

This chapter summarizes how the OTS NPV Model estimates economic values of the assets, liabilities, and financial derivatives and off-balance sheet contracts included in the NPV calculation. These economic values are discussed in the same order as they appear in the Interest Rate Risk Exposure Report.

A more detailed description of the methodology for valuing most of the financial instruments is provided in Chapters 5, 6, and 7.<sup>1</sup>

## Section 3.A - Asset Methodologies

### MORTGAGE LOANS & SECURITIES

#### Fixed-Rate Single-Family First Mortgage Loans & Mortgage-Backed Securities (MBS)

A Monte Carlo pricing approach is used to value fixed-rate single-family mortgage (FRM) loans and securities. Schedule CMR collects information separately on outstanding balances, coupons, and maturities for the following four types of single-family FRM loans and securities backed by those loans:

- 30-year conventional
- 30-year FHA/VA
- 15-year original maturity, and
- balloon payment mortgages.

The economic values of fixed-rate mortgage balances are calculated in three steps:

#### Step 1:

Obtain quarter-end market prices for a set of representative mortgage-backed securities on each of the four asset types and calculate the option-adjusted spread (OAS) of each. For example, for securities backed by 30-year conventional loans, OTS currently obtains market prices for 9 securities with coupons ranging from 5.5 percent to 9.5 percent in increments of 0.5. An OAS is calculated for each security given its coupon, maturity, amortization characteristics, and prepayment assumptions of the NPV Model.

#### Step 2:

Use the OAS values of the representative securities to create look-up tables that contain calculated prices of a larger set of loans and securities of varying coupons and maturities. Eight look-up tables are created and include a loan table and a security table for each of the four types of mortgages listed above.

To calculate the estimated price of each security, future cash flows are projected and discounted by a set of randomly generated short-term rates (see Section 5.A of this manual) plus the OAS for a representative security with similar characteristics.

---

<sup>1</sup> Several financial instruments are not discussed in Chapters 5, 6, and 7 because their valuation methodology is simple and requires no further explanation beyond that given here. Examples are nonperforming loans and accrued interest receivable.

Cash flows are projected for scheduled principal and interest by amortizing the outstanding balance according to the coupon and term to maturity. For mortgage securities, a 50 basis points servicing spread is subtracted from the weighted average coupon (WAC) on the underlying loans before calculating interest cash flows. Prepaid principal is projected using prepayment functions to estimate a mortgage's monthly prepayments based on the ratio of its coupon to the current interest rate for 30-year fixed-rate mortgages (i.e., the rate at which the mortgage could be refinanced). Separate prepayment functions are used to estimate prepayments on 30-year conventional loans, 30-year FHA/VA loans, 15-year loans, and balloon loans (as well as the securities backed by each of these types of loans). The four prepayment functions are based on prepayment projections provided by investment banking firms and are updated periodically as the projections change.

The NPV Model estimates mortgage loan prices using the OAS calculated for a mortgage security whose collateral has a WAC approximately equal to that of the mortgage loan. To that OAS, 25 basis points are added to account for additional credit and liquidity risk because the mortgage security used to derive the OAS is guaranteed by a government-sponsored agency, while the loan is not.

The NPV Model also subtracts a servicing cost of 20 basis points from the loan's coupon to take into account that a thrift incurs a cost to service the loan that a security holder does not.

An excerpt from a sample look-up table for 30-year FHA/VA loans is shown in Table 3.A.1 below.

**Step 3:**

Economic values of the balances reported on Schedule CMR are calculated by referring to the price table corresponding to the particular type of mortgage loan or security.

For example, suppose an institution reported \$500,000 of FHA/VA loans with a weighted average coupon of 8 percent and a weighted average remaining maturity (WARM) of 330 months on Schedule CMR. The NPV Model would estimate the economic value of those balances in each of the interest rate scenarios by multiplying the \$500,000 by the prices in the line indicated with an arrow in Table 3.A.1, divided by 100, because the prices are expressed as a percent of the outstanding balance. The resulting economic values would be as follows in each of the seven interest rate scenarios:

<b>Economic Value of FHA/VA Loans</b>								
(Dollars in Thousands)								
<b>WAC</b>	<b>WARM</b>	<b>-300</b>	<b>-200</b>	<b>-100</b>	<b>0</b>	<b>+100</b>	<b>+200</b>	<b>+300</b>
8.00%	330 mo.	544.75	535.50	520.60	494.20	464.85	436.50	410.35

If there is no line in the look-up table for a loan with the exact coupon and maturity reported by an institution, the NPV Model interpolates between lines to calculate a price for the coupon and maturity combination reported.

*Adjustable-Rate Single-Family First Mortgage Loans & MBS*

The NPV Model uses the OAS approach to estimate the economic values of adjustable-rate single-family mortgage loans (ARMs) and securities. Schedule CMR collects information on ARMs in five columns that correspond to the frequency with which their coupons reset and whether the index is a current-market index or a lagging index. Each Schedule CMR column can accommodate a number of possible indexes and a range of reset frequencies, but balances in the five columns are assumed for modeling purposes to consist of the following types of ARMs:

Table 3.A.1  
 Excerpt from Price Table FHA/VA Loans  
 (as a Percent of Outstanding Balance)

WAC (%)	WARM (mo)	Interest Rate Shock (bp)						
		-300	-200	-100	0	+100	+200	+300
7.50	60	105.49	104.02	101.95	99.75	97.55	95.38	93.26
7.50	120	107.56	105.68	102.35	98.66	94.97	91.39	87.95
7.50	150	108.19	106.20	102.41	98.15	93.91	89.82	85.93
7.50	180	108.68	106.62	102.45	97.73	93.03	88.53	84.28
7.50	192	108.84	106.76	102.46	97.57	92.72	88.07	83.70
7.50	204	108.99	106.89	102.47	97.43	92.43	87.65	83.17
7.50	216	109.13	107.01	102.47	97.30	92.16	87.26	82.68
7.50	228	109.25	107.12	102.48	97.17	91.91	86.90	82.23
7.50	239	109.36	107.21	102.48	97.06	91.69	86.59	81.84
7.50	240	107.77	105.91	102.23	97.00	91.62	86.52	81.80
7.50	252	107.82	105.96	102.22	96.88	91.40	86.21	81.41
7.50	264	107.87	106.01	102.21	96.77	91.19	85.92	81.05
7.50	276	107.92	106.05	102.20	96.67	91.00	85.65	80.72
7.50	288	107.96	106.09	102.19	96.58	90.82	85.40	80.41
7.50	300	108.00	106.12	102.18	96.48	90.65	85.16	80.13
7.50	312	108.03	106.15	102.17	96.40	90.49	84.95	79.87
7.50	324	108.07	106.18	102.16	96.31	90.35	84.74	79.62
7.50	330	108.08	106.20	102.15	96.28	90.28	84.65	79.51
7.50	336	108.16	106.25	102.15	96.23	90.17	84.50	79.32
7.50	348	109.93	106.64	102.19	96.04	89.80	83.98	78.68
7.50	360	110.48	107.40	102.26	95.75	89.23	83.19	77.71
8.00	60	105.95	104.77	102.84	100.67	98.48	96.30	94.17
8.00	120	108.00	106.78	103.80	100.21	96.54	92.94	89.48
8.00	150	108.60	107.40	104.06	99.95	95.73	91.62	87.69
8.00	180	109.04	107.90	104.27	99.72	95.06	90.53	86.24
8.00	192	109.19	108.06	104.34	99.64	94.82	90.15	85.73
8.00	204	109.32	108.22	104.40	99.56	94.60	89.80	85.27
8.00	216	109.44	108.36	104.45	99.49	94.40	89.47	84.84
8.00	228	109.55	108.48	104.50	99.42	94.20	89.17	84.44
8.00	239	109.64	108.59	104.54	99.36	94.04	88.91	84.10
8.00	240	108.63	106.79	104.01	99.26	93.98	88.85	84.05
8.00	252	108.69	106.85	104.04	99.19	93.81	88.59	83.71
8.00	264	108.74	106.90	104.05	99.13	93.66	88.34	83.40
8.00	276	108.79	106.94	104.07	99.07	93.51	88.12	83.11
8.00	288	108.83	106.98	104.08	99.01	93.37	87.91	82.84
8.00	300	108.87	107.02	104.10	98.96	93.25	87.72	82.60
8.00	312	108.90	107.06	104.11	98.91	93.13	87.54	82.37
8.00	324	108.93	107.09	104.11	98.86	93.02	87.38	82.16
8.00	330	108.95	107.10	104.12	98.84	92.97	87.30	82.07
8.00	336	109.04	107.17	104.14	98.81	92.89	87.17	81.89
8.00	348	109.94	107.72	104.29	98.72	92.60	86.72	81.31
8.00	360	111.74	108.80	104.59	98.56	92.15	86.03	80.43
8.50	60	106.36	105.42	103.67	101.56	99.37	97.20	95.06
8.50	120	108.36	107.63	105.11	101.68	98.06	94.46	90.97
8.50	150	108.90	108.31	105.54	101.64	97.48	93.37	89.41
8.50	180	109.30	108.83	105.88	101.59	97.01	92.48	88.15

