Section 6.A - Fixed-Rate, Fixed-Maturity Deposits

Schedule CMR Line Numbers

LIABILITIES

FIXED-RATE, FIXED-MATURITY DEPOSITS	Original Maturity in Months				Early Withdrawal During Quarter (Optional)
Balances by Remaining Maturity:	12 or Less	13 to 36	37 or More		
Balances Maturing in 3 Months or Less	601 $	602 $	603 $		604 $
WAC	605 . %	606 . %	607 . %		
WARM	608 months	609 months	610 months		
Balances Maturing in 4 to 12 Months	615 $	616 $	617 $		618 $
WAC	619 . %	620 . %	621 . %		
WARM	622 months	623 months	624 months		
Balances Maturing in 13 to 36 Months		631 $	632 $		633 $
WAC		634 . %	635 . %		
WARM		636 months	637 months		
Balances Maturing in 37 or More Months			641 $		642 $
WAC			643 . %		
WARM			644 months		
Total Fixed-Rate, Fixed Maturity Deposits:				645 $	

MEMO:	Original Maturity in Months		
	12 or Less	13 to 36	37 or More
Balances in Brokered Deposits	650 $	651 $	652 $
Deposits with Early-Withdrawal Penalties Slated in Terms of Months of Foregone Interest:			
Balances Subject to Penalty	653 $	654 $	655 $
Penalty in Months of Foregone Interest (expressed to two decimal places; e.g., x.xx)	656 months	657 months	658 months
Balances in New Accounts (Optional)	659 $	660 $	661 $

Description of Instruments

This category includes:

- Fixed-rate, fixed-maturity (FRFM) certificates of deposits, and
- Notice accounts, and consecutive monthly payments accounts.

FRFM deposit balances are reported in Schedule CMR in nine categories by their remaining and original maturities. The weighted-average coupon and remaining maturity are also reported for each of the nine balances. In addition, information on brokered deposits and deposits subject to early-withdrawal penalties is reported. Institutions can also report information on balances withdrawn early and balances in new accounts during the reporting quarter.

Valuation Methodology

Method

FRFM deposits are valued using the static discounted cash flow approach, based on the following six characteristics that are reported in Schedule CMR: coupon, remaining maturity, original maturity, type of account (i.e., retail or brokered), size of the early withdrawal penalty, and rollover rate (if information on new accounts is reported). The nine reported balances are disaggregated into as many as 36 sub-balances which are valued separately based on these 6 characteristics [36 balances = 9 reported balances · 2 (retail and brokered) · 2 (subject to and not subject to early withdrawal penalties)].

The total economic value of retail deposits is comprised of two components. The first component, the CD value, is calculated based on the reported coupon rate and remaining maturity.

The second component, the intangible value, represents the value of the customer relationship or core deposit value. This value depends on the likelihood of balances being rolled over at below market rates.

The total economic value of any retail CD balance is equal to the CD value minus the intangible value. The CD value is reported on the liability side of the Exposure Report in two lines: Balances Maturing in 12 Months or Less and Balances Maturing in 13 Months or More. The intangible value is reported on the asset side in a single line for all maturities, titled Retail CD Intangible. For brokered deposits, only the CD value is calculated (i.e., the intangible value of brokered deposits is assumed to be zero).

The NPV Model generates two price tables for retail deposits: one for the CD price and one for the intangible price. Both tables are organized similarly with each line corresponding to a combination of the six characteristics (described above) of the balance to be valued and contains prices for all seven interest rate scenarios. The Model generates a single price table for brokered deposits, since they have no intangible value.

When the NPV Model values a given retail CD subbalance, it selects the line from each of the two price tables whose six characteristics are the closest to those of the reported balance, and multiplies the outstanding balance by the prices from the two tables to derive the CD value and the intangible value.[1] In valuing brokered deposits, only the single table is used. The prices contained in all three tables are calculated using the discounted cash flow approach described below.

Calculation of CD Prices

The CD price is the discounted present value of the deposit s cash flows and is derived as follows:

Equation 6.A.1 - Price Equation for CDs

$$P_{CD} = \sum_{t=1}^{T} CF_t \cdot df_t$$

1 Excerpts from these price tables are provided in the publication, *Asset and Liability Price Tables,* published by OTS each quarter. See Chapter 4 of this manual for more information on the Price Tables.

where: P_{CD} = CD price
T = reported remaining maturity
CF_t = cash flow in month t
df_t = discount factor for month t

Cash Flows

As shown in Equation 6.A.2, the NPV Model projects cash flows that will occur in month t (CF_t) as consisting of noninterest costs and early withdrawals during that month. In the last month of the term, i.e., in the month equal to the reported remaining maturity, T, cash flows also include balances that are not rolled over.

Equation 6.A.2 - Cash Flow Equation for CD Prices

$$CF_t = \begin{cases} NIC_t + BEW_t, \text{ for } t < T \\ NIC_t + BEW_t + B_t, \text{ for } t = T \end{cases}$$

where: CF_t = cash flow in month t
NIC_t = noninterest costs in month t
BEW_t = balances at the end of month t that are withdrawn early
T = reported remaining maturity
B_t = balance at the end of month t

Noninterest Costs

Noninterest costs represent the costs of servicing the deposits and are calculated based on the end-of-month balance (see Equation 6.A.3).

Equation 6.A.3 - Non-Interest Cost Equation for CD Prices

$$NIC_t = a\, B_{t-1}$$

where: NIC_t = noninterest costs in month t
a $\begin{cases} = 0.000175 \text{ for retail deposits}^2 \\ = 0.000019 \text{ for brokered deposits}^2 \end{cases}$
B_{t-1} = balance at end of month (t-1)

Early Withdrawals

The amount of early withdrawals is estimated based on the interest gains and interest costs the depositor would realize by withdrawing the balance before maturity. The interest gains are calculated based on the amount of interest that would be earned by investing the existing balances (minus the reported early-withdrawal penalty) at the projected rate for retail CDs of similar maturity,[3] from the end of month t

[2] NIC values applicable to 1999. For more recent values, see *Asset and Liability Price Tables*, published by OTS each quarter.

[3] The calculation of the projected retail CD rate is described in Section 8.B.

until the remaining reported maturity, T.[4] The interest cost of withdrawing early is the amount of interest (calculated using the reported coupon) that would be foregone if balances were withdrawn (T-t) months before the reported remaining maturity.

For brokered deposits, the entire balance is assumed to be withdrawn early when the gains exceed the costs; otherwise, early-withdrawals are equal to zero. For retail deposits, the percent of balances that are withdrawn early is calculated by Equation A.4 below.

Equation 6.A.4 - Early-Withdrawal Rate Equation for CDs

$$EW_t = 1 - \left\{ 1 - \frac{c1 + c2 \arctan\left(c3\left(c4 - \frac{gain_t}{cost_t} \right) \right)}{100} \right\}^{\frac{1}{12}}$$

where: Ew_t = percent of balances at the end of month t that are withdrawn early (in monthly, decimal form

arctan = arctangent function

$gain_t$ = amount of interest that would be earned at the new rate by making early withdrawals at the end of month t, net of the early withdrawal penalty

$cost_t$ = interest that would be foregone by making early withdrawals at the end of month t

The values of the coefficients c1 through c4 in Equation 6.A.4 are reported in Table 6.A.1, below.

Table 6.A.1
Early-Withdrawal Equation Parameters

Parameter	Retail Deposits
c1	0.30620
c2	-0.1822
c3	8.49000
c4	1.27300

Early-withdrawals of balances are calculated as the product of the early-withdrawal rate and the end-of-month balance, as shown in Equation 6.A.5, below.

Equation 6.A.5 - Equation for Balances That Are Withdrawn Early

$$BEW_t = EW_t \; B_{t-1}$$

where: BEW_t = balances at the end of month t that are withdrawn early

[4] The maturity of the retail CD rate is assumed to depend on the reported original maturity as follows:

Reported Original Maturity	Maturity of the Retail CD Rate (in months)
12 months or less	6
13 to 36 months	24
37 or more months	48

Ew_t = percent of balances at the end of month t that are withdrawn early (in decimal, monthly form)

B_{t-1} = balance at the end of month t-1.

Balances

The level of deposit balances in each future month (B_t) is calculated using Equation 6.A.6.

Equation 6.A.6 - Balance Equation for CD Prices

$$B_t = \begin{cases} 100, \text{ for } t = 0 \\ B_{t-1} + IC_t - BEW_t, \text{ for } t = 1, 2, \ldots T \end{cases}$$

where:
- B_t = balance at the end of month t
- IC_t = interest cost = $B_{t-1}\, c_0$
- c_0 = reported coupon rate
- BEW_t = balances at the end of month t that are withdrawn early

Discount Factors

Monthly cash flows are discounted by the secondary-market CD rate appropriate to each month, described in Section 8.B. That section also describes how those rates change in the alternate interest rate scenarios. Discount factors are calculated as shown in Equation 6.A.7.

Equation 6.A.7 - Discount Factor for Fixed Rate, Fixed Maturity Deposits

$$df_t = \frac{1}{\left(1 + z_t\right)^t}$$

where:
- df_t = discount factor for month t
- z_t = secondary market CD yield applicable to month t (in monthly, decimal form)

Calculation of the Intangible Price for Retail CDs

The intangible price for retail deposits represents the value of the customer relationship due to the likelihood that some percentage of existing balances will be rolled over at maturity at retail rates (that are typically below market rates). Because brokered deposits are assumed to pay market rates, their intangible price is equal to zero. The intangible price for retail deposits is calculated based on Equation 6.A.8, below.

