

## FEDERAL RESERVE SYSTEM

**Interest Rate Risk Management at Community Banks**

*by Doug Gray, Managing Examiner, Federal Reserve Bank of Kansas City*

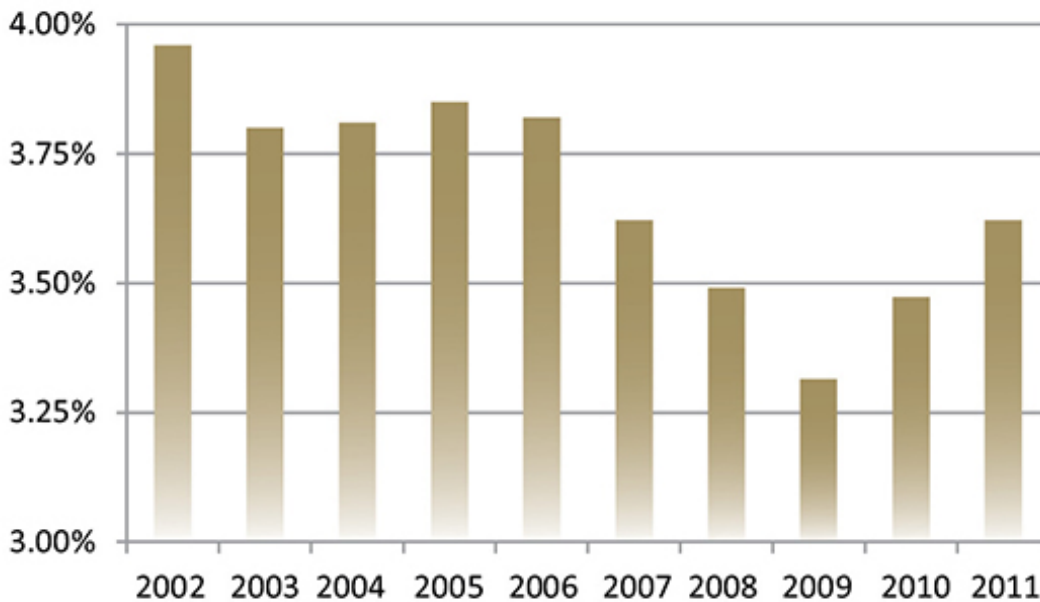
Over the past few years, the banking industry has faced significant earnings challenges. Community bank profitability has been under pressure due to increases in nonaccrual loans, credit losses, other-than-temporary impairment (OTTI) charges, and loan workout expenses. Many banks have responded to these earnings challenges by “tightening their belts,” but, understandably, cost-cutting measures can go only so far for community banks that are committed to meeting the needs of local families and businesses with a level of service that differentiates them from larger banking organizations.

To meet the challenge of generating positive earnings and more suitable returns for their stakeholders, many banks have lengthened asset maturities or increased assets with embedded optionality. These actions serve to increase interest rate risk exposures and, thus, the need for more robust risk management programs. The purpose of this article is to provide an overview of the current banking landscape and to discuss key interest rate risk management activities and concepts for community banks. More detailed discussions of specific interest rate risk management elements are planned for subsequent articles.

**The Current Landscape**

During the credit downturn, problem loan losses and accompanying provision expenses were the most significant contributors to net losses at community banks. Lying further beneath the surface of these net losses was significant contraction of net interest margins. While net interest margins have begun to improve following reductions of nonperforming assets and repricing of term deposits at today’s lower rates, margins continue to lag levels achieved in the past decade, as illustrated in Figure 1.

**Figure 1: Net interest margins  
U.S. banks with assets <\$10b**

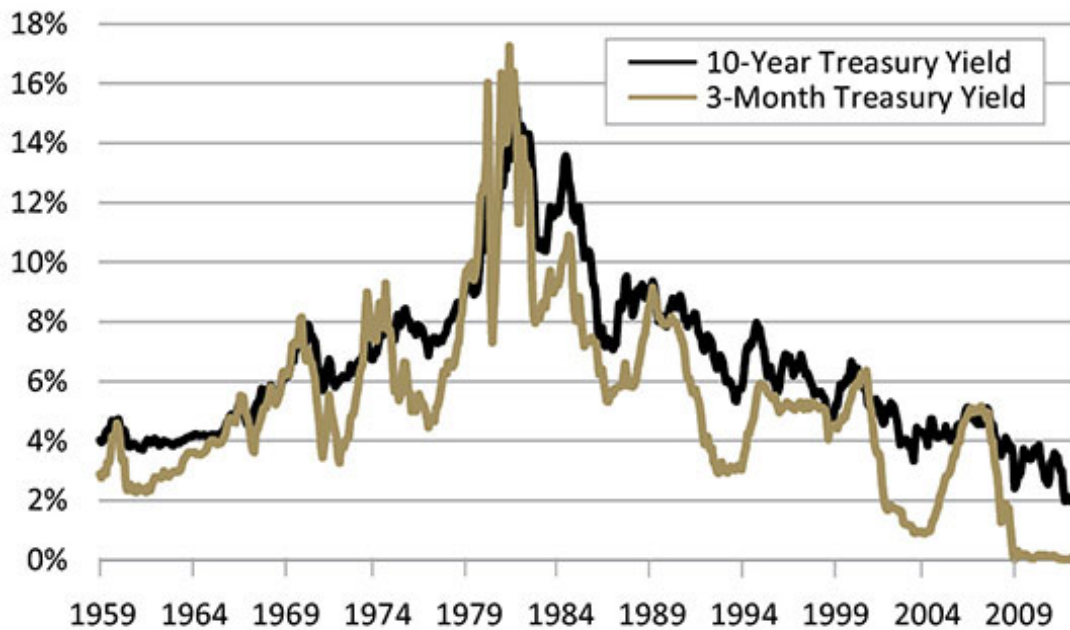


Source: Reports of Condition and Income

By historical standards, interest rates across the maturity spectrum are low and have been for some time, as illustrated by the depiction of short- and long-term Treasury rates in Figure 2.

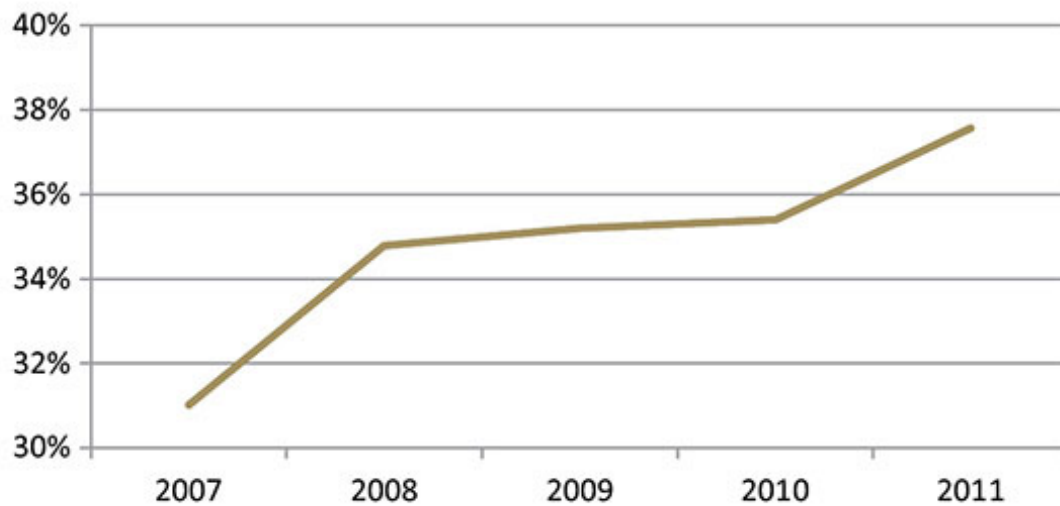
Low interest rates, coupled with business contraction, have created an environment where bankers face difficult choices to maintain earnings performance. Some have elected to pursue new business lines that generate different sources of interest income or additional noninterest income, although these business lines may create new operational, credit, liquidity, and legal risks to those firms. Others have chosen to extend asset maturities and/or increase holdings of bonds with embedded options, thereby widening spreads but taking on greater interest rate risk. This trend is illustrated by the increase in assets with maturities or repricing terms greater than three years as a percentage of total assets (Figure 3).