CMR Column*Current Market Index ARMs*

6 months or less	→	6-month Treasury ARM
7 months to 2 years	→	1-year Treasury ARM
More than 2 to 5 years	→	3-year Treasury ARM

*Lagging Market Index ARMs*

1 month	→	1-month 11th District Cost of Funds Index (COFI) ARM
5 years	→	2 months to 12-month 11th District COFI ARM

The economic values of the ARM balances reported on Schedule CMR are calculated in three steps:

**Step 1:**

Obtain market prices as of quarter-end for a representative ARM security of each of the five types (6-month, 1-year, and 3-year Treasury, and 1-month and 1-year 11th District COFI ARMs) and calculate the OAS of each. An OAS is calculated for each security given the prepayment assumptions of the NPV Model, and taking into account the security's index type, coupon, remaining maturity, margin, periodic and lifetime interest rate caps and floors, and number of months until the next scheduled coupon reset.

**Step 2:**

Use the OAS values of the representative securities to create price tables that contain calculated prices of a larger set of loans and securities of varying coupons, margins, maturities, lifetime and periodic caps and floors, and number of months remaining until the next coupon reset. Twelve price tables are created: a loan table and a security table for Treasury ARMs with indices of 6-months, 1-year, and 3-years; for 11<sup>th</sup> District COFI ARMs with 1-month and 12-month coupon reset frequencies; and for teaser 1-month 11<sup>th</sup> District COFI ARMs.

Cash flows are projected for scheduled principal and interest by amortizing the outstanding balance according to the coupon and term to maturity. For mortgage securities, a 75 basis points servicing spread is subtracted from the WAC of the underlying loans before calculating interest cash flows.) Prepaid principal is projected using prepayment functions to estimate the mortgage's monthly prepayments based on the ratio of the mortgage's coupon to the current interest rate on 30-year fixed-rate mortgages (i.e., the rate at which the mortgage could be refinanced). The same prepayment function is used for both Treasury and COFI ARMs.

To calculate the estimated price for each security to be included in the price table, projected cash flows are discounted using the set of one-month forward rates described in Section 5.A plus the OAS for the representative ARM security having the same index. For example, suppose the representative 1-year Treasury security has a coupon of 7 percent, a margin of 250 basis points, 200 basis point periodic caps and floors and a lifetime cap and floor of 14 and 2 percent, and has 6 months remaining until the next scheduled coupon reset. The NPV Model would calculate the OAS for this security, taking into account all these characteristics, then use that OAS to calculate the price of other 1-year Treasury ARM securities with differing characteristics. The ARM price table for each index type currently contains the prices of 2,700 securities and loans with various combinations of coupons, maturities, margins, periodic and lifetime caps and floors, and number of months to next coupon reset.

The NPV Model estimates mortgage loan prices using the OAS values calculated for the mortgage securities. To the OAS, 25 basis points are added to account for additional credit risk because the security used to derive the OAS is guaranteed by a government-sponsored agency, while the loan is not.

..The NPV Model also subtracts a servicing cost of 38 basis points from the loan's interest cash flow to take into account that the thrift incurs a cost to service the loan that a security holder does not.

An excerpt from a sample price table for 1-Year Treasury ARMs is shown in Table 3.A.2.

**Table 3.A.2**  
**Excerpt from Price Table for 1-Year Treasury ARM Loans**  
**(As a Percent of Outstanding Balance)**

WARM (mo)	Mrgin (bp)	WAC (bp)	Rset (mo)	Pcap (bp)	PFir (bp)	LCap (bp)	LFir (bp)	Interest Rate Shock (bp)						
								-300	-200	-100	0	+100	+200	+300
330	200	500	2	100	none	0	1200	97.03	92.93	88.40	84.08	80.06	76.34	72.91
330	200	500	2	100	none	200	1000	100.35	99.24	96.16	92.15	88.09	84.16	80.44
330	200	500	2	100	none	400	800	100.53	100.36	98.67	95.63	92.06	88.30	84.58
330	200	500	2	100	none	1000	200	100.53	100.42	98.98	96.50	93.65	90.54	87.31
330	200	500	2	100	none	none	none	100.53	100.42	98.98	96.51	93.65	90.55	87.33
330	200	500	2	100	100	0	1200	97.03	92.93	88.40	84.08	80.06	76.34	72.91
330	200	500	2	100	100	200	1000	100.35	99.24	96.16	92.15	88.09	84.16	80.44
330	200	500	2	100	100	400	800	100.53	100.37	98.67	95.63	92.06	88.30	84.58
330	200	500	2	100	100	1000	200	100.53	100.42	98.99	96.52	93.67	90.56	87.32
330	200	500	2	100	100	none	none	100.53	100.42	98.99	96.52	93.67	90.57	87.34
330	200	500	2	200	none	0	1200	97.03	92.93	88.40	84.08	80.06	76.34	72.91
330	200	500	2	200	none	200	1000	100.69	99.41	96.83	93.15	89.11	85.18	81.46
330	200	500	2	200	none	400	800	100.89	100.75	100.28	98.28	95.00	91.32	87.62
330	200	500	2	200	none	1000	200	100.89	100.82	100.70	99.77	98.10	96.08	93.76
330	200	500	2	200	none	none	none	100.89	100.82	100.70	99.77	98.11	96.11	93.86
330	200	500	2	200	200	0	1200	97.03	92.93	88.40	84.08	80.06	76.34	72.91
330	200	500	2	200	200	200	1000	100.69	99.41	96.83	93.15	89.11	85.18	81.46
330	200	500	2	200	200	400	800	100.89	100.75	100.28	98.28	95.00	91.32	87.62
330	200	500	2	200	200	1000	200	100.89	100.82	100.70	99.77	98.11	96.09	93.77
330	200	500	2	200	200	none	none	100.89	100.82	100.70	99.77	98.11	96.12	93.87
330	200	500	2	none	none	0	1200	97.03	92.93	88.40	84.08	80.06	76.34	72.91
330	200	500	2	none	none	200	1000	100.70	99.41	96.83	93.15	89.11	85.18	81.46
330	200	500	2	none	none	400	800	100.90	100.77	100.30	98.92	96.63	93.26	89.60
330	200	500	2	none	none	1000	200	100.90	100.84	100.75	100.64	100.53	100.38	100.16
330	200	500	2	none	none	none	none	100.90	100.84	100.75	100.64	100.54	100.42	100.30

Step 3:

The ARM balances reported in each of the five columns of the single-family ARMs page of Schedule CMR are disaggregated into sub-balances with varying characteristics. The sub-balances are then matched to the price table line that reports the estimated economic value of an ARM loan or security with those particular characteristics.

