs within 300 bp of Life Cap				
Balances	273	\$	274	\$
WA Distance to Lifetime Cap (bp)	275	bp	276	bp
<b>Fixed-Rate:</b>				
Balances	281	\$	282	\$
WARM	283	months	284	months
Remaining Term to Full Amortization	285	months		
WAC	287	%	288	%

Description of Instrument

This category consists of performing multifamily and nonresidential permanent mortgage loans and securities.

The following four categories of multifamily and nonresidential mortgages are reported on Schedule CMR. Each is valued separately by the NPV Model.

- Adjustable-Rate Balloon Mortgages
- Adjustable-Rate Fully Amortizing Mortgages
- Fixed-Rate Balloon Mortgages
- Fixed-Rate Fully Amortizing Mortgages

In addition, for adjustable-rate mortgages (both balloon and fully amortizing), institutions report the volume of balances that have coupons currently within 300 basis points of their lifetime interest rate caps. These balances are valued separately from those whose coupons are more than 300 basis points from their caps (or that have no caps).

Valuation Methodology

Method

Static discounted cash flow.

## Cash Flows

### Coupons

Fixed-rate mortgages: The weighted average coupon for fixed-rate nonresidential and multifamily mortgages is reported on Schedule CMR and is used to calculate all interest cash flows for fixed-rate mortgages.

Adjustable-rate mortgages: The current coupon is not reported on Schedule CMR for adjustable-rate mortgages, and is estimated using the method described in Section 5.O. Interest payments are calculated using this estimated rate until the first coupon reset.

Coupons are assumed to reset with the frequency reported (in CMR271 or CMR272, as appropriate). Beginning at the first reset, and on each reset month for the remaining term of the mortgage, the coupon is calculated by adding the reported margin to the projected value of the index.

Institutions report the dollar value of adjustable-rate balances currently within 300 basis points of their lifetime interest rate caps (in CMR273 and CMR274), and the distance between the coupon and rate cap (in CMR275 and CMR276), in basis points, as of the quarter-end reporting date. The NPV Model calculates the lifetime rate cap by adding that latter value to the estimated quarter-end coupon, and for those balances, restricts the estimated coupon to be no higher than the cap when calculating interest payments. All other balances are treated as having no rate caps.

#### **Example: Calculation of Coupon for Adjustable-Rate Nonresidential and Multifamily Mortgages**

*Suppose an institution reports that its adjustable-rate fully-amortizing mortgages are indexed to the one-year Treasury rate, have a weighted average margin of 300 basis points, and that half of them have a coupon that is currently 200 basis points from the lifetime interest rate cap.*

*First, the Model would estimate the current coupon of the entire balance of mortgages by averaging the historical values of the one-year Treasury yield over the twelve months prior to the CMR reporting date, and adding the reported margin of 300 basis points. If the average one-year Treasury rate were 5 percent, the estimated current coupon would be 8 percent. This coupon would be used to calculate cash flows until the first scheduled coupon reset. The lifetime interest rate cap on half of the balances would be estimated to be 10 percent. After the first coupon reset, the coupon of these balances would be equal to the lesser of the implied forward one-year Treasury rate plus 300 basis points, or 10 percent (the estimated interest rate cap). The remaining balances would not be subject to a cap.*

### Scheduled Payments

Fully amortizing loans amortize over the number of months reported for the Weighted Average Remaining Maturity (CMR264 or CMR284).

Balloon loans amortize over the number of months reported for "Remaining Term to Full Amortization," but all remaining principal is paid as a balloon in the month reported for the WARM (CMR263 or CMR283).

An annual servicing cost of 20 basis points is assumed for all types of multifamily and nonresidential loans. Thus, an amount equal to  $.00016 (= .0020/12)$  times the outstanding balance is deducted from the monthly payment.

### Prepayments

Prepayments for all multifamily and nonresidential balances are assumed to be zero in all interest rate scenarios.

### *Discount Factors*

Different discount factors are used for fully-amortizing and balloon mortgages. (See Section 5.O for a description of the calculation of the discount factors.) For each type of mortgage, separate discount factors are calculated for the following types of loans:

- Fixed-rate loans

Adjustable-rate loans tied to:

- 3-month Treasury
- 6-month Treasury
- 1-year Constant Maturity Treasury
- National Average Contract Rate
- 11th District Cost of Funds Index
- Prime rate

Calculation of the discount factors requires that assumptions be made concerning the coupon, maturity, repricing frequency, prepayment rate, and servicing cost of a new, or "par" loan. These assumed characteristics are listed for balloon loans and fully amortizing loans in Tables P.2 and P.3, respectively. The coupon used to calculate the spread for each type of adjustable-rate loan is equal to the current value of the index, plus the median margin reported on Schedule CMR by all institutions reporting nonresidential and multifamily loans tied to that particular index.<sup>1</sup> In addition to the indices listed above, the NPV Model accommodates adjustable-rate loans tied to other indices listed in Appendix A of the Schedule CMR instructions. Too few institutions report nonresidential and multifamily loans tied to these indices to make their median margins reliable. Therefore, the discount factors of one of the index types for which a discount factor is calculated is used as a proxy. Table P.1 below lists the index types for which a spread is not calculated, along with the type of loan whose discount factor is used as a proxy.

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<sup>1</sup> The margins in Tables P.2 and P.3 are median margins from the March 1994 Schedule CMR. They will be updated periodically.

Table 5.P.1

**Nonresidential and Multifamily Mortgages Index Types  
for Which a Proxy is Used for the Discount Factor**

<b>Index Type</b>	<b>Index of Loan Whose Discount Factor is Used</b>
2-year CMT	1-year CMT
3-year CMT	1-year CMT
5-year CMT	1-year CMT
1-month LIBOR	3-month Treasury
3-month LIBOR	3-month Treasury
6-month LIBOR	6-month Treasury
1-year LIBOR	1-year CMT
3-month FHLB rate	3-month Treasury
6-month FHLB rate	6-month Treasury
1-year FHLB rate	1-year CMT
2-year FHLB rate	1-year CMT
3-year FHLB rate	1-year CMT
4-year FHLB rate	1-year CMT
5-year FHLB rate	1-year CMT
3-month CD rate	3-month Treasury
6-month CD rate	6-month Treasury
1-year CD rate	1-year CMT
5-year CD rate	1-year CMT
FHLMC/FNMA Commitment rate	National Average Contract Rate
Lender's own COF	11th District Cost of Funds
Federal COF	11th District Cost of Funds
Rate Adjusted at Lender's Discretion	11th District Cost of Funds
Other	11th District Cost of Funds

*Table 5.P.2*  
**Assumptions Used to Calculate Spreads for Nonresidential and Multifamily Balloon Mortgages**

	Adjustable Rate						
	Fixed Rate	3-month Treasury	6-month Treasury	1-year CMT	NACR	11th District COF	Prime
Coupon	FNMA Rate*	3-month Treasury + 2.50%	6-month Treasury + 2.74%	1-year CMT + 3.00%	5-year CMT + 4.00%	11th District COF + 2.75%	Prime + 1.94%
Remaining Maturity	84	84	84	84	84	84	84
Months to full amortization	360	360	360	360	360	360	360
Reset Frequency	NA	3	6	12	12	1	1
Annual CPR	0	0	0	0	0	0	0
Annual Servicing Cost	20 bp	20 bp	20 bp	20 bp	20 bp	20 bp	20 bp

\*Fannie Mae 30-day commitment rate for a 7/30 mortgage in the Prior Approval Program.

*Table 5.P.3*  
**Assumptions Used to Calculate Spreads for Nonresidential and Multifamily Fully Amortizing Mortgages**

	Adjustable Rate						
	Fixed Rate	3-month Treasury	6-month Treasury	1-year CMT	NACR	11th District COF	Prime
Coupon	FNMA Rate*	3-month Treasury + 2.97%	6-month Treasury + 2.55%	1-year CMT + 3.00%	5-year CMT + 2.96%	11th District COF + 2.62%	Prime + 1.92%
Remaining Maturity	300	300	300	300	300	300	300
Months to full amortization	300	300	300	300	300	300	300
Reset Frequency	NA	3	6	12	12	1	1
Annual CPR	0	0	0	0	0	0	0
Annual Servicing Cost	20 bp	20 bp	20 bp	20 bp	20 bp	20 bp	20 bp

\*Fannie Mae 30-day commitment rate for a 7/30 mortgage in the Prior Approval Program.

## Section 5.Q - Construction and Land Loans

### Schedule CMR Line Numbers

The lines used to report these loans on Schedule CMR are displayed below.