## Figure 2: Ten-year and three-month Treasury yields



Source: Federal Reserve Bank of New York

## Figure 3: Assets maturing or repricing > three years/ total assets (U.S. banks with assets < \$10b)



Source: Reports of Condition and Income

Those institutions extending asset maturities without a corresponding shift in liabilities are particularly exposed to significant upward movements in interest rates, which is not as uncommon as often perceived. In fact, the overnight federal funds rate experienced a change of 300 basis points or more over a 12-month period 15 percent of the time between 1955 and 2008.<sup>1</sup> It was in response to the pressure banks faced to generate earnings and increase assets with longer maturities, while also shortening their liability maturities, that financial institution regulators issued an *Interagency Advisory on Interest Rate Risk* (interagency advisory) in 2010 and, earlier this year, a follow-up document, *Interagency Advisory on Interest Rate Risk Management: Frequently Asked Questions* (FAQs).<sup>2</sup> The interagency advisory and FAQs are applicable to banks of all sizes and complexities.

### Common Interest Rate Risk Exposures

Generally speaking, interest rate risk is the risk that an adverse outcome will result from changes in interest rates. While interest rate risk can arise from various sources, four key types of interest rate risk are common to community bank balance sheets:

- **Mismatch/Repricing Risk:** The risk that assets and liabilities reprice or mature at different times, causing margins between interest income and interest expense to narrow.
- **Basis Risk:** The risk that changes in underlying index rates used to price assets and liabilities do not change in a correlated manner, causing margins to narrow. For example, loans priced off national prime rates might not change in the same manner as certificates of deposit priced off U.S. Treasury rates.
- **Prepayment/Extension Risks:** The risk that asset repayments accelerate at a time when interest rates are low, resulting in diminished interest income and the need to reinvest repaid funds in lower-yielding assets. This risk intensifies when loan customers or bond issuers exercise their explicit call options to pay off the bank's asset prior to maturity and interest rates decline. The flip side of prepayment risk is extension risk, which stems from the lengthening of asset payoff rates in a rising rate environment, thereby reducing the funds available to invest at higher yields.
- **Yield Curve Risk:** The risk that nonparallel changes in the yield curve will disproportionately affect asset values or cash flows. For example, mortgage assets tend to be priced off 10-year U.S. Treasury rates. Suppose 10-year Treasury rates change significantly, while all other Treasury rates remain unchanged. The value and cash flows from mortgage loans and mortgage-related securities will also change significantly, but other assets and liabilities will not experience similar changes. Thus, banks with significant mortgage asset holdings would be exposed to greater yield curve risk than those with mortgage assets comprising a lower percentage of assets.

### Key Risk Management Elements

Because banks are in the business of transforming short-term deposits into longer-term loans, they are inherently exposed to some degree of interest rate risk. Those exposures warrant risk management programs that allow the bank's management team and board of directors to appropriately identify, measure, monitor, and control these exposures. The rigor and expense applied to these programs should be commensurate with the size of the risk exposures and complexity of activities and holdings. Therefore, while there are elements of interest rate risk management that all banks should have in place, community banks would not necessarily need the same level of sophistication in their risk management practices as

those that are in use at larger, more complex banking organizations. Figure 4 illustrates four key elements that are fundamental to every bank's interest rate risk management program:

## Figure 4: Four key elements of a risk management program for interest rate risk



### **Board and Senior Management Oversight**

A bank's board of directors is ultimately responsible for setting the institution's risk tolerance/appetite and overseeing the establishment of appropriate risk controls, both of which affect the level of interest rate risk exposure at the bank. While many community bank directors may have limited involvement with interest rate risk management in their own professional careers outside the institution, a bank's board is expected to have a collective fundamental working knowledge of the different types of interest rate risk, how business activities could create or change the bank's exposure, and how risk measurement reports can be used to identify exposures. In the past 15 years, significant progress has been made in the banking industry to develop interest rate risk and other training materials for directors, an example of which is the Federal Reserve System's Bank Director's Desktop.<sup>2</sup>

With this knowledge, directors can establish policies, risk limits, and management governance structures that foster appropriate oversight of interest rate risk. Often, community bank boards charge management committees, or even board committees, such as an Asset/Liability Management Committee (ALCO), with risk measurement and monitoring responsibilities. When bank examiners evaluate board and senior management oversight, they assess the degree to which

the board supports risk management activities by funding appropriate risk measurement tools and staff, establishing appropriate risk exposure limits (discussed below), and holding the ALCO accountable for implementing the board's guidance.

### **Policies and Risk Limits**

Effective communication of the board's intentions regarding interest rate risk taking and risk management is important and should be accomplished through policies that are reviewed and updated periodically. Interest rate risk policies can be standalone documents or housed in a broader asset/liability management policy. At a minimum, board policies should describe the bank's risk tolerance/appetite; methods to identify, quantify, and report exposures; parties responsible for ongoing risk measurement and management; and the controls and risk limits necessary to ensure that the risk management function is operating appropriately. When bank examiners evaluate interest rate risk policies, these are the key components considered.

Perhaps the most significant component of a sound interest rate risk policy is the establishment of appropriate risk limits. Risk limits convey to staff how much exposure is acceptable before remedial actions should be taken to address an excessive risk position. Moreover, risk limits should reflect manageable constraints that are not excessively broad so that they provide a meaningful control.

For any risk limit to be useful, it must be understood by management and the board; be capable of being measured with existing risk measurement tools; and be stated relative to meaningful values, such as earnings or capital. For example, effective earnings exposure limits will communicate to bank personnel the maximum percentage of earnings (either net interest income or net income) that the board is willing to put at risk in certain interest rate shock scenarios (e.g., a parallel rate change of +300 basis points). Long-term interest rate risk exposures are best stated relative to a bank's capital level. Earnings and capital limits will allow management and the board to effectively determine whether earnings are adequate to sustain short-term earnings exposures and whether sufficient capital is in place to cover long-term risk exposures.

### **Risk Measurement and Reporting**

Perhaps the most discussed interest rate risk management topic for community banks is risk measurement. Questions often arise regarding the types of tools or models that are needed, how to fine-tune those tools, and how often measurement reports should be provided to the ALCO and the board. At the most basic level, regulatory expectations require a bank's interest rate risk measurement tools and techniques to be sufficient to quantify the bank's risk exposure. Measurement techniques typically fall into two broad categories: short-term and long-term risk measures (Figure 5).

Figure 5: Common interest rate risk measurement techniques



Short-term measurement techniques should quantify the potential reduction in earnings that might result from changing interest rates over a 12- to 24-month horizon. Common measures include repricing gap (or “static gap”) reports and earnings-at-risk (EaR) analysis.<sup>4</sup> While long-term net income simulations (up to five years) are occasionally used at community banks, the most common long-term measurement technique is some variation of economic value of equity (EVE).<sup>5</sup> While the interagency guidance states that simple static gap reporting may be sufficient for small banks with less complex interest rate risk profiles, regulators expect that management and directors of banks with more complex risk profiles will evaluate and actively manage earnings at risk and economic value exposures. Examples of increased complexity include elevated levels of assets with embedded options, increased mortgage banking activities, or the use of financial derivatives.

