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Risk Modeling Bulletin Issue 8

NPV Distribution and VaR Decomposition

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The interest rate risk of a bank can be described by the distribution of the NPV over a three-month horizon. The potential loss in NPV at the 95% confidence level is called the value-at-risk (VaR). Which items are the main contributors to VaR, taking the diversification and cross hedging on the balance sheet into account? This issue provides an answer to this question in the feature article. In the market perspective, the issue describes the correlations among the interest rates used in the simulation that generates the distribution of NPV.

Feature Article: NPV Distribution

To determine the main contributors to VaR is important in managing the interest rate risk of a bank. The information enables the bank to focus on the appropriate items on the balance sheet to hone in on the optimal trade-off between risk and returns.

Consider the following simulation. Table 1 reports the fractional contribution, ($Beta/NPV), of each balance sheet item to VaR(95%). It provides a decomposition of a bank's VaR on June 30, 2006. Table 1 shows that most of the market risk (82.2%) of the bank comes from the Mortgage Loans and Securities item. Note that the contribution can be negative. Consider the item "other assets". Table 1 shows that the "other assets" provide cross hedging to the main risk drivers on the balance sheet. Figure 1 and Table 2 show a further disaggregation of the mortgage risk.

TABLE 1: VaR (95%) Decomposition of the Thrift Benchmark on June 30, 2006

Balance Sheet Item	$Beta/VaR(95%)
MORTGAGE LOANS AND SECURITIES	0.822
NONMORTGAGE LOANS	0.006
CASH, DEPOSITS, AND SECURITIES	0.026
REAL ASSETS, ETC.	0.000
MORTGAGE LOANS SERVICED FOR OTHERS	0.000
OTHER ASSETS	-0.029
DEPOSITS	0.168
BORROWINGS	0.007
OTHER LIABILITIES	0.000
Self-Valued	0.000
Off-Balance-Sheet	0.000
NET PORTFOLIO VALUE #	1.000

Figure 1 and Table 2 show that 15-Year Mortgages and MBS and 30-Year Mortgage Loans contribute 42.8% and 20.7%, respectively, of the mortgage risk. They suggest that the risks are quite concentrated on a few items on the balance sheet and that the management should focus on the 15- and 30-year mortgage loan and securities risks.

FIGURE 1

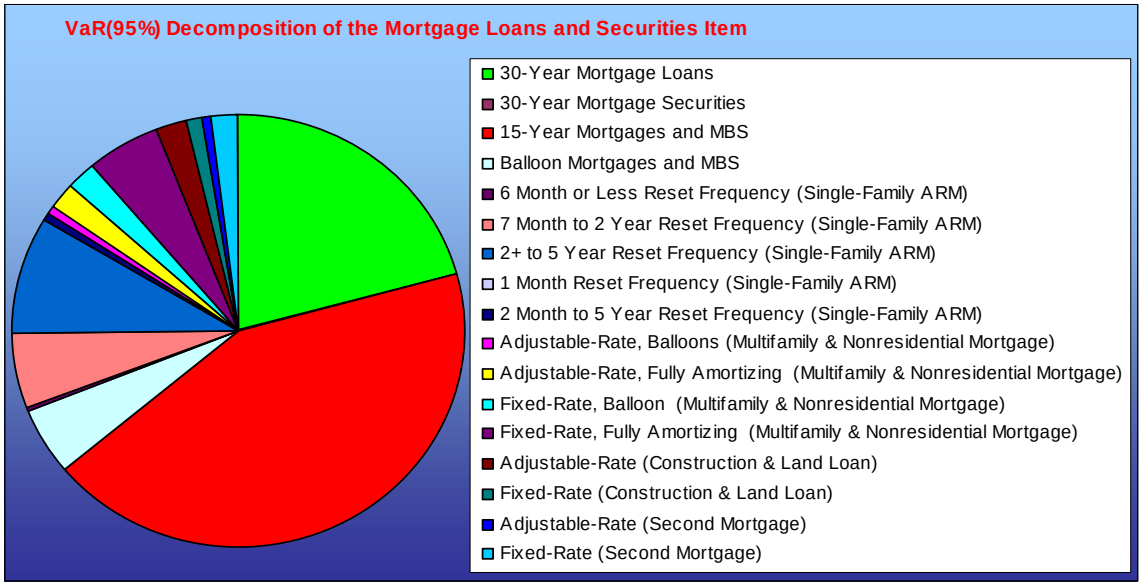

TABLE 2: VaR(95%) Decomposition of the Mortgage Loans and Securities

Mortgage Item	$Beta/VaR(95%)
30-Year Mortgage Loans	0.207
30-Year Mortgage Securities	0.002
15-Year Mortgages and MBS	0.428
Balloon Mortgages and MBS	0.051
6 Month or Less Reset Frequency (Single-Family ARM)	0.003
7 Month to 2 Year Reset Frequency (Single-Family ARM)	0.056
2+ to 5 Year Reset Frequency (Single-Family ARM)	0.089
1 Month Reset Frequency (Single-Family ARM)	0.000
2 Month to 5 Year Reset Frequency (Single-Family ARM)	0.004
Adjustable-Rate, Balloons (Multifamily & Nonresidential Mortgage)	0.005
Adjustable-Rate, Fully Amortizing (Multifamily & Nonresidential Mortgage)	0.020
Fixed-Rate, Balloon (Multifamily & Nonresidential Mortgage)	0.023
Fixed-Rate, Fully Amortizing (Multifamily & Nonresidential Mortgage)	0.052
Adjustable-Rate (Construction & Land Loan)	0.023
Fixed-Rate (Construction & Land Loan)	0.011
Adjustable-Rate (Second Mortgage)	0.006
Fixed-Rate (Second Mortgage)	0.019
TOTAL MORTGAGE LOANS AND SECURITIES	**1.000**

Market Perspective: Interest Rate Correlations for Simulations

The distribution of the NPV is simulated with a Monte Carlo random value generator. The random sample of interest rate scenarios is generated from the historically estimated interest rate volatilities and correlations.

Table 3 reports the correlation matrix of the interest rates used in the simulation. The matrix shows that the interest rates are positively correlated. The long rates are highly correlated. The short rates and the long rates are less correlated.

TABLE 3: Correlation Matrix of the Interest Rates

Term	0.25yr	0.5yr	1yr	2yr	3yr	5yr	7yr	10yr	20yr	30yr
0.25yr	1	0.936	0.837	0.701	0.63	0.533	0.443	0.377	0.087	0.083
0.5yr		1	0.938	0.832	0.77	0.675	0.587	0.509	0.224	0.154
1yr			1	0.94	0.895	0.816	0.731	0.654	0.379	0.291
2yr				1	0.989	0.95	0.898	0.832	0.573	0.426
3yr					1	0.98	0.945	0.887	0.649	0.493
5yr						1	0.982	0.946	0.736	0.595

7yr							1	0.976	0.821	0.67
10yr								1	0.863	0.75
20yr									1	0.867
30yr										1

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Contact us if you have any questions, suggestions or comments

support@thomasho.com Voice: 1-212-732-2878 Fax: 1-212-608-1233
Http://www.thomasho.com 5 Liberty Street, 4B, New York, NY 10005-1003 USA