



# Interest Rate Risk Monitor (IRRM)

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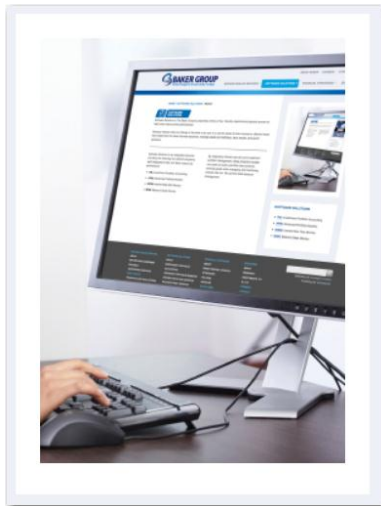
## An Introduction and Overview

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*“At various times, banks have had to cope with panics, recessions, depressions, deflation, and inflation to survive and prosper. Many banks managed to adapt to changing conditions; however, many were engulfed by the events. The survivors either anticipated or recognized the impact events would have on the banking business. Accordingly, they established policies and procedures designed to deal effectively with the particular situation.”*

*...Dr. James V. Baker, Jr.*

Since the founding of The Baker Group in 1979, the firm remains dedicated to helping client institutions navigate the unpredictable changes inherent in the banking industry. Most recently, community banks have been challenged by a painful mix of historically low interest rates, unprecedented monetary policy, and new regulatory expectations. More than ever before, banks need access to powerful tools for modeling exposures to interest rate risk, stress testing the balance sheet, and simulating the impact of different potential environments and market conditions. The Interest Rate Risk Monitor (IRRM) has been designed specifically for community-banks to help them satisfy this need.



IRRM enables banks to assess and manage the future impact of changing interest rates on profitability and equity position. It projects earnings and volatility of equity capital under various balance sheet and interest rate scenarios. It produces standard measures of price risk for the entire balance sheet including modified duration, effective duration and convexity. And it projects balances and yields per account for 12- and 24-month budgeting purposes. Importantly, as the regulatory environment has moved decidedly toward greater scrutiny of interest rate risk processes, IRRM reports are designed to be fully compliant with examiner expectations.

This user's guide is intended to provide basic information about the IRRM model, interpretation of reports, and an explanation of methodologies. Additional sections include information about data input and assumptions, as well as specific information for directors. We hope Baker IRRM clients find it useful.

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## Interest Rate Risk Monitor: Overview & Summary ALCO Reports

Interest Rate Risk Management requires proper analysis of balance sheet data in a dynamic context, and a good reporting system is necessary for that analysis. The **Interest Rate Risk Monitor (IRRM)** has been designed to satisfy the fundamental needs of a sound reporting system. The data is thorough and detailed, but the reports are readable and useful for risk assessment and strategy development. Separate reports are designed for the three primary constituencies who will make use of them: bank management, bank directors, and regulatory authorities. Key reports are accompanied by descriptive text and explanation to assist in interpretation and analysis.

**Summary ALCO:** This is the executive summary for a full set of IRRM reports. It provides the essential information necessary for analysis. This includes the following reports:

### Summary ALCO - Asset/Liability Mix

Sample Bank - Anywhere, US

03/31/2012
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Balances (\$000's)	Book Value	% of Book TA	Total is % of Segment			**Rate Sensitive < 1 Year	*Book Yield/ Rate	*Reinv. Rate	Full Indx. Rate	*12 Mo. Proj. Yield/Rate	Avg. Life	Effective Duration	Effective Convexity
			Fixed	Var.	Non Int.								
Cash & Due	\$23,317	5.35		8.74	91.26	8.74	0.22	0.22 / 0.22	0.22	0.00	0.00	0.00	
Investments <i>(Includes MTM)</i>	\$140,931	32.36	96.72		3.28	16.09	4.11	2.59 / 0.00	3.76	3.97	2.39	(0.69)	
Funds Sold	\$8,120	1.86		100.00		100.00	0.12	0.12 / 0.12	0.12	0.04	0.02	(0.01)	
Loans	\$245,154	56.29	20.00	81.57	(1.57)	40.52	6.22	5.48 / 6.25	6.12	4.78	2.41	(0.96)	
Other Earning Non-Earning	\$17,968	4.13			100.00								
<b>Total Assets</b>	<b>\$435,490</b>	<b>100.00</b>	<b>42.56</b>	<b>48.25</b>	<b>9.19</b>	<b>30.35</b>	<b>5.34</b>	<b>4.35 / 5.98</b>	<b>5.15</b>	<b>3.98</b>	<b>2.13</b>	<b>(0.76)</b>	
Non-Maturing Deposits	\$222,980	51.20		63.28	36.72	24.16	0.45	0.45 / 0.45	0.45	5.76	2.20	(1.10)	
Certificates of Deposit	\$51,687	11.91	100.00		0.00	73.88	1.13	0.98 / 0.00	1.03	0.93	0.63	(0.17)	
Jumbo CDs	\$106,295	25.10	100.00			75.89	1.22	1.02 / 0.00	1.07	1.04	0.72	(0.18)	
Borrowed Funds	\$3,000	0.69		100.00		100.00	0.25	1.00 / 1.00	1.00	0.12	0.08	(0.03)	
Other Paying Non-Paying	\$4,489	1.03			100.00								
<b>Total Liabilities</b>	<b>\$391,651</b>	<b>89.93</b>	<b>41.15</b>	<b>36.79</b>	<b>22.05</b>	<b>45.46</b>	<b>0.84</b>	<b>0.75 / 0.47</b>	<b>0.78</b>	<b>3.70</b>	<b>1.54</b>	<b>(0.70)</b>	
<b>Total Equity Capital</b>	<b>\$43,839</b>	<b>10.07</b>									<b>0.73</b>	<b>(0.13)</b>	
<b>Total Liab &amp; Capital</b>	<b>\$435,490</b>	<b>100.00</b>											

Liquidity Ratios	Constant	ALCO Benchmark
Investments / Deposits	36.69	< 70.00%
Loans / Deposits	63.82	< 80.00%
Loans / Assets	56.29	< 90.00%
Loans / Capital	559.21	< 800.00%
Net Borrowed Funds / Capital	(11.68)	< 200.00%
Reliance on Wholesale Funding	0.77	< 15.00%
Dependency Ratio	22.15	< 25.00%
Liquid Assets / TA	12.42	> 10.00%
Jumbo CDs / TA	25.10	< 35.00%
Available Line of Credit	\$48,000	

Ratio is outside benchmark.

**Asset Mix**

**Liability Mix**

Note: Values are rounded before printing, but full precision values are used in all calculations.  
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**Interest Rate Risk Monitor**

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**Summary ALCO - A/L Mix:** A snapshot of the balance sheet as of report date. This report shows broad categories of assets and liabilities, and essential measures of those items across the columns. Key liquidity measures are also shown on this page along with pie charts of the asset / liability mix. This page provides a starting point for understanding the interest rate risk position of the bank. Among other things, the balances of various asset and liability categories are listed along with the percentage of each balance that is rate sensitive (re-priceable) in the next 12 months. Existing book yields and rates are shown alongside the new reinvestment rates for each category so users can get an idea of rate differentials for repricing balances and the expected impact on interest income and expense.

**Liquidity Ratios** - The IRRM report lists certain key liquidity ratios on the Asset / Liability Mix page. These measures and definitions are listed below.

<b>Liquidity Ratios</b>	<b>Constant</b>	<b>ALCO Benchmark</b>
Investments / Deposits	36.69	< 70.00%
Loans / Deposits	63.82	< 80.00%
Loans / Assets	56.29	< 90.00%
Loans / Capital	559.21	< 800.00%
Net Borrowed Funds / Capital	(11.68)	< 200.00%
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Jumbo CDs / TA	25.10	< 35.00%
Available Line of Credit	\$48,000	
✓ Ratio is outside benchmark.		

▪ **Investments / Deposits**

The investment to deposit ratio displays the percentage of deposits used to fund investments. Since there is an actively traded investment market, a high percentage of investments to deposits could display a very liquid balance sheet if these securities book value was equal or close to market value.

- Investments / Deposits = Total Securities / Total Deposits

▪ **Loan / Deposits**

Many banks and bank analysts monitor loan / deposit ratios as a measure of liquidity. Loans are presumably the least liquid of assets, while deposits are the primary source of funds. A high ratio indicates illiquidity because a bank is fully loaned up relative to its stable funding. Implicitly, new loans or other asset purchases must be financed with large purchased liabilities, which can be very expensive. A low ratio suggests that a bank has additional liquidity because it can grant new loans financed with stable, low cost deposits.

- Loans Category / (Non-Maturing Demand + CD > \$250,000 + CD < \$250,000) 100

▪ **Loans / Capital**

Loans / capital displays the amount of loans versus the amount of primary capital for a particular institution. History has shown that institutions with loan amounts equivalent to eight times tier 1 capital are testing the limits of prudence. Ratios much lower than eight times capital could be considered the norm for most institutions. Loans / capital is derived by:

- Total Loans / Net Tier 1 Capital

▪ **Net Funds Borrowed / Capital**

Net funds borrowed / capital is monitored by analysts and bank managers to display the extent to which bank managers are forced to utilize purchased funds to maintain steady growth.

- ((Borrowed Funds - Funds Sold) / Capital) 100

▪ **Reliance on Wholesale Funding**

- Reliance on Wholesale Funding = (Total Borrowings + Brokered Deposits) / (Total Borrowings + Total Deposits)

- **Dependency Ratio**

The Dependency Ratio displays the amount to which an institution's long term assets are dependent on short term (volatile) liabilities for funding. The dependency ratio is calculated by:

- $\text{Dependency Ratio} = ( ( \text{Non-Core Liabilities} - \text{Short Term Investments} ) / ( \text{Long Term Assets} * 100 ) )$

- **Liquid Assets / Total Assets**

Asset liquidity refers to the ease of converting an asset to cash with a minimum amount of loss. The most liquid assets typically mature in the near term and are highly marketable. The liquidity ratio is expressed as a percentage of total assets. The Liquidity Ratio is calculated by:

- $( \text{Cash \& Due} + \text{ST Investments} - \text{Pledged Investments} + \text{Funds Sold} + \text{Trading Account} ) / \text{Total Assets}$
- ST Investments = all investments that mature or paydown within a one year time frame.

- **Jumbo CDs / Total Assets**

Jumbo CD's, or time deposits over \$250,000, typically tend to be highly volatile in that purchasers of CD's that size tend to pay close attention to interest rates. This close monitoring of the term structure of interest rates allows purchasers to shop around for the highest rate. This shopping around causes this type of liability to be highly volatile money, hot money. It is vital to banks to keep large percentages of deposits from leaving the bank at one time. Therefore, managers and analysts use this ratio to protect against runs on the bank. Over \$250m Dep. / Total Assets is calculated by:

- $( \text{Certificates of deposits of } \$250\text{m or more} + \text{Open Account Time Deposits of } \$250\text{m} ) / \text{Total Assets}$

- **Available Line of Credit**

This includes the amount of any and all borrowing lines that are currently unencumbered and untapped by the bank. Unused lines of credit at the Federal Home Loan Bank, for example, would be listed.

**\*Note:** In some cases, the call report will show different measures for the same ratio seen in IRRM. This is simply due to methodological differences in the calculations (e.g. average balance versus end-of-period balance in the denominator of a calculation can produce notably different results).