Equation 6.A.8 - Price Equation for the Retail CD Intangible

$$P_{INT} = BROLL_{T+1} df_T - \sum_{t=T+1}^{360} CF_t \cdot df_t$$

where:
- P_{INT} = intangible price
- $BROLL_{T+1}$ = balances rolled over at maturity (i.e., at the beginning of month [T+1])
- df_t = discount factor for month t
- T = reported remaining maturity
- CF_t = cash flow in month t

Cash Flows

When a balance is rolled over at maturity into a new CD, it receives a new rate and maturity. Thereafter, it is treated in the same manner as the balances described in Equation A.2 in terms of the cash flows it generates; it pays interest, incurs servicing costs, is subject to early withdrawal, and, at maturity, may again be rolled over at a new rate.

Thus, the cash flows in month t consist of noninterest costs and early withdrawals made during the month. In the last month of each term, cash flows also include balances that are not rolled over.

Equation 6.A.9 - Cash Flow Equation

$$CF_t = \begin{cases} NIC_t + BEW_t, \text{ for all } t > T, \text{ except } T + TR,\ T + 2TR,\ldots \\ NIC_t + BEW_t + \left(B_t - BROLL_{t+1}\right), \text{ for } t = T + TR,\ T + 2TR\ldots \end{cases}$$

where:

CF_t	=	cash flow in month t
NIC_t	=	noninterest costs in month t
BEW_t	=	balances at the end of month t that are withdrawn early
T	=	reported remaining maturity
TR	=	maturity balances that are rolled over (see Table 6.A.2, below)
B_t	=	balances at the end of month t
$BROLL_{t+1}$	=	balances maturing in month t that are rolled over at the beginning of month t+1

Existing balances are assumed to roll over into new deposits whose term to maturity is related to the original maturity of the deposits as follows:

Table 6.A.2
Roll Over Assumptions

Reported Original Maturity	Assumed Maturity of Balance Rolled Over (in months)
12 months or less	6
13 to 36 months	24
37 or more months	48

Noninterest costs

Noninterest costs are calculated for balances that have been rolled over as described in Equation 6.A.3 above. In the first month of each new term, however, the formula is adjusted to account for balances that are not rolled over.

Equation 6.A.10 - Non-Interest Cost Equation

$$NIC_t = \begin{cases} a\ BROLL_t, \text{ for } t = T + 1, T + TR + 1, T + 2TR + 1, \ldots \\ a\ BROLL_{t-1}, \text{ otherwise} \end{cases}$$

where: NIC_t = noninterest costs in month t

a = 0.000175 for retail deposits[5]

a = 0.000019 for brokered deposits[5]

T = reported remaining maturity

TR = maturity of balances that are rolled over (see Table 6.A.2, above)

B_{t-1} = balance at end of month (t-1)

$BROLL_t$ = balances that are rolled over at beginning of month t

Early-Withdrawals

Early withdrawals of balances that have been rolled over are calculated in the same manner as in Equation 6.A.5, above.

Balances

In general, the balance at the end of each month (B_t) is calculated using Equation 6.A.6, above. In the first month of each new term, however, the formula is adjusted to account for balances that are not rolled over, as described in Equation 6.A.11, below.

Equation 6.A.11 - Balance Equation

$$B_t = \begin{cases} BROLL_t + IC_t - BEW_t, & \text{for } t = T+1,\ T+TR+1,\ T+2TR+1, \ldots \\ B_{t-1} + IC_t - BEW_t, & \text{otherwise} \end{cases}$$

where: B_t = balance at end of month t

$BROLL_t$ = balances that are rolled over at beginning of month t

IC_t = interest expenses

BEW_t = balances at end of month t that are withdrawn early (see Equation 6.A.5, above)

T = reported remaining maturity

TR = maturity of balances that are rolled over (see Table 6.A.2 above)

Rollover

The amount of deposit balances rolled over after each end-of-term month is calculated using Equation 6.A.12.

Equation 6.A.12 - Rollover Equation

$$BROLL_{t+1} = B_t \left(\frac{r_t}{R_t} \right)^m e^{[q + a(s-q)/t]}, \quad \text{for } t = T + TR, T + 2TR, \ldots$$

where: B_t = deposit balance at end of month t

e = base of the natural logarithm = 2.7183

q = industry-wide rollover parameter = -1.834

s = institution-specific rollover parameter for institutions that report optional data on new deposit accounts (see below)

a = convergence factor (see below)

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[5] NIC values in1999. For more recent values, see *Asset and Liability Price Tables*, published by OTS each quarter.

r_t = projected interest rate on retail CDs, in annual percentage form (see Section 8.B)
R_t = implied-forward secondary-market CD rate in month t, in annual percentage form (see Section 8.B)
μ = interest rate sensitivity parameter = 0.237
T = reported remaining maturity
TR = maturity of balances that are rolled over (see Table 6.A.2, above)

For institutions that report Balances in New Accounts (on Schedule CMR, cells CMR659, CMR660, and CMR661) for three consecutive quarters, the calculation of the rollover parameter (s) is described below; otherwise, the institution s rollover parameter is equal to the value of the industry s rollover parameter (q).

Calculation of Institution s Rollover Parameter:

1. The rollover rate for the current quarter is calculated as follows:

$$\text{Rollover rate} = \frac{(\text{Current Balances} - \text{Balances in New Accounts})}{(\text{Previous Quarter's Balances})}$$

2. Step 1 is repeated for each of the two previous quarters.
3. The median of the three rates calculated in steps 1 and 2 is chosen by discarding the highest and the lowest rates.
4. Convert the quarterly rate to a monthly rate.
5. The rollover parameter is calculated as the natural logarithm (ln) of the median rate obtained in step 4.

The convergence factor, a, determines how fast the institution s reported rollover parameter (s) converges to the industry s rollover parameter (q). It is calculated as the ratio of the reported coupon rate to the equilibrium retail CD rate, as of the reporting day. Specifically, $a = c_0/(-0.4669 + 1.1776\ R_0)$, where c_0 = reported coupon rate and R_0 = 3-month Treasury bill rate, both as observed on the reporting date.

Equation 6.A.13 - Interest Expense Equation

$$IC_t = \begin{cases} BROLL_t \cdot r_t, \text{ for } t = T + 1,\ T + TR + 1,\ T + 2TR + 1, \ldots \\ B_{t-1} \cdot r_t, \text{ otherwise} \end{cases}$$

where:
IC_t = interest expenses in month t
r_t = market interest rate on retail CDs (see Section 8.B)
B_{t-1} = balance at end of month (t-1)
$BROLL_t$ = balances that are rolled over at beginning of month t
T = reported remaining maturity
TR = maturity of balances that are rolled over (see Table 6.A.2, above)

Interest Expenses

Interest expenses in the above equation are calculated based on the beginning-of-month balance.

Retail CD Rate

The calculation of the retail CD rate, r_t, is described in Section 8.B.

Discount Factors

Monthly cash flows are discounted by the secondary-market CD rate appropriate to each month, described in Section 8.B. That section also describes how those rates change in the alternate interest rate scenarios. Discount factors are calculated as described in Equation 6.A.7.

Section 6.B - Fixed-Rate, Fixed-Maturity Borrowings

Schedule CMR Line Numbers

LIABILITIES

FIXED-RATE, FIXED MATURITY BORROWINGS:
FHLB ADVANCES, OTHER BORROWINGS,
REEDEMABLE PREFERRED STOCK,
& SUBORDINATED DEBT

	Remaining Maturity			
	0 to 3 Months	4 to 36 Months	Over 36 Months	WAC
Balances by Coupon Class:				
Under 5.00%	675 $	676 $	677 $	678 . %
5.00 to 5.99%	679 $	680 $	681 $	682 . %
6.00 to 6.99%	683 $	684 $	685 $	686 . %
7.00 to 7.99%	687 $	688 $	689 $	690 . %
8.00 to 8.99%	691 $	692 $	693 $	694 . %
9.00 to 9.99%	695 $	696 $	697 $	698 . %
10.00 to 10.99%	699 $	700 $	701 $	702 . %
11.00 and Above	703 $	704 $	705 $	706 . %
WARM	711 months	712 months	713 months	
Total Fixed-Rate, Fixed-Maturity Borrowings				715 $

Description of Instruments

This category includes: FHLB Advances, Commercial Bank Loans, Reverse Repurchase Agreements, Retail Repurchase Agreements, Commercial Paper Issued, Subordinated Debt, Redeemable Preferred Stock, and Other Fixed-Rate, Fixed Maturity Borrowings.

Institutions report Fixed-Rate, Fixed-Maturity (FRFM) Borrowings in 24 coupon and maturity categories on Schedule CMR. Each category corresponds to one of eight coupon classes and one of three remaining maturity classes. Weighted-average coupons (WACs) are reported for each coupon class; similarly, weighted-average maturities (WARMs) are reported for each remaining maturity class.