For the balances in each of the five columns, besides information about coupon, time to next coupon reset, and maturity, Schedule CMR also collects the average margin, information about the balances of teaser-loans, the balances in ARM securities, and information about any interest rate caps and floors on the loans.

Using this information, the NPV Model divides the balances reported in each of the five columns into 84 separate balances, each with its own unique set of associated characteristics. For example, instead of assuming that the \$100 million of ARMs reported by an institution in a particular column all have the weighted average periodic rate cap reported in that column (say, 133 basis points), the Model allocates the reported balance into two sets of sub-balances: \$66.7 million with a periodic cap of 100 basis points and \$33.3 million with a periodic cap of 200 basis points. See Section 5.J for a detailed description of this process.

After the balances in each column have been disaggregated, the NPV Model matches each balance to a line on the price table that reports the economic value in seven rate scenarios of an ARM with those same characteristics. For example, consider a \$1 million current index ARM loan balance with a remaining maturity of 330 months, a margin of 200 basis points, a coupon of 5 percent, 2 months until the next scheduled coupon reset, a 200 basis point periodic rate cap and no periodic rate floor, and a coupon that is currently 10 percentage points below the lifetime cap of 15 percent. The economic value of the balance would be calculated by multiplying \$1 million by the price (divided by 100) from the line indicated by the arrow in Table 3.A.2.

**Economic Value of ARM Loans**  
(Dollars in Thousands)

<b>-300</b>	<b>-200</b>	<b>-100</b>	<b>0</b>	<b>+100</b>	<b>+200</b>	<b>+300</b>
1,008.9	1,008.2	1,007.0	997.7	981.0	960.8	937.6

If there is no line in the look-up table for a loan with the exact characteristics reported by an institution, the Model interpolates between lines to calculate a price for an ARM with those characteristics.

In general, ARMs with indices that reset less frequently are more interest rate sensitive (exhibit more price variation due to a change in interest rates) than those that reset more frequently. For example, a 3-year constant maturity Treasury (CMT) ARM that resets every three years would typically be more interest rate sensitive than a 1-year CMT ARM that resets annually. Other characteristics of the ARMs, however, can have an important effect on their interest rate sensitivity. For example, a 1-year CMT ARM with periodic interest rate caps and floors could be more rate sensitive than a 3-year CMT ARM with no caps or floors.

The number of months until the next scheduled coupon reset can also have an important effect on an ARM's rate sensitivity. The NPV Model assumes the full amount of the simulated interest rate shock occurs instantaneously, as opposed to gradually over several months. Thus, the economic value of an ARM whose coupon resets in the second month of the simulation will be much less affected by the rate shock than one whose coupon does not reset until, say, twelve months after the shock.

Generally, an ARM tied to a lagging market index, such as the 11th District Cost of Funds, is more interest rate sensitive than one with the same coupon reset frequency tied to a current market index. Thus, the economic value of a 12-month COFI ARM would be expected to change by a greater amount than that of an otherwise similar 1-year CMT ARM. In practice, such comparisons are difficult to make since the other characteristics of any two particular ARMs with different indices are unlikely to be the same.

*Multifamily & Nonresidential Mortgage Loans & Securities*

The NPV Model uses the static discounted cash flow approach to value multifamily and nonresidential mortgage loans and securities. Adjustable-rate balances are valued separately from fixed-rate balances, as are balloon payment mortgages and fully amortizing mortgages.

The NPV Model values each of the four types of mortgages (fixed-rate balloons, fixed-rate fully amortizing, adjustable-rate balloons, and adjustable-rate fully amortizing) using the reported maturity and coupon specific to each. All balances are assumed to pay monthly principal and interest cash flows. The coupons of adjustable-rate mortgages (equal to the projected value of the index plus the reported margin) reset with the reported frequency, but subject to any interest rate caps reported on Schedule CMR. Interest rate floors are not reported on Schedule CMR. Reported balances are modeled, therefore, assuming they have no interest rate floors.

Due to the prevalence of prepayment penalties on multifamily and nonresidential mortgages, their prepayment rate is assumed to be zero.

Monthly cash flows are discounted using discount factors calculated from the implied forward Treasury rates plus a spread. Separate spreads, and thus separate discount factors, are calculated for fixed-rate mortgages, and

also for adjustable-rate mortgages tied to various indices. Each spread is calculated such that the sum of the discounted cash flows of a new multifamily mortgage with a coupon equal to the estimated current lending rate on such loans would be equal to their outstanding balance. For fixed-rate loans, the current lending rate is assumed to be the quarter-end 30-day Fannie Mae commitment rate on 25-year multifamily loans for the fully amortizing category, and the commitment rate on 7 year multifamily balloon loans for the balloon category. See Section 5.P for a discussion of the calculation of the discount factors for adjustable-rate multifamily and nonresidential mortgages.

#### *Construction & Land Loans*

The NPV Model uses the static discounted cash flow approach to value construction loans and land loans. Schedule CMR collects the outstanding balances of fixed- and adjustable-rate loans separately, and they are valued separately by the Model.

Construction and land loans are assumed to pay monthly interest and all principal at maturity. No prepayments are assumed.

The coupon on adjustable-rate construction and land loans is calculated as the sum of the reported index and margin and changes with the reported reset frequency. The Model treats all adjustable-rate construction and land loans as having no interest rate caps or floors.

Monthly cash flows are discounted using discount factors calculated from the implied forward Treasury rates plus a spread. Each spread is calculated such that the sum of the discounted cash flows of a new loan with a coupon equal to the estimated current lending rate would be equal to par. For fixed-rate construction and land loans, the current lending rate is taken from a survey of construction lending rates conducted by the U.S. Department of Housing and Urban Development. See Section 5.Q for a discussion of the calculation of the discount factors for adjustable-rate construction and land loans.

#### *Second Mortgage Loans & Securities*

The NPV Model values second mortgage loans using the static discounted cash flow approach. Second mortgages are assumed to be level-payment amortizing loans that generate monthly cash flows of interest and principal. Prepayment rates for second mortgages are based on observed prepayment rates of home equity loans underlying asset-backed securities.

The coupon on adjustable-rate second mortgages is calculated as the sum of the reported index and margin and changes with the reported reset frequency. The Model treats all adjustable-rate second mortgages as having no interest rate caps or floors.

Monthly cash flows are discounted using discount factors calculated from the implied forward Treasury rates plus a spread. Separate spreads, and thus separate discount factors, are calculated for fixed-rate second mortgages and for adjustable-rate second mortgages tied to various indices. The spreads are calculated such that the sum of the discounted cash flows of a new second mortgage with a coupon equal to the estimated current lending rate would be equal to par. For fixed-rate mortgages, the current lending rate is estimated as the commitment rate on 30-year fixed-rate mortgages plus 100 basis points. See Section 5.R for a discussion of the calculation of the discount factors for second mortgages.

## Other Assets Related to Mortgage Loans &amp; Securities

*Net Nonperforming Mortgage Loans*

Valuation allowances established for mortgage assets (reported in CMR507) are subtracted from nonperforming mortgage loans (CMR501) as a means of incorporating institution-specific credit problems into the NPV measure.<sup>2</sup>

The base case economic value of net nonperforming mortgage loans is equal to their face value as reported on Schedule CMR, minus valuation allowances. The net value of each institution's nonperforming mortgage loans are assumed to have the same interest rate sensitivity as that institution's total mortgage loan portfolio.

*Accrued Interest Receivable Advances for Taxes/Insurance*

The economic value of both of these items (reported in CMR502 and CMR503) is assumed to be equal to their reported book values in all interest rate scenarios. That is, their interest rate sensitivity is zero.

*Float on Escrows on Owned Mortgages*

Float on Escrows on Owned Mortgages is a measure of the benefit escrow deposits provide to the institution. Float on these escrows is equal to the estimated average balance of escrow deposits associated with mortgages owned by the institution, less their estimated economic value. The amount of benefit the institution derives from these deposits depends on the level of interest it pays the mortgagors and the length of time the accounts are expected to remain on deposit (i.e., until the associated mortgage matures or prepays).