## Summary ALCO - Gap Measures

Sample Bank - Anywhere, US

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Effective Gap (\$000's)	12 Month	12 Month	24 Month*
	Cumulative	ALCO Benchmark	Cumulative
RS Assets/RS Liabilities	74.23	70 to 130%	115.37
GAP	(45,880)		32,316
GAP/Equity	(104.66)	+/- 200%	73.72
RS Assets/Total Assets	30.35 ✓	40 to 60%	55.71
RS Liabs./Total Assets	40.88	40 to 60%	48.29
GAP/Total Assets	(10.54)	+/- 15%	7.42

Effective Gap considers effective maturities of core deposits, it reports non-maturing demand accounts according to the preferred maturity distribution table.

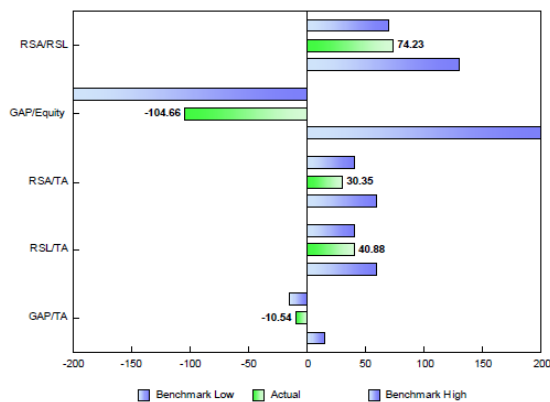
✓ Ratio is outside benchmark.

Repricing Gap Position (\$000's)	12 Month	12 Month	24 Month*
	Cumulative	ALCO Benchmark	Cumulative
RS Assets/RS Liabilities	49.82 ✓	70 to 130%	84.72
GAP	(133,112)		(43,768)
GAP/Equity	(303.64) ✓	+/- 200%	(99.84)
RS Assets/Total Assets	30.35 ✓	40 to 60%	55.71
RS Liabs./Total Assets	60.91	60 to 80%	65.76
GAP/Total Assets	(30.57) ✓	+/- 15%	(10.05)

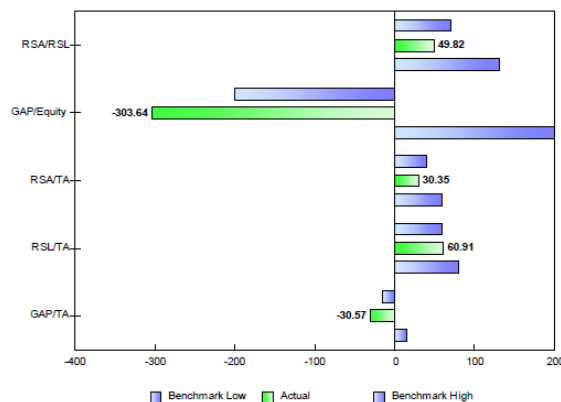
Repricing Gap does not consider effective maturities of core deposits, it reports non-maturing demand accounts according to repricing opportunity.

✓ Ratio is outside benchmark.

Cumulative Effective Gap Measures  
12 Month Horizon



Cumulative Repricing Gap Measures  
12 Month Horizon



\* The 24 month period could be extended if the 24th month is in the middle of a bucket period.

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**Interest Rate Risk Monitor**

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**Summary ALCO - Gap Measures:** This report shows various measures of the rate sensitive Gap which is simply the dollar difference between rate sensitive assets (i.e. assets that re-price or mature) and rate sensitive liabilities for a particular time period, usually 12 months. If more assets re-price than liabilities, the number will be positive which shows that an institution is asset sensitive, or "positively gapped". Traditional Gap theory says that an asset sensitive institution will generally realize an increase in income if interest rates rise due to the fact that more assets than liabilities will be rolling over and repricing into higher market rates. In this case, all else being equal, earning asset yield will rise faster than the cost of liabilities. The exact opposite takes place if the bank has a negative Gap, where more liabilities than assets re-price during the period. It is important to note that Gap analysis deals only with balances of rate sensitive assets and liabilities, and ignores the rates (yields or costs) associated with those repricing balances. It is therefore only a crude indicator of the potential change in net income.

**Effective Gap versus Repricing Gap:** One of the problems with Gap measures involves the treatment of non-maturing deposits. These liability accounts (such as Checking, Savings, and MMDA) do not have an identifiable maturity date and contractually the rate may be changed by the bank any time it chooses. So there arises a question as to whether these items should be treated as always and immediately rate sensitive, or if they should be assigned a rate sensitivity that more accurately reflects their true behavior.

- **Repricing Gap** is defined as a gap measure that utilizes contractual repricing dates in the allocation of assets and liabilities across predefined time periods. A repricing gap treats non-maturing deposits as though they will immediately and instantly re-price each time market rates move. Repricing Gap does not consider the actual behavior of non-maturing deposits in terms of how they affect the balance sheet.
- **Effective Gap** is a more useful measure for rate sensitivity analysis. Effective gap uses behavioral assumptions that more accurately model the rate sensitivity of non-maturing deposits. Effective Gap is considered to be the more meaningful measure for analysis since it looks at the true behavior of non-maturing deposits rather than the contractual ability to re-price. The IRRM uses FDICIA 305 guidelines as a default treatment of non-maturing deposits in order to arrive at the Effective GAP.

**Treatment of Non-Maturity Deposits:** Most banks have a large percentage of their liabilities in core deposits or non-maturity deposits (DDA, NOW, and MMDA). These liabilities are difficult to model with respect to rate sensitivity and repricing behavior. The rates paid on Core deposits are generally considered to be “administered” rates in the sense that they set or changed at anytime at the discretion of bank management. Often, core deposit rates are barely moved for lengthy periods of time, but to some degree bank managers will move these rates according to changes in the general interest rate environment. Every bank is different in this respect. In order to model these deposits appropriately, we must use some sort of guidelines for estimating how rate sensitive these accounts are likely to be.

As a base case default or starting point, the **IRRM** may draw on the sort of guidelines originally proposed in section 305 of the FDIC Improvement Act of 1991 (FDICIA). These guidelines provide for a percentage of the balance in different non-maturing deposit accounts to be treated as re-priceable or rate sensitive across a range of maturity buckets. This scheme of maturity distribution is shown in the table below.

**FDICIA 305: Maturity Distribution Limits for Non-Maturity Deposits**

	0-3 mos (pct)	3-12 mos (pct)	1-3 yrs (pct)	3-5 yrs (pct)	5-10 yrs (pct)
Commercial DDA....	50	0	30	20	.....
Retail DDA.....	0	0	60	20	20
MMDA.....	0	50	50	.....	.....
Savings.....	0	0	60	20	20
NOW.....	0	0	60	20	20

This treatment of non-maturity deposits will result in average life and duration measures that are greater than zero, but still fall within reasonable ranges for analysis of economic value. ***It is important to note that industry averages or guidelines may serve as a starting point, but are not intended to replace the need for banks to evaluate and consider the unique characteristics of their individual deposit bases when determining their rate sensitivity.*** IRRM clients now have a non-maturity deposits analysis done periodically in order to more accurately reflect the behavior of their bank’s deposit balances.

**Note: More detail on the treatment of non-maturity deposits can be found in a supplemental section of this report.**



## Summary ALCO - Earning Power Measures

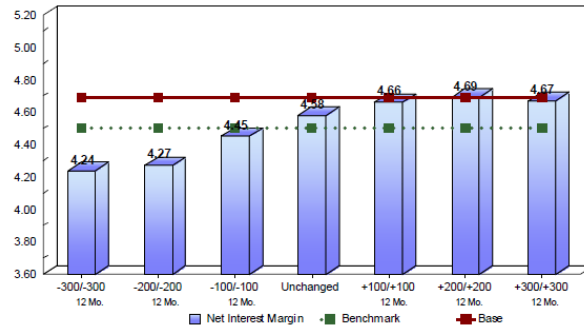
Sample Bank - Anywhere, US

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Earning Power	YTD Annualized	Constant Balance Sheet *		YTD Annualized	Constant Balance Sheet	ALCO Benchmark
Interest Income:	\$19,498	\$21,103	Efficiency Ratio	70.40 ✓	68.99 ✓	< 65.00%
Tax Adjusted Interest Income: <sup>⊖</sup>	\$20,372	\$21,103	Earning Assets/Paying Liab.		129.54	> 115.00%
Interest Expense:	\$2,515	\$2,565	Yield on Earning Assets (EA)		5.34	
<b>Net Interest Income before Provision:</b>	<b>\$16,983</b>	<b>\$18,538</b>	Rate on Paying Liabilities (PL)		0.84	
Provisions for Loan Loss:	\$(380)	\$(380)	Earning Interest Spread (difference)		4.50	> 4.20%
<b>Net Interest Income:</b>	<b>\$16,603</b>	<b>\$18,158</b>	Cost of Funds	0.61	0.59	
Non Interest Income:	\$3,256	\$3,256	Net Interest Margin	4.56	4.69	> 4.50%
Non Interest Expense:	\$15,036	\$15,036	To break even the bank needs a margin of	3.01	2.98	
Operating Income before G/L, Tax & Extra Items:	\$4,823	\$6,378	To achieve a target of 1.00 ROA, the bank needs a Margin of <sup>⊖</sup>	4.71	4.74	
Realized Gain/Loss + Extra Items: <sup>⊖</sup>	\$0	\$0	To achieve a target of 10.00 ROE, the bank needs a Margin of	4.80	4.76	
Taxes:	\$(800)	\$(1,850)				
<b>Net Income(Loss):</b>	<b>\$4,023</b>	<b>\$4,528</b>				
Available Line of Credit:	\$48,000					
Risk Weighted Assets:	\$247,237					
Avg. Earning Assets:	\$391,628					
Avg. Total Assets:	\$414,401					
Equity/Total Assets:	10.07					
Desired After Tax ROA:	1.00					
Desired After Tax ROE:	10.00					
Effective Tax Rate:	29.00%					
Marginal Tax Rate:	34.00%					
Taxable this year?	Yes					
OREO:	\$0					

Net Interest Margin per Rate Shift  
12 Month Horizon



<sup>⊖</sup> Adjusted Interest Income is calculated using the Interest Income, Tax Exempt Income, and Marginal Tax Rate. <sup>⊖</sup> For YTD Annualized, if Average Total Assets or Average Earning Assets were entered, they will be used.  
<sup>⊖</sup> Realized Gain & Extra Items are non-recurring events. \* Indicates which column is used for calculating base case.

**Summary ALCO - Earning Power Measures:** This report provides several key pieces of information about the baseline performance of the bank. Key performance ratios are shown on a YTD annualized basis as well as a “Constant Balance Sheet” basis which is defined below. The establishment of a base case of earnings is a necessary precondition to the dynamic analysis of a bank’s interest rate risk. Knowing that we must first establish a baseline or benchmark against which to measure changes, we may use one of two different methods for deriving this base case.

- **YTD Annualized** – One method for determining the base case is to simply look at actual year-to-date annualized performance and assume that the bank continues on the same trajectory for the next twelve months. We are using the performance of the recent past to project the base case for the coming year. The potential problem with this method is that often there may have been one-time or non-recurring income or expense events that skew the year-to-date performance. Also, many banks experience seasonality or calendar-year patterns of performance that can introduce distortions. For banks such as these, we use an alternative method for deriving the base case called the Constant Balance Sheet method.
- **Constant Balance Sheet** – This method for calculating the base case simply takes the balances of assets and liabilities that existed on report date, applies the actual rates associated with those balances and then does the multiplication. This method takes a snapshot of existing (not historical) balances and rates, and extrapolates a baseline for earnings. The base case net-interest income is just (Earning Assets Balance x Asset Yield –

Paying Liabilities Balance x Liability Cost). Non-interest income and expense are plugged in or assumed to be the actual year-to-date numbers annualized.