Once management and the board have determined the appropriate measurement tools for evaluating interest rate risk exposures, a decision must be made regarding reporting frequency. This decision should also be based on a bank’s inherent risk profile. Banks with low interest rate risk profiles typically provide risk measurement reports to the ALCO and the board at least quarterly. As a bank’s risk profile increases, either through an elevated EaR or economic value exposure or increased holdings of more complex assets, reporting frequency to the ALCO or the board should also increase. It is not uncommon for community banks with moderate and high risk exposures to provide monthly reports to the ALCO and quarterly reports to the full board of directors.

Regardless of reporting frequency, sufficient information should be provided to allow decision-makers to evaluate the sources of exposures and identify potential noncompliance with risk limits. In situations where interest rate risk exposures exceed the bank’s risk limits, senior management should also provide a report to the board detailing actions planned to return the bank to an acceptable risk level, and subsequent meetings should include updates to those action plans. It is important to document policy exceptions and resulting action plans in board and ALCO minutes. During examinations, examiners will evaluate the adequacy of the risk measurement tools to quantify the institution’s risk exposures, controls, and accuracy of assumptions used to generate model results (if an interest rate risk model is being used), as well as the appropriateness of information reported to management committees and the board.

### Internal Controls and Audit

The interagency advisory and subsequent FAQs attempt to bring greater clarity to regulatory expectations about internal controls and audit requirements. Examiners have long expected all banks to maintain appropriate controls over risk measurement and reporting processes. Generally speaking, these controls include secondary reviews of data accuracy in risk measurement tools, reporting of compliance with policy limits, and periodic review and documentation of the reasonableness of assumptions used in risk measurement tools.

As community banks have increased their use of interest rate risk models, examiners have expected management teams to take greater steps to ensure that data, assumptions, and output are reasonable and accurate.

At a minimum, an independent review of data inputs, key assumptions,<sup>6</sup> the accuracy of ALCO and board reports, and policy compliance should be conducted annually.

An independent review does not necessarily need to be conducted by a consultant or external party, but the reviewer must be independent of interest rate risk management activities and have sufficient understanding of accounting, modeling, and risk management requirements to be competent to complete the review. For community banks with increasing balance-sheet complexity or scope of activities, adequate independence and competency often require contracting with an outside party. As with any type of independent review or audit, results should be reported to the board, and action plans should be developed to address identified weaknesses.

### Common Pitfalls

One of the unique opportunities examiners have is to observe both best practices and common weaknesses at a broad cross-section of banks. At community banks, three common deficiencies in interest rate risk management tend to recur and are often cited in examination reports as matters requiring board attention.

First, many examiners have reported that they often find gaps between board-prescribed risk limits and the risk measurement tools used to quantify risk exposures. For example, a bank policy may specify a risk limit in terms of EVE, but the bank's risk measurement tool may not measure EVE exposures. While not every risk measure captured by the measurement tool requires a risk limit, the risk limits established by the board should be routinely calculated and reported. If the risk limit can't be captured by the risk measurement tool in place, the board should determine whether a new, appropriate, and calculable limit should be established or whether a new risk measurement tool is needed.

Second, many examiners have evaluated assumptions used in interest rate risk models and determined that default or industry standard assumptions provided by the vendor have never been evaluated or customized by the bank's management team. While certain vendor-provided assumptions may be appropriate for some banks, the management team should evaluate the reasonableness of those assumptions before accepting them for use in a given model.



Third, many banks have not incorporated independent or third-party reviews to ensure the integrity of their interest rate risk management programs. Since 2010, this has been perhaps the most prevalent interest rate risk matter identified by examiners, as community bank management teams work to comply with the guidance set forth in the interagency advisory.

### Conclusion

Community banks face a number of formidable challenges in the current economic environment. However, with appropriate interest rate risk management programs, the inherent interest rate risks that are intrinsic to banking can be managed effectively for given levels of capital and earnings.

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<sup>1</sup> Discussed in greater detail in the Federal Deposit Insurance Corporation's Winter 2009 Supervisory Insights article, "Nowhere To Go But Up: Managing Interest Rate Risk in a Low-Rate Environment."

<sup>2</sup> SR Letter 10-1, "Interagency Advisory on Interest Rate Risk," and SR Letter 12-2, "Questions and Answers on Interagency Advisory on Interest Rate Risk Management," are available at <http://www.federalreserve.gov/boarddocs/srletters/2010/sr1001.htm> and <http://www.federalreserve.gov/bankinfo/srletters/sr1202.htm>.

<sup>3</sup> The Bank Director's Desktop is available at <http://www.bankdirectorsdesktop.org>.

<sup>4</sup> EaR analysis calculates revenues and expenses based on various interest rate scenarios and assumptions established jointly by management and model vendors regarding price sensitivities, asset prepayments, reinvestment of cash flows, and deposit mix changes (among other factors). Net interest income or net income results from these calculations are then compared to a base case (no rate change) scenario to determine how much income exposure exists with each interest rate change scenario.

<sup>5</sup> EVE analysis computes expected cash flows related to asset and liability accounts, given various interest rate scenarios based on assumptions established jointly by bank management and model vendors. These cash flows are discounted to arrive at present values of bank equity, and these present values are compared with discounted economic values of bank equity for a zero interest rate change scenario to express the risk exposure as a percent change in EVE.

<sup>6</sup> Key assumptions for interest rate risk models could include asset prepayment speeds, nonmaturity deposit assumptions, and interest rate price sensitivities for significant balance-sheet accounts. Price sensitivities refer to the percent change for asset or liability pricing for a 100-basis-point change in the underlying interest rate (e.g., rates for savings accounts may increase 15 basis points for every 100-basis-point increase in interest rates).

## FEDERAL RESERVE SYSTEM

The logo for 'Community Banking Connections' is centered on a dark brown background with a subtle horizontal line pattern. The words 'COMMUNITY BANKING' are in a smaller, white, sans-serif font above the word 'CONNECTIONS', which is in a large, white, serif font with a slight 3D effect. Below 'CONNECTIONS' is the tagline 'A SUPERVISION AND REGULATION RESOURCE' in a smaller, white, sans-serif font.

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**Effective Asset/Liability Management: A View from the Top**

*by Doug Gray, Managing Examiner, Federal Reserve Bank of Kansas City*

"With growing cash balances and ever-declining interest rates over the past several years, the banking industry's net interest margins have trended downward, exhibiting some volatility."<sup>1</sup> While this quotation could certainly come from any banking publication today, the statement is actually from a paper published in 2005 that discusses balance-sheet management at community banks. Today, community banks are encountering some of the same challenges they faced nearly a decade ago: sizable cash balances, low interest rates, and reduced loan demand. The words of radio news broadcaster Paul Harvey seem appropriate: "In times like these, it helps to recall that there have always been times like these." However, simply acknowledging that these challenges have persisted does not help institutions respond to them. Rather, each community bank should have its board of directors' and its senior management's "view from the top" to effectively lead it through these challenging asset/liability management (ALM) times.