The economic value of escrow deposits is estimated using the Monte Carlo methodology. To estimate the economic value of escrow deposits, monthly escrow cash out is projected and discounted using discount factors based on secondary market CD yields. Escrow deposits have no explicit maturity, but rather remain on deposit as long as their associated mortgages are outstanding. The NPV Model uses the prepayment rate applied to owned mortgages as an escrow run-off rate to project monthly escrow cash out flows.

*Value of Servicing on Mortgages Serviced by Others*

When estimating the economic value of mortgage loans held in portfolio, the NPV Model assumes the institution incurs a cost of 20 basis points in servicing its FRMs and 38 basis point for its ARMs. If, however, the institution pays someone else to service the mortgage, and pays more than 20 basis points (or 38 basis points in the case of ARMs), the value of the mortgage loans on the IRR Exposure Report will be overstated because too small a servicing cost is being subtracted from the mortgage cash flows when estimating their economic value. Conversely, if an institution pays less than that amount for servicing, the value of those mortgages will be understated.

This line of the Exposure Report makes an adjustment to the value of mortgage loans for any over- or underestimate of the cost of servicing the mortgage portfolio. The adjustment is *deducted* from the total value of the institution's mortgage portfolio and is equal to the present value of the difference between the reported servicing fee paid to the servicer, and the NPV Model's assumption about how much it costs the institution to service its own loans. The value of this line will be negative (i.e., it will *augment* the value of the mortgage portfolio) if an institution pays less than 20 basis points (38 for ARMs) and positive (thus *reducing* the value of the mortgage portfolio) if it pays more.

---

<sup>2</sup> The discount rates used in the NPV Model to estimate the economic value of various assets are representative of the required assets in the institution's balance sheet.



To calculate the present value of the net servicing cost streams, assumptions must be made about the characteristics (such as coupon and maturity) of the institution's mortgages that are serviced by others. Fixed-rate mortgages serviced by others are assumed to be spread uniformly across the reporting institution's conventional 30-year mortgages, while the adjustable-rate mortgages serviced by others are assumed to be distributed evenly across all ARMs held in portfolio. The net servicing cost streams of both types of servicing are valued using the OAS methodology. The OAS is the same as that used for the corresponding type of mortgage loan.

## NONMORTGAGE LOANS

### Commercial Loans

The NPV Model uses the static discounted cash flow approach to value commercial loans. All loans are assumed to pay monthly interest and all principal at maturity. No prepayments are assumed.

Adjustable-rate commercial loans are assumed to be indexed to the index reported on Schedule CMR, and reset with the reported reset frequency.

Cash flows are discounted using discount factors calculated from the implied forward Treasury rates plus a spread. Separate spreads, and thus separate discount factors, are calculated for fixed-rate commercial loans, and for adjustable-rate commercial loans tied to various indices. Each spread is calculated such that, the sum of the discounted cash flows of a new commercial loan with a coupon equal to the estimated current lending rate on such loans would be equal to their outstanding balance. For fixed-rate commercial loans, the current lending rate is calculated as the balance weighted average on fixed-rate commercial loans under one year and over one year, and less than \$500,000, as reported in the Federal Reserve's *Survey of Terms of Bank Lending*, Release E.2. See Section 5.S of this manual for a discussion of the calculation of the discount factors for adjustable-rate commercial loans.

### Consumer Loans

The NPV Model uses the static discounted cash flow approach to value consumer loans. All consumer loans are assumed to be level-payment amortizing loans that generate monthly cash flows of interest and principal.

The NPV Model applies a unique prepayment rate to each institution's consumer loan balances. On Schedule SC of the Thrift Financial Report, consumer loan balances are grouped into eight types. The NPV Model calculates a weighted average prepayment rate for each institution's total consumer loan balances, using as weights the proportion of balances represented by each loan type on Schedule SC. Prepayment estimates for each type of loan are based on observed prepayment rates of collateral underlying various types of asset backed securities. Prepayment rates are assumed to remain constant in the alternate rate scenarios. This is based on the presumption that interest rate changes do not result in significant refinancing activity for consumer loans because of their relatively small balances and the fact that they represent liens on depreciating assets whose value may be less than the outstanding balance of the loan.

Using the balances reported by type on Schedule SC, the NPV Model also determines a unique weighted average discount factor for each institution's consumer loan balances. For each loan type, the discount factor is based on the implied forward Treasury rate plus a spread. The spread is calculated such that the sum of the discounted cash flows of a new consumer loan of that type, with a coupon equal to the estimated current lending rate, would be equal to par. Interest rates for various types of consumer loans from *Federal Reserve Statistical Release G.19* are used as estimates of current lending rates.

*Other Assets Related to Nonmortgage Loans & Securities**Net Nonperforming Nonmortgage Loans*

Valuation allowances established for nonmortgage assets (CMR516) are subtracted from nonperforming nonmortgage loans as a means of incorporating institution-specific credit problems into the NPV measure. The base case value of nonperforming nonmortgage loans is equal to their face value as reported in CMR511, less valuation allowances on nonmortgage loans. The net value for each institution is assumed to have the same interest rate sensitivity as that institution's total nonmortgage loan portfolio. That is, if total nonmortgage loans decline in value by a given percentage in the +100 basis point scenario, net nonperforming loans will decline by the same percentage in that scenario.

*Accrued Interest Receivable*

The economic value of Accrued Interest Receivable (CMR512) is assumed to be equal to its reported book value in all interest rate scenarios. That is, its interest rate sensitivity is zero.

**CASH, DEPOSITS, & SECURITIES***Cash, Non-Interest-Earning Deposits, Overnight Fed Funds & Repos*

These short-term assets (reported in CMR461) are valued at their face value in all of the interest rate scenarios evaluated by the NPV Model.

*Equities & All Mutual Funds*

Although equities and all mutual funds are listed as a single item in the IRR Exposure Report, the economic values of mortgage-related-mutual funds are estimated separately from those of equities and nonmortgage-related mutual funds.

*Equities and Nonmortgage-Related Mutual Funds*

Institutions report the market value of their equity securities and non-mortgage-related mutual funds on Schedule CMR. This value is used as the base case economic value by the NPV Model. To value these assets in the alternative interest rate scenarios, the NPV Model assumes their interest rate elasticity to be -4.5. That is, for every 100 basis point increase in interest rates, the value of equity securities and non-mortgage-related mutual funds is assumed to decrease by 4.5 percent, and vice versa. For example, if an institution reported \$100 of equity securities on Schedule CMR, the estimated economic value in the plus 200 basis point scenario would be  $\$100 \times (1-.09) = \$91.00$ .

This interest rate elasticity was estimated by regressing the monthly average of the Wilshire 5,000 Stock Index on the monthly average ten-year Treasury yield over a five-year period. A time trend was included to allow for an upward drift in the index.

*Mortgage-Related Mutual Funds*

Institutions report the market value of non-high-risk mortgage-related mutual fund investments on Schedule CMR and this value is used directly in the base case of the NPV Model.

The Model uses one of two methods to value mortgage-related mutual fund investments in the alternate interest rate scenarios, depending on the information institutions supply on Schedule CMR. Institutions may report information on the types of assets in their mortgage-related mutual funds in the Optional Supplemental Reporting section of Schedule CMR. For any institution that reports this information, the Model

applies interest-rate sensitivity measures appropriate to the specific mix of mortgage assets held by the mutual fund. For example, for mutual funds investing in ARM securities, the Model would use the estimated interest rate sensitivity of the industry aggregate ARM holdings in the previous quarter. See Section 5.X for more information.

For institutions that choose not to report information on mortgage-related mutual funds in the Optional Supplemental Reporting section of Schedule CMR, the Model applies the estimated duration of a selected benchmark single-family, 30-year, fixed-rate mortgage security that represents the most predominant coupon of FRM security held by institutions.