- **Earning Power Measures:** Bank Earnings arise ultimately from income exceeding expenses. Various metrics exist which allow us to track the earning potential or earning power of a bank at a point in time. For example:
  - **Efficiency Ratio:** The efficiency ratio displays how well bank managers are utilizing the bank's resources to produce healthy returns for the shareholders. The efficiency ratio can be thought of as total overhead expense (i.e. non-interest expense) divided by total operating income less interest expense. The efficiency ratio is calculated by:  $\text{Total Overhead Expense} / (\text{Total Operating Income} - \text{Interest Expense})$ .
  - **Earning Assets / Paying Liabilities:** This ratio is an earning power measure that displays the amount of earning assets that an institution possesses for every dollar of paying liabilities. Equilibrium is achieved when a measure of 100 is achieved, however for an institution to profit from business a spread should exist. In historical terms banks have been able to maintain a level of \$1.17 of earning assets for every \$1.00 of paying liabilities.
  - **Net Interest Margin:** The net interest margin is the dollar difference between interest income and interest expense expressed as a percentage of average assets.
    - **Breakeven Margin:** The breakeven margin is the level of net interest margin that an institution must earn on its average earning assets in order to pay all of its expenses. It is the level of net interest margin that produces no net income.
    - **Target Margin:** The target margin is the level of net interest margin that an institution must earn on its average earning assets in order to reach its desired return goals.

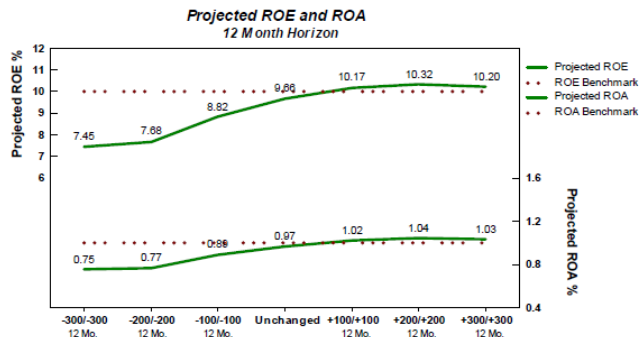
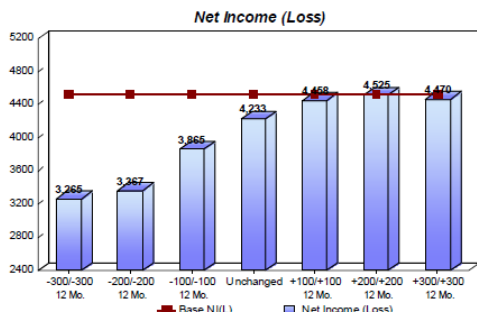
## Summary ALCO - Earnings Simulation - 12 Month Horizon

Sample Bank - Anywhere, US

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Interest Rate Risk (\$'s) Shift Horizon	YTD Annualized	Constant Balance Sheet **	Parallel	Parallel	Parallel	Unchanged Rate Scenario	Parallel	Parallel	Parallel	
			-300/-300 bp 12 Mo.	-200/-200 bp 12 Mo.	-100/-100 bp 12 Mo.		+100/+100 bp 12 Mo.	+200/+200 bp 12 Mo.	+300/+300 bp 12 Mo.	
<b>12 Month Horizon in \$'s</b>										
Change in Interest Income *	\$20,372	\$21,103	(2,512,886)	(2,232,434)	(1,314,701)	(514,765)	63,170	442,160	697,446	
Change in Interest Expense	\$2,515	\$2,565	(733,153)	(596,890)	(379,784)	(98,919)	161,820	446,554	779,820	
<b>Net Interest Change</b>			<b>(1,779,733)</b>	<b>(1,635,544)</b>	<b>(934,917)</b>	<b>(415,846)</b>	<b>(98,650)</b>	<b>(4,394)</b>	<b>(82,374)</b>	
<b>Projected Impact in \$000's</b>										
Net Interest Income *	\$16,983	\$18,538	16,758	16,903	17,603	18,122	18,439	18,534	18,456	
Net Interest Margin *	4.56	4.69	4.24 ✓	4.27 ✓	4.45 ✓	4.58	4.66	4.69	4.67	
ALCO Benchmark	> 4.50%									
NIC as a % of NII			(9.60)	(8.82)	(5.04)	(2.24)	(0.53)	(0.02)	(0.44)	
ALCO Risk Limits			> -20.00%	> -20.00%	> -15.00%	> -10.00%	> -15.00%	> -20.00%	> -20.00%	
<b>Net Income (Loss)</b>	<b>\$4,023</b>	<b>\$4,528</b>	<b>3,265</b>	<b>3,367</b>	<b>3,865</b>	<b>4,233</b>	<b>4,458</b>	<b>4,525</b>	<b>4,470</b>	
Return on Assets	0.97	1.04	0.75 ✓	0.77 ✓	0.89 ✓	0.97 ✓	1.02	1.04	1.03	
ALCO Benchmark	> 1.00%									
Return on Equity	9.18	10.33	7.45 ✓	7.68 ✓	8.82 ✓	9.66 ✓	10.17	10.32	10.20	
ALCO Benchmark	> 10.00%									



\* Income is tax adjusted and calculated before Provisions.

\*\* Indicates which column is used for calculating base case.

(Short End = 1yr; Long End = 10yr)

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The Baker Group Software Solutions, Inc. - IRRM - (Ver 4.0 R6) Copyrighted 1994 - 2013 1/28/2012 9:33:26AM - JEPFC/ABC13

**Interest Rate Risk Monitor**

4

**The Baker Group**  
Software Solutions

**Summary ALCO Earnings Simulation – 12 Month Horizon:** This is a key report for management to gauge future performance under different conditions. **IRRM** simulates the dynamics of repricing and maturing balances of assets and liabilities in order to capture the fluctuations in income and expense under different interest rate scenarios. This requires a variety of behavioral assumptions to be built into the model. These assumptions include critical inputs about principal prepayment rates, time lags, and sensitivities of different types of assets and liabilities to changes in market interest rates. The output of the simulation shows the projected changes in a number of performance measures including net interest income, net interest margin, and returns on assets and equity among others. The **IRRM** allows for non-parallel yield curve shifts to be modeled as well.

- Net Interest Change (NIC)** – Net Interest Change displays how interest income and expense will change over time, as balances of assets and liabilities naturally re-price, mature, and rollover into new rate environments. Net interest change is extremely useful in displaying how changes in market interest rates as well as changes in an institution’s balance sheet will affect the institution’s earnings. The power of net interest change comes through the analysis of several different rate scenarios at one time as well as the ability to adjust prepayment speeds for cash flows and monitor reinvestment assumptions for different interest rate scenarios. Once Net Interest Change is calculated for each rate scenario, the corresponding net income and performance measures (return on assets and return on equity) are easily derived.

## Economic Value of Equity (EVE)

Sample Bank - Anywhere, US

03/31/2012

Page 1 of 1

Book Value	Assets	Risk Weighted Assets	Liabilities	Total Equity Capital	Tier 1 Capital	Tier 2 Capital	Total RBC
Total	435,490 *	247,237	391,651	43,839	40,787	3,090	43,877
as a % of TA		56.77	89.93	10.07			9.37
as a % of RWA				17.73	16.50		17.75
Unadjusted BV	430,865						

\* Adjusted Book Value includes MTM adjustment of 4,625

Fair Value	Fair Value of Assets	Appreciation / (Depreciation)		Fair Value of Liab.	(Appreciation) / Depreciation		Fair Value of Equity
Rate Shock		\$	%		\$	%	
+300/+300 bp	400,221	(30,644)	(7.11)	357,865	(33,786)	(8.63)	42,356
+200/+200 bp	414,417	(16,448)	(3.82)	366,361	(25,290)	(6.46)	48,056
+100/+100 bp	431,446	581	0.13	376,681	(14,970)	(3.82)	54,765
Unchanged	444,349	13,484	3.13	388,755	(2,896)	(0.74)	55,594
-100/-100 bp	452,711	21,846	5.07	396,233	4,582	1.17	56,478
-200/-200 bp	451,464	20,599	4.78	395,506	3,855	0.98	55,958
-300/-300 bp	457,537	26,672	6.19	394,458	2,807	0.72	63,079

Fair Value of Equity Ratios	Rate Shock	FV of Equity / FV of TA	FV of Equity / FV of RWA	Change in FV of Equity		
				\$ Change	%	ALCO Benchmark %
	+300/+300 bp	10.58	18.64	(13,238)	(23.81)	> -40.00 %
	+200/+200 bp	11.60	20.43	(7,538)	(13.56)	> -30.00 %
	+100/+100 bp	12.69	22.36	(829)	(1.49)	> -20.00 %
	Unchanged	12.51	22.04			
	-100/-100 bp	12.48	21.97	884	1.59	> -20.00 %
	-200/-200 bp	12.39	21.83	364	0.65	> -30.00 %
	-300/-300 bp	13.79	24.28	7,485	13.46	> -40.00 %

Note: Values are rounded before printing, but full precision values are used in all calculations.

(Short End = 1yr, Long End = 10yr)

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**Interest Rate Risk Monitor**

6

The Baker Group  
Software Solutions

**Summary ALCO - Economic Value of Equity (EVE):** This is an economic concept that gauges the impact of interest rate changes on fair market values of asset, liabilities, and equity. EVE captures the change in economic value of the bank even though that change may not be reflected in the bank's accounting books and records. This report shows management the "capital at risk" of the bank based on the underlying values of all components of the balance sheet. As a measure of interest rate risk it is separate and distinct from Earnings at Risk.

**The EVE concept:** Consider the underlying market value of bonds in the investment portfolio. We all know that if interest rates rise, bond prices fall. This is the manifestation of price risk. What is not as clear, however, is the degree to which that change in the economic value of the investment portfolio value will impact the overall value of the balance sheet. Note that loans also have a theoretical economic value just like bonds. If market interest rates rise sharply, then existing fixed-rate loans will be worth less from an economic standpoint. Indeed, any financial asset or liability... anything with a cash flow... will have an underlying value that fluctuates as interest rates move up and down. Whereas the value of assets will move inversely to interest rates, the value of liabilities will move directly with rates. This is because existing fixed rate deposits become more valuable to the institution if market interest rates rise.

The **IRR** uses standard financial discounting methodology to derive fair value of assets and liabilities, then shocks interest rates up and down 100, 200, and 300 basis points, and then recalculates values in

order to measure projected changes. The effect of these changes on various equity ratios is reported along with the percentage change in fair market value for equity among other metrics.

#### **Important to Note -**

**Benchmarks:** The **IRRM** reports include benchmark or target ranges and ratios for key measures. These benchmarks are entirely flexible and may be adjusted at management's discretion. The benchmark targets may serve as policy limits if management so desires, or they may simply serve as strategic targets separate and distinct from policy parameters.

**Assumptions:** Interest rate risk modeling involves projecting (or estimating) behavioral characteristics which cannot be known with complete precision or certainty. The response and behavior of depositors or borrowers to a given change in interest rates will vary from one to another and from institution to institution. For a given bank, we can use historical experience and statistical probabilities to arrive at reasonable assumptions, but always with the knowledge that these are assumptions about unknowns and they should be monitored, tested, and adjusted if deemed appropriate. These assumptions include Reinvestment rates, prepayment rates, sensitivities (or betas) associated with market rate changes, time lags, direction (or redirection) of maturing balances, and growth rates among others. **IRRM** includes default assumptions for all of these but users will need to assess these assumptions and adjust them if appropriate in order to capture the unique characteristics of the institution.