In general, ALM refers to efforts by a bank's board and senior management team to carefully balance the bank's current and long-term potential earnings with the need to maintain adequate liquidity and appropriate interest rate risk (IRR) exposures. Each bank has a distinct strategy, customer base, product selection, funding distribution, asset mix, and risk profile. These differences require that assessments of risk exposures and risk management practices be customized to each bank's specific risks and activities and not take a one-size-fits-all approach.

**Regulatory Assessment of Asset/Liability Risk Management**

Regulators assess risks and risk management activities in four broad categories, reflected in the figure below. This article will discuss two of these key aspects as they relate to ALM: 1) board and senior management oversight, and 2) policies, procedures, and risk limits.



### Board Oversight

In 1995, the Federal Reserve Board issued risk management guidance that emphasized that each bank's board is ultimately responsible for the bank's condition and performance.<sup>2</sup> Interagency guidance and policy statements issued since that time have reinforced the principle that although bank directors can delegate certain activities, they retain ultimate responsibility.

Effective oversight requires the board of directors to rely on sound ALM. Because ALM is complex, some bank directors might find overseeing interest rate and liquidity risks challenging. Senior management typically provides the board with information derived from IRR or liquidity models that contain general assumptions and produce output reports. Much of this information is driven by very detailed "behind-the-scenes" model inputs and assumptions. As a result, the directors' review is generally limited to monitoring exposures through key model output reports and measures but with little knowledge of the assumptions behind or limitations of those measures. While being able to quantify and monitor risk positions is important for sound oversight of balance-sheet exposures, effective board oversight requires more than simply evaluating model outputs; it also requires a broad perspective on all business lines and products, strategic goals, and risk management.

Board oversight should include:

- *Understanding Risks.* Through policies, reporting mechanisms, and discussions at board meetings, bank directors should demonstrate that they clearly understand the risks inherent in the institution's ongoing activities. Directors should also question senior management about risks and risk management costs presented by new activities and deliberate about the risk/reward trade-offs.
- *Providing Appropriate Guidance.* The board sets the tone and communicates the risk tolerance for the organization. Risk tolerance, including quantitative risk limits and definitions of permissible and impermissible activities, should be communicated so that the board, senior management, and other bank personnel clearly understand the bank's risk thresholds and approach to managing the effects of balance-sheet exposures on capital and earnings. This is most frequently accomplished by establishing appropriate policies and risk limits, which is discussed in greater detail later in this article.

- *Monitoring Exposures.* Once the risks inherent in the institution's activities are recognized and guidance is provided to staff, directors should require that senior management report risk exposures on a timely basis. In community banks with low IRR or liquidity risks, the board should review risk reports at least quarterly. However, in community banks with high IRR or liquidity risks, the board, or a designated committee, should review risk reports more frequently.

Board reports should also be meaningful to the directors in their risk oversight role. For example, many IRR models have been developed to provide detailed quantitative data. However, some of this information is more meaningful to the senior managers evaluating daily activities than to the directors overseeing institutional risks and setting strategic direction. To be useful, board ALM reports should be timely, accurate, and appropriately detailed and should clearly note any noncompliance with bank policies. While directors should understand, at a high level, the assumptions made and any weaknesses in the models used to produce the reports, they do not need a detailed understanding of all the nuances or model mechanics. Too much or too little information, along with the wrong kind of information, can hamper the board's ability to effectively steer the institution through the sea of IRR and liquidity risks.

- *Making Personnel Decisions and Delegating.* Many community bank directors are specialists in fields outside of banking and likely lack a background in ALM issues and other risk areas. However, most community bank boards recruit key managers who possess the expertise necessary to effectively administer risk management activities. Bank directors also have the opportunity to allocate time and funding to train and develop individuals who need enhanced knowledge in balance-sheet risk management commensurate with the bank's risk exposure. Once key personnel are identified and developed, the board may confidently delegate daily risk oversight to these capable managers.

### Senior Management Activities

In many cases, the board delegates routine oversight of balance-sheet risks to a committee of senior managers known as the Asset and Liability Management (ALM) Committee or the Asset and Liability Committee (ALCO). A community bank's ALCO often assesses earnings, establishes loan and deposit strategies and pricing, monitors detailed IRR exposures, and evaluates liquidity risk exposures and contingency funding needs. Given the broad array of activities the ALCO conducts, representation should include senior managers from the bank's lending, investment, deposit-gathering, and accounting functions.<sup>3</sup> The ALCO should make regular reports to the full board, so appropriate oversight by the board can be carried out.

Senior management activities should include:

- *Implementing ALM Policies.* The primary responsibility of senior management when carrying out ALM activities is to ensure that policy and risk guidance established by the board is appropriately implemented. ALM policies should provide the blueprint for ALCO and other bank personnel to follow when identifying, measuring, and controlling IRR and liquidity risks. In addition to communicating appropriate risk tolerances, policies should direct management to develop or acquire risk measurement tools that provide ongoing quantitative reporting of the relevant risk exposures.

- *Developing Risk Monitoring and Reporting Tools.* Many community banks use a battery of tools to oversee ALM risks depending on the complexity of their balance sheet. IRR is often monitored using vendor models to identify and measure risk exposures under various rate scenarios. Liquidity risk is typically identified, measured, and monitored through spreadsheets that compute existing balance-sheet liquidity positions, forward-looking source and use projections, and adverse scenario effects. The key consideration for any management team in determining what measurement tool to use is ensuring that the tool can quantify the institution's specific risk exposures. For example, a small bank located in a rural community with nearly 50 percent of its total assets invested in callable bonds should not be relying on a simple maturity gap, since the complexity of the balance sheet would demand a more sophisticated tool regardless of asset size. It is imperative that management implement appropriate tools to adequately measure the risk in the balance sheet.
- *Reporting Risk Exposures to the Board.* Reports provided to senior management and the board should evaluate the institution's compliance with established risk limits. Regardless of asset complexity, funding characteristics, or the risk measurement mechanism used, the board relies on management's ability to properly identify the risk in the bank. For example, many community banks establish net interest income change limits for various interest rate change scenarios in their IRR management policies. In these banks, management would be expected to quantify and report to the board the level of and trend in net interest change percentages for those scenarios specified in the bank's policy. Directors should receive sufficient information to understand the bank's existing interest rate and liquidity risk profiles relative to established limits and the potential impact of strategic and tactical decisions on those exposures.
- *Attracting and Developing Personnel.* It is also critical that a bank's staff maintain adequate depth and expertise for carrying out risk measurement and mitigation activities. Risk oversight is dependent on having the proper personnel to understand the balance sheet's complexity and properly develop an ALM oversight program capable of ensuring that risks stay within the boundaries set by board policies. Hiring and developing appropriate staff can be particularly challenging for rapidly growing community banks or those with increasing product complexity. Typically, these banks are either acquiring other institutions or implementing new business lines. In these situations, the bank can avoid pitfalls by ensuring that the appropriate staffing infrastructure is in place to identify, measure, and report interest rate and liquidity risks from new activities prior to commencement. This requires that senior management exercise appropriate due diligence and risk analysis to determine how the new activities (for example, a new mortgage origination program) or products (for example, a new CD) could affect the bank's overall IRR profile. The results of these analyses should be presented to the board prior to implementing the new activity. This exercise, in turn, will allow senior management to propose and the board to adopt changes to policy and establish risk limits related to the new activities.

The responsibilities of the board of directors and senior management are summarized in the figure below.