<b>ASSETS</b>				
CONSTRUCTION & LAND LOANS				
Balances	Adjustable Rate		Fixed Rate	
WARM	291	\$	292	\$
Rate Index Code	293	months	294	months
Margin in Col 1; WAC in Col 2	295			
Reset Frequency	297	bp	298	%
	299	months		

### Description of Instrument

This category includes performing construction and land loans. It does not include construction loans in process, which are valued with off-balance sheet instruments and described in Chapter 7.

Adjustable-rate and fixed-rate loans are reported separately on Schedule CMR and valued separately by the NPV Model.

### Valuation Methodology

#### Method

Static discounted cash flow.

### Cash Flows

#### Coupons

**Fixed-rate loans:** The weighted average coupon for fixed-rate construction and land loans is reported on Schedule CMR and is used to calculate all interest cash flows for fixed-rate loans.

**Adjustable-rate loans:** The current coupon for adjustable-rate loans is not reported on Schedule CMR but is estimated using the method described in Section 5.O. Interest payments are calculated using the estimated current coupon rate until the first coupon reset.

Coupons are assumed to reset with a frequency equal to the reported reset frequency. Beginning at the first reset, and continuing for the remaining term of the loan, the coupon is projected by adding the reported margin to the projected value of the index. Index values are projected as described in Chapter 8. For example, if an institution reported that its adjustable-rate construction and land loans are indexed to the prime rate and have a margin of 150 basis points, the Model would calculate the coupon (in annual terms) in each future month as the projected value of the prime rate in that month plus 150 basis points.

Scheduled Payments

Construction and land loans are assumed to pay monthly interest cash flows and the entire principal balance at maturity.

An annual servicing cost of 20 basis points is assumed for both fixed-rate and adjustable-rate construction and land loans. Thus, an amount equal to .000167 ( $=.0020/12$ ) times the outstanding balance is deducted from the monthly payment.

Prepayments

Prepayments of construction and land loans are assumed to be zero in all interest rate scenarios.

*Discount Factors*

Different discount factors are calculated for the following types of construction and land loans:

- Fixed-rate loans

Adjustable-rate loans tied to:

- 3-month Treasury
- 6-month Treasury
- 1-year Constant Maturity Treasury
- National Average Contract Rate
- 11th District Cost of Funds Index
- Prime rate

Calculation of the discount factors requires that assumptions be made concerning the coupon, maturity, re-pricing frequency, prepayment rate, and servicing cost of a new, or "par" loan. These assumed characteristics are listed in Table 5.Q.2. The coupon used to calculate the spread for each type of adjustable-rate loan is equal to the current value of the index, plus the median margin reported on Schedule CMR by all institutions reporting construction and land loans tied to that particular index.<sup>1</sup>

In addition to the indices listed above, the NPV Model accommodates adjustable-rate loans tied to other indices listed in Appendix A of the Schedule CMR instructions. Too few institutions report construction and land loans tied to these indices to make their median margins reliable. Therefore, the discount factors of one of the other index types listed above for which a discount factor is calculated is used as a proxy. Table 5.Q.1 below lists the index types for which a spread is not calculated along with the type of loan whose discount factor is used as a proxy.

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<sup>1</sup> The margins in Table 5.Q.2 are median margins from the March 1994 Schedule CMR. They will be updated periodically.

*Table 5.Q.1*  
**Construction and Land Loans Index Types  
 for Which a Proxy is Used for the Discount Factor**

<b>Index Type</b>	<b>Index of Loan Whose Discount Factor is Used</b>
2-year CMT	1-year CMT
3-year CMT	1-year CMT
5-year CMT	1-year CMT
1-month LIBOR	3-month Treasury
3-month LIBOR	3-month Treasury
6-month LIBOR	6-month Treasury
1-year LIBOR	1-year CMT
3-month FHLB rate	3-month Treasury
6-month FHLB rate	6-month Treasury
1-year FHLB rate	1-year CMT
2-year FHLB rate	1-year CMT
3-year FHLB rate	1-year CMT
4-year FHLB rate	1-year CMT
5-year FHLB rate	1-year CMT
3-month CD rate	3-month Treasury
6-month CD rate	6-month Treasury
1-year CD rate	1-year CMT
5-year CD rate	1-year CMT
FHLMC/FNMA Commitment rate	National Average Contract Rate
Lender's own COF	11th District Cost of Funds
Federal COF	11th District Cost of Funds
Rate Adjusted at Lender's Discretion	11th District Cost of Funds
Other	11th District Cost of Funds

*Table 5.Q.2*  
**Assumptions Used to Calculate Spreads for Construction and Land Loans**

	Fixed Rate	Adjustable Rate					11th District COF	Prime
		3-month Treasury	6-month Treasury	1-year CMT	NACR	5-year CMT		
Coupon	HUD Survey Rate*	3-month Treasury + 1.90%	6-month Treasury + 2.45%	1-year CMT + 2.82%	5-year CMT + 2.68%	11th District COF +3.00%	Prime + 1.75%	
Remaining Maturity	36	36	36	36	36	36	36	
Months to full amortization	36	36	36	36	36	36	36	
Reset Frequency	NA	3	6	12	12	1	1	
Annual CPR	0	0	0	0	0	0	0	
Annual Servicing Cost	20 bp	20 bp	20 bp	20 bp	20 bp	20 bp	20 bp	

\*The national average interest rate for home loan construction from the HUD monthly news release, Secondary Market Prices and Yields and Interest Rates for Home Loans.

## Section 5.R - Second Mortgages

### Schedule CMR Line Numbers

The lines used to report information on second mortgages on Schedule CMR are displayed below.

<b>ASSETS</b>				
SECOND MORTGAGE LOANS & SECURITIES				
Balances	Adjustable Rate		Fixed Rate	
WARM	311	\$	312	\$
Rate Index Code	313	months	314	months
Margin in Col 1; WAC in Col 2	315			
Reset Frequency	317	bp	318	%
	319	months		

### Description of Instrument

This category includes performing single-family second mortgage loans and securities backed by such loans.

Adjustable-rate and fixed-rate second mortgages are reported separately on Schedule CMR and valued separately by the NPV Model.

### Valuation Methodology

#### Method

Static discounted cash flow.

#### Cash Flows

##### Coupons

Fixed-rate mortgages: The weighted average coupon for fixed-rate second mortgages is reported on Schedule CMR, and is used to calculate all cash flows for fixed-rate mortgages.

Adjustable-rate mortgages: The current coupon is not reported on Schedule CMR for adjustable-rate second mortgages, but is estimated using the method described in Section 5.O. Interest payments are calculated using this estimated rate until the first coupon reset.

Beginning at the first reset, and continuing for the remaining term of the loan, future values of the coupon are projected by adding the reported margin to the projected value of the index. Index values are projected as described in Chapter 8. For example, if an institution reports that its adjustable-rate second mortgages are indexed to the prime rate and have a margin of 200 basis points, the Model would calculate the annual coupon in each future month as the projected value of the prime rate in that month plus 200 basis points.

### Scheduled Payments

Second mortgages are assumed to pay monthly principal and interest, amortizing over the number of months reported for the WARM in CMR313 or CMR314, as appropriate.

An annual servicing cost of 20 basis points is assumed for both fixed-rate and adjustable-rate second mortgages. Thus, an amount equal to  $.000167 (= .0020/12)$  times the outstanding balance is deducted from the monthly payment.

### Prepayments

The annual prepayment rate is assumed to be 25 percent in all interest rate scenarios for both fixed-rate and adjustable-rate second mortgages.

### *Discount Factors*

Separate discount factors are calculated for the following types of loans:

- Fixed-rate loans

Adjustable-rate loans tied to:

- 3-month Treasury
- 6-month Treasury
- 1-year Constant Maturity Treasury
- National Average Contract Rate
- 11th District Cost of Funds Index
- Prime rate

Calculation of the discount factors requires that assumptions be made concerning the coupon, maturity, repricing frequency, prepayment rate, and servicing cost of a new, or "par," loan. These assumed characteristics are listed in Table 5.R.2. The coupon used to calculate the spread for each type of adjustable-rate loan is equal to the current value of the index, plus the median margin reported on Schedule CMR by all institutions reporting second mortgages tied to that particular index.<sup>1</sup>

In addition to the indices listed above, the NPV Model accommodates adjustable-rate loans tied to other indices listed in Appendix A of the Schedule CMR instructions. Too few institutions report second mortgages tied to these indices to make their median margins reliable. Therefore, the discount factors of one of the other index types listed above for which a discount factor is calculated is used as a proxy. Table 5.R.1 below lists the index types for which a spread is not calculated along with the type of loan whose discount factor is used as a proxy.