Each reported balance is valued separately based on the reported WAC and WARM. For example, suppose an institution reports $100 in CMR684. This balance will be evaluated as a FRFM Borrowing with a WAC equal to the entry in cell CMR686 and a WARM equal to the entry in cell CMR712.

Valuation Methodology

Method

All FRFM Borrowings are treated as non-amortizing, coupon-bearing securities and each reported balance is valued using the static discounted cash flow approach. The present value calculation for FRFM Borrowings is shown in Equation 6.B.1.

Equation 6.B.1- Present Value Calculation for Fixed-Rate, Fixed-Maturity Borrowings

$$PV = \sum_{t=1}^{T} CF_t \cdot df_t$$

where:	PV	=	present value of FRFM Borrowing balance
	CF_t	=	cash flow occurring in month t
	df_t	=	discount factor applicable to month t
	T	=	reported remaining maturity (WARM)

Cash Flows

The NPV Model assumes interest is paid monthly and principal is paid at maturity as shown in Equation 6.B.2.

Equation 6.B.2 - Cash Flow Equation for FRFM Borrowings

$$CF_t = \begin{cases} c_0 B_0, \text{ for } t = 1, 2, \ldots (T - 1) \\ (1 + c_0) B_0, \text{ for } t = T \end{cases}$$

where:	CF_t	=	cash flow occurring in month t
	B_0	=	reported balance (i.e., balance at time t=0)
	c_0	=	reported coupon rate (WAC in monthly, decimal form)
	T	=	reported remaining maturity

Discount Factors

Monthly cash flows are discounted by the LIBOR appropriate to each month as shown in Equation 6.B.3.

Equation 6.B.3 - Discount Factor for Fixed-Rate, Fixed-Maturity Borrowings

$$df_t = \frac{1}{(1 + z_t)^t}$$

where:	df_t	=	discount factor for month t
	z_t	=	LIBOR applicable to month t (in monthly, decimal form)

Section 8.A describes how LIBOR changes in the alternate interest rate scenarios.

Section 6.C - Variable-Rate, Fixed-Maturity Liabilities

Schedule CMR Line Numbers

LIABILITIES

VARIABLE-RATE, FIXED-MATURITY LIABILITIES	Liability Code	Rate Index Code	Balance	Margin	Rate Reset Frequency	Months to Next Reset	WARM
Position 1	721	722	723 $	724 bp	725 mo	726 mo	727 mo
Position 2	728	729	730 $	731 bp	732 mo	733 mo	734 mo
Position 3	735	736	737 $	738 bp	739 mo	740 mo	741 mo
All Other Positions			744 $	745 bp	746 mo	747 mo	748 mo

Memo: Book Value of Redeemable Preferred Stock 755 $

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

Description of Instruments

The variable-rate, fixed-maturity (VRFM) liabilities include:

- VRFM Deposits, and
- VRFM Borrowings: FHLB Advances, Commercial Bank Loans, Reverse Repurchase Agreements, Retail Repurchase Agreements, Commercial Paper Issued, Subordinated Debt, Redeemable Preferred Stock, and Other Fixed-Rate, Fixed Maturity Borrowings.

Each VRFM liability position is reported on Schedule CMR along with a liability code and rate index code. Up to four positions can be reported in CMR721 - CMR748, while up to 1,000 positions can be reported on the Optional Supplemental Reporting for Assets/Liabilities section of Schedule CMR.

Each position is valued separately based on the reported liability and index codes, margin, rate reset frequency, months to next reset, and remaining maturity (WARM).

Valuation Methodology

VRFM liabilities are assumed to be non-amortizing instruments. VRFM liabilities that have a reported rate reset frequency of 1 month are valued at par under all interest rate scenarios. Those with a reported Rate Reset Frequency greater than 1 month are valued separately using the static discounted cash flow approach.

Valuation of VRFM Deposits

VRFM deposits are assumed to be zero-coupon instruments. Interest is credited to the account and there is a single cash flow at maturity consisting of accrued interest and principal repayment. The present value calculation for VRFM Deposits is shown in Equation 6.C.1.

Equation 6.C.1 - Present Value Equation for VRFM Deposits

$$PV = B_0 df_T \left[\prod_{t=1}^{T} \left(1 + INDEX_T + MARGIN\right) \right]$$

where:

- PV = present value of VRFM Liability balance as of reporting date
- B_0 = reported balance (i.e., at time t=0)
- df_T = discount factor applicable to month T
- T = reported remaining maturity (WARM)
- $INDEX_t$ = index rate to which coupon is tied in month t (in monthly, decimal form). See the discussion in Index Rate, below
- MARGIN = reported margin (in monthly, decimal form)

Valuation of VRFM Borrowings

VRFM Borrowings are assumed to be coupon bearing instruments with monthly, interest-only cash flows and a single principal payment at maturity. The present value calculation for VRFM Borrowings is shown in Equation 6.C.2.

Equation 6.C.2 - Present Value Equation for VRFM Borrowings

$$PV = B_0 \sum_{t=1}^{T} \left(INDEX_t + MARGIN\right) df_t + B_0 df_T$$

where:

- PV = present value of VRFM Liability balance as of reporting date (i.e., at time t=0)
- B_0 = reported balance
- T = reported remaining maturity (WARM)
- $INDEX_t$ = index rate to which coupon is tied in month t (in monthly, decimal form). See discussion in Index Rate, below
- MARGIN = reported margin (in monthly, decimal form)
- df_t = discount factor applicable to month t

Index Rate

Interest payments for variable rate instruments are tied to an index rate which is identified on Schedule CMR through the use of an index code. The interest rate currently being paid on the liability balance is not reported, so the Model must assume a level for the index rate for each month until the interest rate is to be reset. It does this as follows.

First, the number of months since the last reset (L) is calculated as the difference between the reported rate reset frequency (F) and the reported months to next reset (N), i.e., L = F - N. Second, the Model assumes the value of the index rate at the last reset was equal to the historical value of the index L months prior to the reporting date. Third, it extracts that value from a file of historical interest rates and uses it to calculate the coupon for the N months until the next rate reset.

Starting with the month in which the interest rate is scheduled to reset (N+1), the Model projects the future level of the index rate in each month as equal to the implied forward rate relevant for that month and interest rate scenario.

Example: Calculation of the Index Rate for VRFM Liabilities

Suppose that as of June 30, an institution reported a VRFM Liability indexed to the 1-year CMT rate, with 3 months remaining until the next reset, and a reset frequency of 12 months. Then, the value of the index as of the reporting date is assumed to equal the value of the 1-year CMT nine months prior to the reporting date, that is, as of September 30, of the prior year. This rate would be in effect until the next reset in month 4.

If the institution reported a remaining maturity of 15 months, the coupon for months 4 through 15 would be based on the implied-forward 1-year CMT rate that applies to the 4th month.

Discount Factors

The cash flows of VRFM deposits are discounted by the secondary-market CD rate appropriate to each month and rate scenario. Cash flows of VRFM Borrowings are discounted by LIBOR. The discount factors are calculated as shown in Equation 6.C.3.

Equation 6.C.3 - Discount Factor Equation

$$df_t = \frac{1}{\left(1+z_t\right)^t}$$

where: df_t = discount factor for month t

z_t = zero-coupon rate applicable to month t (in monthly, decimal form), where deposits use secondary-market CD rates, and borrowings use LIBOR

Section 6.D - Demand Deposits

Schedule CMR Line Numbers

LIABILITIES, MINORITY INTEREST, & CAPITAL

NON-MATURITY DEPOSITS	Total Balances		WAC		Balances in New Accounts (Optional)	
Transaction Accounts	762	$	763	. %	764	$
Money Market Deposit Accounts (MMDAs)	765	$	766	. %	767	$
Passbook Accounts	768	$	769	. %	770	$
Noninterest-Bearing Demand Deposits	771	$			773	$

Description of Instruments

This category includes:

- Transaction Accounts, including NOW, Super NOW, and other interest-bearing transaction accounts;
- Money Market Deposit Accounts, which are saving accounts that pay market rates of interest and the depositor may access no more than six times per month, of which three may be by check;
- Passbook Accounts, which are interest paying demand deposit accounts that are not classified as either transaction or money market accounts; and
- Noninterest-Bearing Demand Deposits, which are demand deposits that are permanently noninterest-bearing deposits.

For each type of demand deposit shown on Schedule CMR, institutions report the total amount in each deposit category and the interest rate offered on the account. At their option, institutions may also report balances in new accounts opened during the quarter.[1] The NPV Model calculates the value of each of the four types of demand deposits separately.

The liability side of the Exposure Report lists the reported balance of each of the four types of demand deposits. The asset side of the report lists the difference between the reported balance of each type of deposit, and its estimated economic value. These values are referred to as Transaction Account Intangible, MMDA Intangible, Passbook Account Intangible, and Noninterest-Bearing Account Intangible.

Valuation Methodology

Method

Demand deposits are valued using the static discounted cash flow approach. Each of the four types of accounts is valued separately using the present value equation shown in Equation 6.D.1.

[1] This information, if reported, is used to calculate institution-specific retention rates. See the discussion of Equation 6.D.6 below.