### **Policies, Procedures, and Risk Limits**

One of the most effective tools the board and senior management can provide to their staff is a sound policy directive for the bank's various activities and risk exposures. Through sound policies, the board communicates to frontline and senior personnel its expectations with respect to risk tolerance, desirable and undesirable activities, internal control and audit, and risk measurement. Typically, directors develop ALM policies that consolidate the board's expectations for interest rate and liquidity risk exposures and oversight. When examiners evaluate ALM policies, they are looking to see that the following issues are appropriately addressed:

- The policy should state the bank's objectives for ALM and provide a well-articulated strategy for managing the risks associated with balance-sheet accounts. This would typically include the board's view regarding trade-offs between earnings and interest rate and liquidity risk exposures.
- Another critical element of any ALM policy is appropriate aggregate risk limits for interest rate and liquidity risk exposures. Traditionally, community bank ALM policies would establish maturity/repricing gap risk limits to address IRR exposures and one or two liquidity ratio metrics (e.g., loans-to-deposits or noncore funding dependence ratios) for liquidity risk exposures. With the proliferation of callable bonds, mortgage-backed securities, Internet and brokered CDs, correspondent bank and Federal Home Loan Bank borrowings, and financial derivatives, many community banks have implemented more robust, forward-looking risk measurement techniques.

While many community banks have implemented better risk measurement tools, risk limits are not always established. For example, regulatory guidance suggests that sound risk limits for IRR exposures should address the risk in relation to earnings and capital exposures – usually framed in terms of limits to net interest income, net

income, and/or the economic value of equity change percentages for specific interest rate shock scenarios.<sup>4</sup>

Regulatory guidance has also pointed to the need for forward-looking analysis for sound liquidity risk management. Often, this takes the form of sources/uses projections. A sound policy would establish risk parameters in the form of minimum forward-looking cash flow coverage ratios. These risk limits should be clearly stated, should meaningfully address the bank's activities, and should effectively communicate the board's risk tolerance. Risk limits should also be periodically reevaluated in light of the institution's other risk exposures (e.g., credit, operational, reputational) and any new products or business activities.

- The policy should provide clear lines of authority, responsibility, and accountability regarding risk management activities. It should include addressing situations where the institution falls outside of its established risk parameters, defining who is responsible for implementing strategic and tactical activities, establishing and maintaining risk measurement systems, and identifying risks that may arise from new products or activities. In many community banks, these responsibilities fall to one or a few individuals. The board should be aware of any concentration in responsibility or authority and ensure that adequate controls are in place to mitigate any resulting risks. An effective control might include, for example, independent reviews of these activities by someone who understands the risk management activities and potential problems that could arise.
- The policy should also clearly delineate the types of activities that an institution may conduct. This might include the types of financial instruments or activities that are permissible for either the banking book or risk mitigation (that is, hedging) activities. When managing liquidity risks, the policy should indicate what types of funding are acceptable and to what degree these sources should be used. For example, some community banks have incorporated the use of Internet or brokered deposits to augment local deposit volumes. For such institutions, the ALM policy should discuss how Internet or brokered deposits might be appropriately used and the extent to which the board considers these deposits acceptable. While nontraditional funding may change the bank's inherent liquidity risk profile, sound controls over the volume and type of inherently riskier funding sources may help to mitigate risks.

While the use of financial derivatives by community banks to hedge certain interest rate risks remains relatively modest, especially at the smallest banks, the use of derivatives has nevertheless become somewhat more prevalent in community banks in the past several years. Any community bank using financial derivatives to hedge exposures should have personnel with sufficient knowledge and expertise to ensure that the bank's risk exposure is not elevated by these activities. Before the bank engages in the use of financial derivatives, bank policies should address the appropriate use of these instruments, including a discussion of permissible derivative activities, an independent review of derivatives and the effectiveness of hedging activities, and appropriate accounting policies. Management should ensure that, prior to using financial derivatives, they understand the economics of the instruments, the potential risks from improper use, and accounting requirements for hedging activities.

### **Leading ALM Risk Management Practices**

Many community banks have developed structures and policies to enable the board and senior management to effectively oversee balance-sheet risk exposures. However, examiners continue to identify opportunities to improve oversight of these risks. Occasionally, those opportunities rest with the board's knowledge of IRR and liquidity concepts. While community bank directors are not expected to be subject matter experts, board members should have a certain level of foundational understanding to effectively carry out their fiduciary responsibilities. To ensure that the board has sufficient understanding of balance-sheet risk management concepts, some banks have benefitted from external resources for educating directors.<sup>2</sup> Other banks have included on their board at least one outside director who possesses a sound understanding of balance-sheet management concepts. Together, these approaches have been effective in improving boards' abilities to oversee balance-sheet risk exposures.

Another leading practice is to identify risks and update policies before implementing new products or activities.<sup>3</sup> In many cases, community bankers have responded to the challenge of meeting desired earnings targets by implementing new business lines or investing in new categories of assets. In some instances, while the board and senior management may have held cursory discussions regarding the characteristics of these assets or business lines, they nevertheless failed to conduct a thorough due diligence evaluation of risks, including interest rate and liquidity risks. In some cases, the bank commenced an activity or invested significant funds in a particular asset only to later learn that additional processes, resources, and personnel were needed to effectively manage the risks arising from these activities or assets. Thus, the potential boost to earnings initially expected from these strategies was consumed by unexpected risks and additional post-implementation expenses related to risk management.

## Conclusion


The community banking landscape has changed significantly in the past decade, and these changes have required heightened attention to ALM risk management strategies and processes. These changes, which include more products with embedded options, have required directors and senior managers to acquire enhanced knowledge about interest rate and liquidity risks to both manage traditional ALM risks and keep up with new ways of doing business. Changes have also reinforced the need for directors and senior managers to reevaluate and communicate guidance and risk tolerances to bank personnel. By ensuring that a sound oversight structure based on strong communication of risk tolerance is in place, directors can effectively steer the bank through challenging banking conditions whenever they occur.

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\* This is the second in a series of three articles on asset/liability management. Please see the first article "Interest Rate Risk Management at Community Banks" in the Third Quarter 2012 issue of Community Banking Connections.


<sup>1</sup> Todd Taylor and Sasha Antskaitis, "Balance Sheet Management for Community Banks," Bank Accounting & Finance (December-January 2005), p. 29.

<sup>2</sup> See Supervision and Regulation (SR) Letter 95-51, "Rating the Adequacy of Risk Management Processes and Internal Controls at State Member Banks and Bank Holding Companies," available at [www.federalreserve.gov/boarddocs/srletters/1995/sr9551.htm](http://www.federalreserve.gov/boarddocs/srletters/1995/sr9551.htm). 



<sup>3</sup> Often, outside directors are also included as ALCO members to ensure that an appropriate degree of independence is maintained in the oversight of balance-sheet risk decisions.

<sup>4</sup> Interest rate shock scenarios often take the form of assumed instantaneous shifts “either up or down” in all interest rates affecting a bank’s assets and liabilities. Regulatory guidance indicates that these shocks should be significant (i.e., 300/400 basis points or more), and limits should be established for significant and meaningful shocks. See SR Letter 10-1, “Interagency Advisory on Interest Rate Risk,” available at [www.federalreserve.gov/boarddocs/srletters/2010/sr1001.htm](http://www.federalreserve.gov/boarddocs/srletters/2010/sr1001.htm). 

<sup>5</sup> External resources for educating directors can include consultant training and ALCO support, external training seminars, and online training modules. The Federal Reserve System has developed a resource for bank directors that can be accessed at [www.bankdirectorsdesktop.org](http://www.bankdirectorsdesktop.org). 

<sup>6</sup> For more information on new product or service considerations, please refer to the article “Considerations When Introducing a New Product or Service at a Community Bank” in this issue.