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<sup>1</sup> The margins in Table 5.R.2 are median margins from the March 1994 Schedule CMR. They will be updated periodically.

*Table 5.R.1*  
**Second Mortgages Index Types**  
**for Which a Proxy is Used for the Discount Factor**

Index Type	Index of Loan Whose Discount Factor is Used
2-year CMT	1-year CMT
3-year CMT	1-year CMT
5-year CMT	1-year CMT
1-month LIBOR	3-month Treasury
3-month LIBOR	3-month Treasury
6-month LIBOR	6-month Treasury
1-year LIBOR	1-year CMT
3-month FHLB rate	3-month Treasury
6-month FHLB rate	6-month Treasury
1-year FHLB rate	1-year CMT
2-year FHLB rate	1-year CMT
3-year FHLB rate	1-year CMT
4-year FHLB rate	1-year CMT
5-year FHLB rate	1-year CMT
3-month CD rate	3-month Treasury
6-month CD rate	6-month Treasury
1-year CD rate	1-year CMT
5-year CD rate	1-year CMT
FHLMC/FNMA Commitment rate	National Average Contract Rate
Lender's own COF	11th District Cost of Funds
Federal COF	11th District Cost of Funds
Rate Adjusted at Lender's Discretion	11th District Cost of Funds
Other	11th District Cost of Funds

*Table 5.R.2*  
**Assumptions Used to Calculate Spreads for Nonresidential and Multifamily Balloon Mortgages**

	Adjustable Rate						
	Fixed Rate	3-month Treasury	6-month Treasury	1-year CMT	NACR	11th District COF	Prime
Coupon	FNMA 1st Mort Rate +1%*	3-month Treasury + 3.75%	6-month Treasury + 4.00%	1-year CMT + 3.00%	5-year CMT + 2.89%	11th District COF +2.88%	Prime + 1.75%
Remaining Maturity	120	120	120	120	120	120	120
Months to full amortization	120	120	120	120	120	120	120
Reset Frequency	NA	3	6	12	12	1	1
Annual CPR	10	10	10	10	10	10	0
Annual Servicing Cost	20 bp	20 bp	20 bp	20 bp	20 bp	20 bp	20 bp

\*The Fannie Mae 60-day commitment rate on a single-family fixed-rate mortgages plus 1%.

## Section 5.S - Commercial Loans

### Schedule CMR Line Numbers

The lines used to report information on Commercial Loans on Schedule CMR are displayed below.

<b>ASSETS</b>			
COMMERCIAL LOANS	Adjustable Rate		Fixed Rate
Balances	325	\$	326
WARM	327	months	328
Margin in Col 1; WAC in Col 2	329	bp	330
Reset Frequency	331	months	
Rate Index Code	333		

### Description of Instrument

This category consists of performing commercial loans and financing leases, including mortgage "warehouse" loans.<sup>1</sup>

Adjustable-rate and fixed-rate commercial loans are reported separately on Schedule CMR and valued separately by the NPV Model.

### Valuation Methodology

#### Method

Static discounted cash flow.

#### Cash Flows

##### Coupons

Fixed-rate loans: The weighted average coupon for fixed-rate commercial loans is reported on Schedule CMR and is used to calculate all interest cash flows for fixed-rate loans.

Adjustable-rate loans: The current coupon for adjustable-rate commercial loans is not reported on Schedule CMR, but is estimated using the method described in Section 5.O.

The coupon of adjustable-rate commercial loans is assumed to reset with the frequency reported in CMR331. Future values of the adjustable-rate coupon are projected by adding the reported margin to the projected value of that index. Index values are projected as described in Chapter 8. For example, if an institution reports that its adjustable-rate commercial loans are tied to the 11th District COF (index code 811), and have a margin of 150 basis points, the Model would calculate the annual coupon in each future month as the projected value of the prime rate in that month plus 150 basis points.

<sup>1</sup> Warehouse loans are loans collateralized by mortgage loans rather than liens directly on real estate.

Scheduled Payments

Commercial loans are assumed to pay monthly interest cash flows and the entire principal balance at maturity.

An annual servicing cost of 20 basis points is assumed for both fixed-rate and adjustable-rate commercial loans. Thus, an amount equal to .000167 ( $=.002/12$ ) times the outstanding balance is deducted from each monthly payment.

Prepayments

Prepayments are assumed to be zero in all interest rate scenarios.

*Discount Factors*

Separate discount factors are calculated for the following types of commercial loans.

- Fixed-rate loans

Adjustable-rate loans tied to:

- 1-year Treasury
- National Average Contract Rate (NACR)
- 11th District Cost of Funds (COF)
- Prime Rate

Calculation of discount factors requires that assumptions be made concerning the coupon, remaining maturity, repricing frequency, prepayment rate, and servicing cost of a new, or "par," loan. These assumed characteristics are listed in Table 5.S.2. The coupon used to calculate the spread for each type of adjustable-rate loan is equal to the current value of the index, plus the median margin reported on Schedule CMR by all institutions reporting commercial loans tied to that particular index.

In addition to the indices listed above, the NPV Model accommodates adjustable-rate commercial loans tied to other indices listed in Appendix A of the Schedule CMR instructions. Too few institutions report commercial loans tied to these indices to make their median margins reliable. Therefore, the discount factors of one of the other index types listed above for which a discount factor is calculated is used as a proxy. Table 5.S.1 below lists the index types for which a spread is not calculated, along with the type of loan whose discount factor is used as a proxy.

*Table 5.S.1*  
**Commercial Loans Index Types**  
**for Which a Proxy is Used for the Discount Factor**

Index Type	Index of Loan Whose Discount Factor is Used
2-year CMT	1-year CMT
3-year CMT	1-year CMT
5-year CMT	1-year CMT
1-month LIBOR	1-year CMT
3-month LIBOR	1-year CMT
6-month LIBOR	1-year CMT
1-year LIBOR	1-year CMT
3-month FHLB rate	1-year CMT
6-month FHLB rate	1-year CMT
1-year FHLB rate	1-year CMT
2-year FHLB rate	1-year CMT
3-year FHLB rate	1-year CMT
4-year FHLB rate	1-year CMT
5-year FHLB rate	1-year CMT
3-month CD rate	1-year CMT
6-month CD rate	1-year CMT
1-year CD rate	1-year CMT
5-year CD rate	1-year CMT
Fed Funds Rate	1-year CMT
FHLMC/FNMA Commitment rate	National Average Contract Rate
Lender's own COF	11th District Cost of Funds
Federal COF	11th District Cost of Funds
Rate Adjusted at Lender's Discretion	11th District Cost of Funds
Other	11th District Cost of Funds

*Table 5.S.2*  
**Assumptions Used to Calculate Spreads for Commercial Loans**

	Fixed Rate	Adjustable Rate			
		1-year CMT	NACR	11th District COF	Prime
Coupon	Fed Survey Rate*	1-year Treasury + 2.26%	5-year CMT + 3.65%	11th District COF + 2.54%	Prime + 1.62%
Remaining Maturity	48	48	48	48	48
Reset Frequency	NA	12	12	1	1
Annual CPR	0	0	0	0	0
Annual Servicing Cost	20 bp	20 bp	20 bp	20 bp	20 bp

\*The balance-weighted average rate on fixed-rate loans less than \$500,000, with maturities over one year, and under one year, from the Federal Reserve's Survey of Terms of Bank Lending, release E.2.

**Section 5.T - Consumer Loans**

Schedule CMR Line Numbers

The lines used to report information on consumer loans on Schedules CMR and SC are displayed below.

<b>Schedule CMR - ASSETS</b>			
CONSUMER LOANS		Adjustable Rate	Fixed Rate
Balances	335	\$	336   \$
WARM	337	months	338   months
Rate Index Code	339		
Margin in Col 1; WAC in Col 2	341	bp	342   . %
Reset Frequency	343	months	

<b>Schedule SC - Statement of Condition</b>					
		Line	Billion	Million	Thousand
CONSUMER LOANS:	Total	34			
Closed-End:					
Loans on Deposits		310			
Home improvement Loans		316			
Education Loans		320			
Auto Loans		323			
Mobile Home Loans		326			
Other, Including Leases		330			

Description of Instrument

This category includes performing consumer loans and securities backed by such loans.