Equation 6.D.1 - Present Value Equation for Demand Deposits

$$PV = \sum_{t+1}^{360} CF_t df_t$$

where: PV = present value of demand deposit balance
CF_t = expected cash out flow resulting from that balance in month t
df_t = discount factor applicable to month t

Cash Flows

Monthly cash out flows result from three sources: (1) interest payments, (2) decline of the account balance, and (3) non-interest expenses associated with servicing these accounts. Future levels of the deposit interest rate (for interest bearing deposits) and the retention rate of the account balance are determined using two statistically-derived equations explained later in this section. The rate of non-interest expense for each type of account is shown in Table 6.D.1.

The Model calculates demand deposit cash out flows as shown in Equation 6.D.2

Equation 6.D.2 - Cash Flow Equation for Demand Deposits

$$CF_t = NIC \bullet B_{t-1} + \left[(1 + r_t)B_{t-1} - B_t\right]$$

where: CF_t = cash flow in month t
NIC = rate of noninterest cost of retail deposits (in monthly, decimal form)
B_t = demand deposit balance at end of month t
r_t = deposit rate in month t (in monthly, decimal form)

Table 6.D.1
Non-Interest Costs[2]
(in monthly, decimal form)

Type of Account	NIC
Transaction Accounts	0.0015
Money Market Deposit Accounts	0.0007
Passbook Accounts	0.0012
Non-interest Bearing Deposits	0.0021

Offered Rates

Future interest rates offered on interest bearing demand deposits are projected using Equation 6.D.3. The values of the coefficients used in the equation (c, d, etc.) are shown in Table 6.D.2, below.

[2] NIC values applicable to 2001. For more recent values, see “Asset and Liability Price Tables” published by OTS each quarter.

Equation 6.D.3 - Offered Rate Equation

$$r_t = r_{t-1} + c \cdot (r_{t-1} - r_{t-2}) + d \cdot (R_t - R_{t-1}) + e \cdot (R_{t-2} - R_{t-3}) + C_{t-1}, \text{ for } t = 1,2,\ldots$$

where: r_t = deposit rate in month t (in annual, percentage form)
R_t = implied-forward 3-month LIBOR in month t (in annual, percentage form)
C_{t-1} = adjustment toward equilibrium rate = $\begin{cases} f \cdot (r_{t-1} - E_{t-1}), \text{if } r_{t-1} \geq E_{t-1} \\ g \cdot (r_{t-1} - E_{t-1}), \text{if } r_{t-1} < E_{t-1} \end{cases}$
E_t = equilibrium rate for demand deposits (see Equation 6.D.4)

The equilibrium deposit rate, E_t, for a particular type of demand deposit is the level of interest that would be paid on such deposits in long-run equilibrium. The equilibrium deposit rate is projected for each month by Equation 6.D.4, and the deposit rate, r_t, tends always to move toward that equilibrium level. The variable C_{t-1} determines the amount of adjustment toward the equilibrium level. The amount of adjustment varies depending on whether the prior months' deposit rate[3] was above or below the equilibrium rates in those months.

Equation 6.D.4 - Equilibrium Demand Deposit Interest Rate Equation

$$E_t = a + b \bullet R_t$$

where: E_t = equilibrium demand deposit rate (in annual, percentage form)
R_t = implied-forward 3-month LIBOR (in annual, percentage form)

The parameters value used by the Model to determine future deposit rates are shown in Table 6.D.2.

Table 6.D.2
Parameters for Equations 6.D.3 and 6.D.4

Parameter	Transaction Accounts	Money Market Accounts	Passbook Accounts
a	-2.659	-0.985	-2.293
b	0.857	0.825	0.983
c	0.424	0.448	0.504
d	0.021	0.039	0.006
e	-0.017	0.013	-0.004
f	-0.133	-0.091	-0.264
g	-0.005	-0.007	-0.001

Balances

The demand deposit balance, B_t, in each future month is projected using Equation 6.D.5. The deposit balance in existing accounts will decline over time and the rate of decline is influenced by the rate of interest being paid on the account relative to the 3-month LIBOR (i.e., by the ratio r_t/R_t).

3 The deposit rate for month 0 (r_0) is the reported interest rate offered on the account. The deposit rate for month -1 (r_{t-1}) is calculated by interpolating between the current and prior quarter reported rates.

Equation 6.D.5 - Demand Deposit Balance Equation

$$B_t = B_{t-1} \bullet (a + b \bullet \arctan(d + c \bullet r_t / R_t) + e \bullet r_t)^{\frac{1}{12}}$$

where: B_t = demand deposit balance at end of month t
arctan = arctangent function
r_t = interest rate offered on deposits in month t by reporting institution (in annual, percentage form).
R_t = implied-forward 3-month LIBOR in month t (in annual, percentage form)

The value of parameters a through e in Equation 6.D.5 are shown in Table 6.D.3, below.

Table 6.D.3
Parameters for Balance Equations 6.D.5

Parameter	Transaction Accounts	Money Market Accounts	Passbook Accounts	Noninterest Bearing Accounts
a	0.773	0.643	0.756	0.82
b	-0.065	-0.069	-0.062	-0.09
c	-5.959	-6.284	-5.693	0
d	0.997	2.011	1.077	5
e	0.0001	0.0001	0.0001	0

For institutions that report Balances in New Accounts (on Schedule CMR, cells CMR764, CMR767, CMR770, and CMR773) for three consecutive quarters, calculate the retention rate as follows:

Equation 6.D.6 - Demand Deposit Balance Equation for Institutions that Report Balances in New Accounts

$$B_t / B_{t-1} = \mathrm{L} \bullet \mathrm{rr}_0 + (1 - \mathrm{L}) \bullet \mathrm{RR}_t$$

where: B_t = demand deposit balance at end of month t
L = 1 / t
rr_0 = institution s retention rate parameter(see below)
RR_t = retention rate in month t = $(a + b \bullet \arctan(d + c \bullet r_t / R_t) + e \bullet r_t)^{\frac{1}{12}}$
arctan = arctangent function
r_t = interest rate offered on deposits in month t by reporting institution (in annual, percentage form).
R_t = implied-forward 3-month LIBOR in month t (in annual, percentage form)

The value of parameters a through e in Equation 6.D.6 are shown in Table 6.D.3, above.

The Institution's Retention Parameter (rr_0), is calculated as follows:

1. The retention rate for the current quarter is calculated as follows:

$$\text{Retention rate} = \frac{(\text{Current Balances} - \text{Balances in New Accounts})}{(\text{Previous Quarter's Balances})}$$

2. Step 1 is repeated for each of the two previous quarters.

3. The median of the three rates calculated in steps 1 and 2 is chosen by discarding the highest and the lowest rates.

4. Convert the quarterly rate to an annual rate (decimal form).

5. The retention parameter rr_0 in Equation 6.D.6 is the rate obtained in step 4.

Any account balance remaining after 359 months is assumed to be withdrawn as a lump sum in month 360.

Discount Factors

The cash flows of demand deposits are discounted by the zero-coupon LIBOR appropriate to each month and rate scenario, plus a spread. The spread calibrates demand deposit prices to observed prices for deposit purchase/assumption transactions. The discount factors are calculated as shown in Equation 6.D.6.

Equation 6.D.7 - Discount Factor Equation

$$df_t = \frac{1}{(1 + z_t + 0.0012)^t}$$

where: df_t = discount factor for month t
z_t = zero-coupon, LIBOR applicable to month t (in monthly, decimal form)

Section 6.E - Escrow Accounts for Mortgages Held in Portfolio

Schedule CMR Line Numbers

LIABILITIES, MINORITY INTEREST, & CAPITAL

ESCROW ACCOUNTS	Total Balances		WAC	
Escrows for Mortgages Held in Portfolio	775	$	776	. %

Description of Instruments

This category includes escrow balances collected by the institution from mortgagors for tax and insurance payments in connection with mortgages owned by the institution. (These balances will be referred to as owned escrows.) Schedule CMR collects the quarter-end balance of such accounts and the weighted average interest rate paid by the institution to account owners.

Escrow accounts benefit an institution because they are a stable source of low (or no) cost funding. The NPV Model measures the economic benefit (termed float) that the institution derives from these accounts and presents it on the Exposure Report as an asset. This treatment is analogous to the GAAP treatment of the core deposit intangible associated with purchased core deposits[1]. The current quarter s escrow balance is treated as a liability, at face value.

Valuation Methodology

Method

Escrow accounts have two unique features that need to be dealt with in calculating their economic value. First, their maturity is linked to that of their associated mortgages. Thus, their value depends on the prepayment rates of the mortgages. Second, escrow balances may undergo a high degree of seasonal fluctuation. The way the NPV Model deals with these features is discussed before describing the valuation of escrows in greater detail below.

<u>Maturity of Escrows Linked to Mortgages</u>

Escrow accounts have no explicit maturity, but instead remain on deposit as long as their associated mortgages are outstanding. Because of this linkage to the behavior of the underlying mortgages, the NPV Model values these escrow balances in parallel with its valuation of the mortgages, themselves, and stores the present value per unit of escrow account balance (which will be referred to as unit present value) in look-up tables analogous to those of the mortgage price tables[2]. The unit present values stored in the owned escrow look-up tables are estimated as part of the same option-based approach used to estimate prices of the corresponding mortgages. Their calculation is described below.