**Back-Testing:** Each bank's **IRRM** is back-tested annually to assess modeling efficiency and see how close the estimates were to actual performance. Actual versus projected changes are compared for different categories of assets and liabilities. From this, we can determine the accuracy of assumptions. Back-testing is a critical component of the Asset / Liability Management process as it often results in adjustments or changes to assumptions in order to improve the process going forward. More information on back-testing can be found in a separate section of this guide.

**Note:** *"Back-Testing" is separate and distinct from "Validation". Back-testing involves comparing actual results versus the model's projections. Validation involves a detailed analysis of the integrity of calculations and methodology of the model itself. The IRRM model has been validated by an outside auditor and a certification letter of that validation is available to all users.*

#### **Other Useful Definitions:**

**Fully Indexed Yield:** This is the yield that would exist on a floating-rate loan or security if the adjustment were to occur today given the current level of index plus margin and taking into account any caps or floors. For example, if a floating rate bond has a contractual adjustment of 150 basis points over the one-year T-Bill, and the one-year T-Bill today is trading at 1%, then the fully indexed yield would be 2.50%. The fully-indexed yield provides helpful information even for floating rate assets that may not actually adjust for some time.

**Reinvestment Rate (Cap or Floor):** Market interest rates are changing daily and banks are constantly adjusting their loan and deposit rates for new business. The reinvestment rate is simply the newest rate or yield that would be applied to any given asset or liability if it were to be originated or priced today. The reinvestment rate cap or floor is the cap or floor that would apply to newly originated assets or liabilities.

**Reset Rate (Cap or Floor):** This is the rate on floating- or adjustable-rate assets or liabilities that is calculated by the contractual formula (index plus margin). The reset rate cap or floor is the cap or floor that is applied to that principal amount which is resetting.

**Note:** It is important to recognize the distinction between the cap or floor on re-investing balances on the one hand, and the cap or floor on resetting principal balances on the other hand. For example, a floating rate loan may have some portion of principal which is paying down (actual maturing or amortizing dollars) and another portion which is resetting (dollars of principal which are having their coupon reset or adjusted). The cap or floor for each of these may be different.

## Modeling the Rate Sensitivity of Non-Maturity Deposits (NMD)

In order to properly measure interest rate risk, we must be able to make reasonable assumptions about uncertain balance sheet characteristics. One of the most difficult and critical of these assumptions is the behavior of non-maturity or “core” deposits in terms of rate sensitivity. We must approximate and model the frequency with which these deposit balances re-price or mature. The problem is that by their very nature they have no re-pricing or maturity date. How then do we estimate their rate sensitivity?

### Balance Stability:

It’s difficult to overstate the importance of core deposits to bank performance. Most community banks hold non-maturity deposits which represent one-third to one-half of their total assets. These are very low cost funds which are clearly valuable to banks from a net earnings standpoint. Bank customers who maintain core deposits may do so because of convenience or service, but their balances may also fluctuate depending on the returns they can earn if they put those dollars to use elsewhere. Some customers have a preference for liquidity regardless of the opportunity cost, while others are willing to take greater risk or have less access to immediate cash. Each bank customer has different preferences and needs. Depositors may add or withdraw funds from these accounts on demand. What ultimately matters for an asset / liability analyst, though, is the general degree of stability of those deposit balances.

### Non-Maturing Liability Analysis

#### Sample Bank

##### Anywhere, USA

One of the most common issues with interest rate risk modeling is the implementation of non-maturing liability assumptions. While there are a number of methodologies which can be employed, these estimations can be considered an inexact science. This study provides information about the historical trends and behavior of these balances over the last 20 quarters. The data is broken out according to standard call report classification for non-maturity liabilities. The report shows calculated maximum, minimum and average levels of those deposits expressed as a percentage of both total deposits and total assets. Measures of variance and dispersion (Standard Deviation) are calculated as well in order to assess the degree of stability (or volatility) of those balances over time. These results are then compared to an appropriate peer group to help determine whether and to what degree the modeling treatment (the appropriate matrix) for those deposits may need to be adjusted.

The IRRM software uses estimated maturity percentages recorded in various time buckets in order to model the rate sensitivity of non-maturity deposits. Industry standards (OTS or FDICIA) are used as starting points only, then may be adjusted per the results of the balance stability analysis. The analysis automatically produces a suggested bucketing matrix which reflects rate sensitivity (and average life) of NMD that comports with the degree of balance stability based on the historical data. Management should assess the information produced by this report along with unique characteristics of the bank's deposit base, business model, and other factors that may affect behavior. If an adjustment to the modeling assumptions is desired per the results of this analysis, we are happy to make those changes.

FDICIA 305 Proposed Distribution							
	0 - 3 M	3 - 12 M	1 - 3 Yr	3 - 5 Yr	5 - 10 Yr	10 + Yr	Avg. Life
DDA*	13%	13%	45%	20%	10%	0%	2.54
NOW	0%	0%	60%	20%	20%	0%	3.50
SAVINGS	0%	0%	60%	20%	20%	0%	3.50
MMDA	0%	50%	50%	0%	0%	0%	1.31

OTS Proposed Distribution							
	0 - 3 M	3 - 12 M	1 - 3 Yr	3 - 5 Yr	5 - 10 Yr	10 + Yr	Avg. Life
DDA	0%	18%	27%	18%	23%	14%	4.50
NOW	0%	32%	36%	17%	13%	2%	2.78
SAVINGS	0%	14%	22%	17%	25%	22%	5.28
MMDA	0%	32%	37%	17%	12%	2%	2.72

Suggested Distribution							
	0 - 3 M	3 - 12 M	1 - 3 Yr	3 - 5 Yr	5 - 10 Yr	10 + Yr	Avg. Life
DDA	0%	18%	27%	18%	23%	14%	4.50
NOW	0%	32%	36%	17%	13%	2%	2.78
SAVINGS	0%	14%	22%	17%	25%	22%	5.28
MMDA	0%	32%	37%	17%	12%	2%	2.72

#### Non-Maturing Balances

Austin | Birmingham | Indianapolis | Oklahoma City | Salt Lake City | Springfield  
1.800.937.2257

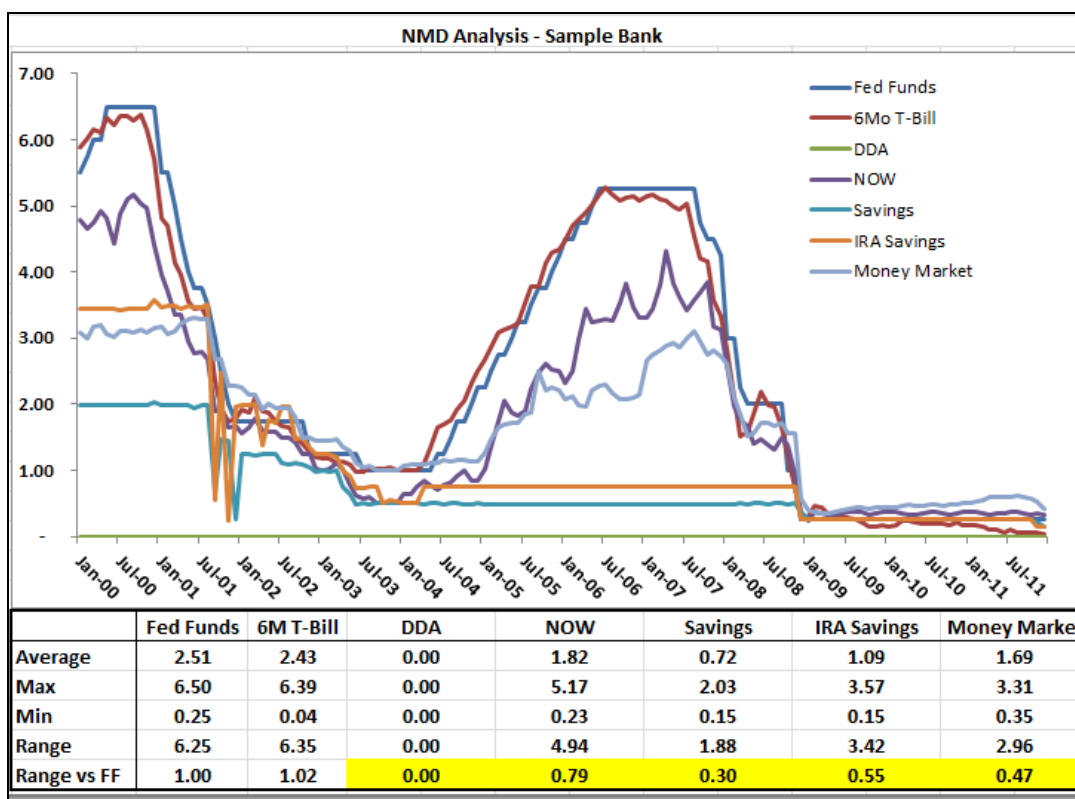
FDIC Call Report Data Page 1

There are different methods for estimating rate sensitivity of non-maturity deposits. One is to do a historical study of actual life cycles of accounts. This method looks at when accounts are opened, when they are closed, and therefore what sort of decay rate is implied. From this we can extrapolate an average life estimate. An alternative method is to focus on the stability of NMD balances regardless of

the age, decay, or retention rate of the underlying accounts. This method relies instead on statistical measures of variance in order to determine how stable NMD balances have been over a time horizon or an interest rate cycle. The variance of an individual bank can then be compared with the variance of an appropriate peer group in order to determine whether the bank's balances should be modeled with greater or lesser rate sensitivity. This helps determine the appropriate bucketing percentages which in turn will lengthen or shorten average life of the NMD. For IRRM clients, this balance stability analysis is done regularly to determine appropriate modeling assumptions for NMD.

**Pricing Behavior:**

The other important aspect of non-maturity deposits is the price behavior. Core deposits are typically paid an “administered” rate. That is to say, the rate for different account-types is established by bank management and changes relatively infrequently. For most banks, there is a generally weak correlation between changes in short-term market interest rates (Fed Funds or T-Bills, for example) and the resulting change in core deposit rates. There may also be long time lags as bank managers wait to assess the durability of market trends and potential changes in competitive rates. All of this adds up to a difficult problem for those who must try to model the rate sensitivity of these instruments. Fortunately, historical pricing data gives us information that allows us to project and model shift sensitivities (betas) and time lags based on actual observed behavior.





## IRRM: Notes on Methodology & Capabilities

### Tax Treatment of Earnings-

The IRRM model produces measures of performance on either a pre-tax or after-tax basis depending on client preference. As part of the quarterly data input, the bank is asked to provide marginal and effective tax rates. These rates are then used in calculating and reporting appropriate after-tax income levels in the IRRM reports. Tax exempt income from municipal bonds is grossed up to reflect the tax-equivalent yield prior to being imported into IRRM. This process, as with all analytics involving investments, is handled by the Advanced Portfolio Monitor (APM), an adjunct model to the IRRM itself.