The "Consumer Loans" line on the IRR Exposure Report includes all balances reported as consumer loans on Schedule CMR. Credit card balances, however, are deducted from the consumer loan balances on Schedule CMR, valued separately, then added back to the consumer loans category for presentation on the Report. See Section 5.U, Consumer Loans - Credit Cards, for a discussion of how credit card balances are valued.

Adjustable-rate and fixed-rate consumer loans are reported separately on Schedule CMR and valued separately by the NPV Model.

Valuation Methodology

Method

Static discounted cash flow.

*Cash Flows*Coupons

Fixed-rate loans: The weighted average coupon for fixed-rate consumer loans is reported on Schedule CMR and is used to calculate all interest cash flows.

Adjustable-rate loans: The current coupon is not reported on Schedule CMR for adjustable-rate loans but is estimated using the method described in Section 5.O. Interest payments are calculated using this estimated rate until the first coupon reset.

Beginning at the first reset, and continuing for the remaining term of the loan, future coupons are projected by adding the reported margin to the projected value of the index. (Index values are projected as described in Chapter 8.) For example, if an institution reported that its adjustable-rate consumer loans are indexed to the prime rate and have a margin of 400 basis points, the Model would calculate the annual coupon in each future month as the projected value of the prime rate in that month plus 400 basis points.<sup>1</sup>

Scheduled Payments

Consumer loans are assumed to pay monthly principal and interest cash flows, amortizing over the number of months reported for the WARM in CMR337 or CMR338, as appropriate.

An annual servicing cost of 20 basis points is assumed for both fixed-rate and adjustable-rate consumer loans. Thus, an amount equal to  $.000167 (= .0020/12)$  times the outstanding balance is deducted from the monthly payment.

Prepayments

A unique prepayment rate is calculated for each institution based on the types of consumer loans it reports on Schedule SC of the Thrift Financial Report. Schedule SC breaks out consumer loans into the categories listed below.<sup>2</sup> The NPV Model calculates a weighted average prepayment rate using a given prepayment rate for each type of consumer loan, and weights each rate by the proportion each type of loan represents of their total. The weighted average prepayment rate does not differ in the alternate interest rate scenarios.

<b>Loan Type</b>	<b>Annual Prepayment Rate</b>
Loans on Deposits	25%
Education Loans	8
Auto Loans	18
Mobile Home Loans	12
Other	10

<sup>1</sup> Adjustable-rate consumer loans tied to indices 910 and 911 are treated differently. Such loans have a base case economic value equal to their outstanding balance. Their values in the alternate rate scenarios are calculated using an elasticity of .001.

<sup>2</sup> Schedule SC lists two additional categories, Revolving Loans Secured by 1-4 Dwelling Units, and Home Improvement Loans. These revolving loans and any secured home improvement loans are reported in the Second Mortgages category on Schedule CMR. Thus, their SC balances are not used to calculate the weighted average prepayment rate for the CMR consumer loan balances.

**Example: Calculation of Weighted Average Prepayment Rate**

Suppose an institution reports on Schedule SC a balance of \$50 for education loans, \$40 for auto loans, \$10 for "other," and zero balances for the other two categories. The weighted average prepayment rate that would be applied to this consumer loan portfolio is 12.2%.

$$12.2 = \left(\frac{50}{100}\right) \cdot 8 + \left(\frac{40}{100}\right) \cdot 18 + \left(\frac{10}{100}\right) \cdot 10$$

*Discount Factors*

The same set of discount factors is used for both fixed-and adjustable-rate consumer loans.

The discount factors are calculated using weighted average spreads that reflect the composition of consumer loans reported on Schedule SC. First a spread is calculated for each of the five types of loans listed above, then a weighted average spread is calculated for each institution in the same manner as the weighted average prepayment rate. Finally, the weighted average spread is used to calculate the discount factors as described in Section 5.O.

To calculate the spread for a given type of loan, assumptions must be made concerning the maturity, prepayment rate, and coupon of a new loan of that type. The prepayment rates are the same as those listed above. The assumptions for the maturity and current lending rate are listed below. The cash flows are calculated assuming the coupon is a fixed rate.

Loan Type	Maturity	Current Lending Rate	
Loans on Deposits	24 months	6-month	CD + 100 bp <sup>1</sup>
Education Loans	36 months	3-month	T-bill + 300 bp <sup>1</sup>
Auto Loans	48 months	48-month	new car rate <sup>2</sup>
Mobile Home Loans	120 months	120-month	mobile home <sup>2</sup>
Other	24 months	24-month	personal loan <sup>2</sup>

<sup>1</sup> Source: *Federal Reserve Statistical Release G.13*

<sup>2</sup> Source: *Federal Reserve Statistical Release G.19*

### Section 5.U - Consumer Loans-Credit Cards

Schedule CMR Line Numbers

The lines used to report information concerning credit cards on Schedules CMR and SC are displayed below.

<b>ASSETS</b>			
CONSUMER LOANS	Adjustable Rate		Fixed Rate
Balances	335	\$	336   \$
WARM	337	months	338   months
Rate Index Code	339		
Margin in Col 1; WAC in Col 2	341	bp	342   %
Reset Frequency	343	months	

<b>ASSETS</b>	
MEMORANDUM ITEMS	
Credit Card Balances expected to Pay Off in Grace Period	590   \$

<b>Schedule SC - Statement of Condition</b>					
		Line	Billion	Million	Thousand
CONSUMER LOANS:	Total	34			
Open-End:					
Revolving Loans Secured by 1-4 Dwelling Units		340			
Unsecured, Including Credit Cards and Other		345			

Description of Instruments

This category is comprised of unsecured, open-ended consumer loans, including credit cards.

Credit card balances are included with other types of consumer credit on CMR335 and CMR336. The NPV Model uses information reported on Schedule SC of the Thrift Financial Report to estimate the volume of each institution's credit card balances, and values these separately from other consumer debt. It assumes the amount reported in SC345 (unsecured, open-ended consumer loans) consists entirely of credit card balances and values them using the method described in this section. The Model determines what portion of SC345 to value as adjustable-rate credit card balances, and what portion to value as fixed-rate credit card balances as follows.

If SC345 is less than or equal to CMR336 (fixed-rate consumer loans), the NPV Model values an amount equal to the balance in SC345 as fixed-rate credit card balances and an amount equal to CMR336 minus SC345 as regular consumer loans (see Section 5.T for a description of the valuation method for consumer loans). All balances reported in CMR335 (adjustable-rate consumer loans) are valued as regular consumer loans.

If SC345 is greater than CMR336, all of CMR336 is valued as fixed-rate credit cards, and an amount equal to SC345 minus CMR336 is valued as adjustable-rate credit card balances. Any balances remaining in CMR335 not valued as adjustable-rate credit card balances are valued as regular adjustable-rate consumer loans.

## Valuation Methodology

*Method*

Static discounted cash flow.

*Cash Flows*Coupons

Fixed-rate credit cards are valued using the weighted average coupon reported in CMR342. The current coupon for adjustable-rate credit cards is not reported on Schedule CMR. It is estimated using the method described in Section 5.O.

Beginning at the first reset, and continuing for the remaining term of the loan, the future values of the coupon are projected by adding the reported margin to the projected value of the index. Index values are projected as described in Chapter 8. For example, if an institution reported that its adjustable-rate credit cards are indexed to the prime rate and have a margin of 600 basis points, the Model would calculate the annual coupon in each future month as the projected value of the prime rate in that month plus 600 basis points.

Scheduled Payments

Credit cards pay monthly principal and interest cash flows. Balances that remain outstanding after the interest-free grace period (see the Prepayments section below) are assumed to be paid down at a rate of 10 percent per month, with any balance remaining after 36 months being paid off at that time. The same payment rate is applied in all interest rate scenarios.

An annual servicing cost of 100 basis points is assumed for credit card balances. Thus, an amount equal to 0.0008 (= 0.01/12) times the outstanding balance is deducted from each monthly payment.<sup>1</sup>

Prepayments

CMR590 collects the credit card balances the institution expects will be paid off during the interest-free grace period. These balances are split pro-rata between fixed- and adjustable-rate balances, and treated as cash, with an economic value equal to their face value in all interest rate scenarios.

*Discount Factors*

Separate discount factors are used for both fixed- and adjustable-rate credit card balances using the method described in Section 5.O.

To calculate the spreads, assumptions are made concerning the coupon, maturity, repricing frequency, payment rate, and servicing cost of a par credit card loan. Both fixed- and adjustable-rate credit cards are assumed to pay down at a rate of 10 percent per month, with any remaining balance after 36 months paid off at that time. The annual servicing cost is assumed to be 100 basis points.