#### Zero-Coupon Securities

Zero-coupon securities are assumed to be stripped Treasury securities and are valued using the static discounted cash flow approach. A single cash flow is assumed to occur at the weighted average maturity of the zero-coupon bond portfolio and is discounted by the Treasury zero-coupon yield applicable to that maturity.

#### Government & Agency Securities & Deposits at FHLBs

These assets are valued using the static discounted cash flow approach. They are assumed to generate semiannual interest cash flows with principal repaid at maturity. The cash flows are discounted by the Treasury zero-coupon yields applicable to the month in which each will be received.

#### Term Federal Funds and Repurchase Agreements, & Interest-Earning Deposits

These assets are valued using the static discounted cash flow approach. They are assumed to generate monthly interest cash flows and pay all principal at maturity. The discount rate in each month is calculated as the zero-coupon Treasury yield applicable to that month plus a spread. The spread is calculated such that the sum of the projected cash flows of a new asset with a coupon equal to the current market rate on such an asset would be equal to par when discounted by the Treasury zero coupon yield plus the spread. The 3-month commercial paper rate published in *Federal Reserve Release G.13* is used as the current rate.

#### Municipal Securities, Mortgage-Backed Bonds, Corporates, Commercial Paper

These assets are valued using the static discounted cash flow approach. On Schedule CMR, institutions report the outstanding principal balance of these assets and their weighted average coupon and maturity. They are assumed to generate semiannual interest cash flows and pay all principal at maturity. The discount rate is the zero-coupon Treasury yield corresponding to the timing of the cash flow, plus a spread. The spread is calculated such that the sum of the projected cash flows of a new bond with a coupon equal to the AAA-rate corporate bond rate (published in *Federal Reserve Release G.13*) would equal par when discounted by the Treasury zero-coupon yield plus the spread.

The Schedule CMR instructions require institutions to report the tax-equivalent yield for county, state, and municipal securities. Because all securities in this general category are discounted using the same discount rate, it is important that institutions do report the tax-equivalent yields on these securities. Otherwise, their economic values will likely be underestimated by the NPV Model.

#### Mortgage Derivative Securities

The NPV Model values mortgage derivatives using one of two approaches: a self-reporting approach or a benchmark approach, depending on the information the institution reports on Schedule CMR.

***Self-Reporting Approach***

Under the self-reporting approach, an institution reports its own estimates of the economic value of its mortgage derivatives in each of the seven interest rate scenarios evaluated by the NPV Model. These estimates are then incorporated into the Model's estimate of the institution's interest rate exposure.

Savings associations meeting the following criteria are required to report their own economic value estimates for mortgage derivatives:

- Assets exceeding \$500 million, or
- Any high-risk mortgage derivatives acquired after December 31, 1988 (see CMR instructions for a definition of high-risk derivatives), or
- The recorded investment value of mortgage derivatives exceeds 5 percent of assets.

Savings associations not required to provide their own estimates may provide the economic value estimates if they wish. The self-reporting approach should result in better estimates of the interest rate sensitivity of these instruments than the benchmark approach described below.

***Benchmark Approach***

The NPV Model uses a benchmark approach to value the mortgage derivatives of savings associations that do not provide economic value estimates for their mortgage derivatives. Under this approach, a benchmark security is chosen to represent the securities reported in each of the cells on Schedule CMR. The economic value of the mortgage derivatives in each cell is estimated in each interest rate scenario based upon the price of the benchmark representing that cell in each of those scenarios. A listing of the benchmarks and their price profiles is included in the Asset and Liability Price Tables, published by the OTS each quarter. The benchmark for each class of derivative will be updated periodically.

Interest-only strips and principal-only strips are valued using the Monte Carlo methodology of the NPV Model. The NPV Model uses the coupon information reported by savings institutions and assumed maturities to calculate the economic value in each scenario.

**STRUCTURED SECURITIES*****Valuation Allowances for Investment Securities***

Valuation allowances established for investment securities are subtracted from the estimated economic value of investment securities in the NPV Model. In the base case, the amount subtracted is equal to the amount reported in CMR540. In the alternate rate scenarios, valuation allowances are assumed to show the same percent change from the base case as the total category Total Cash, Deposits, and Securities, minus the line for Cash, Non-Interest-Earning Deposits, Overnight Fed Funds, & Repos.

**REPOSSESSED ASSETS**

Institutions report the carrying value, net of valuation allowances, of repossessed assets in CMR525. The economic value of these assets in all interest rate scenarios is assumed to be equal to their book value. That is, their interest rate sensitivity is assumed to be zero.

**REAL ESTATE HELD FOR INVESTMENT**

Institutions report the carrying value, net of valuation allowances, of real estate held for investment in CMR520. Because the economic value and interest rate sensitivity of real estate investments is very difficult to estimate, the OTS assumes their economic value in all interest rate scenarios equals their book value. That is, their interest rate sensitivity is zero.

**INVESTMENT IN UNCONSOLIDATED SUBSIDIARIES**

Institutions report the carrying value, net of valuation allowances, of their investment in unconsolidated subsidiaries in CMR530. The base case economic value is assumed to equal the book value. These assets are assumed to have the same interest rate sensitivity as the weighted average NPV of all savings and loan institutions for which an IRR Exposure Report was generated by the NPV Model in the previous quarter.

**OFFICE PREMISES & EQUIPMENT**

Institutions report the book value office premises and equipment in CMR535. The estimated economic value in all interest rate scenarios is equal to the book value. That is, these assets are assumed to have an interest rate sensitivity of zero.

**MORTGAGE LOAN SERVICING FOR OTHERS**

The NPV Model uses the Monte Carlo methodology to value mortgage loan servicing. The estimated economic value of mortgage servicing in the Model is equal to the discounted present value of servicing fee income and ancillary income, minus the discounted present value of servicing cost out flows, plus the value derived from escrow deposits associated with mortgages serviced for others. It includes the value of all future servicing fee income, including that from sources other than excess servicing and purchased servicing. For example, it includes servicing for which an institution receives only the normal fee (i.e., retained servicing), and those for which it acts as a sub-service for another entity that owns the servicing rights.

The total value of mortgage servicing is comprised of values appearing on three lines of the IRR Exposure Report. Lines titled Fixed-Rate Servicing and Adjustable-Rate Servicing list the estimated economic value of servicing income less cost, while the benefit institutions derive from escrow deposits is listed in Float from Escrows on Mortgages Serviced for Others.

To calculate the discount factors, spreads are calculated for each of the three types of mortgage servicing valued by the Model (fixed-rate FNMA/FHLMC and GNMA, and ARM servicing). The same spreads are used to calculate the present value of all cash flows (that is, those associated with servicing fees and cost, and with escrow deposits).

Fixed-Rate Servicing

Adjustable-Rate Servicing

These lines report the estimated economic value of servicing income (fee income plus ancillary income), net of cost. Monthly servicing fee cash flows are projected by adjusting the balances reported on CMR for expected prepayments and amortization, and multiplying the outstanding balances in each month by the reported weighted average servicing fee. Fixed-rate balances are assumed to be 30-year fully-amortizing mortgages. Current-market-index adjustable-rate balances are treated as 1-year CMT mortgages, while lagging market index ARMs are treated as 1-month 11th District COFI ARMs.

Monthly ancillary income is estimated by adjusting the reported number of loans outstanding in each future month for expected prepayments and multiplying the number of loans serviced by an estimate of monthly ancil-

lary income per loan. Servicing cost out flows are projected in the same manner as ancillary income cash flows, but using an estimate of the monthly servicing cost per loan. Estimates of per-loan ancillary income and servicing cost are taken from the Mortgage Bankers Association's (MBA) annual survey. These estimates are updated annually as new estimates become available.