<b>Supplemental Information</b>			
Sample Bank - Sample City, US			
Parallel & 400bps Scenario			
06/30/2012			
Balances (\$000's)	Entered Value YTD	Entered Value Annualized	Constant Balance Sheet
Interest Income:	\$3,803 [Y]	\$7,625	
Cash & Due:	0	0	6
Investments:	414	828	1,038
Funds Sold:	9	18	8
Loans:	3,380	6,779	6,266
Other Interest Earning:	0	0	80
Tax Adjusted Interest Income: <sup>Ⓞ</sup>	\$3,857	\$7,732	\$7,397
Interest Expense:	\$396 [Y]	\$794	\$592
Non-Maturing Demand:	152	305	146
Under 100M Time Deposits:	84	168	155
Over 100M Time Deposits:	116	233	203
Borrowed Funds:	44	88	88
Other Interest Paying:	0	0	0
<b>Net Interest Income before Provision:</b>	<b>\$3,407</b>	<b>\$6,830</b>	<b>\$6,805</b>
Provisions for Loan Loss:	\$(248) [Y]	\$(496)	\$(496)
<b>Net Interest Income:</b>	<b>\$3,159</b>	<b>\$6,334</b>	<b>\$6,309</b>
Non Interest Income:	\$1,312 [Y]	\$2,624	\$2,624
Non Interest Expense:	\$2,772 [Y]	\$5,544	\$5,544
<b>Operating Income before G/L, Tax &amp; Extra Items:</b>	<b>\$1,699</b>	<b>\$3,414</b>	<b>\$3,389</b>
Realized Gain/Loss + Extra Items: <sup>Ⓞ</sup>	\$0	\$0	\$0
Taxes:	\$(644) [Y]	\$(1,288)	\$(1,280)
<b>Net Income(Loss):</b>	<b>\$1,055</b>	<b>\$2,126</b>	<b>\$2,109</b>
Dividend:			\$(2,109)
<b>Retained Earnings:</b>			<b>\$0</b>

[M] Original amount was entered using month-to-date values.  
[Y] Original amount was entered using year-to-date values.  
[A] Original amount was entered using annualized values.

Year-to-date income and expense detail is shown alongside calculated values using the Constant Balance Sheet (CBS) Method. The CBS values are generally used as the baseline or starting point for analysis.

On the supplemental information report, tax-adjusted interest income is reported along with interest expense and provision for loan losses. The resulting net interest income number then adds non-interest income and expense to arrive at Operating Income before Gains/Losses, Taxes, and Extraordinary Items. The last adjustments are Realized Gains/Losses and finally taxes. Adjusted interest income is calculated using the interest income, tax exempt income, and marginal tax rate.

### APM Import into IRRM-

For most community banks, investments represent around one fourth of total assets. The behavior of investments is often complex with respect to cash flows, price movement, and re-pricing dynamics. For this reason, the IRRM model relies on a separate module called the Advanced Portfolio Monitor (APM) to perform investment calculations and analytics. The dynamic cash flows resulting from the APM

calculations produce income changes, average lives and durations. This data flows into the IRRM model alongside the direct data download from the bank's general ledger which contains the necessary information on loans and liabilities. Investments by definition are instantly responsive to market changes so that the rate shift sensitivities (betas) are 100 percent and time lags are zero. Prepayment speeds on mortgage-related securities are derived from industry sources, generally Yield Book, and pulled from APM as well.

### Liquidity Stress Tests: IRRM Cash Flow Reports-

Liquidity stress tests involve different aspects of liquidity, some of which can easily be modeled in IRRM. Specifically, the IRRM produces reports that show the dynamics of balance sheet cash flows under different rate environments. These are the "Principal Cash Flow Scenario Reports" which include 12mo and 24mo horizons and a variety of different rate scenarios.

It should be noted, however, that liquidity stress tests also refer to things like "what would the bank do if a large employer in the community shut down and deposits dropped sharply" or "what would the bank do if they could no longer access certain lines of credit that they previously had"? These are things that are not modeled in IRRM, but can be incorporated into a liquidity report (such as a simple spreadsheet) that includes the dynamic cash flows from IRRM.

Principal Cash Flow by Scenario - Categories Only - 12 Mo. Horizon												
Sample Bank - Anywhere, US												
09/30/2012												Page 2 of 4
Balances (\$000's)	Oct 12	Nov 12	Dec 12	Jan 13	Feb 13	Mar 13	Apr 13	May 13	Jun 13	Jul 13	Aug 13	Sep 13
<b>Total Assets</b>												
+300/+300 bp 12 Mo. Horizon	15,919	2,863	5,277	7,079	1,280	4,247	4,035	4,017	4,026	4,034	4,003	3,963
+200/+200 bp 12 Mo. Horizon	16,100	2,832	5,680	7,208	1,399	4,383	4,161	4,140	4,146	4,137	4,098	4,048
+100/+100 bp 12 Mo. Horizon	16,375	3,090	5,680	7,414	1,616	4,595	4,364	4,336	4,335	4,305	4,256	4,192
Unchanged 12 Mo. Horizon	16,887	3,565	6,120	7,776	2,006	4,966	4,700	4,659	4,637	4,566	4,493	4,750
-100/-100 bp 12 Mo. Horizon	17,627	4,246	6,751	8,289	2,530	5,423	5,102	5,025	4,958	4,847	4,734	4,946
+400/+100 bp 12 Mo. Horizon	16,097	2,835	5,442	7,240	1,415	4,398	4,188	4,162	4,166	4,169	4,134	4,088
+400/+400 bp 0 Mo. Horizon	15,919	2,863	5,277	7,079	1,280	4,247	4,035	4,017	4,026	4,034	4,003	3,963

IRRM produces a variety of dynamic cash flow reports which can be helpful input for banks that prepare internal liquidity reports.

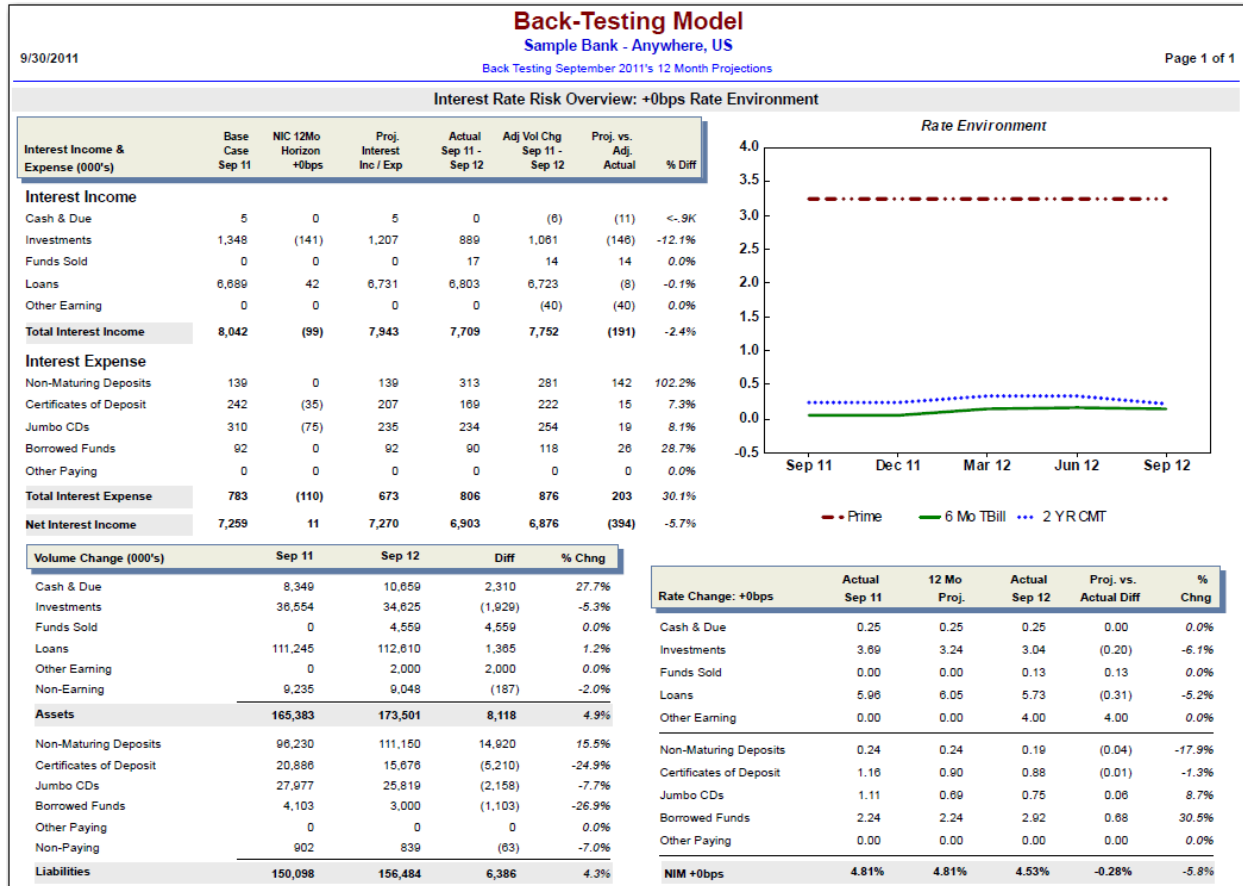
### Back-Testing-

Back Testing is the process of reviewing the projections of an A/L model after the fact and comparing those projections against actual performance. It is much like the budgeting process where we track budgeted versus actual results over a given time period. In the case of A/L back testing, we see whether and to what degree the model gave an accurate projection of bank performance, particularly with respect to interest rate risk. With the results of a back test, we can ask:

1. Were our projections different from actual bank performance?
2. If so, by how much? And...

3. What inputs, assumptions, or dynamics might explain the variance (e.g. time lags, the competitive environment, changes in the local economy, etc)?


The ultimate objective of a back test is to give guidance as to if and how management might want to adjust current assumptions within the A/L model in order to more accurately represent the performance trends of the bank. A back test, unlike model validation (which is a distinctly different process), does not need to be performed by an outside auditor. The back test may be done internally or with support from the vendor or model provider. In either case, back testing should be performed, assumptions should be reviewed, and adjustments should be made when necessary. Ideally we want to drill down to specific categories of assets and liabilities to see where projections were high or low, and scrutinize the assumptions that are applied to those categories.



The back-test assesses the accuracy of model projections by comparing the results of a previously run IRRM report with actual results. The purpose of this exercise is to test the reasonableness of assumptions and make adjustments where necessary.