The coupons for both adjustable- and fixed-rate credit cards are taken from the *Bank Rate Monitor*, which surveys credit card lenders. These coupons are based on an average of the outstanding credit card rates used by these lenders.

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<sup>1</sup> Adjustable-rate credit cards with index codes 910 and 911 are treated differently. Such loans have a base case economic value equal to their outstanding balance. Their values in the alternate rate scenarios are calculated using an elasticity of 0.001.

**Section 5.V - Zero-Coupon Securities, Government and Agency Securities, "Other" Securities**

Schedule CMR Line Numbers

The lines used to report information on these securities on Schedule CMR are displayed below.

<b>ASSETS</b>					
CASH, DEPOSITS, & SECURITIES					
	Balances		WAC		WARM
Zero-Coupon Securities	470 \$	471	. %	472	months
Government and Agency Securities	473 \$	474	. %	475	months
Term Fed Funds, Term Repos, and Interest-Earning Deposits	476 \$	477	. %	478	months
Other (Munis, Mortgage-Backed Bonds, Corporate Securities, Commercial Paper, Etc.)	479 \$	480	. %	481	months

Description of Instrument

These three categories of securities are valued separately by the NPV Model and listed separately on the IRR Exposure Report. They include the following types of securities:

- Zero-coupon securities, including Treasury bills
- U.S. Government debt and non-mortgage debt issued by federal agencies
- "Other" Securities, comprised of securities issued by state and local governments, corporate securities and commercial paper, mortgage-backed bonds, and preferred stock<sup>1</sup>

Valuation Methodology

Method

Static discounted cash flow.

Cash Flows

Coupons

All securities are assumed to be fixed rate. Thus, the weighted average coupon for each type of security reported is used to calculate all interest cash flows.<sup>2</sup>

<sup>1</sup> The balances reported in CMR473 and CMR479 may contain "Structured Notes" (see TB 13a). Beginning in March 1995, the outstanding balance of Structured Notes will be collected in a new cell in the Cash, Deposits, & Securities section, and institutions will report their estimated market values in cells CMR931 - CMR939. These estimated market values will be incorporated into NPV in the same manner as is currently done for Mortgage Derivative Securities reported in CMR921 through CMR929.

Scheduled Payments

Government and "Other" securities are assumed to pay semi-annual interest cash flows and all principal at maturity. Interest payments are calculated as follows, where  $c$  is the annual bond equivalent yield and  $B$  is the outstanding balance.

**Equation 5.V.1: Interest Payments on Government and "Other Securities"**

$$I_t = B \cdot \left( \frac{c}{2} \right)$$

The present value of the security equals the sum of the discounted semi-annual interest payments plus the discounted value of the face value of the bond, where  $T$  is the number of months remaining to maturity.

**Equation 5.V.2: Present Value of Government and "Other" Securities**

$$PV = (I_1 \cdot df_1) + (I_2 \cdot df_2) + \dots + (I_T + B) \cdot df_T$$

Zero-coupon bonds pay a single cash flow at maturity. Their economic value is calculated as follows where  $BV$  is the book value reported in CMR470 and  $y$  is the number of years to maturity.

**Equation 5.V.3: Present Value of Zero Coupon Securities**

$$PV = BV \cdot \left( 1 + \frac{c}{2} \right)^{2y} \cdot df_T$$

Prepayments

Prepayment rates are assumed to be zero in all interest rate scenarios.

Discount Factors

The discount factors are calculated as described in Section 5.O. For government securities and zero-coupon bonds, the spread,  $s$ , is zero.

For "Other" securities, the spread is that which would cause a new security with a remaining maturity of 60 months and a coupon equal to the AAA corporate bond rate to be priced at par. The quarter-end AAA corporate bond rate is taken from *Federal Reserve Statistical Release G.13*.

<sup>2</sup> Institutions may report information on floating rate securities in the Schedule CMR section, "Optional Supplemental Reporting for Assets and Liabilities." See Section 5.X of this manual for a description of how the Model values those securities.

**Section 5.W -**

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**Deposits**

Schedule CMR Line Numbers

The lines used to report these instruments on Schedule CMR are displayed below.

<b>ASSETS</b>				
CASH, DEPOSITS, & SECURITIES	Balances		WAC	WARM
Complex Securities	485 \$	477	.	& 478 months

Description of Instrument

This category includes Fed Funds sold and securities purchased under repurchase agreements, other than overnight transactions, and interest-earning deposits at other depository institutions.

Valuation Methodology

*Method*

Static discounted cash flow.

*Cash Flows*

Coupons

These assets are assumed to be fixed rate. Thus, the weighted average coupon reported in CMR477 is used to calculate all interest cash flows.

Scheduled Payments

These assets are assumed to pay monthly interest cash flows and the entire principal balance at maturity.

Prepayments

Prepayments are assumed to be zero in all interest rate scenarios.

*Discount Factors*

The spread used to calculate the discount factors is calculated using the method described in Section 5.O for an asset with three months remaining to maturity, and whose interest rate equals the quarter-end rate listed for 3-month commercial paper on *Federal Reserve Statistical Release G.13*.

### Section 5.X – Complex Securities

#### Schedule CMR Line Numbers

The lines used to report these instruments on Schedule CMR are displayed below.

<b>ASSETS</b>	
CASH, DEPOSITS, & SECURITIES	Balances
Complex Securities	485 \$

<b>REPORTING OF MARKET VALUE ESTIMATES</b>										
Estimated Market Value After Specified Rate Shock										
	Required Reporting Items				Optional Reporting Items				Required Reporting Items	
Rate Shock in Basis Points	Off-Balance Sheet Contracts Reported Under Additional		Mortgage- Derivative Securities		Options on Liabilities		Collateralized Mortgage Securities Issued		Structured Securities	
+300	912	\$	922	\$	942	\$	952	\$	962	\$
+200	913	\$	923	\$	943	\$	953	\$	963	\$
+100	914	\$	924	\$	944	\$	954	\$	964	\$
No Change	915	\$	925	\$	945	\$	955	\$	965	\$
-100	916	\$	926	\$	946	\$	956	\$	966	\$
-200	917	\$	927	\$	947	\$	957	\$	967	\$
-300	918	\$	928	\$	948	\$	958	\$	968	\$
Memo: Face Value of Liabilities with Options (reported CMR942 thru CMR948)					950 \$					

#### Description of Instruments

Complex securities are debt securities with derivative-like characteristics that are issued by corporations and government-sponsored enterprises ( GSEs ), including the Federal National Mortgage Association, the Federal Home Loan Mortgage Corporation, and the Federal Home Loan Banks. Complex securities can take various forms and often contain complex rate-adjustment formulas and embedded options (e.g., calls, caps, and collars). As stated in TB 13a, the term complex security includes any collateralized mortgage obligation (CMO), real estate residential mortgage conduit (REMIC), callable mortgage pass-through security, stripped mortgage-backed security, and structured note.

The most common complex securities include step-up bonds, index amortizing notes, dual index notes, de-leveraged bonds, range bonds, and inverse floaters.

All institutions that file Schedule CMR must report the book value of their complex securities in CMR485. In addition, institutions with complex securities are required to report the estimated economic value of these notes in the base case and alternate rate scenarios in CMR962 to CMR968.

*Valuation Methodology*

Institutions that report a value in CMR485 must report the economic value of their complex securities in the base case and six alternate rate scenarios. If an institution has complex securities, the Model reports the institution's reported values on the line Complex Securities.

**Section 5.Y - Assets Valued Using Optional Supplemental Data**

OPTIONAL SUPPLEMENTAL REPORTING FOR ASSETS/LIABILITIES								
Entry #	[1] Asset/ Liability Code	[2] Rate Index Code	[3] Balance \$000	[4] Margin/ WAC in bp	[5] Rate Reset Frequency	[6] Months to Full Amort/ Next Reset	[7] Remaining Maturity	[8] Distance to Lifetime Cap
			\$	bp	mo	mo	mo	bp
			\$	bp	mo	mo	mo	bp
			\$	bp	mo	mo	mo	bp
			\$	bp	mo	mo	mo	bp
			\$	bp	mo	mo	mo	bp

In the Schedule CMR section titled, "Optional Supplemental Reporting for Assets/Liabilities," institutions may report information on selected assets at a more disaggregated level than in the Assets and Liabilities sections of Schedule CMR. The IRR exposure estimates of institutions that report information in this section are derived using this more detailed information instead of the data reported in the Assets and Liabilities sections. For any item valued using the Optional Supplemental data, an asterisk appears next to the title of the item on the IRR Exposure Report.