#### *Float from Escrows on Mortgages Serviced for Others*

Escrow deposits provide value to depository institutions because they typically pay a significant lower rate of interest than other types of deposits. The estimated economic value of escrow deposits in the NPV Model is typically considerably less than their face value depending on the rate of interest paid. Float on Escrows on Mortgages Serviced for Others is equal to the face value of the escrow balance averaged over the last four quarters, less their estimated economic value. The reported face value of escrow balances appears in the liabilities section of the IRR Exposure Report.

To estimate the economic value of escrow deposits, monthly cash out flows are projected assuming average escrow balances remain on deposit as long as their associated mortgages are outstanding. That is, the NPV Model uses the prepayment rate applied to mortgages serviced for others as an escrow "run-off" rate to project monthly escrow cash out flows.

#### **OTHER ASSETS**

##### *Margin Accounts*

##### *Miscellaneous I*

The estimated economic value of Margin Accounts and the assets in Miscellaneous I are assumed to be equal to their book values (reported in CMR542 and CMR543 respectively) in all interest rate scenarios.

The category Miscellaneous I includes property leased to others and items of the types reported in cell SC690 of the Thrift Financial Report (including Federal Home Loan Bank stock).

#### *Deposit Intangibles*

Deposit intangibles are a measure of the benefit an institution derives from holding core deposits. Core deposits provide such benefit because they remain on deposit despite typically paying a rate of interest below wholesale deposits. Core deposits include retail CDs, interest bearing transactions deposits, money market deposit accounts (MMDAs), passbook deposits, and noninterest-bearing deposits.

The value of deposit intangibles is positive for most institutions. Changes in the interest paid on core deposits typically lags changes in market rates. In very low interest rate environments, institutions may pay the same or even slightly more for core deposits (on an all-in basis, including servicing cost) than they do for wholesale funds, causing the value for deposit intangibles to be very small or negative. The derivation of the economic value estimates for each type of core deposit is described below.

#### *Retail CD Intangible*

The retail CD intangible is an estimate of the value that accrues to a depository institution when depositors roll over their deposits at interest rates below those available in the wholesale market. The intangible value is equal to the estimated economic value of the CD balances assuming that depositors do not roll over their deposits, less the estimated economic value of those balances calculated under the assumption that depositors do roll them over upon maturity. See Section 6.A for a description of how the economic value of retail CDs is estimated by the NPV Model.

*Transaction Account Intangible**MMDA Intangible**Passbook Account Intangible**Non-Interest-Bearing Account Intangible*

For each type of demand deposit, the Deposit Intangible is calculated as the face value of the deposit (which appears in the liabilities section of the Exposure Report), less its estimated economic value. The economic values of the deposits are calculated as follows.

Demand deposits have no stated maturity, and their offered rates react relatively slowly to changes in market rates (except for non-interest bearing deposits which, by definition, do not have an offered rate). Consequently, estimation of the cash out flows of demand deposits requires assumptions about the relationship between offered rates, balances, and market rates.

These relationships were estimated statistically for each type of demand deposit. The change in the offered rate on interest-bearing deposits is assumed to depend on changes in the wholesale CD rate, and has differing speeds of adjustment under rising and falling market rates. Out flows of principal and interest depend on the attrition of deposit balances (due to depositor relocation and other factors) and, for interest-bearing deposits, on the relationship between offered and market rates. In addition to principal and interest, the cash out flows of demand deposits also include an estimate of the non-interest cost incurred by the institution of maintaining the deposits.

Discount rates for demand deposits are based on secondary market CD yields. See Chapter 6 for details.

## Section 3.B - Liability Methodologies

This section summarizes the methodologies used by the OTS NPV Model to estimate the economic value of each liability line in the IRR Exposure Report.

### DEPOSITS

#### *Fixed-Rate, Fixed-Maturity Deposit*

Fixed-rate, fixed-maturity deposits may be of two types: retail CDs and wholesale (or brokered) CDs. The two types are valued separately by the NPV Model, but are aggregated into two lines according to their remaining maturity in the IRR Exposure Report.

Both types of deposits are assumed to behave like zero-coupon instruments, with monthly payments of interest credited to the account balance rather than being paid out. Out flows of principal and accumulated interest are assumed to occur at maturity (for brokered CDs), upon early-withdrawal, or when the account balance is no longer rolled over in the case of retail CDs. In addition to principal and accumulated interest, the cash out flows of deposits include an estimate of the non-interest costs attributable to servicing such deposits.

The only early-withdrawal penalties considered explicitly are those stated in terms of months of forgone interest. Other types of early-withdrawal penalties, as well as other options (e.g., the option to roll over at a predetermined rate, etc.), are not valued by the Model, but may be valued by the reporting institution and reported in the Schedule CMR section titled, Reporting of Market Value Estimates. The value of any such options is incorporated into the institution's NPV estimate.

Wholesale deposits are assumed to be replaced at maturity with deposits paying market rates. Wholesale deposits are assumed to be withdrawn whenever the early-withdrawal penalty is less than the value of the spread between the current market rate on wholesale deposits and the rate currently being paid on the account.

Retail CDs share some of the valuation features of both wholesale CDs and demand deposits. Like wholesale CDs, retail CDs have a contractual maturity and an interest rate that is constant over the entire term to maturity. Upon reaching maturity, however, retail CDs have a probability of being rolled over at an interest rate that is lower than the prevailing rate for wholesale CDs of comparable maturity. In this respect, retail CDs resemble demand deposits.

The reporting of retail CDs in the Exposure Report reflects these two value components. The present value of a retail CD's cash flows up to and including its maturity date is reported on the liability side of the Report. The value that accrues to the institution from the likelihood that a given fraction of its retail CDs will roll-over after each maturity period and at rates favorable to the institution is reported on the asset side as a deposit intangible.

#### *Variable-Rate, Fixed-Maturity Deposits*

This category includes certificates that have contractually stated maturities and index rates. Cash flows are assumed to consist of periodic interest payments that are credited to the account balance and one principal payment at maturity.

The interest cash outflows of variable-rate deposits are estimated based on assumptions about the relationship between the index and market rates. These relationships are estimated statistically for each index rate.



Demand Deposits

*Transaction Accounts*

*MMDAs*

*Passbook Accounts*

*Non-Interest-Bearing Accounts*

Demand deposits are entered at their face value in the liabilities section of the Exposure Report. See the heading *Deposit Intangibles* in Section 3.A for more information on how demand deposits affect NPV.

## **BORROWINGS**

Discount rates for borrowings are based on the London Interbank Offered Rates (LIBOR). LIBOR is the rate that major international banks charge each other for large-volume loans and thus provides a benchmark for the marginal cost of funds for depository institutions. The zero-coupon LIBOR curve is derived from market quotes for several maturities of LIBOR.

*Fixed-Rate, Fixed-Maturity Borrowings*

FHLB advances, other borrowings, redeemable preferred stock, and subordinated debt are aggregated as *fixed-rate, fixed maturity borrowings*, and are assumed to have cash flows that depend only on the instruments remaining maturity and coupon. Thus, cash flows are assumed to consist of monthly or semi-annual interest payments, with all principal being paid at maturity. At the institution's option, the economic value of any option embedded in these instruments (such as call features) may be valued by the reporting institution and reported separately on Schedule CMR in the section titled, *Reporting of Market Value Estimates*.

*Variable-Rate, Fixed-Maturity Borrowings*

This category includes liabilities that have contractually stated maturities and indexed rates, such as FHLB advances. Cash flows are assumed to consist of periodic interest payments with principal repaid at maturity.

The interest cash out flows of variable-rate borrowings are estimated based on assumptions about the relationship between the index and market rates. These relationships are estimated statistically for each index rate.

## **OTHER LIABILITIES**

*Escrow Accounts for Mortgages*

Escrow accounts for mortgages are entered at their face value in the liabilities section of the IRR Exposure Report. For escrows associated with both owned mortgages and mortgages serviced for others, the face values less the estimated economic value appear in the assets section under the headings *Float on Escrows on Owned Mortgages* and *Float on Escrows on Mortgages Serviced for Others*. See those sections for more information on the calculation of their economic values.