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1 For example, suppose that the current escrow balance at an institution happens to be zero, as a result of seasonal property tax payouts. Also suppose that the escrow balance over the coming year will average $100 and that the present value of that balance is $60. The institution, under such circumstances, derives $40 of float value from its escrow accounts — despite the current escrow balance of zero. This float value is shown as an intangible asset on the Exposure Report.

2 The major difference between the mortgage price tables and the escrow tables is that the latter have an additional dimension to allow for different interest rates to be paid to the account owner. The lower the rate of interest paid by the institution, the lower will be the economic value of the escrow account and the greater will be the contribution by the escrow account to the institution’s NPV.

Dealing with Seasonal Fluctuations in Escrow Balance

Escrow balances can be highly seasonal, reflecting periodic payment of property taxes. Rather than attempt to model that seasonality explicitly, the NPV Model calculates the present value of owned escrow accounts by assuming that the escrow balance remains constant at its average level over the course of the year (except for permanent reductions caused by prepayments of the associated mortgages). That is, instead of taking account of the cyclical build-up and payout of escrow balances, the Model projects monthly escrow cash flows using the 4-quarter average balance of owned escrows, under the assumption that seasonal fluctuations average out. The Model calculates the beginning average escrow balance as the product of the quarter-end balance of whole mortgage loans and the four-quarter average ratio of escrow balances to mortgage balances at the institution[3].

Creation of Look-Up Tables

Look-up tables are calculated for escrows associated with each of the single-family mortgage types valued by the NPV Model[4].

For escrows related to fixed-rate mortgages, the lines of the look-up tables correspond to the same combinations of WAC and WARM that are presented in the corresponding mortgage price table, however, each of the lines is calculated for each of a range of seven escrow interest rates ranging from 0 to 3 percent in increments of 50 basis points.

For escrows related to ARMs, the lines of the look-up tables correspond to much-abbreviated versions of the ARMs tables. For the five types of ARMs, the tables contain three lines each (for remaining maturities of 200, 330, and 360 months) for the same seven escrow interest rates described above. The other characteristics of the ARM with which the escrows are assumed to be associated (including the WAC, margin, months to next reset, lifetime and periodic caps and floors) are chosen to be representative of the ARMs reported by the industry on Schedule CMR in the previous quarter. The unit present values stored in all of the escrow tables are calculated using the following process.

Cash Flows

In calculating the unit present values for escrows associated with any particular type of mortgage, the Model calculates a stream of monthly escrow cash flows along each of the 200 randomly generated rate paths, based on a beginning average escrow balance of $100. Monthly cash outflows, resulting from prepayment-related escrow payoffs and from interest payments on the average escrow balance, are projected for each path. Account payoffs are calculated each month by applying the same prepayment rate to the remaining average escrow balance that was applied to the corresponding mortgage balance in the corresponding month on the same rate path. The result is that the average escrow balance along each path declines according to the prepayments of its corresponding mortgage. Unlike the mortgage balance, the average escrow balance is not affected by principal amortization (except in the relatively rare instance when a mortgage is paid off at maturity).

Discount Factors

The present value of the stream of cash out flows along each of the 200 simulated interest rate paths is calculated by multiplying each monthly cash flow by the discount factor, based on secondary-market CD

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3 This approach to calculating the average balance has two advantages over simply averaging the escrow balances reported during the last four quarters. First, it properly leaves out of the average balance those escrows whose associated mortgages were prepaid during the last four quarters. Second, it reduces possible distortions in the starting escrow balance that would result from mergers, acquisitions, or the purchase or sale of mortgages.

4 Owned escrow look-up tables are created for: conventional 30-year FRMs; 30-year FHA/VA FRMs; 15-year FRMs; balloon mortgages; 6-month, 1-year, and 3-year Treasury ARMs; and 1-month and 1-year COFI ARMs.

yields, appropriate to that path and month. The discount factor for any month, t, along any given rate path, n, is calculated as:

$$df_{n,t} = \frac{1}{\left[\left(1+f_{n,1}+s_1\right)\left(1+f_{n,2}+s_2\right)\ldots\left(1+f_{n,t}+s_t\right)\right]}$$

where the f variables are the simulated 1-month Treasury rates along path n for the months up to and including month t, and the s variables are the spreads, as of the quarter-end, between the implied forward 1-month CD yields and implied forward 1-month Treasury rates at each month in the sequence to month t. (See Chapter 8 for a description of the calculation of implied forward interest rates.) Basing discount factors on secondary-market CD yields is consistent with the treatment applied to other deposit liabilities.

Use of Escrow Look-Up Tables

The NPV Model assumes that the average escrow balance is associated pro rata with the various categories of mortgages in the institution s portfolio. Thus, before using the look-up tables to value the average escrow balance, that balance is disaggregated into 25 sub-balances. Sub-balances are calculated for five different coupon categories for each of the four following types of fixed-rate mortgages: 30-year conventional FRMs, 30-year FHA/VA FRMs, 15-year FRMs, and balloon mortgages. In addition, sub-balances are calculated for five different ARM types (assumed to be 6-month, 1-year, and 3-year Treasury ARMs, and 1-month and 1-year COFI ARMs).

Example: Valuation of Escrow Accounts for Mortgages Held in Portfolio

Suppose an institution reports the simple $10 million mortgage portfolio shown below.

CMR067 = 2,000	CMR068 = 5,000	CMR157 = 3,000
CMR072 = 7.50 %	CMR073 = 8.00 %	CMR172 = 330
CMR087 = 160	CMR088 = 144	

Assume the institution reports an escrow balance of $1 million (in CMR775) and an escrow interest rate of 0.50% (in CMR776). Furthermore, assume the institution has reported a mortgage balance of $10 million during each of the past three quarters and that in the prior three quarters it has reported the following escrow balances in CMR775: $1.5 million, $2 million, and $0.5 million. The NPV Model calculates the economic value of the institution s escrow balances as follows.

Step 1: Calculate the Average Escrow Balance

The beginnings average balance is calculated as the product of the current quarter s mortgage balance and the average ratio of escrow balances to total mortgages during the current quarter and prior three quarters. The escrow-to-mortgage ratio for the current quarter is 0.10 (= $1,000/$10,000) and in the prior three quarters was 0.15, 0.20, and 0.05, respectively. The average of these ratios is 0.125. The Model, therefore, calculates the beginning average escrow balance as $1.25 million ($1,250 = 0.125 · $10,000).

Step 2: Disaggregate the Average Escrow Balance

The average escrow balance is disaggregated into sub-balances according to the proportional distribution of the institution s mortgage balances across the various mortgage loan categories[5]. Because this institution reports only three mortgage categories, there will be three escrow sub-balances.

5 In performing the calculations in Steps 1 and 2, the Model adjusts for any mortgages that are serviced by others, since typically the servicer, not the owner, holds the escrow accounts. Specifically, in calculating the ratios of escrows to mortgage balances in Step 1, mortgage balances serviced by others are deducted from the denominator of each ratio. In calculating the average escrow balance in that same step, the current mortgage balance is adjusted by deducting

Example: Valuation of Escrow Accounts for Mortgages Held in Portfolio - continued

The first sub-balance corresponds to the $2 million of 15-year FRMs reported in CMR067. That escrow sub-balance contains $250 thousand ($250 = $1,250 · $2,000/$10,000). The escrow sub-balance that corresponds to the 15-year FRMs reported in CMR068 contains $625 thousand ($625 = $1,250 · $5,000/$10,000) and the sub-balance that corresponds to the ARMs reported in CMR157 (which the Model assumes are 1-year Treasury ARMs) contains $375 thousand ($375 = $1,250 · $3,000/$10,000).

Step 3: Use the Look-Up Tables to Value Each Escrow Sub-Balance

An excerpt of the look-up table used to determine the value of the first two escrow sub-balances is shown in Table 6.E.1 and an excerpt of the table used to value the third sub-balance is shown in Table 6.E.2. (The full tables contain unit present values for escrows paying seven different interest rates.)

The mortgages associated with the first escrow sub-balance have a WAC of 7.50% (CMR072) and WARM of 160 months (CMR087). The unit present value for that sub-balance is 64.43 in the base case and 57.23 in the +100 basis point shocked scenario[6]. The value of the sub-balance in those same rate scenarios is $161 thousand ($161.08 = $250 · 64.43/100) and $143 thousand, respectively.

The unit present values for the second escrow sub-balance in the base case and +100 basis point scenarios are 67.77 and 60.30 (based on a WAC of 8.00% and WARM of 144 months). The value of the sub-balance is $424 thousand ($423.56 = $625 · 67.77/100) and $377 thousand in the two scenarios.

Unit presents values for the third sub-balance are determined based on the ARM type, which is assumed to be 1-year Treasury ARMs because the ARM balance was reported in CMR157, and on the reported WARM of 330 months reported for those ARM balances (in CMR172). The unit present values for the escrow sub-balance are 80.51 in the base case and of 76.74 in the +100 basis point scenario. The value of the sub-balance in those scenarios is, therefore, $302 thousand ($301.91 = $375 • 80.51/100) and $288 thousand.

Step 4: Aggregate Values by Interest Rate Scenario

The values of the escrow sub-balances are added to calculate the present value of the average escrow balance. In this example, the institution s average escrow balance has a value of $887 thousand ($887 = $161 + $424 + $302) in the base case and $808 thousand in the =100 basis point scenario. The other scenarios would, of course, be calculated the same way.

balances–serviced by others before being multiplied by the average escrow-to-mortgage ratio. In Step 2, escrow sub-balances are calculated on the basis of the proportional distribution of mortgages after deducting those serviced by others.