Valuation Method

Most of the assets reporting in the Optional Supplemental section are valued using the same methods as for the corresponding items reported in the Assets section of Schedule CMR (described in Sections 5.0 to 5.W). However, the way in which information is collected in the Optional Supplemental section permits the NPV Model to take account of additional factors that can have an impact on the measurement of IRR exposure.

For example, adjustable-rate nonresidential and multifamily balloon loans are collected as a single balance in the Assets section of Schedule CMR, but in the Optional Supplemental section they may be disaggregated by the type of index to which the coupon is tied. (Appendix A of the Schedule CMR instructions list approximately 30 rate index codes representing indices to which adjustable-rate loans may be tied.)

Schedule CMR Reporting

Information on the following types of assets may be reported in the Optional Supplemental section:

- Adjustable-rate Multifamily and Nonresidential Mortgages
- Adjustable-rate Construction and Land Loans
- Adjustable-rate Second Mortgages
- Adjustable-rate Commercial Loans
- Adjustable-rate and Fixed-rate Consumer Loans
- Investments in Mortgage-Related Mutual Funds
- Investment securities reported in CMR479 (e.g., municipal securities, mortgage-backed bonds, corporate securities, commercial paper)

The Optional Supplemental section collects information in row format where the balance in each row is identified by an Asset/Liability code representing the type of asset or liability (e.g., second mortgages, commercial loans). Also reported in each row are the rate index code identifying the index to which the asset or liability is tied, and other information (such as margin, WAC, rate reset frequency, etc.) that is needed to value the item.

**Example: Use of Data Reported in Optional Supplemental Reporting for Assets/Liabilities**

Suppose an institution had \$100 million of adjustable-rate nonresidential and multifamily balloon mortgages tied to three different indices in the following amounts: one-year Treasury (\$50 million), 11<sup>th</sup> District Cost of Funds (\$30 million), and the prime rate (\$20 million).

In the Assets section of Schedule CMR, the institution would report \$100 million of nonresidential and multifamily balloon mortgages and a rate index code for the one-year Treasury rate (303) since that code represents the index to which the largest proportion of those types of loans are tied. The NPV Model would treat the entire \$100 million balance as one-year Treasury ARMs.

The institution could, however, report those balances in the Optional Supplemental section of Schedule CMR as shown below. The Asset/Liability code of 105 identifies the balances as nonresidential and multifamily balloon mortgages and the rate index codes of 303, 811, and 830 are the codes for the one-year Treasury rate, 11<sup>th</sup> District COF index, and prime rate, respectively.

OPTIONAL SUPPLEMENTAL REPORTING FOR ASSETS/LIABILITIES								
Entry #	[1] Asset/ Liability Code	[2] Rate Index Code	[3] Balance \$000	[4] Margin/ WAC in bp	[5] Rate Reset Frequency	[6] Months to Full Amort/ Next Reset	[7] Remaining Maturity	[8] Distance to Lifetime Cap
			\$	bp	mo	mo	mo	bp
			\$	bp	mo	mo	mo	bp
			\$	bp	mo	mo	mo	bp
			\$	bp	mo	mo	mo	bp
			\$	bp	mo	mo	mo	bp

The NPV Model would use these data instead of those reported the Assets section and value three separate balances using the information on the index type, margin, maturity, reset frequency, etc., for each balance. The sum of the estimated economic values in each rate scenario would appear on the institution's IRR Exposure Report in the line Multifamily and Nonresidential Balloon Mortgages with an asterisk next to the title.

Edit Checks

The data reported in the Optional Supplemental section must pass certain edit checks before the NPV Model will use them to calculate economic values. Importantly, the balances in all rows for a given type of asset must sum to the total for that item reported in the Assets section of Schedule CMR. Suppose that for the institution in the example above, the balances reported in the three lines in the Optional Supplemental section summed to a total of only \$90,000,000 instead of the \$100,000,000 reported in the Assets section. In that case, the NPV Model would use the information reported in the Assets section instead of the Optional Supplemental section to estimate the economic value of adjustable-rate multifamily and nonresidential balloon mortgages. No asterisk would appear next to the line for that asset on the IRR Exposure Report, indicating that the Optional Supplemental data had not been used.

In the following sections, the NPV Model's treatment of each of the types of assets that may be reported in the Optional Supplemental section is described.

#### Adjustable-Rate Multifamily and Nonresidential Mortgages

These mortgages may be disaggregated into the following four categories, each represented by a unique Asset/Liability code (see Appendix C of the Schedule CMR instructions for a list of Asset/Liability codes).

Asset/Liability Code	Description of Asset
100	Adjustable-rate Multifamily and Nonresidential Balloon Mortgages with coupon within 300 basis points of the lifetime rate cap
105	Adjustable-rate Multifamily and Nonresidential Balloon Mortgages with coupon more than 300 basis points from lifetime cap, or no cap
110	Adjustable-rate Multifamily and Nonresidential Fully-Amortizing Mortgages with coupon within 300 basis points of the lifetime rate cap
115	Adjustable-rate Multifamily and Nonresidential Fully-Amortizing Mortgages with coupon more than 300 basis points from lifetime cap, or no cap

In addition to disaggregating balances by Asset/Liability code, any of the above categories of mortgages may be disaggregated by rate index type as shown in the example in the previous section. See Section 5.P for a discussion of the valuation methods for multifamily and nonresidential mortgages.

The economic values for all balances with the asset/liability codes 100 and 105 are summed and presented on the IRR Exposure Report in the line titled "Multifamily and Nonresidential Mortgage Loans & Securities: Adjustable-rate, Balloon." Similarly, economic values for all balances with codes 110 and 115 are summed and presented in the line titled "Multifamily and Nonresidential Mortgage Loans and Securities: Adjustable-rate Fully Amortizing."

#### Adjustable-Rate Construction and Land Loans

Adjustable-rate construction and loan loans may be disaggregated by rate index type in the Optional Supplemental section of Schedule CMR. Each balance is valued separately by the NPV Model. The economic values are summed and presented on the Exposure Report in the line titled "Construction and Land Loans: Adjustable-rate."

#### Adjustable-Rate Second Mortgages

Adjustable-rate second mortgages may be disaggregated by rate index type in the Optional Supplemental section of Schedule CMR. Each balance is valued separately by the NPV Model. The economic values are summed and presented on the Exposure Report in the line titled "Second Mortgage Loans and Securities: Adjustable-rate."

#### Adjustable-Rate Commercial Loans

Adjustable-rate commercial loans may be disaggregated by rate index type in the Optional Supplemental section of Schedule CMR. Each balance is valued separately by the NPV Model. The economic values are summed and presented on the Exposure Report in the line titled "Commercial Loans: Adjustable-rate."

## Fixed-Rate and Adjustable-Rate Consumer Loans

**Fixed-rate consumer** loans may be disaggregated into the following 7 categories, each with a separate asset/liability code:

Asset/Liability Code	Category
180	Loans on Deposits
181	Unsecured Home Improvement Loans
182	Education Loans
183	Auto Loans and Leases
184	Mobile Home Loans
185	Credit Cards
189	Other Types of Consumer Loans

Each category is valued separately, using the methods described in Sections 5.T and 5.U. The only category not discussed in those sections is unsecured home improvement loans. Those loans are valued in the same manner as the other types of consumer loans using the following assumptions concerning the "par" loan to generate the spread used in calculating the discount factor: maturity of 48 months, current lending rate is the 60-day commitment rate on 30-year fixed-rate mortgages plus 200 basis points.

The economic values of the above categories of loans are summed and presented on the Exposure Report in the line titled "Consumer Loans: Fixed-rate."

**Adjustable-rate consumer** loans may be disaggregated by into the same categories as fixed-rate loans, as well as by rate index type. Each balance is valued separately by the NPV Model. The economic values are summed and presented on the Exposure Report in the line titled "Consumer Loans: Adjustable-rate."

## Investments in Mortgage-Related Mutual Funds

To report information about mortgage-related mutual funds in the Optional Supplemental section of Schedule CMR, institutions determine their pro rata share of the quarter-end market value of the fund, and distribute that value among the 14 categories listed below.

For each category of mutual fund, the "base case" value is set equal to the reported market value, and the interest rate sensitivity is assumed to be equal to that of a selected benchmark asset, or group of assets as described in Table 5.Y.1 below.