## FEDERAL RESERVE SYSTEM

The logo for 'Community Banking Connections' is centered on a dark brown background. The words 'COMMUNITY BANKING' are in a smaller, white, sans-serif font above the word 'CONNECTIONS', which is in a large, white, serif font with a slight 3D effect. Below 'CONNECTIONS' is the tagline 'A SUPERVISION AND REGULATION RESOURCE' in a smaller, white, sans-serif font.

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## Essentials of Effective Interest Rate Risk Measurement

by Emily Greenwald, Assistant Vice President, Federal Reserve Bank of Chicago and Doug Gray, Managing Examiner, Federal Reserve Bank of Kansas City

Interest rate risk (IRR) is defined as the potential for changing market interest rates to adversely affect a bank's earnings or capital protection. Two previous issues of *Community Banking Connections* included articles on IRR management for community banks.<sup>1</sup> The first article provided an overview of key elements of an IRR management program and common pitfalls faced at community banks. The second article focused more attention on directors' and senior managers' specific responsibilities, including development of sound policies and IRR exposure limits. In this article, the discussion proceeds to IRR measurement issues, including the appropriateness of certain measures and some of the challenges faced in modeling risk exposures.

Perhaps the most discussed IRR management topic for community banks is risk measurement. Community bankers often ask which techniques, tools, and models are needed and how those tools can be fine-tuned. At the most basic level, regulators expect a bank's IRR measurement tools and techniques to be sufficient to quantify the bank's risk exposure.<sup>2</sup>

Measurement techniques typically fall into two broad categories: short-term and long-term risk measures (Figure 1). Generally speaking, short-term measurement techniques attempt to quantify the size of a bank's risk relative to the earnings stream generated by bank operations. Alternatively, long-term measurement techniques attempt to quantify the size of a bank's risk relative to its capital protection.

Measuring IRR is nothing new, as bankers have measured aspects of IRR for decades beginning with basic static gap analyses. Technological advancements have allowed IRR measurements to evolve from simple spreadsheet calculations to software and third-party vendors capable of measuring complex cash flows. Today, even noncomplex community banks can obtain cost-effective asset/liability management (ALM) models to quantify both short-term and long-term IRR exposures (although the Federal Reserve does not require community banks to purchase such models). While some of these models use complex mathematical computations to calculate a bank's IRR exposure, the short- and long-term measures captured by these ALM models are conceptually straightforward. Before discussing essential considerations in selecting and operating an ALM model, it is important to clearly understand each measure conceptually.

**Figure 1: Common Interest Rate Risk Measurement Techniques**



### **Short-Term Measures**

Short-term measurement techniques quantify the potential reduction in earnings that might result from changing interest rates over a 12- to 24-month time horizon. The two most common short-term measures for community banks are static gap reports and earnings-at-risk (EaR) analysis.

#### **Static Gap**

Static gap reports attempt to highlight potential "gaps" in the near future (typically over the next 12 months), where changes to interest rates on assets such as loans and bonds, or liabilities such as deposits, do not occur contemporaneously. Thus, when the prevailing market interest rates change, a bank could experience net interest margin compression, reduced net income, or both. Assets and liabilities with interest rates that change in the measurement window (say 12 months) are referred to as "rate-sensitive." The difference between cumulative rate-sensitive assets and liabilities for the period being measured is referred to as the "static gap." A large gap indicates a potentially significant IRR exposure. For example, a bank with rate-sensitive assets that significantly exceed the volume of rate-sensitive liabilities would expect the net interest margin to decline when market interest rates also decline. While the static gap report might provide some indication of the direction of IRR, it is an imprecise risk measurement tool. Specifically, the static gap report does not effectively capture cash flow timing from unscheduled loan and bond payments (prepayments), and slotting the repricing horizon of nonmaturity deposits becomes extremely difficult at best. Thus, it may only be suitable for banks that have very low IRR profiles to rely solely on this measure to quantify short-term IRR exposures.

#### **Earnings at Risk (EaR)**

Because of the shortcomings of static gap reports, most community banks have implemented IRR models that compute EaR over a 12-month or 24-month time horizon to quantify short-term earnings exposures. To compute these earnings exposures, most models begin by calculating either net interest income or net income in a scenario in which interest rates do not change (base case). Income and expenses are then recalculated in scenarios with higher and lower interest rates. The results of each variation are compared against the base case scenario to determine the potential change in earnings from each.

### **Long-Term Measures**

Long-term measurement techniques quantify the potential exposure to capital — either through reduced long-term earnings or a reduced economic value of capital — that might result from changing interest rates. While long-term (up to five years) net income simulations (i.e., EaR analysis) are occasionally used at community banks, the most common long-term measurement technique is some variation of economic value of equity (EVE) analysis. EVE analysis, unlike the EaR measure, involves projecting cash flows from assets and liabilities over the economic life of each product, assuming interest rates will not change. Cash flows are then discounted to determine their present value, and the present value of liabilities is subtracted from the present value of assets to determine the bank's EVE in a base case. Cash flows are also projected for various rising and falling interest rate scenarios and discounted at higher and lower discount rates to recalculate the EVE. The percent change in EVE from the various scenarios provides a meaningful measure of the bank's long-term IRR exposure relative to capital. The real value in EVE analysis is identifying risk exposures that extend beyond the next 12 to 24 months. For example, if a bank's analysis reflects a significant reduction in EVE in a period of rising rates, research has indicated that the bank's financial performance would be expected to deteriorate in the years following a period of increasing interest rates. <sup>3</sup>

It is a longstanding expectation by U.S. banking supervisors that all banks will assess the potential impact of IRR on earnings and capital. While EVE analysis is a beneficial measure of long-term IRR exposure for community banks, regulatory guidance does not require every community bank to conduct such analysis. EVE analysis is particularly useful, and often required by examiners, for banks with long-term bond portfolios and assets with embedded options. The risks from these assets are typically not captured by short-term measures. Community banks with short-term balance-sheet structures and ample capital and earnings, however, would not always be expected to use EVE analysis to compute long-term IRR exposures.

### **Key Considerations**

When a bank considers purchasing ALM model software or contracting with a third party to measure its IRR, a number of considerations should factor into the decision. Some of these considerations include, but are not limited to, the intended use of the model, cost, measurement capabilities, features, reporting, and customer support. When selecting any ALM model, management should also weigh the strengths of the model against its limitations. Choosing an ALM model is a bank-specific decision, where one size truly does not fit all. From a regulatory perspective, we will focus on two key considerations: a bank's intended use and the measurement capabilities of the model.

#### **Intended Use**

Evaluating management's intended use is a key first step in selecting an ALM model. An important primary use of any bank's ALM model is measuring the bank's IRR exposure. While this seems intuitive, not all community bankers have given the appropriate consideration to measuring all of the bank's material IRR exposures. Once established, the ALM model may also be used for other purposes, such as profit planning, asset pricing, liquidity planning, and other functions, all of which are distinct and secondary to basic IRR measurement.

As discussed earlier, ALM model results are derived by projecting cash flows, which contemplate likely behavior of the bank's management team and customers to changing market interest rates. The simplest ALM models create cash flows and accrual calculations from Call Report data fields, while more sophisticated models derive such information from detailed product attributes of the bank's assets and liabilities. By projecting these cash flows, ALM models are used to construct commonly utilized EaR and EVE measures. Since the primary intended use is measuring EaR and EVE, understanding the capabilities and key assumptions that go into these calculations is crucial to evaluating an ALM model.