Table 6.E.1
Excerpt from Look-Up Table for Escrows Paying 50 Basis Points of Interest and Associated with 15-Year Fixed-Rate Mortgages
(as a Percent of Starting Escrow Balance)

WAC	WARM	Interest Rate Shock (bp)						
(%)	(mo)	-300	-200	-100	0	+100	+200	+300
7.50	12	97.94	96.91	95.86	94.88	93.93	92.99	92.06
7.50	24	96.32	94.09	91.76	89.78	87.95	86.19	84.48
7.50	36	95.37	92.01	88.35	85.37	82.73	80.27	77.91
7.50	48	94.81	90.44	85.51	81.58	78.21	75.12	72.23
7.50	60	94.44	89.23	83.14	78.32	74.28	70.67	67.34
7.50	72	94.20	88.27	81.15	75.51	70.89	66.82	63.12
7.50	84	94.03	87.51	79.47	73.12	67.96	63.50	59.50
7.50	96	93.91	86.89	78.06	71.06	65.44	60.65	56.40
7.50	108	93.82	86.38	76.86	69.28	63.26	58.19	53.75
7.50	120	93.75	85.98	75.88	67.81	61.44	56.13	51.53
7.50	132	93.70	85.66	75.08	66.60	59.94	54.43	49.70
7.50	144	93.66	85.40	74.41	65.57	58.66	52.98	48.15
7.50	156	93.62	85.18	73.84	64.69	57.56	51.74	46.83
7.50	160	93.61	85.11	73.67	64.43	57.23	51.37	46.44
7.50	168	93.29	84.56	72.87	63.40	56.03	50.04	45.04
7.50	180	91.13	81.68	69.94	60.36	52.87	46.79	41.71
8.00	12	97.98	96.98	95.91	94.92	93.96	93.02	92.09
8.00	24	96.46	94.43	92.01	89.93	88.06	86.29	84.58
8.00	36	95.63	92.69	88.88	85.69	82.96	80.46	78.09
8.00	48	95.16	91.47	86.37	82.10	78.58	75.43	72.50
8.00	60	94.88	90.57	84.32	79.07	74.82	71.10	67.70
8.00	72	94.71	89.89	82.65	76.50	71.59	67.37	63.59
8.00	84	94.60	89.37	81.28	74.34	68.84	64.19	60.09
8.00	96	94.52	88.97	80.15	72.50	66.49	61.47	57.10
8.00	108	94.47	88.65	79.20	70.95	64.48	59.14	54.55
8.00	120	94.43	88.40	78.44	69.67	62.81	57.20	52.43
8.00	132	94.40	88.21	77.84	68.64	61.45	55.62	50.70
8.00	144	94.38	88.06	77.34	67.77	60.30	54.28	49.23
8.00	156	94.37	87.93	76.92	67.03	59.32	53.14	48.00
8.00	160	94.36	87.89	76.79	66.81	59.03	52.80	47.63
8.00	168	94.04	87.38	76.05	65.82	57.85	51.47	46.20
8.00	180	91.98	84.46	73.00	62.71	54.61	48.12	42.77

Table 6.E.2
Excerpt from Look-Up Table for Escrows Paying 50 Basis Points of Interest and Associated with 1-Year Treasury ARMs
(as a Percent of Starting Escrow Balance)

WARM	Interest Rate Shock (bp)						
(mo)	-300	-200	-100	0	+100	+200	+300
200	90.48	87.17	83.77	80.21	76.44	72.42	68.50
330	90.79	87.48	84.07	80.51	76.74	72.72	68.79
360	87.34	83.20	79.06	74.88	70.62	66.32	62.15

Presentation of Owned Escrow Account Values on Exposure Report

The escrow values described above represent the present values of future out flows from the average escrow balance that is currently used by the institution as a source of funds. The smaller the present value of these out flows as a percent of the average balance, the greater is the economic benefit (or float) that the institution derives from holding that average escrow balance. This float is calculated by the Model, in each scenario, as the difference between the average escrow balance and its present value in that scenario.

It is reported as an asset on page 2 of the Exposure Report as a line item entitled Float on Escrows of Owned Mortgages. (This form of reporting is analogous to the treatment under GAAP of the core deposit intangible associated with purchased core deposits.)

The face value of the current quarter s escrow balance (CMR775) is treated as a liability and is constant across all rate scenarios. It is combined with the face value of the current quarter s escrow balances relating to mortgages serviced for others, and is reported on page 5 of the Exposure Report as a line item entitled Escrow Accounts for Mortgages.

Example: Presentation of Owned Escrow Account Values on Exposure Report

Continuing the example from above, the institution had an average escrow balance of $1.25 million, which had a value of $887 thousand in the base case scenario and $808 thousand in the +100 basis point scenario. The institution reported a quarter-end escrow balance of $1 million (in CMR775).

The value of the line, Float on Escrows of Owned Mortgages, on this institution s Exposure Report in the base case is $363 thousand ($363 = $1,250 - $887) and in the +100 basis point scenario is $442. In other words, the benefit to the institution from having these low-cost funds increases when market interest rates rise.

On the liability side, the line, Escrow Accounts for Mortgages, would include $1 million to reflect the current quarter s owned escrow balance. This line is constant across all 9 interest rate scenarios.

Section 6.F - Float on Mortgages Serviced for Others

Schedule CMR Line Numbers

LIABILITIES, MINORITY INTEREST & CAPITAL

ESCROW ACCOUNTS	Total Balances		WAC	
Escrows for Mortgages Serviced for Others	777	$	778	. %

Description of Instruments

As part of the business of servicing mortgages, servicers have an opportunity to benefit from timing lags between the receipt and remittance of the cash flows they handle on behalf of mortgage owners (or investors). The NPV Model estimates the value of two components of such mortgage servicing float . The first component results from the escrow balances collected by the servicer from mortgagors for tax and insurance (T&I) payments. (These balances will be referred to as serviced T&I escrows.) Schedule CMR collects the quarter-end balance of such accounts and the weighted average interest rate paid to account owners. The second component of float results from the fact that servicers have the ability to use mortgagors monthly principal and interest (P&I) payments to fund assets during the interval between receiving and remitting those payments. Both sources of float provide mortgage servicers with a stable source of no cost (or low cost, since interest is paid on some T&I escrow accounts) funding.

On the Exposure Report, the value of the float that the institution derives from its mortgage servicing business is treated as an asset. Thus, for example, suppose the average balance of serviced T&I escrows at an institution is $100 and the present value of the future cash out flows from that account is estimated as $90 in the base case and $98 in the -200 basis point scenario. In those two scenarios, the Exposure Report would list the float resulting from this account as an asset, Float on Mortgages Serviced for Others, valued at $10 (= $100 - $90), in the base case, and $2 (= $100 - $98), in the -200 scenario. The current face value of the serviced escrow balance would be included in the liability line entitled, Escrow Accounts for Mortgages.[1]

Because the methods used by the NPV Model to value the two components of float differ considerably, they are discussed separately, below. The methodology for valuing float on serviced T&I escrow accounts is described first, followed by a description of the valuation of float on principal and interest payments.

Valuation Methodology for Float on Serviced Tax & Insurance Escrows

Method

The approach to valuing escrow accounts associated with mortgages serviced for others is similar to the method used to value owned escrows (see Section 6.E). Like owned escrows, the maturity of serviced escrows is linked to that of the associated mortgages, and their balances are subject to the same potentially high degree of seasonal fluctuation. The major difference between the NPV Model s valuation of owned and serviced escrows is that it uses different discount factors. Both the similarities and differences are discussed below.

[1] The value of servicing P&I float is also included in Float on Mortgages Serviced for Others. The face value of any P&I balances related to the institution’s servicing for others (reported in CMR786) are included on the Exposure Report’s liabilities section in the line entitled, Miscellaneous Liabilities I.

Maturity of Serviced Escrows Linked to Mortgages

Like owned escrows, serviced escrow accounts have no explicit maturity, but instead remain on deposit as long as their associated mortgages are outstanding. The NPV Model values serviced escrow balances in parallel with the valuation of the mortgage servicing rights, themselves. The present value per unit of escrow account balance (referred to as unit present value) for each rate scenario is stored in look-up tables like those of the owned escrows. The unit present values stored in the escrow look-up tables are estimated as part of the same option-based approach used to estimate prices of the corresponding mortgage servicing rights.

Dealing with Seasonal Fluctuations in Escrow Balance

Because they are used to make periodic property tax payments, serviced escrows have the same potential for seasonal fluctuation as owned escrows, and the Model treats them the same way. It calculates the present value of serviced escrow accounts on the basis of their 4-quarter average balance. The Model calculates the beginning average escrow balance as the product of the quarter-end number of mortgage loans being serviced for others (i.e., CMR422, CMR423, and CMR441)[2] and the institution s four-quarter average ratio of serviced escrow balances to serviced mortgage loans.[3]

Creation of Look-Up Tables

Schedule CMR divides serviced mortgage balances into four categories: conventional FRMs, FHA/VA FRMs, current market indexed ARMs, and lagging market indexed ARMs. The Model treats serviced FRMs as either 30-year conventional or 30-year FHA/VA mortgages. The two ARM categories are treated as 1-year Treasury and 1-month COFI ARMs, respectively. Look-up tables are provided for escrows associated with each of those types of mortgages.