For mutual funds investing in mortgage derivative products, those categories are assumed to have the same interest rate sensitivity as the benchmark chosen to represent the corresponding category of Mortgage Derivatives. See Section 5.N for more information on the Mortgage Derivative benchmarks.

Other categories of mutual funds (such as FRM, ARM, and servicing rights) are assumed to have the same interest rate sensitivities as those estimated by the NPV Model for other groups of assets. For example, the mutual fund category for fixed-rate mortgages and MBS is assumed to have the same sensitivity as the industry's aggregate single-family fixed-rate mortgage holdings in the previous quarter, as estimated by the NPV Model for all institutions for which an IRR Exposure Report was generated.

Table 5.Y.1

## Assumptions Concerning Rate Sensitivity of Mortgage Related Mutual Funds

Asset/Liability Code	Category	Sensitivity determined by:
160	FRMs or fixed-rate MBS	Industry aggregate FRM holdings in previous quarter
162	ARMs or adjustable-rate MBS	Industry aggregate ARM holdings in previous quarter
166	CMO: Floating rate	Benchmark for CMR352
167	CMO: Fixed-rate, WAL < 5yrs	Benchmark for CMR354
168	CMO: Fixed-rate, WAL 5-10 yrs	Benchmark for CMR356
169	CMO: Fixed-rate, WAL > 10 yrs	Benchmark for CMR357
170	CMO: Superfloater	Benchmark for CMR359
171	CMO: Inverse Floaters & Superfloaters	Benchmark for CMR361
172	CMO: Fixed-rate Residuals	Benchmark for CMR366
173	CMO: Floating-rate Residuals	Benchmark for CMR368
175	Interest-only MBS	Benchmark for CMR370
176	Principal-only MBS	Benchmark for CMR374
178	Mortgage Servicing Rights	Industry aggregate holdings of servicing rights in the previous quarter*
179	Other	Treated as cash; i.e., economic value equal to reported balance in all rate scenarios.

\* Weighted average sensitivity of all fixed and adjustable-rate mortgage servicing not including float.

*Investment Securities Reported in CMR479*

The investment securities reported in CMR479 in the Assets section of Schedule CMR are all treated as fixed-rate securities with semi-annual interest payments and all principal repaid at maturity. (See Section 5.V) Institutions holding investment securities with characteristics different from these may report those balances in the Optional Supplemental section in the following categories:

<b>Asset/Liability Code</b>	<b>Category</b>
120	Fixed-Coupon Securities
122	Floating-Rate Securities
124	Inverse Floating-Rate Securities

Fixed-coupon securities are valued as described in Section 5.V. Floating-rate securities and inverse floating-rate securities are valued as described below.

The same discount factor is used to calculate the economic values of all three categories of securities. (See Section 5.O for a discussion of the calculation of the discount factor.) The spread used in calculating the discount factor is that which would cause a new security with a maturity of 60 months and a coupon equal to the AAA corporate bond rate to be priced at par.

*Floating-Rate Securities*

Institutions report the following information for floating-rate securities in the Optional Supplemental section: rate index code, outstanding balance of the security, margin, rate reset frequency, and remaining maturity.

Cash flows are projected in a manner similar to that described in Section 5.O for adjustable-rate loans. The current coupon is not reported in the Optional Supplemental section and is, therefore, estimated by calculating the historical average of values of the reported index over a number of months equal to the reset frequency.

The Model assumes interest cash flows are paid semi-annually and uses the reported remaining maturity to determine in what month the next cash flow is due by dividing it by 6 and taking the remainder. For example, if the reported remaining maturity were 27 months, the Model would assume the next cash flow would be paid in 3 months, since  $27/6=4$  with a remainder of 3 months.

After the first coupon reset (assumed to occur at the same time as the first cash flow, described above), the floating-rate coupon is calculated by adding the reported margin to the value of the projected index. See Chapter 8 for a description of how various indices are projected.

*Inverse Floating-Rate Securities*

Institutions report the outstanding balance, index type, reset frequency, remaining maturity and the "benchmark" rate used in calculating the coupon of these types of securities. The method for valuing inverse floating-rate securities is the same as floating-rate securities described above, except for the projection of the coupon. The coupon in each coupon reset month is calculated as the benchmark rate less the projected value of the reported index in that month. For example, suppose an institution reported a benchmark rate of 12 percent, and an index of 3-month LIBOR. The coupon in each reset month would be calculated as 12 percent minus the projected value of 3-month LIBOR in that month.

## Section 5.Z - Mortgage Loan Servicing for Others

### Schedule CMR Line Numbers

<b>ASSETS</b>										
MORTGAGE LOANS SERVICED FOR OTHERS				<b>Coupon of Fixed-Rate Mortgages Serviced for Others</b>						
Fixed-Rate Mortgage Loan Servicing	Less Than 7%		7.00 to 7.99%		8.00 to 8.99%		9.00 to 9.99%		10.00% & Above	
Balances Serviced	401	\$	402	\$	403	\$	404	\$	405	\$
WARM	406	months	407	months	408	months	409	months	410	months
Wtd Avg Servicing Fee	411	bp	412	bp	413	bp	414	bp	415	bp
Total # of Fixed-Rate Loans Serviced That Are:										
Conventional Loans	421			loans						
FHA/VA Loans	422			loans						
Subserviced by Others	423			loans						

### Description of Instruments

The line, Mortgage Loan Servicing for Others, on the Exposure Report lists the economic value of servicing rights on all performing mortgages for which the reporting institution receives a fee, including purchased, excess, and "off-balance sheet" retained servicing.

The total value of mortgage loan servicing for others is comprised of three components, each listed separately on the Exposure Report. They are: Fixed-Rate Servicing, Adjustable-Rate Servicing, and Float from Escrows on Mortgages Serviced for Others. This section describes how the Model calculates the first two items. The calculation of the value of float on escrow deposits associated with mortgage servicing is described in Section 6.F.

### Valuation Methodology

#### Method

Balances of fixed-rate mortgages serviced for others are reported in five cells on Schedule CMR, each containing a particular range of coupons. Institutions also report the number of fixed-rate conventional loans and fixed-rate FHA/VA loans represented by those balances, as well as the number of loans that are sub-serviced by a third party.

Balances of adjustable-rate mortgages serviced for others are reported in two cells on Schedule CMR, one for current-market index mortgages (e.g., Treasury-indexed ARMs) and one for lagging-market index mortgages (e.g., Cost of Funds ARMs). As for fixed-rate balances, institutions report the number of loans represented by those balances and the number of loans that are sub-serviced.

There are four steps involved in calculating the economic value of servicing for others. First, the five reported fixed-rate balances are disaggregated into ten sub-balances representing conventional and FHA/VA balances.<sup>1</sup> Second, those sub-balances and the balances of current-market ARMs and lagging-market ARMs are multiplied by the appropriate elements from the fee look-up tables to derive the present value of the fee stream. The numbers of loans serviced (net of those subserviced) are multiplied by the appropriate elements from the cost tables to derive the present value of the cost stream. Third, for each sub-balance, the present

<sup>1</sup> The Model divides each of the fixed-rate balances reported on Schedule CMR into conventional and FHA/VA sub-balances, based, pro rata, on the number of loans of each type reported in CMR421 and CMR422.

value of the cost is subtracted from the present value of the fee. Finally, the total value of fixed-rate servicing is calculated by aggregating the economic values of all fixed-rate sub-balances. Likewise, the total value of adjustable-rate servicing is calculated by aggregating the economic value of current-market index balances and lagging-market index balances.

The calculation of the present values in the fee and cost look-up tables is described in the section "Cash Flows" below. The use of the look-up tables is described in the section "Using the Look-up Tables", following that.

### *Cash Flows*

The present values in the fee and cost look-up tables are estimated using the option-based approach as described in Section 5.A.

#### Servicing Fees

The elements in the fee look-up tables represent the present value of the stream of servicing fee income generated by \$100 of mortgage balances over their remaining life. The Model calculates a stream of monthly servicing fee cash flows along each of the 200 randomly generated rate paths, assuming an annual servicing fee of 50 basis points for FRM servicing and 75 basis points for ARM servicing.<sup>2</sup> In each subsequent month until maturity, each path's balance is reduced to reflect amortization and prepayment. Prepayments are determined as discussed in Section 5.A using the same prepayment equations as for the corresponding type of owned mortgage loans described in Sections 5.B and 5.G.