## Budgeting -

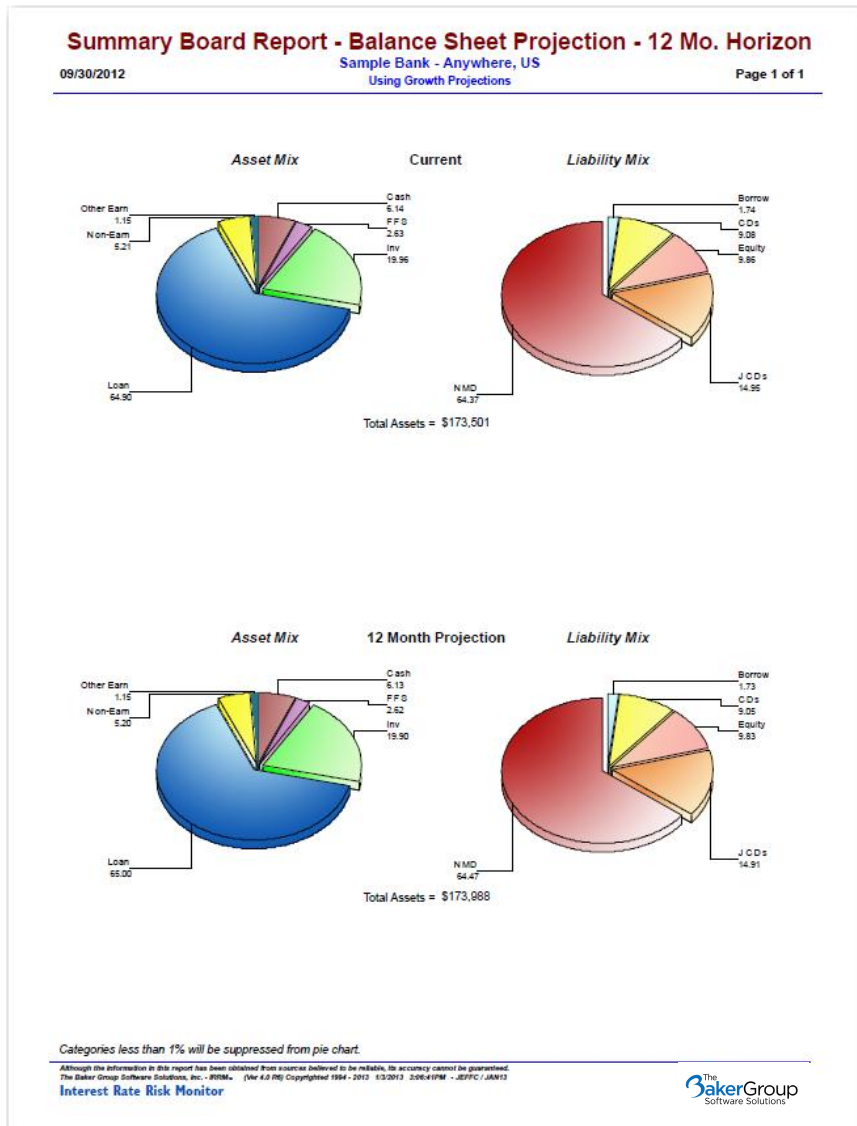
There is an important distinction to be made between the budgeting process and interest rate risk management. Budgeting involves the estimation of growth in different accounts and categories of assets and liabilities, and the resulting income and expense projections. The development of an annual budget and the monthly tracking of variance (actual balances and levels versus budgeted balances and levels) is an important component of strategy development for any bank. The budget process also produces key inputs that go into the IRRM model. Specifically, the budgeted non-interest income and expense items, provision for loan losses, and any one-time income or expense events that are expected to occur can be incorporated into the baseline Constant Balance Sheet projections.

<b>Average Balance &amp; Rates - Categories Only</b>														
Sample Bank - Anywhere, US														
Using Growth Projections														
09/30/2012	Page 1 of 14													
Balances (\$000's)	Total	Oct 12	Nov 12	Dec 12	Jan 13	Feb 13	Mar 13	Apr 13 Jun 13	Jul 13 Sep 13	Oct 13 Sep 14	Oct 14 Sep 15	Oct 15 Sep 16	Oct 16 Sep 17	Oct 17 >
<b>Total Cash &amp; Due</b>														
Balance	\$10,659													
Static Yield	0.25	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Principal (Reprice)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yield (Reprice)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total Rate Sensitive</b>	<b>2,224</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
WA Yield	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Base Income (Annual \$'s)	\$5,560													
Average Balance (000's) and Rates		Oct 12	Nov 12	Dec 12	Jan 13	Feb 13	Mar 13	Apr 13	May 13	Jun 13	Jul 13	Aug 13	Sep 13	
+300/+300 bp	Avg Balance	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	
12 Mo. Horizon	Avg Rate	0.31	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	
+200/+200 bp	Avg Balance	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	
12 Mo. Horizon	Avg Rate	0.29	0.42	0.58	0.75	0.92	1.08	1.25	1.42	1.58	1.75	1.92	2.08	
+100/+100 bp	Avg Balance	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	
12 Mo. Horizon	Avg Rate	0.27	0.33	0.42	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.08	1.17	
Unchanged	Avg Balance	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	
12 Mo. Horizon	Avg Rate	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
-100/-100 bp	Avg Balance	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	
12 Mo. Horizon	Avg Rate	0.23	0.17	0.08	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
+400/+100 bp	Avg Balance	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	
12 Mo. Horizon	Avg Rate	0.33	0.58	0.92	1.25	1.58	1.92	2.25	2.58	2.92	3.25	3.58	3.92	
+400/+400 bp	Avg Balance	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	10,659	
0 Mo. Horizon	Avg Rate	2.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	
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<b>Interest Rate Risk Monitor</b> 														

IRRM is a dynamic interest rate risk model, not a budgeting program. However, critical information that is used in the budgeting process can be found in the Average Balance and Rates report among others.

## Dynamic Simulation Capabilities (Growth, A/L Mix) -

In addition to **static** simulation analysis which is required by regulators, the IRRM can model a variety of balance sheet dynamics such as growth and sector re-allocation. During the course of a year, a bank's balance sheet may change dramatically. Loans may grow, investments may shrink, and the mix of deposits may change through over the course of time. This may be due to execution of the bank's strategy or marketing plan, plus general economic conditions in the community served. All of these things can be modeled in IRRM.



The Balance Sheet Projection report, found in the Summary Board Packet, shows the change in book balances due to projected growth or mix adjustments. These reports show the change over 12mo or 24mo time horizons.


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## Data Input and Assumptions for Interest Rate Risk Monitor (IRRM)

Computer simulations are used to project the performance of complex systems under varying conditions. In banks, an asset / liability management model is used to capture the dynamics of a bank's balance sheet and to project financial performance under different interest rate environments. As with any model, the input and assumptions that are built into the framework are critical to the integrity of the resulting output. From the standpoint of management efficiency, a good model should produce reports that detail the key inputs and assumptions.

The IRRM model produces three important reports containing information about data input and assumptions. These reports are designed for management's use as well as for regulatory compliance. Below is a list of those key reports:

- **Reinvestment Rates Detail Report** – this report lists every category of asset and liability. Information for each item includes:
  - the current balance (book value)
  - the current book yield (or rate)
  - the fully indexed yield (FIY) for adjustable, variable or floating rate instruments

<b>Reinvestment Rates (Detail)</b>										
Sample Bank - Anywhere, US										
03/31/2012 <span style="float: right;">Page 1 of 4</span>										
Balances (\$000's)	Balance	Yield	FIY	Var Cap/ Floor	Reinv. Cap/ Floor	Wtd Avg. Reinvest.	First Reinvest.	Second Reinvest.	Third Reinvest.	Roll To Account
<b>Cash &amp; Due</b>										
Total Cash and Cash Items	\$17,799						Non Earning/Paying			
Fed Reserve Bank	\$1,802	0.25	0.25			0.25	0.25 (100% for 1 Mo.)	0.00 (0% for 24 Mo.)		
FHLB DDA	\$236	0.01	0.01			0.01	0.01 (100% for 1 Mo.)	0.00 (0% for 24 Mo.)		
<b>Investments</b>										
Other Investments	\$0	0.00				0.00	0.00 (100% for 3 Mo.)	0.00 (0% for 24 Mo.)		
Federal Reserve Bank Stock	\$23	3.00				3.00	3.00 (100% for 5 Yrs.)	0.00 (0% for 24 Mo.)		
FHLB Stock	\$238	3.00				3.00	3.00 (100% for 5 Yrs.)	0.00 (0% for 24 Mo.)		
Investment Balancing	\$0						Non Earning/Paying			
Mark-To-Market Adjustment	\$4,025						Non Earning/Paying			
Trading Account	\$0	0.00				0.00	0.00 (100% for 24 Mo.)	0.00 (0% for 24 Mo.)		
Munis	\$44,835	5.80				3.75	3.75 (100% for 24 Mo.)	0.00 (0% for 24 Mo.)		
MBS FX	\$85,216	3.04				2.00	2.00 (100% for 24 Mo.)	0.00 (0% for 24 Mo.)		
<b>Funds Sold</b>										
Fed Funds Sold	\$4,600	0.20	0.20			0.20	0.20 (100% for 1 Mo.)	0.00 (0% for 24 Mo.)		
Fed Funds Sold	\$3,500	0.01	0.01			0.01	0.01 (100% for 1 Mo.)	0.00 (0% for 24 Mo.)		
<b>Loans</b>										
✓ Comm'l Loans Fixed	\$12,311	5.35				6.00	6.00 (100% for 3 Yrs.)	0.00 (0% for 24 Mo.)		
Comm'l - V-	\$4,256	4.82	4.82	0.00/3.39		5.25	5.25 (100% for 3 Yrs.)	0.00 (0% for 24 Mo.)		
Comm'l Loans - A- VAR	\$210	6.49	6.48	0.00/6.48		5.25	5.25 (100% for 3 Yrs.)	0.00 (0% for 24 Mo.)		
✓ R/E - Fixed	\$19,987	7.06				6.50	6.50 (100% for 24 Mo.)	0.00 (0% for 24 Mo.)		
R/E - VAR	\$5,861	4.24	4.23	0.00/2.30		6.25	6.25 (100% for 24 Mo.)	0.00 (0% for 24 Mo.)		
R/E-A-	\$189,216	6.37	6.36	0.00/6.36		5.25	5.25 (100% for 24 Mo.)	0.00 (0% for 24 Mo.)		
✓ Consumer- Fix	\$12,664	5.39				6.50	6.50 (100% for 24 Mo.)	0.00 (0% for 24 Mo.)		
Consumer-V-	\$1,362	4.68	4.68	0.00/4.68		3.00	3.00 (100% for 24 Mo.)	0.00 (0% for 24 Mo.)		
✓ Consumer-A-	\$15	7.00	7.00	0.00/7.00		6.50	6.50 (100% for 24 Mo.)	0.00 (0% for 24 Mo.)		
✓ Line of Credit-	\$20	18.00				18.00	18.00 (100% for 5 Yrs.)	0.00 (0% for 24 Mo.)		
✓ Line of Credit- Var	\$80	6.04	6.04	0.00/0.63		4.25	4.25 (100% for 5 Yrs.)	0.00 (0% for 24 Mo.)		
Credit Card Loans	\$0						Non Earning/Paying			
Overdrafts	\$70						Non Earning/Paying			
✓ Reinvestment assumptions not changed in the past year. <span style="float: right;">* Notional Balance. (Short End = 1yr; Long End = 10yr)</span>										
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<b>Interest Rate Risk Monitor</b> <span style="float: right;">124</span>										
										

- the cap or floor for adjustable, variable, or floating rate instruments
  - the cap or floor for reinvested principal or new money
  - the weighted average reinvestment rate (this is the bank's average current offering rate for new money)
  - columns for three alternative re-investment options which show any re-allocation of re-investing balances within the same account
  - a column showing any balances that may roll into another asset or liability category
- **Rate Shift Assumptions Report** – this report shows various behavioral assumptions across different interest rate environments for each category of asset and liability. The rate environments are user-defined and flexible. They may include instantaneous rate shocks, rate shifts over a time horizon, parallel shifts or non-parallel shifts. (a bias for rates may also be set as a starting point when banks know that a pricing change is imminent). Normally, the base case is simply for no change over a 12 month horizon. The other assumptions that vary include:
    - CPR Projection – this is the assumption for speed of principal return that is assigned to amortizing assets and liabilities
    - Shift Sensitivity – this is the category-specific sensitivity (or beta) that corresponds to each rate scenario
    - Time Lag – this is the category-specific time lag applied to the pricing change for each rate scenario

**Rate Shift Assumptions**  
Sample Bank - Anywhere, US

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Shift Horizon	Parallel	Parallel	Parallel	Unchanged Rate Scenario	Parallel	Parallel	Parallel
	-300/-300 bp 12 Mo.	-200/-200 bp 12 Mo.	-100/-100 bp 12 Mo.		+100/+100 bp 12 Mo.	+200/+200 bp 12 Mo.	+300/+300 bp 12 Mo.