Tables for serviced escrows have the same dimensions (e.g., WAC, WARM, escrow interest rate) as the corresponding tables for owned escrows, and they are calculated in the same way (see Section 6.E), except that different discount factors are used.

Discount Factors

The discount factors used to value serviced escrows are the same ones used to value mortgage servicing fees and costs (see Section 5.Z).[4] Present values are 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, that discount factor is:

$$df_{n,t} = \frac{1}{\left[\left(1+f_{n,1}+oas\right)\left(1+f_{n,2}+oas\right)\ldots\left(1+f_{n,t}+oas\right)\right]}$$

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[2] For mortgage servicers that have part of their servicing portfolio sub-serviced by a third party, the Model assumes the sub-servicer holds any associated escrow balances. In calculating the average escrow balance, therefore, the number of mortgages sub-serviced by others (i.e., CMR423 and CMR442) is deducted from the number of mortgages being serviced for others.

[3] This approach to calculating the average balance has two advantages over simply averaging the serviced escrow balances reported during the last four quarters. First, it correctly leaves out of the average balance those escrows whose associated mortgages were prepaid during the last four quarters. Second, it reduces possible distortions in the average balance that would result from mergers, acquisitions, or the purchase or sale of mortgage servicing rights.

[4] OTS obtains quotes on required servicing yields for the entire “bundle” of servicing cash flows, including servicing fees, costs, ancillary income, float on escrows, and P&I float. So that the total estimated value of these components will be consistent with the quoted yields, the NPV Model applies the same discount factors to all of them.

where the f variables are the simulated 1-month Treasury rates along path n for the months up to and including month t, and oas is the option-adjusted spread that was used to value servicing fees and costs for this type of mortgage.

Use of Escrow Look-Up Tables

The NPV Model values serviced escrows in a way that is analogous to its valuation of owned escrows (see Section 6.E). Thus, instead of taking account of the cyclical build-up and payout of escrow balances, the Model projects monthly escrow cash flows under the assumption that seasonal fluctuations average out by using the four-quarter average escrow balance (described above).

As with owned escrows, the NPV Model assumes that the average serviced escrow balance is associated, pro rata, with the various categories of mortgages in the mortgage servicing portfolio.[5] Thus, before using the look-up tables to value the average escrow balance, that balance is disaggregated into 12 sub-balances. (Sub-balances are calculated for five different coupon categories of 30-year conventional FRMs and 30-year FHA/VA FRMs. In addition, a sub-balance is calculated for each of the two types of ARMs.)

The escrow values described above represent the present values of future cash out flows from the average escrow balance which is currently being used as a source of funds by the institution. The smaller the present value of these outflows as a percent of the average balance, the greater is the economic benefit, or float, that the institution derives from that escrow balance. In each scenario, the Model calculates float as the difference between the average serviced T&I escrow balance and its present value in that scenario.

The second component of float resulting from mortgages serviced for others is P&I float. The Model s treatment of this component is discussed below.

Valuation Methodology for Float on Principal and Interest Payments

Method

The business of servicing mortgages for others gives servicers the use of monthly principal and interest payments received from mortgagors[6] during the interval between when they are received and when they are remitted to the parties for whom the mortgages are being serviced. The Model values such P&I float using a separate set of look-up tables.

Look-Up Tables

Look-up tables for P&I float related to fixed-rate mortgage servicing have the same combinations of WAC and WARM that are provided in the corresponding mortgage price tables. Tables for P&I escrows related to ARMs are much-abbreviated versions of the ARM price tables. For the two types of serviced ARMs, the tables contain three lines each, representing remaining maturities of 200, 330, and 360 months. The other characteristics of the ARM with which the escrows are assumed to be associated (including the WAC, margin, months to next reset, lifetime and periodic caps and floors) are chosen to be representative of the ARMs reported by the industry on Schedule CMR in the previous quarter. A description of the calculation of the unit present values contained in these tables follows.

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[5] In calculating the percentage composition of the servicing portfolio, the Model adjusts for the number of FRMs and ARMs being sub-serviced. For example, if the servicing portfolio is reported to consist of 100 FRMs and 100 ARMs, but all 100 ARMs are also being subserviced by a third party, the Model would allocate the entire escrow balance to the FRM portfolio and none to the ARM portfolio.

[6] In addition to scheduled principal and interest, servicers also handle any unscheduled principal payments, such as mortgage payoffs resulting from prepayment.

Cash Flows

The Model assumes that the servicer has temporary use of all principal (including prepaid principal) and interest flows generated by the mortgages being serviced. Specifically, it assumes that the servicer receives principal and interest payments each month from mortgagors, holds that balance for 10 days, and then remits it.[7]

To estimate the unit present values for P&I float associated with any particular mortgage, the Model calculates a stream of discounted monthly cash flows along each of the 200 randomly generated interest rate paths, based on a beginning mortgage balance of $100. Each cash flow stream consists of the interest, scheduled principal, and prepaid principal payments to be received, and subsequently remitted, by the mortgage servicer.

The Model calculates the monthly payments that will be received by the servicer along each rate path using the same procedures and prepayment equations used to value the mortgages, themselves.[8] (For a detailed description of those procedures for each type of mortgage, see Section 5.B for conventional and FHA/VA 30-year FRMs and Sections 5.G and 5.H, respectively, for 1-year Treasury ARMs and 1-month COFI ARMs.)

Each monthly P&I in flow is followed, 10 days later, by an out flow of equal size, as the servicer remits the funds to the parties for whom the mortgages are being serviced. On each path, the Model calculates the out flow as equal to negative one times the amount of the immediately preceding in flow on that path. Along each path, this alternating sequence of P&I in flows and out flows continues until the initial $100 mortgage balance has been reduced to zero through amortization and prepayment.

Discount Factors

The monthly P&I in flows received by the servicer are discounted using the same monthly discount factors used to discount servicing fees, servicing costs, and serviced escrow cash flows, described above. That is, for any month, t, along any given rate path, n, the discount factor is:

$$df_{n,t} = \frac{1}{\left[\left(1+f_{n,1}+oas\right)\left(1+f_{n,2}+oas\right)\ldots\left(1+f_{n,t}+oas\right)\right]}$$

where the f variables are the simulated 1-month Treasury rates along path n for the months up to and including month t, and oas is the option-adjusted spread that was used to value servicing fees and costs for this type of mortgage.

The subsequent P&I out flow that occurs when the servicer remits payment is assumed to happen one-third of a month later (at time = t+0.33). The discount factor for that cash flow (on path n) is approximated by the Model as:

$$df_{n,t} = \frac{1}{\left[\left(1+f_{n,1}+oas\right)\left(1+f_{n,2}+oas\right)\ldots\left(1+f_{n,t}+oas\right)\left(1+\frac{f_{n,t+1}+oas}{3}\right)\right]}$$

7 While the exact timing varies according to the individual servicing agreement, the servicer typically is required to remit such payments monthly, within approximately ten days of the mortgagor's payment due date.

8 The servicer retains a fraction of each cash flow as a servicing fee, which the Model values separately (see Section 5.Z for a description). The Model, therefore, deducts a servicing fee from each cash in flow. The fee is calculated based upon the outstanding principal balance and is assumed to be 25 basis points per year for FRM servicing and 50 basis points for ARM servicing.

The two discount factors differ only in the presence of the last factor, involving $f_{n,t+1}$, in the denominator. The discount factor to be applied to the P&I out flow, $df_{n,t+.33}$, is simply equal to $df_{n,t}$ compounded for an additional one-third of a month. This relationship can be seen more clearly by re-writing the discount factor as:

$$df_{n,\,t+.33} = df_{n,\,t} \cdot \frac{1}{\left[1+\frac{\left(f_{n,\,t+1}+oas\right)}{3}\right]}$$

To summarize the process, for each month on each rate path, the Model first multiplies the P&I cash in flow by the discount factor, $df_{n,t}$, then multiplies the out flow (which is equal to negative one times the amount of the P&I in flow) by the discount factor, $df_{n,t+.33}$, and then adds the two resulting present values. Because the discount factor that is applied to the cash in flow is always slightly larger than that applied to the out flow, the resulting net present value of the P&I cash flows is always positive.

The Model cumulates the net present values of the monthly P&I in flows and out flows along each of the 200 rate paths and calculates their average. The average net present value across the 200 paths represents the present value of having ten days of float on all principal and interest payments (including prepayments) generated by a mortgage with an outstanding balance of $100. Similar unit present values are calculated for each of the seven rate scenarios and stored in the P&I float look-up table for the appropriate type of mortgage.

Use of P&I Float Look-Up Tables

Before the NPV Model can use the look-up tables to value P&I float, the mortgage balances being serviced must be adjusted for sub-servicing by others, because the Model assumes the sub-servicer will receive the P&I float relating to such mortgages.