*Other Escrow Accounts*

The economic value of Other Escrows (i.e., those not associated with mortgages) is calculated assuming a constant annual run-off rate. Monthly cash flows consist of accrued interest plus that month's decline in the principal balance. The cash flows are discounted by LIBOR.

*Collateralized Mortgage Securities Issued*

Collateralized Mortgage Securities Issued consists of collateralized mortgage securities that are not recorded as sales. Institutions may report the estimated economic value of these securities in Schedule CMR. For those institutions that elect not to use this option, it is assumed that the economic value of this category is equal to its book value in all interest rate scenarios.

*Miscellaneous I*

Miscellaneous Liabilities I consists of Accrued Interest Payable, Accumulated and Accrued Taxes, Dividends Payable, Accounts Payable, and Other Liabilities and Deferred Income. The economic value of these liabilities is assumed to be equal to their book value in all interest rate scenarios.

**OPTIONS ON LIABILITIES**

This line of the IRR Exposure Report contains the incremental value of options on liabilities as estimated by the institution. The incremental value is the difference between the estimated economic value of the liability with the option, minus the value of the liability without the option.

Institutions report information about liabilities with embedded options along with that reported for other liabilities in the appropriate sections of Schedule CMR. Thus, the estimated economic value of the liability without the option appears in the IRR Exposure Report line for that particular class of liabilities.

## Section 3.C – Financial Derivative and Off-Balance Sheet Contract Methodologies

This section summarizes the methodologies used by the NPV Model to estimate the economic values of financial derivative and off-balance sheet positions.

### OPTIONAL COMMITMENTS TO ORIGINATE

FRMs & Balloon/2-Step Mortgages

ARMs

Other Mortgages

Optional commitments to originate mortgages are contracts that obligate the reporting institution to originate mortgage loans at a specified interest rate wherein the potential borrower faces no substantial penalty for failing to take the loan. Mortgage commitments whose interest rate is free to change (i.e., those that do not have an interest rate lock) are not reported on Schedule CMR. Commitments that have a rate lock, but that have not received final credit approval are reported as optional commitments, despite the fact that the mortgage can yet be denied.

The NPV Model distinguishes, and values separately, optional commitments to originate the following eight types of mortgages: (1) 1-month COFI ARMs, (2) 6-month or 1-year COFI ARMs, (3) 6-month or 1-year Treasury ARMs, (4) 3-year or 5-year Treasury ARMs, (5) 5-year or 7-year balloon or 2-step mortgages, (6) 10-year, 15-year or 20-year FRMs, (7) 25-year or 30-year FRMs, and (8) all other mortgages.

The first step in valuing these commitments is to determine the economic value of the loans expected to close. This is done by referring to the same price look-up tables used to value mortgage loans. (The methodology used to value mortgage commitments is discussed in Section 7.B).

The second step is to determine the amount of loan origination and loan discount fees to be collected if all loans close. These fees contribute dollar-for-dollar to the value of the commitments.

Third, the NPV Model estimates the percent of the reported commitments that will actually close and become mortgage loans in each of the seven interest rate scenarios. The Model uses a closure rate of approximately 79 percent for commitments whose mortgage rate is less than or equal to the quarter-end, 60-day commitment rate. The closure rate decreases to a minimum of 64 percent for reported commitments whose rate is more than the quarter-end commitment rate.

Finally, the economic value of commitments to originate is determined by subtracting the par value of the mortgages to be originated from the economic value of the mortgage underlying the commitment, and adding the value of net origination fees. For example, if the underlying mortgage loans are determined to have a price of 102 percent of face value, the commitment to make the loan would have an economic value equal to 2 percent of face value.

### FIRM COMMITMENTS

Purchase/Originate Mortgages & MBS

Sell Mortgages and MBS

A firm commitment to purchase or sell mortgages or mortgage securities is an agreement to buy or sell a specified mortgage instrument on a specified date at a specified price. A firm commitment to originate a mortgage is

an obligation, binding both the lender and the borrower, to make a mortgage loan of a specified amount at a specified interest rate.

The NPV Model values firm commitments on eight categories of mortgages: (1) 1-month COFI ARMs, (2) 6-month or 1-year COFI ARMs, (3) 6-month or 1-year Treasury ARMs, (4) 3-year or 5-year Treasury ARMs, (5) 5-year or 7-year balloon or 2-step mortgages, (6) 10- 15- or 20-year FRMs, (7) 25-year or 30-year FRMs, and (8) all other mortgages. The Model distinguishes between commitments to purchase or sell whole loans versus MBS.

The NPV Model values separately each reported position in firm commitments to originate, purchase, or sell mortgages using a series of four steps. First, the Model determines the value of the underlying mortgage in each of the interest rate scenarios using the same look up table of mortgage prices used to value whole mortgage loans. Second, it determines the origination fees that will be realized and origination costs that will be incurred from originating the underlying loans. Third, the delivery value of the mortgages is calculated by multiplying the reported price stipulated in the commitment by the amount of the commitment. Finally, the Model calculates the value of commitments to originate in each scenario as: the value of the underlying mortgages in that scenario, plus net origination fees, less the delivery value of the mortgages.

To value commitments to sell mortgages or MBS, the procedure is the same as for commitments to purchase, but the result is multiplied by negative one.

Purchase Non-Mortgage Items

Sell Non-Mortgage Items

Why not have the institution report its own estimates as to the values of these instruments?

Commitments to purchase or sell liabilities and non-mortgage financial assets are agreements to purchase or sell financial assets other than mortgages or mortgage-backed securities, and commitments to purchase or sell liabilities, for a specified price, on a specified date.

All liabilities and non-mortgage assets underlying these commitments are valued as generic instruments that pay monthly interest cash flows and all principal at maturity. The commitments are assumed to have a base case value of zero. To accomplish this, the NPV Model calculates a set of discount factors that would discount the cash flows such that their sum equals the price at which the institution has committed to buy or sell the instrument.<sup>1</sup>

The commitments are valued in the alternate interest rate scenarios by estimating the price of the underlying asset or liability (using the same discount rate used in the base case plus the amount of the interest rate shock for that scenario), subtracting the price at which the institution has agreed to buy it, and multiplying the difference by the outstanding amount of the asset or liability. For example, if an institution has agreed to buy a bond for 98 percent of par, and the bond is estimated to have a price of 101 in the -100 basis point interest rate scenario, the commitment would have an economic value of 3 percent of par in that scenario. Commitments to sell are valued in the same way as commitments to purchase, with the result multiplied by negative one.

## **OPTIONS ON MORTGAGES & MBS**

An optional commitment to purchase mortgages grants the holder the right, but not the obligation, to buy mortgages or mortgage-backed securities, at a specified price (called the strike price), on a specified date (called the expiration date). An optional commitment to sell mortgages grants the holder the right, but not the obligation, to sell a specified type and amount of mortgages or MBS, with a specified WAC or pass-through rate, at a specified price on a specified date.

---

<sup>1</sup> For example, if an institution has agreed to sell a bond for 98 percent of par, the NPV Model calculates a set of discount factors to be used in the base case that causes the sum of the discounted cash flows of the "generic" instrument to equal 98 percent of par.

The NPV Model values four types of option positions for eight categories of mortgages. The four positions are: (1) long positions to purchase mortgages, (2) long positions to sell mortgages, (3) short positions to purchase mortgages, and (4) short positions to sell mortgages. (A long position means the thrift owns the option. A short position means the thrift has sold the option). Values for optional commitments are calculated for the following categories of mortgages: (1) 1-month COFI ARMs, (2) 6-month or 1-year COFI ARMs, (3) 6-month or 1-year Treasury ARMs, (4) 3-year or 5-year Treasury ARMs, (5) 5-year or 7-year balloon or 2-step mortgages, (6) 10-year, 15-year or 20-year FRMs, (7) 25-year or 30-year FRMs, and (8) all other mortgages.