#### **Measurement Capabilities**

Another key consideration in choosing the appropriate ALM model is the measurement capabilities of the software or third-party vendor. Some models provide the user with a standard set of basic interest rate change scenarios, such as instantaneous, uniform changes in all prevailing market rates (for example, all rates increase 300 basis points) that are evaluated against the existing balance sheet. Other models provide the ability to evaluate the effects of nonparallel interest rate changes (for example, short-term rates increase, while long-term rates remain stable), delayed reactions to rate changes (for example, certificate of deposit (CD) rate changes 90 days after prevailing market rate changes), and balance-sheet changes that may result from market rate changes (referred to as "dynamic" balance-sheet modeling). Guidance from federal and state banking regulators in 2010 (with subsequent frequently asked questions in 2012 to clarify the 2010 guidance) emphasized the importance of evaluating the ALM model's measurement capabilities against material products and services on the bank's balance sheet.<sup>4</sup>

A couple of examples might be helpful in clarifying the guidance in this area. First, consider a bank that is exposed to basis risk because the rates that drive asset pricing differ from the rates that drive liability pricing. This bank has a large volume of loans priced off of national prime rates, which are funded by three-month CDs priced off of U.S. Treasury bill rates. To quantify this IRR exposure, management would need to ensure that the ALM model is capable of evaluating changes to more than one key market rate.

Another example that has become more prominent in recent years is a bank that originates and sells mortgage loans but retains the servicing rights. Some ALM models only measure changes to net interest income (NII) rather than potential changes to all income and expense categories. Since fee income from mortgage originations and ongoing servicing fees are sensitive to interest rates, calculating the change in NII would fail to capture the fee income at risk in various rate environments. Banks with significant noninterest income that is sensitive to changing rates should focus special attention on quantifying potential changes to net income. A bank should ensure that its ALM model is capable of quantifying the effect that market rate variations could indirectly have on its earnings.

More broadly, a bank should also understand the benefits and limitations in the level of detail for which assets and liabilities are analyzed in the model. A model that is based upon Call Report schedules may be appropriate for lower-risk banks with homogeneous loan and security characteristics. While these ALM models are often less expensive and more easily implemented and operated, grouping assets and liabilities in the model based upon Call Report categorization also has a downside. For example, Call Report instructions define any loan operating at or below an interest rate floor as a fixed-rate loan. ALM models using this categorization of assets would also treat these otherwise variable-rate loans as fixed-rate loans and miscalculate the contribution of these assets to earnings in various interest rate change scenarios. Call Report-based models have similar limitations for other loan and deposit features as well, lessening their accuracy as a risk measurement tool. Thus, an ALM model's material limitations should be clearly understood by the ALM committee or board of directors when reviewing ALM model reports.

Questions to consider when reviewing the measurement capabilities of an ALM model include:

- How much flexibility does the bank have to set and/or modify the interest rate scenarios employed in the ALM model?
- How frequently can the ALM model be run and the results be made available to the bank?
- Can the level of asset and liability detail be customized, or is the model limited to Call Report fields?
- Can the ALM model measure nonparallel interest rate scenarios? If so, how much input does the bank have in determining the scenario(s) to run?
- Does the model measure key risks, such as basis, mismatch, prepayment, and yield curve risks? If not, are any of these risks material to the balance sheet?

### **ALM Model Assumptions**

An effective IRR measurement tool is expected to have an appropriate degree of precision, which depends upon properly established assumptions. While regulators do not expect an ALM model to predict the future, the data used in the tool should have a high degree of accuracy. If data inputs or model assumptions are invalid or inaccurate, the model output reports will not be very useful and could result in poor decisions being made. Likewise, if the reports do not provide meaningful information, they could be ignored by management. As community bank examiners have reviewed ALM models over the past 15 years, they have found that two common assumptions significantly impact the accuracy of model results - deposit behaviors and prepayments. In fact, slight errors in these assumptions can result in significant errors in ALM model results.

#### **Common Deposit Assumptions**

**Deposit beta** measures how responsive management's deposit repricing is to the change in market rates. Assume, for example, that prevailing interest rates increase from 1 percent to 2 percent, and management increases the rate paid on savings accounts from 0.5 percent to 0.9 percent in response. The beta is then  $0.4/1.0$ , or 40 percent of the

market rate change.

**Deposit average life** measures customers' nonmaturity deposit (NMD) withdrawal behavior. ALM models use the average life of an NMD balance as their effective maturity when projecting cash flows.

#### **Deposit Assumptions**

Deposit products continue to represent the most significant funding source for community banks, making deposit assumptions critical to ALM model accuracy. While a bank holds the option to set deposit rates for NMDs and other deposit products like CDs, consumers hold the option to withdraw funds at will. Consequently, assumptions like deposit betas and deposit average lives play a vital role in a bank's measurement system. (See box above for descriptions of deposit beta and deposit average life.)

Most ALM models provide a bank with the flexibility to customize deposit betas. However, not all ALM models provide the ability to input different deposit betas for rising and falling rate scenarios. Deposit betas indirectly affect projected interest expenses under various interest rate change scenarios. In most situations, banks delay raising or lowering deposit rates at the beginning of a rate cycle. When a bank finally elects to change deposit rates, it often will do so to a lesser extent than the prevailing change in market interest rates and often to different degrees depending on whether the rate change is upward or downward. Thus, setting deposit beta assumptions is challenging, as bankers must balance controlling interest expense with customers' ability to transfer accounts.

An ALM model's deposit assumptions also include setting deposit average lives. Assumptions made about the average life of NMDs often have a critical effect on model calculations of EVE. Risk managers should explore how an ALM model enables deposit average life information (sometimes entered as a rate of decay to the balance) to be input. Many community banks turn to vendor-supplied deposit assumptions as a starting point or source for setting the average life for NMD products. Bank management should evaluate how any vendor-supplied assumptions in the model, such as deposit decay rate tables, are updated and maintained by the vendor and compare them with their customers' behavior.

In today's environment, deposit volumes at community banks are at high levels relative to total liabilities. Many community banks have also experienced migration of customer balances from CDs into NMDs since 2008. This influx of NMDs makes sensitivity testing of ALM model assumptions valuable to a community bank. Sensitivity testing takes one key assumption, such as deposit betas, and changes the value to be larger or smaller than its current value. The model scenarios are then run again to see what impact changing one assumption has on the overall ALM model results. Another approach to sensitivity testing is to reallocate a portion of NMD balances into CDs. By measuring traditional deposit mix balances, a bank can be informed of possible outcomes should funds revert back to a more traditional NMD/CD deposit mix that prevailed before 2008.

Questions to consider regarding an ALM model's deposit assumption capabilities include:

- Does the ALM model break out NMDs and CDs beyond the Call Report categories? If the ALM model is Call Report-based, how does customer behavior compare with characteristics of deposits grouped together?
- Does the model allow for different deposit betas in rising and falling rate scenarios?
- How does the model handle deposit average lives? If default assumptions are provided, how are they generated? Can the bank alter default assumptions to reflect customer behavior?
- Does the model allow sensitivity testing of deposit betas and decay rates?
- Does the model enable the deposit product mix to be altered for sensitivity testing purposes?