P&I Float from Fixed-Rate Mortgage Servicing

The fraction of FRMs that are sub-serviced by others is calculated as the number of FRMs sub-serviced by others divided by the sum of conventional FRM loans and FHA/VA FRM loans. That is:

$$frms\_subserviced = \frac{CMR423}{\left(CMR421 + CMR422\right)}$$

Each of the five FRM servicing balances (CMR401 through CMR405) is adjusted for sub-servicing by multiplying it by the fraction of FRMs that are not sub-serviced (i.e., by [1 - frms_subserviced]).

Then each of the resulting five adjusted balances is divided into conventional and FHA/VA sub-balances on a pro rata basis according to the number of loans of each type in the FRM servicing portfolio. That is:

$$fraction\_conven = \frac{CMR421}{\left(CMR421 + CMR422\right)}$$

$$fraction\_fha\_va = 1 - fraction\_conven$$

Each of the resulting ten sub-balances is evaluated, using the P&I float look-up table for conventional or FHA/VA mortgages, as appropriate, based on the reported WARM (CMR406 through CMR410) and an assumed WAC.[9]

P&I Float from ARM Servicing

A similar procedure is used to estimate the value of P&I float stemming from ARM servicing. First, the Model adjusts the reported ARM servicing balances for sub-servicing. The fraction of ARMs that are sub-serviced by others is calculated as:

$$\text{arms\_ subserviced} = \frac{\text{CMR422}}{\text{CMR441}}$$

Both of the reported ARM servicing balances (CMR431 and CMR432) are adjusted for sub-servicing by multiplying them by the fraction of ARMs that are not sub-serviced (i.e., by [1 - arms_subserviced]). ARM servicing balances for current and lagging market indexes are reported separately on Schedule CMR, so, unlike FRM servicing, no further disaggregation of the resulting adjusted balances is necessary.

The two adjusted ARM balances are evaluated, using the P&I float look-up table for ARMs indexed to 1-year Treasury and 1-month COFI, as appropriate, based on the reported WARM (CMR433 and CMR434). All other ARM characteristics are assumed, as described above.

The value of P&I float resulting from fixed- and adjustable-rate servicing is then combined by scenario.

9 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 April 1998:

CMR401	-	6.50%,	CMR402	-	7.50%,
CMR403	-	8.50%,	CMR404	-	9.50%, and
CMR405	-	10.50%			

Example: Valuation of FRM Servicing for Others

Suppose an institution reports the $7 million mortgage servicing portfolio shown in the Schedule CMR, below.

ASSETS

MORTGAGE LOANS SERVICED FOR OTHERS	Coupon									
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	$ 2,000	402	$ 5,000	403	$ 0	404	$ 0	405	$ 0
WARM	406	360 months	407	330 months	408	0 months	409	0 months	410	0 months
Weighted Average Servicing Fee	411	35 bp	412	45 bp	413	0 bp	414	0 bp	415	0 bp

Total # of Fixed-Rate Loans Serviced That Are:

Conventional Loans	421	50 loans
FHA/VA	422	20 loans
Subserviced by Others	423	7 loans

Step 1: Adjust Fixed-Rate Balances for Sub-Servicing

The fraction of FRMs sub-serviced by others is:

$$\text{frms\_subserviced} = \frac{\text{CMR423}}{(\text{CMR421} + \text{CMR422})}$$

$$= \frac{7}{(50+20)} = .10$$

The reported FRM servicing balances are adjusted for sub-servicing as follows:

$$\begin{aligned}
\text{BAL_1} &= \text{CMR401} \cdot (1\text{-frms_subserviced}) = 2{,}000 \cdot (.9) = 1{,}800 \\
\text{BAL_2} &= \text{CMR402} \cdot (1\text{-frms_subserviced}) = 5{,}000 \cdot (.9) = 4{,}500 \\
\text{BAL_3} &= \text{CMR403} \cdot (1\text{-frms_subserviced}) = 0 \cdot (.9) = 0 \\
\text{BAL_4} &= \text{CMR404} \cdot (1\text{-frms_subserviced}) = 0 \cdot (.9) = 0 \\
\text{BAL_5} &= \text{CMR405} \cdot (1\text{-frms_subserviced}) = 0 \cdot (.9) = 0
\end{aligned}$$

Step 2: Disaggregate Fixed-Rate Balances

Each of the five adjusted serviced FRM balances is divided into conventional and FHA/VA sub-balances according to the fractions:

$$\text{fraction\_conven} = \frac{\text{CMR421}}{(\text{CMR421} + \text{CMR422})}$$

$$= \frac{50}{(50+20)} = .7143$$

$$\text{fraction\_fha\_va} = 1 - \text{fraction\_conven}$$

$$= .2857$$

The resulting sub-balances are:

$$\begin{aligned}
\text{BAL_1_CONV} &= \text{BAL_1} \cdot \text{fraction_conven} = 1{,}800 \cdot (.7143) = 1{,}285.74 \\
\text{BAL_1_FHA} &= \text{BAL_1} \cdot \text{fraction_fha_va} = 1{,}800 \cdot (.2857) = 514.29 \\
\text{BAL_2_CONV} &= \text{BAL_2} \cdot \text{fraction_conven} = 4{,}500 \cdot (.7143) = 3{,}214.29 \\
\text{BAL_2_FHA} &= \text{BAL_2} \cdot \text{fraction_fha_va} = 4{,}500 \cdot (.2857) = 1{,}285.71
\end{aligned}$$

Example: Valuation of FRM Servicing for Others - continued

BAL_3_CONV	=	BAL_3	· fraction_conven	=	0	·	(.7143)	=	0
BAL_3_FHA	=	BAL_3	· fraction_fha_va	=	0	·	(.2857)	=	0
BAL_4_CONV	=	BAL_4	· fraction_conven	=	0	·	(.7143)	=	0
BAL_4_FHA	=	BAL_4	· fraction_fha_va	=	0	·	(.2857)	=	0
BAL_5_CONV	=	BAL_5	· fraction_conven	=	0	·	(.7143)	=	0
BAL_5_FHA	=	BAL_5	· fraction_fha_va	=	0	·	(.2857)	=	0

Step 3: Use the Look-Up Tables to Value Each FRM Sub-Balance

The Model locates the unit present values for BAL_1_CONV and BAL_2_FHA in the P&I float look-up tables for conventional and FHA/VA FRMs, respectively, based on the reported WARM of 360 months and the assumed WAC of 6.50%. Values are calculated for P&I float for each sub-balance in each scenario by multiplying the sub-balance by the appropriate unit present value.

A similar procedure is followed for estimating the value of float for the other serviced FRM sub-balances.

Presentation of Float on Mortgages Serviced for Others on Exposure Report

Float stemming from serviced (T&I) escrows is combined with float from P&I payments and their sum is presented as an asset on page 02 of the Exposure Report in the line entitled, Float on Mortgages Serviced for Others. (This form of presentation is analogous to the treatment under GAAP of the core deposit intangible associated with purchased core deposits.)

The face value of the current quarter s balance of serviced escrows (CMR775) is treated as a liability and is constant across all rate scenarios. It is combined with the face value of the current quarter s owned escrow balances (also constant across scenarios) and is presented on page 5 of the Exposure Report as a line item entitled, Escrow Accounts for Mortgages. Principal and interest flows that are payable to mortgage owners or investors are generally reported as part of CMR786, Other Liabilities: Miscellaneous I. This account is shown on the Exposure Report as a line item with the same name. It is included at face value and is constant across all seven scenarios.

Section 6.G - Unamortized Yield Adjustments on Deposits and Borrowings, Other Liabilities and Minority Interest in Consolidated Subsidiaries

Schedule CMR Line Numbers

LIABILITIES (CON'T.), MINORITY INTEREST, &

UNAMORTIZED YIELD ADJUSTMENTS ON DEPOSITS	782	$
UNAMORTIZED YIELD ADJUSTMENTS ON BORROWINGS	784	$
OTHER LIABILITIES		
Collateralized Mortgage Securities Issued	785	$
Miscellaneous I	786	$
Miscellaneous II	787	$
Total Liabilities (Incl. Redeemable Preferred Stock)	790	$
MINORITY INTEREST IN CONSOLIDATED SUBSIDIARIES	793	$

REPORTING OF MARKET VALUE ESTIMATES

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 CMR941 thru CMR949)					950	$				

Description of Instruments

This category includes:

- Unamortized yield adjustments on deposits and borrowings;
- Collateralized Mortgage Securities Issued (CMOs Issued);
- Miscellaneous Liabilities I: Accrued Interest Payable on Deposits, Accrued Interest Payable on Other Liabilities, Accumulated Annual Income Payments Not Yet Due, Dividends Payable on Stock, Accrued Taxes, Accounts Payable, Other Liabilities and Deferred Income;

- Miscellaneous Liabilities II: Financial Options Fee Received, Deferred Income Taxes, Deferred Net Gains or Losses on Liability Hedges;
- Minority Interest in Consolidated Subsidiaries.

Valuation Methodology

- Unamortized Yield Adjustments on Deposits and Borrowings are assumed to have no value under all seven interest rate scenarios;
- CMOs Issued are valued at par under all interest rate risk scenarios unless the reporting institution chooses to report their market values in the section of Schedule CMR entitled Reporting of Market Value Estimates (cells CMR951 through CMR959);
- Miscellaneous Liabilities I are valued at par under all interest rate scenarios;
- Miscellaneous Liabilities II and Minority Interest in Consolidated Subsidiaries are assumed to have no value under all interest rate scenarios.