**Loans-(con't)**

**R/E-A-**

	Bias(bp) = 0	Horizon = 12 Mo.	0 Mo.				
Bias/Horizon/Lag							
CPR Projection *	40.00	40.00	20.00	15.00	10.00	8.00	6.00
Shift Sensitivity *	100%	100%	100%		100%	100%	100%
Time Lag *	0 Mo.	0 Mo.	0 Mo.		0 Mo.	0 Mo.	0 Mo.
Reinvest Rate (1yr)	2.25	3.25	4.25	5.25	6.25	7.25	8.25
Repricing Rate (1yr)	6.36	6.36	6.36	6.36	6.36	6.36	7.10
Average Life	1.95	1.95	4.22	5.43	7.23	8.19	9.33
Reinvestment	Cap/Floor			100% @ 6.25 for 24 Mo.,	0% @ 0.00 for 24 Mo.,		0% @ 0.00 for 24 Mo.
Fully Indexed Yield	8.36	100% X Prime (3.25 ) + 84.6741	Margin/Eff. 65 / 84		Reset Annual 0.00 collar		0.00 cap 6.36 floor.
Additional	Book Value = 168,216		Term = 371.0				

**Consumer-Fix**


	Bias(bp) = 0	Horizon = 12 Mo.	0 Mo.				
Bias/Horizon/Lag							
CPR Projection *	30.00	20.00	10.00	10.00	10.00	8.00	6.00
Shift Sensitivity *	90%	90%	90%		100%	100%	100%
Time Lag *	1 Mo.	1 Mo.	1 Mo.		0 Mo.	0 Mo.	0 Mo.
Reinvest Rate (1yr)	3.80	4.70	5.60	6.50	7.50	8.50	9.50
Average Life	1.04	1.22	1.45	1.45	1.45	1.51	1.57
Reinvestment	Cap/Floor			100% @ 6.50 for 24 Mo.,	0% @ 0.00 for 24 Mo.,		0% @ 0.00 for 24 Mo.
Additional	Book Value = 12,694		Term = 123.0				

**Consumer-V-**

	Bias(bp) = 0	Horizon = 12 Mo.	0 Mo.				
Bias/Horizon/Lag							
CPR Projection *	30.00	20.00	10.00	10.00	10.00	8.00	6.00
Shift Sensitivity *	100%	100%	100%		100%	100%	100%
Time Lag *	0 Mo.	0 Mo.	0 Mo.		0 Mo.	0 Mo.	0 Mo.
Reinvest Rate (1yr)	0.00	1.00	2.00	3.00	4.00	5.00	6.00
Repricing Rate (1yr)	4.68	4.68	4.68	4.68	5.23	6.23	7.23
Average Life	1.23	1.42	1.63	1.63	1.63	1.67	1.72
Reinvestment	Cap/Floor			100% @ 3.00 for 24 Mo.,	0% @ 0.00 for 24 Mo.,		0% @ 0.00 for 24 Mo.
Fully Indexed Yield	4.68	100% X Prime (3.25 ) + 98.1644	Margin/Eff. 98 / 98		Reset Monthly 0.00 collar		0.00 cap 4.68 floor.
Additional	Book Value = 1,362		Term = 123.0				

(Short End = 1yr; Long End = 10yr) \* Entered data using standard shock scenarios.

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**Interest Rate Risk Monitor** 108 

- Reinvestment Rate (1yr) – this is the reinvestment rate for the account that will exist after one year given the time lags and shift sensitivities



- Average Life – this is the average length of time that each dollar of principal is outstanding
- There are also rows for additional information about reinvestment of principal (three options)
- **Balance and Rate Entry Report** – this report details cash flows and associated yields or rates month-over-month (or per defined period) for each category of asset and liability. It breaks down cash flows into maturing dollars versus principal paydowns as well as variable or floating rate adjustments to principal dollars. Each cash flow balance has the appropriate yield or rate associated with it in each time period. There is also information on this report regarding caps and floors associated with the account, the current fair market value, the discount rate used for EVE calculations, average life, modified and effective durations, and the effective convexity among other things.

<b>Balance &amp; Rate Entry</b>																
Sample Bank - Anywhere, US																
03/31/2012		Page 9 of 34														
Balances (\$000's)		Total	Apr 12	May 12	Jun 12	Jul 12	Aug 12	Sep 12	Oct 12	Nov 12	Dec 12	Jan 13	Feb 13	Mar 13	Apr 13	
															Sep 13	
<b>Loans-(con't)</b>																
405	Comm'l Loans - A- VAR															
	Principal (Mature)	\$210	0	0	0	0	0	0	0	0	0	6	0	0	0	
	Current Yield	6.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.25	0.00	0.00	0.00	
	GAP Cashflow		1	2	3	4	4	5	6	7	8	20	71	72	77	
	Adjusted Yield	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	Principal (Paydown)		1	1	1	1	1	1	1	1	1	1	1	1	5	
	Yield (Paydown)	6.49	6.49	6.49	6.49	6.49	6.49	6.49	6.49	6.49	6.49	6.49	6.62	6.30	6.30	
	Principal (Reprice)	0	0	0	0	0	0	0	0	0	0	8	50	0	0	
	Yield (Reprice)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.25	7.75	7.75	7.75	
	Reinvest at	5.25	100% @ 5.25 for 3 Yrs.													
	Fully Indexed Yield	6.48	100% X Prime (3.25 ) + 100 Margin/ Eff. 100 / 100										Reset Annual	0.00 collar	0.00 cap	6.48 floor.
	Fair Value	\$224	Discount Rate = 5.25										Term = 231.0			
	Price Volatility		Average Life = 8.91			Modified Duration = 4.70			Effective Duration = 3.05			Effective Convexity = (1.34)				
	CPR	5.00	Prepay into Comm'l Loans - A- VAR													
	Base Income (Annual \$'s)	\$13,635														
410	R/E- Fixed															
	Principal (Mature)	\$19,997	708	5	368	168	0	205	19	32	324	0	257	2	1,974	
	Current Yield	7.06	14.11	6.25	6.00	5.75	0.00	6.00	6.50	5.00	6.88	0.00	5.72	8.00	5.87	
	GAP Cashflow		974	1,239	1,857	2,271	2,514	2,952	3,204	3,459	4,010	4,229	4,681	4,893	7,983	
	Principal (Paydown)		265	261	249	249	243	232	234	223	227	219	195	210	1,116	
	Yield (Paydown)		7.06	6.80	6.80	6.82	6.83	6.83	6.84	6.84	6.84	6.84	6.84	6.86	6.86	
	Reinvest at	6.50	100% @ 6.50 for 24 Mo.													
	Fair Value	\$20,282	Discount Rate = 6.50										Term = 240.0			
	Price Volatility		Average Life = 3.02			Modified Duration = 2.08			Effective Duration = 2.08			Effective Convexity = (0.64)				
	CPR	15.00	Prepay into R/E- Fixed													
	Base Income (Annual \$'s)	\$1,412,388														

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**Interest Rate Risk Monitor**

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Software Solutions

- **Supplemental Information Report**

In order for projected changes in interest income and expense to translate into bottom-line performance, we need to have some idea of what the bank is expecting in terms of non-interest income and expense as well as provision for loan losses and taxes. This data must be provided by the bank as supplemental input in order for the IRRM to establish a baseline measure of performance. Once this



baseline is established, changes in interest income and expense can be applied to arrive at projected performance over the different interest rate environments.

There are two methods for establishing the baseline (base case) net income. One method is simply to annualize the year-to-date performance. Another is to calculate projected interest income and expense based on actual balances and rates that exist on the balance sheet as of report date. In this latter case, we still need projections or estimates (from bank management) for the non-interest items, provision for loan loss, and taxes. Unless we tell the model otherwise, it will simply default to the actual year-to-date numbers for those projections. This report also includes information on the rate of dividend payout (where applicable) and OREO.

<b>Supplemental Information</b>			
Sample Bank - Anywhere, US			
03/31/2012			Page 1 of 1
Balances (\$000's)	Entered Value YTD	Entered Value Annualized	Constant Balance Sheet
Interest Income:	\$4,864 [Y]	\$19,498	
Cash & Due:	0	0	5
Investments:	1,052	4,208	5,808
Funds Sold:	2	8	10
Loans:	3,810	15,282	15,276
Other Interest Earning:	0	0	0
Tax Adjusted Interest Income: <sup>⊕</sup>	\$5,083	\$20,372	\$20,898
Interest Expense:	\$627 [Y]	\$2,515	\$2,557
Non-Maturing Demand:	148	594	642
Under 100M Time Deposits:	123	493	585
Over 100M Time Deposits:	355	1,424	1,330
Borrowed Funds:	1	4	0
Other Interest Paying:	0	0	0
Net Interest Income before Provision:	<u>\$4,237</u>	<u>\$18,983</u>	<u>\$18,341</u>
Provisions for Loan Loss:	\$(95) [Y]	\$(380)	\$(380)
Net Interest Income:	<u>\$4,142</u>	<u>\$18,603</u>	<u>\$17,961</u>
Non Interest Income:	\$514 [Y]	\$2,056	\$2,056
Non Interest Expense:	<u>\$3,759 [Y]</u>	<u>\$15,036</u>	<u>\$15,036</u>
Operating Income before G/L, Tax & Extra Items:	<u>\$897</u>	<u>\$3,623</u>	<u>\$4,981</u>
Realized Gain/Loss + Extra Items: <sup>⊖</sup>	\$0	\$0	\$0
Taxes:	\$(200) [Y]	\$(800)	\$(1,444)
Net Income(Loss):	<u>\$697</u>	<u>\$2,823</u>	<u>\$3,536</u>
Dividend:			\$(3,536)
Retained Earnings:			<u>\$0</u>

Available Line of Credit:	\$31,000
Risk Weighted Assets:	\$247,237
Avg. Earning Assets:	\$ 391,628
Avg. Total Assets:	\$ 414,401
Equity/Total Assets:	9.19
Desired After Tax ROA:	1.35
Desired After Tax ROE:	13.00
Effective Tax Rate:	29.00%
Marginal Tax Rate:	34.00%
Taxable this year?	Yes
OREO:	\$0
Dividend Pay Out:	100%

[M] Original amount was entered using month-to-date values.  
[Y] Original amount was entered using year-to-date values.  
[A] Original amount was entered using annualized values.

<sup>⊕</sup> Adjusted Interest Income is calculated using the Interest Income, Tax Exempt Income, and Marginal Tax Rate.  
<sup>⊖</sup> Realized Gain & Extra Items are non-recurring events.  
Note: Values are rounded before printing, but full precision values are used in all calculations.

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## Basics of Interest Rate Risk & Asset / Liability Management A Primer for Community Bank Directors

### Introduction:

The successful performance of a community bank ultimately depends on proper understanding and management of interest rate risk (IRR). Recent regulatory communications have emphasized the importance of board education on IRR issues along with sound and thorough processes for IRR management. This document provides essential explanations and definitions of the basics of interest rate risk and is designed for community bank directors.

Interest Rate Risk (IRR) is the risk to earnings or capital that arises from changing interest rates and the resulting impact on a bank's balance sheet. Every day, the bank experiences inflows and outflows of deposits, loans, and investments. Those dollars come in and go out of the balance sheet in many forms. New money is deposited, loans are re-paid, bonds mature, new loans are made, deposits leave, adjustable loans re-price... there is clearly a lot involved in the daily dynamics of a bank balance sheet. Meanwhile, in the midst of this dynamic swirl, interest rates are changing in different ways on different types of loans, deposits, and investments.

In order to manage interest rate risk, we must have policies procedures and reporting tools to help us define, measure, and manage the dynamics of the balance sheet in the face of changing interest rates. The comprehensive process of managing IRR within the context of the overall bank is often referred to as Asset / Liability Management or ALM. The internal committee which is responsible for IRR management is usually referred to as the Asset / Liability committee or ALCO.