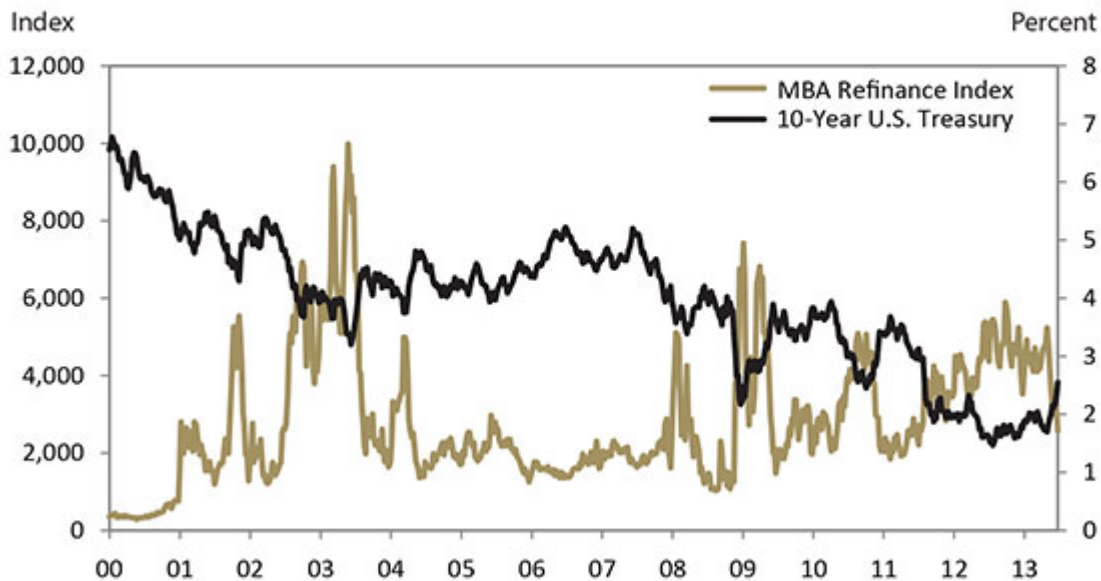
#### **Prepayment Assumptions**

Typically, one of the most difficult IRR measurement challenges is modeling cash flows for mortgages and mortgage-related products. For example, the uncertainty of expected cash flow timing and amounts for products such as residential mortgages, mortgage-backed securities (MBS), and collateralized mortgage obligations (CMOs) depends on the embedded option held by each underlying borrower to refinance or prepay. During periods of low and/or decreasing interest rates, similar to the current environment, the incentive for borrowers to refinance their mortgage is greater and, as such, their propensity to prepay increases. Conversely, during periods of increasing rates, this incentive diminishes and prepayments are likely to be lower. Volatile mortgage refinancing cycles over the past decade, however, have not followed traditional theory, which further emphasizes the difficulty in developing prepayment assumptions. Figure 2 illustrates the Mortgage Banking Association's Refinance Index level and the 10-year constant maturity Treasury (CMT) rate between January 2000 and January 2013. As illustrated, homeowners' refinancing activities have not always behaved as expected during periods of interest rate changes, which causes difficulties in estimating future cash flows and potentially leads to erroneous IRR model results. For example, in 2009, 10-year Treasury rates increased after a brief period of low rates. Normal expectations would be that refinancing activity would decline. However, the opposite actually occurred. Other factors,



such as government programs, were influencing prepayments during that period.

**Figure 2: MBA Refinance Index (left) vs. 10-Year U.S. Treasury Rates (right)**



Source: Mortgage Banking Association via Bloomberg

For banks with material volumes of mortgage-related products, understanding the ALM model's incorporation of prepayment assumptions is essential. ALM model vendors offer an array of prepayment measurement capabilities, from a single prepayment speed for all products to different prepayment speeds for assorted products based on various factors. With respect to modeling mortgages and mortgage-related products, factors such as loan size, seasonality, age of the loan, home sale rates, and loan-to-value percentages may be used to derive prepayment measures and model assumptions.

As with deposit assumptions, value may be found in sensitivity testing prepayment assumptions to determine the risk that earnings may be reduced by elevated prepayments or that EVE may be reduced by slower prepayments. In considering an ALM model, banks should explore the ability and ease of changing prepayment assumptions. With some models, the ability to implement and customize prepayment assumptions requires add-on features, which often adds expense. Regulators would expect that banks having a material amount of mortgage-related or other amortizing assets would incorporate these add-on ALM model features. For these banks, an ALM model that does not effectively incorporate prepayments or resolve the difficulties in estimating future cash flows is likely to produce results that do not adequately quantify the bank's actual IRR exposure.

Bankers often rely on vendors or modeling software providers to provide prepayment assumptions. Regardless of the method used to derive these assumptions, the ultimate goal should be to capture the risk to earnings and capital created by unexpected changes to projected cash flows. Questions to consider when evaluating an ALM model's prepayment assumption capabilities include:





- How does the ALM model incorporate prepayment assumptions?
- Does the ALM model allow prepayment speeds to be assigned for each product?
- Does the model provide default prepayment options? If default assumptions are provided, does the vendor explain how they are generated?
- How reasonable are the prepayment assumptions provided?
- Does management have the ability to alter default assumptions to reflect customer behavior?

In closing, not all ALM models provide the same functionality or produce the same results. The forward-looking nature of IRR measurement techniques presents challenges even for sophisticated ALM models. A bank should select an ALM solution that reliably and cost-effectively delivers the necessary functions for the bank's activities and risk profile. This discussion has provided several considerations and questions that should be useful in evaluating a bank's IRR measurement practices. As additional ALM questions arise, banks should not hesitate to contact supervisory staff at their local Reserve Bank.

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<sup>1</sup> Doug Gray, "Interest Rate Risk Management at Community Banks," *Community Banking Connections*, Third Quarter 2012, at [www.cbefrs.org/articles/2012/Q3/Interest-Rate-Risk-Management.cfm](http://www.cbefrs.org/articles/2012/Q3/Interest-Rate-Risk-Management.cfm); and Doug Gray, "Effective Asset/Liability Management: A View from the Top," *Community Banking Connections*, First Quarter 2013, at [www.cbefrs.org/articles/2013/Q1/Effective-Asset-Liability-Management.cfm](http://www.cbefrs.org/articles/2013/Q1/Effective-Asset-Liability-Management.cfm).

<sup>2</sup> Refer to interagency guidance on IRR communicated by Federal Reserve Supervision & Regulation (SR) Letter 12-2, "Questions and Answers on Interagency Advisory on Interest Rate Risk Management," at [www.federalreserve.gov/bankinforeg/srletters/sr1202.htm](http://www.federalreserve.gov/bankinforeg/srletters/sr1202.htm);  SR Letter 10-1, "Interagency Advisory on Interest Rate Risk," at [www.federalreserve.gov/boarddocs/srletters/2010/sr1001.htm](http://www.federalreserve.gov/boarddocs/srletters/2010/sr1001.htm);  and SR Letter 96-13, "Joint Policy Statement on Interest Rate Risk," at [www.federalreserve.gov/boarddocs/srletters/1996/sr9613.htm](http://www.federalreserve.gov/boarddocs/srletters/1996/sr9613.htm).  Also see section 4090, "Interest-Rate Risk Management," of the Federal Reserve's *Commercial Bank Examination Manual*, at [www.federalreserve.gov/boarddocs/supmanual/cbem/4000.pdf](http://www.federalreserve.gov/boarddocs/supmanual/cbem/4000.pdf). 

<sup>3</sup> Gregory E. Sierra and Timothy J. Yeager, "What Does the Federal Reserve's Economic Value Model Tell Us About Interest Rate Risk at U.S. Community Banks?" *Federal Reserve Bank of St. Louis Review*, 86 (November/December 2004), pp. 45-60, available at [research.stlouisfed.org/publications/review/04/11/SierraYeager.pdf](http://research.stlouisfed.org/publications/review/04/11/SierraYeager.pdf). 

<sup>4</sup> See SR Letters 10-1 and 12-2, respectively.