#### Servicing Costs

The elements in the cost look-up tables represent the present value of the cost to service one mortgage over its remaining life. The Model assumes that it costs \$101.85 per loan, per year, to service fixed-rate mortgages and \$116.85 to service adjustable-rate mortgages.<sup>3</sup> It also assumes that both types of loans produce an average of \$42 of ancillary income (late fees, etc.) per loan, resulting in a net servicing cost of \$59.85 and \$74.85 for fixed and adjustable-rate loans respectively. Based on those assumptions, the Model calculates a stream of monthly servicing cost cash flows along each of the 200 randomly generated paths for a single loan. In each subsequent month until maturity, the number of loans serviced declines at the rate of prepayment of the mortgages being serviced.

### *Discount Factors*

For both servicing fee and servicing cost cash flow streams, the present value is calculated along each of the 200 simulated interest rate paths by multiplying each monthly cash flow by the discount factor appropriate to that path and month. For any month,  $t$ , along any given rate path,  $n$ , the discount factor is:

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<sup>2</sup> If an institution reports a servicing fee different from those used to generate the present values, the Model scales the present values in the table to account for the higher or lower fee. The adjustment is described in the section "Using the Cost and Fee Look-Up Tables", below.

<sup>3</sup> These estimates are based on figures from an annual survey performed by the Mortgage Banker's Association. They will be updated as new estimates become available.

**Equation 5.Z.1: Discount Factor for Mortgage Servicing**

$$df_{n,t} = \frac{1}{(1 + f_{n,1} + oas)(1 + f_{n,2} + oas) \dots (1 + f_{n,t} + oas)}$$

where the  $f$  variables are the simulated 1-month rates along path  $n$  and  $oas$  is the option-adjusted spread. The same discount factor is applied to the fee and cost cash flows for a given month and path.

**Option Adjusted Spread**

OASs are calculated for mortgage servicing rights in a somewhat different way than that described for mortgage securities in Section 5.A. The practice in the mortgage servicing market is to provide quotes in terms of required yields instead of price. At each quarter-end, OTS obtains yield quotes from several servicing brokers for good quality, fixed-rate conventional and GNMA servicing rights, and for ARM servicing. For each of the three types, the yield that is most representative of the quotes is chosen to calculate the OAS. The OAS is then calculated as the spread that, when added to the average of the 200 short-term rate paths over the first 120 months of the simulation, would result in a discount rate equal to the required yield.

The same OAS is used to estimate prices for all servicing of a given type in all 9 rate scenarios.

**Using the Look-up Tables**

Separate look-up tables are produced for the fee and cost components for four types of mortgages: 30-year fixed-rate conventional mortgages, 30-year fixed-rate FHA/VA mortgages, 1-year Treasury-indexed ARMs (used to value all current-market index balances), and 11th District COFI ARMs (used to value all lagging-market index ARMs).

The FRM fee and cost tables contain present values for all combinations of 5 WACs and 21 WARMs. The ARM fee and cost tables contain three lines each, for remaining maturities of 200, 330, and 360 months. The other characteristics of the ARM loans underlying the present value estimates (including the WAC, margin, lifetime and periodic caps and floors) are chosen to be most representative of the ARMs reported by the industry on Schedule CMR in the previous quarter.

Each of the fixed-rate and adjustable-rate servicing sub-balances for a given institution is valued separately. For FRM servicing, the present values are retrieved from both the servicing fee and servicing cost table based upon the balance's reported WARM and its assumed WAC,<sup>4</sup> interpolating where necessary (see Section 5.A for a description of the interpolation process). For ARM servicing, the present values are retrieved from the appropriate table based upon the balance's reported WARM only. Interpolation is used if the reported WARM does not match one of the three WARMs listed in the tables.

To estimate the economic value of the weighted average servicing fee associated with the sub-balance, the present values must be scaled up or down to account for any difference between the reported fee (in CMR411-CMR415) and the fees used to calculate the present values in the tables (50 basis points for FRM servicing and 75 basis points for ARM servicing). That scaling factor is derived simply by dividing the reported fee by 50 basis points (75 basis points for ARM servicing). The economic value in a given rate scenario is then calculated as the product of the scaling factor times and the value from the look-up table for that scenario, divided by 100, times that month's balance. (Division by \$100 is necessary because the values in the table are expressed per \$100 of outstanding balance.)

<sup>4</sup> A representative WAC is chosen for each of the five columns on the reporting form. For balances reported in the following cells the following WACs were assumed in June 1999:

CMR 401:	6.50%	CMR 404:	9.50%
CMR 402:	7.50%	CMR 405:	10.50%
CMR 403:	8.50%		

To estimate the economic value of the cost of servicing, the Model deducts the number of FRMs subserviced (CMR423) proportionally from the number of conventional loans and FHA/VA loans serviced (CMR421 and CMR422), and the number of ARMs subserviced (CMR442) from the total number of ARMs serviced (CMR441). Then, for fixed-rate loans, it splits the adjusted number of conventional and FHA/VA loans across the five coupon ranges based on the proportion of balances reported in each range. For adjustable-rate loans, it splits the adjusted number of ARMs serviced into current-market index ARMs and lagging-market index ARMs. Then, the adjusted number of loans in each category is multiplied by the appropriate present values from the cost look-up tables to arrive at the present value of the cost of servicing those loans.

An example of how the Model uses the fee and cost look-up tables follows.

**Example: Calculation of the Economic Value of Current-Market Index ARM Servicing for Others**

Suppose an institution reported the following information for ARM servicing on Schedule CMR:

**ASSETS**

Adjustable-Rate Mortgage Loan

Servicing

Balances Serviced

WARM

Wtd Avg Servicing Fee

		Index on Serviced Loan					
		Current Market		Lagging Market			
431	\$240	432	\$120				
433	200 months	434	330 months	Total # of Adjustable-Rate Loans Serviced		441	7 loans
435	40 bp	436	50 bp	Of Which, Number Subserviced by Others		442	1 loans

To calculate the economic value of the fee associated with current market index ARMS, the Model would extract the seven values listed in the first row (for a WARM of 200 months) of the Treasury ARM Servicing Fee table shown below. The reported fee of 40 basis points is less than the 50 basis point fee on which the values in the look-up tables are based. Thus, each of the nine values in the table would be scaled by 40/50. The economic value of the fee in the base case is calculated as the product of the scaling factor, times the present value from the table divided by 100, times the reported balance.

$$PV \text{ of Fee} = \frac{40}{50} \cdot \frac{1.89}{100} \cdot 240 = 3.629$$

To calculate the economic value of the cost associated with current-market index ARMS, the Model would first deduct the number of ARMs subserviced from the total number of ARMs serviced (7-1=6). Next, using the share of balances reported for each type of ARM, the Model would split the adjusted number of ARMs serviced proportionally between current-index and lagging-index ARMs. In the example, 4 loans would be assumed to be current-index ARMs (4=6\*240/360) and the remaining two would be treated as lagging-index ARMs. Finally, the Model

**Example: Calculation of the Economic Value of Current-Market Index ARM Servicing for others - continued**

would multiply the number of current-market index ARMs by the values from the first line from the Treasury ARM Servicing Cost table (for a WARM of 200), and divide by 1000, since the economic values are presented in thousands of dollars on the IRR Exposure Report. The economic value of the cost in the base case is calculated as follows:

$$\text{PV of Cost} = 4 \cdot \frac{206.71}{1000} = .827$$

The economic value of the servicing on current-market index ARMs would be  $3.629 - .827 = 2.802$ . Lagging-market index ARMs would be valued in the same way using the fee and cost tables for those types of ARMs. Then, the economic values of the two types of servicing would be aggregated and listed on page four of the IRR Exposure Report on the line "Adjustable-rate Servicing."

<b>Treasury ARM Servicing Fee</b>							
As a Percent of the Underlying Mortgage Balance							
<u>Interest Rate Shock (in basis points)</u>							
<b>WARM</b>							
(mo)	-300	-200	-100	0	+100	+200	+300
200	1.78	1.82	1.86	1.89	1.93	1.98	2.01
330	1.90	1.94	1.98	2.02	2.06	2.11	2.14
360	2.55	2.56	2.57	2.58	2.58	2.59	2.59

<b>Treasury ARM Servicing Cost</b>							
Present Value of Future Servicing Cost per Loan							
<u>Interest Rate Shock (in basis points)</u>							
<b>WARM</b>							
(mo)	-300	-200	-100	0	+100	+200	+300
200	196.46	200.09	203.44	206.71	210.84	215.62	218.82
330	196.88	200.50	203.85	207.12	211.27	216.07	219.26
360	263.52	263.65	263.29	263.13	263.58	264.13	263.69