Reporting systems that give us information about interest rate risk exposures generally rely on three primary methods: GAP analysis, Earnings Simulation, and Economic Value analysis. These three methods will be explained below.

### Components of IRR:

Interest rate risk can be broken down into four basic components:

#### *Re-pricing risk*

The risk presented by assets and liabilities that re-price at different times and rates. For example, a loan with a variable rate will generate more interest income when rates rise and less interest income when rates fall. If the loan is funded with fixed rated deposits, the bank's interest margin will fluctuate.

#### *Basis risk*

The risk presented when yields on assets and costs on liabilities are pegged to different bases, such as the London Interbank Offered Rate (LIBOR) versus the U.S. prime rate. In some circumstances different bases will move at different rates or in different directions, which can cause erratic changes in revenues and expenses.

### *Yield curve risk*

The risk presented by differences between short-term and long-term interest rates. Short-term rates are normally lower than long-term rates, and banks earn profits by borrowing short-term money (at lower rates) and investing in long-term assets (at higher rates). But the relationship between short-term and long-term rates can shift quickly and dramatically, which can cause erratic changes in revenues and expenses.

### *Option risk*

Option risk entails uncertainty of cash flow. For example, the bank may purchase a bond which has a five year maturity, but it contains an option whereby the issuer of the bond may call it in early, say after one year. In this example, there is uncertainty as to whether the bank will have its principal returned in five years or in one year. This uncertainty is due to options risk. Similarly, if a mortgage loan customer decides to re-finance their loan prior to the scheduled maturity... that loan customer is exercising an option to re-finance. Again, this results in earlier return of principal than would otherwise be the case. There a variety of other examples of options risk in bank balance sheets and they all entail cash flow uncertainty. Option risk can be difficult to measure and control.

## **Measuring Interest Rate Risk:**

### *GAP Analysis*

Gap is simply the dollar difference between rate sensitive assets (i.e. assets that re-price or mature) and rate sensitive liabilities for a particular time period, usually 12 months. If more assets re-price than liabilities, the number will be positive which shows that an institution is asset sensitive, or “positively gapped”. Traditional Gap theory says that an asset sensitive institution will generally realize an increase in income if interest rates rise due to the fact that more assets than liabilities will be rolling over and re-pricing into higher market rates. In this case, all else being equal, earning asset yield will rise faster than the cost of liabilities. The exact opposite takes place if the bank has a negative Gap, where more liabilities than assets re-price during the period. It is important to note that Gap analysis deals only with balances of rate sensitive assets and liabilities, and ignores the rates (yields or costs) associated with those re-pricing balances. It is therefore only a crude indicator of the potential change in net income.

**Effective Gap versus Re-pricing Gap:** One of the problems with Gap measures involves the treatment of non-maturing deposits. These liability accounts (such as Checking, Savings, and MMDA) do not have an identifiable maturity date and contractually the rate may be changed by the bank any time it chooses. So there arises a question as to whether these items should be treated as always and immediately rate sensitive, or if they should be assigned a rate sensitivity that more accurately reflects their true behavior.

**Re-pricing Gap** is defined as a gap measure that utilizes contractual re-pricing dates in the allocation of assets and liabilities across predefined time periods. A re-pricing gap treats non-maturing deposits as though they will immediately and instantly re-price each time market rates move. Re-pricing Gap does not consider the actual behavior of non-maturing deposits in terms of how they affect the balance sheet.

**Effective Gap** is a more useful measure for rate sensitivity analysis. Effective gap uses behavioral assumptions that more accurately model the rate sensitivity of non-maturing deposits. Effective Gap is considered to be the more meaningful measure for analysis since it looks at the true behavior of non-maturing deposits rather than the contractual ability to re-price. The IRRM uses FDICIA 305 guidelines as a default treatment of non-maturing deposits in order to arrive at the Effective GAP.

**Treatment of Non-Maturity Deposits:** Most banks have a large percentage of their liabilities in core deposits or non-maturity deposits (DDA, NOW, and MMDA). These liabilities are difficult to model with respect to rate sensitivity and re-pricing behavior. The rates paid on Core deposits are generally considered to be “administered” rates in the sense that they set or changed at anytime at the discretion of bank management. Often, core deposit rates are barely moved for lengthy periods of time, but to some degree bank managers will move these rates according to changes in the general interest rate environment. Every bank is different in this respect. In order to model these deposits appropriately, we must use some sort of guidelines for estimating how rate sensitive these accounts are likely to be. As a base case default, a bank may use the guidelines originally proposed in section 305 of the FDIC Improvement Act of 1991 (FDICIA). These guidelines provide for a percentage of the balance in different non-maturing deposit accounts to be treated as re-priceable or rate sensitive across a range of maturity buckets. This scheme of maturity distribution is shown in the table below.

**FDICIA 305: Maturity Distribution Limits for Non-Maturity Deposits**

	0-3 mos (pct)	3-12 mos (pct)	1-3 yrs (pct)	3-5 yrs (pct)	5-10 yrs (pct)
Commercial DDA....	50	0	30	20	.....
Retail DDA.....	0	0	60	20	20
MMDA.....	0	50	50	.....	.....
Savings.....	0	0	60	20	20
NOW.....	0	0	60	20	20

This treatment of non-maturity deposits will result in average life and duration measures that are greater than zero, but still fall within reasonable ranges for analysis of economic value. It is important to note that the FDICIA guidelines are a default and are not intended to replace the need for banks to evaluate and consider the unique characteristics of their individual deposit bases when determining their rate sensitivity.

**Earning Simulation Analysis:**

It’s always important to remember that the margins and earnings being reported today are a reflection of the loans that were made and bonds that were purchased years ago, along with deposits that were priced months ago. Bank managers must be aware that everything they do today with respect to pricing loans and liabilities or choosing securities for purchase is going to have an impact on the income statement at some point in the future. All of this points to the importance of forward-thinking analysis and the simulation of future expected trends. As discussed previously, bank balance sheets are constantly changing as the volumes of different asset and liability accounts, the rates paid (or earned) on those balances and the cash flows moving into and out of those accounts are increasingly dynamic and unpredictable. What we need to know is, given the current mix of assets and liabilities and the rates associated with them, how can we expect margins and earnings to perform as the dynamics of re-pricing assets and liabilities filter through the balance sheet over time? This is what earnings simulation analysis is all about.

In order to do this analysis, we must have essential balance sheet data pulled into the model. We begin with an electronic import of the balances of assets and liabilities, the re-pricing or maturing schedules of those balances, and the rates you are earning or paying on those balances. We then input re-investment rates and other assumptions (for example, estimates of how fast principle will prepay above and beyond what is scheduled). Then we simply ask the model to calculate how the dynamics of re-pricing and rate changes will filter through into interest income, interest expense, and net-interest income.

In general, earnings simulation models are more dynamic than gap analyses and market valuation simulations. Whereas gap and market valuation models generally take a “snapshot” of the risk inherent in a bank’s balance sheet structure at a particular point in time, most earnings simulation models evaluate risk exposure over a period of time, taking into account projected changes in balance sheet structures, pricing, and maturity relationships, and assumptions about new business. Banks often use simulation models to analyze alternative business decisions and to test the effect of those decisions on a bank’s risk profile before implementation. Banks also use simulation models in budgeting and profit planning processes.

### **Economic Value of Equity:**

Economic value of equity (EVE) is a concept that gauges the impact of interest rate changes on fair market values of asset, liabilities, and equity. EVE captures the change in economic value of the bank even though that change may not be reflected in the bank’s accounting books and records. Consider the underlying market value of bonds in the investment portfolio. We all know that if interest rates rise, bond prices fall. This is the manifestation of price risk. What is not as clear, however, is the degree to which that change in the economic value of the investment portfolio value will impact the overall value of the balance sheet. Note that loans also have a theoretical economic value just like bonds. If market interest rates rise sharply, then existing fixed-rate loans will be worth less from an economic standpoint. Indeed, any financial asset or liability... anything with a cash flow... will have an underlying value that fluctuates as interest rates move up and down. Whereas the value of assets will move inversely to interest rates, the value of liabilities will move directly with rates. This is because existing fixed rate deposits become more valuable to the institution if market interest rates rise. A good IRR model will use standard financial discounting methodology to derive fair value of assets and liabilities, then shock interest rates up and down 100, 200, and 300 basis points, and recalculate values in order to measure projected changes. The effect of these changes on various equity ratios is reported along with the percentage change in fair market value for equity among other metrics.

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# Regulatory Guidance: Interest Rate Risk

## FFIEC Advisory on Interest Rate Risk Management – Jan. 2010: Abridged Version

1. Corporate Governance –
  - a. Directors should “understand and be regularly informed about the level and trend of their of their institutions’ IRR exposure.”
  - b. Senior management is responsible for ensuring that board-approved strategies, policies, and procedures for managing IRR are appropriately executed.
    - i. Appropriate policies, procedures and internal controls
    - ii. Comprehensive systems and standards for measuring IRR
    - iii. Sufficiently detailed reporting processes
2. Policies and Procedures-
  - a. Policies should address the potential impact of changing interest rates on earnings and capital
  - b. Policies should specify IRR tolerances in the context of scenarios of potential changes in market interest rates and a target or range for performance metrics.
3. Measurement and Monitoring of IRR-
  - a. Institutions expected to have robust IRR measurement processes (commensurate with the size and complexity of the institution)
  - b. Institutions expected to fully understand the underlying analytics, assumptions, and methodologies and ensure such systems and processes are incorporated appropriately in the strategic (long-term) and tactical (short-term) management of IRR exposures.
  - c. *Measurement Methodologies* –
    - i. Primarily use simulations to assess the impact of changing rates on earnings and capital
    - ii. Run static simulations to provide ALCO or senior management a complete and comparative description of the institution’s IRR exposure.
    - iii. Economic Value (EVE) methodologies should also be which capture all future cash flows expected from existing assets and liabilities, and is more effective in considering embedded options in a typical institution’s portfolio.

*An institution’s IRR measurement system should be sufficiently robust to capture all material on and off-balance sheet positions and incorporate a stress-testing process to identify and quantify the institution’s IRR exposure.*

- d. *Stress Testing*-
  - i. Regularly assess IRR exposures beyond typical industry conventions, including changes in rates of greater magnitude (e.g. up and down 300 and 400 basis points) across different tenors to reflect changing slopes and twists of the yield curve.
  - ii. In low-rate environments, scenarios involving significant declines in market rates can be deemphasized in favor of increasing the number and size of alternative rising-rate scenarios.
  - iii. Include instantaneous shocks, non-parallel curve changes, and basis risk in stress scenarios

- e. *Assumptions-*
  - i. Regularly assess the reasonableness of assumptions... document, monitor, and update key assumptions.
  - ii. Assumptions about non-maturity deposits are critical.
    - 1. Generally, rate-sensitive and higher-cost deposits, such as brokered and Internet deposits, would reflect higher decay rates than other types of deposits.
  - iii. Sensitivity testing of key assumptions that exert the greatest impact on measurement results. When actual experience differs from past assumptions and expectations, institutions should use a range of assumptions to appropriately reflect this uncertainty.
- 4. Internal Controls and Validation-
  - a. Validation of IRR model is fundamental
    - i. Credible third-party should test the mechanics and mathematics of the measurement model.
    - ii. Independent review (may be an internal audit at smaller banks) assessing the bank's process for IRR measurement (including reasonableness of assumptions and back-testing) to ensure the integrity of risk management process.

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