Optional commitments on mortgages are valued using the Black (1976) option valuation formula. Five inputs are used to calculate the option's value: (1) the forward price of the underlying mortgage in each scenario, as calculated by the NPV Model, (2) the strike price, (3) time to expiration of the option, (4) the risk-free rate, given by the appropriate maturity treasury rate, and (5) the volatility of logarithmic price changes in the relevant mortgage.

## **INTEREST RATE SWAPS**

### *Pay Fixed, Receive Floating*

Fixed-for-floating interest-rate swaps are agreements to exchange a stream of fixed-rate interest payments for a stream of interest payments that float with a specified index of interest rates. The coupon payments are based on a notional principal amount.

The NPV Model values fixed-for-floating swaps with each of the following floating rate indices: one-month, three-month, and six-month LIBOR, three-month, one-year, three-year, five-year, seven-year, and ten-year Treasury, the 11th District Cost of Funds (COFI), and the prime rate.

The economic value of a swap is estimated as the present value of the floating-rate cash flows received minus the discounted present value of the fixed-rate cash flows paid. All swaps are assumed to have a zero dollar value at origination (i.e., the values of the pay and receive sides are equal).

For swaps based on LIBOR and Treasury indices, the projected floating rate equals the corresponding implied forward LIBOR or Treasury rate. For cost of funds swaps, the COFI index rates are projected using the equation for COFI mortgages. Both the fixed-rate and floating-rate side cash flows are discounted by the appropriate maturity spot rate corresponding to the rate paid by the floating-rate payer.

These swaps may include mortgage swaps or other amortizing swaps.

### *Pay Floating, Receive Fixed*

These swaps are valued in the same manner as the pay fixed, receive floating swaps described above except their economic value is estimated as the present value of the fixed-rate cash flows received minus the discounted present value of the adjustable-rate cash flows paid.

### *Basis Swaps*

Basis swaps are agreements to exchange one stream of interest payments that float with a given index of rates for a stream of payments that floats with a different index of rates.

The NPV Model values four types of basis swaps: one-month LIBOR-for-COFI, three-month LIBOR-for-COFI, six-month LIBOR-for-COFI, and three-month Treasury-for COFI swaps. (Treasury-for-LIBOR swaps are not reported on Schedule CMR because they are not considered to exhibit significant sensitivity to the interest rate simulations performed by the OTS model.)

The methodology used to value basis swaps is the same as that for fixed-for-floating swaps, except two floating rates are projected.

### Swaptions

A swaption is an option to enter into a specified swap agreement on a specified future date. The NPV Model values swaptions on Fixed-For-Floating swaps.

Swaptions are valued with the Black (1976) option valuation formula. Six inputs are used to calculate the option's value: (1) The forward swap rate (estimated as the corresponding implied forward rate), (2) the expiration date of the swap that underlies the swaption, (3) the expiration date of the swaption, (4) The strike price, (5) the risk-free rate, represented by the 3-month Treasury rate, and (6) the volatility, assumed to be an average historical volatility, of short-term rates.

To calculate the economic value in the alternate rate environments, the corresponding Treasury or LIBOR curves are adjusted by the amount of the interest rate shock, which alters the forward swap rate, and the risk-free rate of return is adjusted by the amount of the shock.

## **INTEREST RATE CAPS INTEREST RATE FLOORS**

An interest rate cap is an option contract that compensates the holder of the contract when an interest rate index rises above a preset rate (the cap rate or strike rate). An interest rate floor is a contract that compensates the holder when the interest rate falls below a preset rate (the floor rate or strike rate). The party that purchases the cap or floor is said to be long the cap or floor, while the party that sells the cap or floor is said to be short the cap or floor.

Caps and floors are valued using the Black (1976) option valuation formula. Each cap or floor is valued as a series of options represented by the contract. Five inputs are used to calculate each option's value: (1) the forward rate (estimated as the corresponding implied forward rate), (2) the strike rate, (3) the time to expiration, (4) the risk-free rate, represented by the appropriate maturity Treasury rate, and (5) the volatility, estimated as the average historical volatility of the nearby Eurodollar Futures contract for near-term options in the series, adjusting to a long-term estimate of volatility for LIBOR for later options in the series.

## **FUTURES**

The NPV Model values the following futures contracts: Treasury bond, 2-year, 5-year, and 10-year Treasury notes, 1-month LIBOR, 3-month Eurodollar, 3-month Treasury bill, 30-day interest rate, 3-year and 5-year swaps, and 30-year mortgage-backed futures. On Schedule CMR, institutions report the contract codes that represent the types of futures contracts they hold, and the amounts of their positions.

Futures contracts are marked-to-market daily and cash is paid or received so that the market value of the position is zero at the end of each day. As a result, the economic value of futures in the base case of the IRR Exposure Report is zero.

The estimated economic value of a futures position in the alternate rate scenarios is equal to the difference between the estimated futures price in the alternate rate environment and the futures price in the base case, multiplied by the size of the position. For Treasury note or bond futures, the NPV Model uses the futures price of the cheapest-to-deliver (CTD) security in each alternate rate environment.

**OPTIONS ON FUTURES**

A call option on a futures contract gives the holder the right, but not the obligation, to acquire a long position in a futures contract at a specified price (the strike price) on a specified date (the expiration date). A put option on a futures contract gives the holder the right, but not the obligation, to acquire a short position in a futures contract at a specified price and on a specified date.

The NPV Model values four types of options positions on eight different futures contracts. The four option positions are: (1) long call, (2) long put, (3) short call, and (4) short put. (A long position indicates the thrift has bought the option. A short position indicates the thrift has sold the option.) The eight futures contracts underlying the options are: (1) 30-day interest rate futures, (2) 3-month Treasury bill futures, (3) 2-year Treasury note futures, (4) 5-year Treasury note futures, (5) 10-year Treasury note futures, (6) Treasury bond futures, (7) 1-month LIBOR futures, and (8) Eurodollar futures.

Schedule CMR provides the following information on each option position reported: (1) the notional principal amount, (2) the strike price, and (3) the expiration date of the option.

The NPV Model values options on futures with the Black (1976) option valuation formula described in Section 7.A. Five inputs are used to calculate the option's value in each scenario: (1) the price of the underlying futures contract in the scenario being evaluated (2) the strike price, (3) the time to expiration, (4) the risk-free rate, represented by the appropriate Treasury rate, and (5) the volatility, estimated as an average historical volatility of the option contract.

**CONSTRUCTION LIP**

Construction loans in process (LIP) are construction loans on which the institution has closed but has not yet disbursed the proceeds.

The economic value of construction LIP is determined by estimating the value of the underlying loan, and subtracting par. For example, if the underlying loan has a value of 102 percent of par, the commitment to make the loan would have a value equal to 2 percent of par. The underlying loan is valued in the same way as construction loans. (See Section 5.Q for a discussion of the valuation of construction loans).

**SELF-VALUED POSITIONS [CMR912 through 918]**

The financial derivative and off-balance sheet page of Schedule CMR accommodates the reporting of 16 financial derivative and off-balance sheet positions and their associated characteristics. If an institution has more than 16 contracts, it may provide its own estimated economic values for the seven interest rate scenarios of any remaining positions. The Self-Valued line on the Exposure Report reports the economic values of contracts institutions have chosen to value themselves.

Alternatively, institutions can report additional contracts in the same manner as the initial 16 by adding pages to the financial derivative and off-balance sheet section of Schedule CMR. In the latter case, OTS calculates the estimated economic values of these positions and reports them along with the initial 16 in the appropriate categories of the Exposure Report.

**NET PORTFOLIO VALUE**

Net Portfolio Value equals the estimated economic values of all assets, less the estimated economic values of all liabilities, plus or minus the estimated economic values of financial derivative and off-balance sheet contracts.